EXPERT MATHEMATICS TEACHERS OF AFRICAN AMERICAN MIDDLE- AND HIGH-SCHOOL STUDENTS

by

DORIS MICHELLE DAVIS

(Under the Direction of Louis Castenell)

ABSTRACT

There is a lack of research in cognitive psychology regarding how experts teach African American learners. If mathematics teachers better understood how these expert teachers deliver instruction to African American students, such teaching could lead to increased performance in African American middle- and high-school math students. To explore how expert teachers' practices and behaviors influenced student achievement, this study seeks to illuminate the world of mathematics teachers and their influences on African American adolescents. While limited quantitative studies suggest teacher behavior matters (Rivkin, Hanushek, & Kain, 2000; Rowan, Correnti, & Miller, 2002; Wright, Horn, & Sanders, 1997), there is a gap in the literature of studies that include rich, contextual data of how beginning, or novice teachers, best meet the learning needs of African American students in their study of mathematics. To situate the role of novice teachers and their influence on students in this qualitative interview study, expert mathematics teachers' pedagogy and behaviors are explored.

INDEX WORDS: Expert Teachers Mathematics Middle Schools High Schools African American

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DEDICATION

This book is dedicated to my grandparents:

Mr. & Mrs. Jessie Griffin Sr.

Mr. & Mrs. Jonnie Thomas

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To God, my Ultimate Expert Teacher, Advisor, Counselor and Friend- thank you for guiding me along this and every path of my life. To my parents, who provided the foundation of my "Never quit; Finish What You Start" attitude- thank you for teaching me this important life lesson. . And to Dr. Louis Castenell, who "took me on" as his student and provided the guidance and support I needed to get out of my own way- thank you so much. And to my committee members, thank you for agreeing to serve and assist me in birthing this work.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Because of concerns about the general mathematics performance of youth in the United States, teachers, advocates, and policymakers continue to search for strategies and approaches that will reduce the achievement gap in mathematics among diverse groups of learners (Hidden Curriculum, 2014). There is a need to truly understand what factors contribute to disparate performance in mathematics for students and how this performance exacerbates the achievement gap. Darling-Hammond (2000) notes that the performance of teachers' matters, particularly for those students who underachieve, with cumulative and long-lasting effects (Lockwood, Koretz, & Hamilton, 2003). Research suggests that even among different age cohorts, when employing different models, statistical approaches, and achievement measures, there is evidence of teacher effects. Most of the research in this area employs quantitative approaches and there might be a need to use more qualitative approaches to examine the influence of teacher behavior and its relationship to achievement. Berliner (2004) defined an expert teacher as one who has evolved from novice status to one who spent at least 5,000 to 7,000 hours teaching and has displayed pedagogical and cognitive behaviors with rich schema, specific approaches to planning, and automaticity of routines.

To aid in understanding the contribution of expert teachers' pedagogy as well as the decisions teachers make in their instructional delivery, this study seeks to provide insight into the world of expert mathematics teachers who primarily teach African-American students. Consequently, this study did not focus on teacher quality, effectiveness, or efficacy. Rather, this study examined expertise as a cognitive construct addressing the behaviors exhibited as one attains expert status.

This operational definition provides one specific way to study this construct. In sum, this study was limited to a discussion of teaching expertise and the behaviors expert teachers display.

Background of the Study

Teacher effectiveness and its relationship to the achievement gap is a debated issue in American schooling (Ladson-Billings, 2006). Researchers and practitioners have grappled with strategies to close this gap for several decades (Gutiérrez, 2008). Although genetics (Hernstein & Murray, 1994), gender (Fogg, 2005), and socioeconomic status (Ceci & Papierno, 2005) have been examined as contributors of the gap's persistence, the gap between African-American learners and their White peers persists.

Reforms implemented by the federal government and designed to close the achievement gap have made their way into federal legislation. In 2002, No Child Left Behind (NCLB) was signed into law and with the intent to hold schools accountable for adequate yearly progress. Despite the mandates of this legislation including the inclusion of challenging learning standards and higher levels of accountability for schools and students, it appears that the gap has not been drastically narrowed (Elias, White, & Stepney, 2014). Other reforms such as the movement toward smaller learning communities, the spread of research-based curricula, and attempts to develop a stronger corps of mathematics and science teachers (Burrill, 1998) have also witnessed varying success. Despite the interventions and professional development efforts to address mandates in NCLB, the achievement gap persists. By 2008, African-American middle-school students' performance actually dropped by one point for as a group that scored 28 points below their White peers (NAEP, 2009). More than a decade earlier, African-American eighth graders scored 27 points below their White peers in mathematics (Lee, 2002).

Although there are controversial views about the No Child Left Behind legislation, other federal reforms have been enacted to further explore closing the achievement gap. An initiative called Race to the Top (RTT), was enacted as part of the federal American Recovery and Reinvestment Act of 2009 (ARRA). It is a competitive grant program that provides states with monetary incentives to reform educational systems. Contingency clauses are found in the RTT law, where mandated changes in state and local education systems were a condition to receive federal funds which pays for educational programs for children from disadvantaged homes. Nonetheless, RTT has yet to realize benefits. It appears that grantee states overpromised to raise student achievement and close achievement gaps to degrees that would be virtually impossible even with longer timelines and larger funding boosts (Anyon, 2014). Some of the intended products from RTT projects have been slow to realize success. For example, states have delayed implementation of their teacher evaluation systems based on insufficient time to develop rubrics, pilot new systems, and train evaluators. Without rigorous metrics to evaluate teachers, additional research is needed to reveal how successful teachers teach mathematics to African American students.

Research from the National Assessment of Educational Progress (NAEP) indicates African-American learners have made some gains in mathematics and reading, but their gains are low in comparison to their White peers (NAEP, 2009). In 1996, 3% of African-American fourth graders performed proficiently in mathematics while 26% of White children were proficient. In 2009, 15% of African-American fourth graders performed proficiently in mathematics while 50% of White children demonstrated proficient performance. In that same year, 12% of African-American eighth graders were proficient in mathematics compared to 43% of their White peers.

These data suggest the gap is approaching a gulf. In 2009, 51% of African-American students in the United States did not demonstrate basic mathematics skills on achievement exams where only 12% demonstrated proficiency in mathematics. Eighteen percent of White students could not perform basic mathematics skills and 43% of those tested demonstrated mathematics proficiency. NAEP data indicate that in Georgia, 50% of African-American students had basic mathematics ability, while 80% of White students demonstrated basic mathematics skills (NAEP, 2009).

Research on the intersection of mathematics achievement and ethnicity is well represented in the literature (Belfanz, 2006; Martin 2009; Landson-Billings, 2006). Although there seems to be no clear understanding of the link between the mathematics achievement for African-American learners and the teaching behaviors that contribute to positive math achievement (Hanushek & Rivkin, 2010), some research indicates teacher quality affects student achievement more than any other school-based variable (Darling-Hammond et al, 2002). Further, according to Darling-Hammond & Sykes (2003), instructional practices are related to teacher quality where teachers who are highly qualified have strong pedagogical knowledge and strong mathematical knowledge.

Teachers who lack knowledge of mathematics content might struggle just like their students. This fact, coupled with high-stakes testing for students, has prompted accountability measures for teachers (Palmer, Stough, Burdenski & Gonzales, 2005). Not only do teachers need to demonstrate that they can produce acceptable standardized test scores from their students, teachers must be able to deliver instruction that meets the new "highly qualified" standard in the subjects they teach. Because of these demands on teachers, researchers have become more

aggressive in evaluating teachers who are able to demonstrate both pedagogical proficiency as well as content area expertise.

One operational definition of an expert teacher is a teacher who has completed a minimum of 7,000 hours, or 5-7 years, in the classroom. In a study conducted in Australia, Berliner (2004) found inexperienced teachers took about 4.5 years to learn to teach while exemplary teachers took about 3.5 years to develop their skills. Berliner noted learning to teach is predicated on the teacher being able to articulate knowledge and make that information explicit so as to enable students to draw on the information. Expert teachers also display an ability to do things with automaticity, and routinization, skills needed to accomplish their goals. Expert teachers have been found to be more sensitive to task demands and social situations when solving pedagogical problems and tend to represent problems in qualitatively different ways than do novices (Berliner, 2004). Thus, expert teachers are better equipped to teach students form varying backgrounds.

Although existing research has identified a number of qualities of expert teachers, there is little information about expert mathematics teachers and even less information about expert mathematics teachers of African-American adolescents. This study aims to add to the literature by providing a description of the behaviors of expert mathematics teachers of middle- and high-school African-American learners.

Why Study Teaching Expertise?

To show that teacher behaviors matter, quantitative researchers have utilized a statistical tool called Value-Added Modeling (VAM) (Lockwood, Koretz, & Hamilton, 2003). VAM (also known as value-added analysis and value-added assessment) is a method of teacher evaluation

that measures the teacher's contribution in a given year by comparing the current school year test scores of their students to the scores of those same students in the previous school year, as well as to the scores of other students in the same grade. In this manner, VAM seeks to isolate the contribution that each teacher makes in a given year, which then can be compared to the performance measures of other teachers. VAM is a collection of complex statistical techniques using multiple years of students' test score data to estimate the effects of individual schools or teachers.

Recent literature on VAM suggests teachers influence student learning and growth in achievement in different ways. This literature suggests teacher effects are large, accounting for a significant portion of the variability in growth, and that they persist for at least three to four years.

Sanders, Wright, & Horn, (1997) and Rowan, Correnti, and Miller (2002) provide evidence that teachers have distinct, differential effects on student achievement and such effects appear to persist into the future. While VAM is informative in making the research community aware teacher behaviors influence student achievement, what VAM fails to do - because of its quantitative nature - is provide details about what specific actions teachers utilize in their classrooms to influence student growth. This study will seek to uncover the routines, behaviors and pedagogies that successful teachers use in their classrooms. Further, VAM focuses on teachers' contributions to students' success as a metric of quality, not necessarily teacher expertise. Thus, this qualitative study of expert teachers will provide information about the behaviors and practices teachers' exhibit within the classroom.

The influence of teaching on student achievement has been widely studied. For example, Marzano, Pickering, and Pollock (2001) and Sanders and Rivers (1996) concluded teachers'

influence is the most important factor in the growth of student achievement, not only in reading but in mathematics and other content areas. Teachers with less than three years of experience are often less effective than their more senior colleagues (Kain & Singleton, 1996). Further, 70% of surveyed administrators report teachers with more experience are more knowledgeable about curriculum, assessment, and instruction. Sanders and Rivers (1996) noted the effect of unsuccessful teaching cannot be easily compensated for by effective teachers in subsequent years; the teacher may be the most important factor in the academic growth of students. Therefore, learners should be taught by quality teachers from the beginning of their educational career.

Other researchers (Berliner, 1988; Borko & Putnum, 1996; Leinhardt & Greeno, 1986; Meyer, 2004) contend that deepening our understanding of the cognitive processes inherent in the teaching profession remains necessary to improve current practices of both pre-service and in-service teachers. Such understanding of cognitive processes will enable teacher educators to have a prototype of teaching of which they can expose preservice and in-service educators. Further, pre-service and in-service educators will have a model to guide their approach to teaching, potentially curtailing the possibility of early attrition rates in teachers leaving the profession because of feelings of being overwhelmed or ineffective.

Statement of the Problem

A lack of research on how expert teachers deliver instruction to African-American learners might contribute to why African-American students continue to underperform when compared to their White counterparts. Understanding how expert mathematics teachers of African-American students deliver instruction might lead to increased performance in African-American middle- and high-school mathematics students. This study provides insight into the world of expert

mathematics teachers of African-American students. Quantitative data posits that teacher behavior matters (Rivkin, Hanushek, & Kain 2000; Rowan, Correnti, & Miller, 2002; Wright, Horn, & Sanders, 1997). There is a gap in the literature documenting studies on how teachers reach and promote success in African-American mathematics students. As an interview study, this study begins to fill that gap by exploring how expert mathematics teachers of African-American students' employ pedagogical techniques to teach such students.

Purpose of the Study & Research Questions

The purpose of this study is to examine expert mathematics teachers' tacit knowledge (or not easily expressed), their pedagogy, behaviors, and routines. Research questions that guided the study were:

1. What strategies, routines and behaviors do expert teachers use to teach African American middle and high school students in mathematics?
2. How do expert teachers describe ensuring comprehension among African American learners?
    a. Do expert teachers tailor their instruction based on their students' culture?

Summary

There is a persistent gap in mathematics achievement literature between African-American learners and their White counterparts (Landson-Billings, 2006). It has been hypothesized that this gap has long-term ramifications for the learner that will impact the student beyond his or her time in school. The lack of ability to perform well in mathematics affects career choices and quality of life (Milner, 2007).

This gap continues to exist in schools although there are expert teachers within the confines of their classrooms who are able to close this gap. Although existing literature has revealed that

teacher behavior matters, research is lacking a holistic description of what expert teachers do in their mathematics classrooms to effectively educate African American middle and high school students. The following chapter reviews the literature informing the reader of the existing research in expert teaching and the achievement gap.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The following chapter presents a literature review that situates the current study. While a complete review of all existing literature on the constructs that support this study would be a massive endeavor, this review aims to illuminate a clear picture of the intersection of expertise, math teaching and the African American learner relate to achieving the current study's purpose. This chapter's purpose is to examine the literature the supports a study about expert teachers of African American Middle and High School Students.

Early Research of Expertise

In 1957, Noam Chomsky wrote *Syntactic Structures*. As a pioneer in the field of psycholinguistics, Chomsky helped establish a new relationship between linguistics and psychology. In Chomsky's view, linguistic knowledge and ability were the products of a language acquisition device (LAD) that enables each typically-developing child to construct a systematic grammar and generate phrases (Feltovich, 2006). According to Chomsky, this theory explains why children acquire language skills more rapidly than other abilities. Around that same time, progress accelerated in the field of information-processing and problem solving, especially in studies of expertise in chess (de Groot, 1946, 1965). After asking players to think aloud while they tried to choose the best move in an unfamiliar position, he discovered that the most proficient players did not think further ahead to plan their moves than did less-skilled players. But in a later study (1965) when he briefly presented chess positions, he found that skilled players had a superior memory for chess positions (by two to fifteen seconds), compared

to the novices in the study. De Groot concluded that expert performance in this domain has much to do with knowledge and perceptual organization.

These findings were constructivist in nature because de Groot (1965) posited that two people can look at the same stimulus and see totally different things. This occurrence prompted researchers to study the phenomena, beginning with a study of an expert's memory and perceptual abilities. Consequently, expertise can be most clearly understood by considering four different components including tacit knowledge, chunking, deliberate practice, and content knowledge.

An expert displays tacit knowledge when he or she is not aware of the knowledge they possess or how it can be valuable to others (Feltovich, Prietula, & Ericsson, 2006). Tacit knowledge is not easily shared. The tacit aspects of knowledge are those that cannot be codified, but can only be transmitted via training or gained through personal experience. Tacit knowledge as it relates to experts is important because it is not easily transferable. Experts are often less likely to share their knowledge, thus often not contributing to the development of novices into experts. In one of the earliest studies of expertise, de Groot (1946) attempted to codify the behavior of the chess grandmaster. It was later that he concluded that their tacit knowledge was derived from behaviors that had become automatic thus allowing the grandmaster to display automaticity. Automaticity happens as a result of chunking behaviors.

As an extension of De Groot's study, Chase and Simon (1973) found that the advantage for expert chess players was only obtained when they were viewed in chunked chess positions. Conversely, when pieces were randomly arranged on the board, there was little memory advantage for the player. This research was the beginning of the concept of chunking with importance associated with the acquisition of patterns to account for skill differences. Further,

the research provided some evidence that innate abilities in the form of knowledge, spatial abilities, or perceptual abilities were not the basis for expert behaviors.

Dreyfus (2004) rejected the notion that expertise is only a memory extension of the processes (or chunks) observed in everyday skill acquisition. According to his skill acquisition model, acquisition of skill proceeds in stages. During the first stage, people acquire both a cognitive representation of the task as well as the knowledge of how to react in typical situations to avoid errors. During subsequent stages, performance becomes smoother and more efficient. In the final stage, people are able to perform with a minimal amount of effort, and performance runs essentially automatic without active cognitive control.

Chase and Ericsson (1982) posited the Skilled Memory Theory which explained how, through deliberate practice, memory performance can be improved. The authors further noted experts can develop skilled memory to rapidly store and retrieve information using long term memory for information in their domain of expertise. Ericsson (2006) found that after 50 hours of practice, novice players could be trained to memorize chess positions at a level that approached that of grand masters.

The notion of deliberate practice requires activities that are designed, typically by a teacher or coach, for the purpose of improving specific aspects of an individual's performance. For example, the difference between expert musicians varying in the level of solo performance concerns the amount of time they spent in solitary deliberate practice during their music development. This time totaled around 10,000 hours by age 20 for the best experts, around 5,000 hours for the least accomplished expert musicians, and only 2,000 hours for serious amateur pianists (Lehman & Ericsson, 1998). Evidence from chess (Lehman & Ericsson, 1998) proposes that experts rapidly store information in long-term memory through two mechanisms which

include elaboration of long-term memory patterns and schemas and the use of retrieval structures.

Experts tend to display expert level performance in only one area of content knowledge**,** performance and/or profession (Glaser & Chi, 1988). Eisenstadt and Kareev (1975) studied the memories for displays within expert GO and Gomoko players. GO is an abstract strategy board game also called "Five in a Row" that is traditionally played with GO pieces (black and white stones) on a GO board. This research revealed skills were not transferable, although the boards for the two games were the same. In another study, Voss and Post (1988) gave political science problems to expert Russian political scientists and chemists. They observed that the political scientists performed no better than the chemists at finding solutions. Additionally, Johnson et al. (1981) found expert medical clinicians' had more differentiations in the diagnosis of common diseases than did novices. When investigating clinical reasoning for practitioners, their competence level depended on history with different types of cases (Barrows et al., 1978; Elstein et al., 1978).

While there is a clear path to understanding the research on expertise, the line that ties expertise and expert teaching is not a clear but is connected in the following section.

Foundation of Research on Expert Teaching

A second construct informing the current study is expert teaching - a very challenging concept to define. Educational practice has evolved into a practice in which teachers are required to deliver instruction that meets rigorous standards in the subjects they teach (writeslaw.com, 2009).

Because of these high demands, researchers have begun to evaluate the qualities of teachers suggesting both pedagogical proficiency and content area expertise. This heightened focus on teacher quality is a result of educational reforms (Dwyer & Stuffebean as quoted in Palmer, 2005), most recently the Bush Administration's No Child Life Behind Act of 2001 and Obama's Race to the Top Initiatives of 2009.

David Berliner conducted much of the seminal research on expert teachers (1986). Prior to this research, expert teachers (from a perspective of cognitive psychology) had not been defined. Thusly, Berliner (1987) defined an expert teacher is one who has completed a minimum of 7,000 hours, or 7 years of classroom teaching. In this instance the term "expert teacher" considers the qualities tacit knowledge, chunking, deliberate practice, and content knowledge). In Australia, Berliner (2004) found that non-exemplary experienced teachers took about 2.5 years to reach this level (displaying the ability to codify knowledge so as to draw on it again- and not be surprised in one's work environment) while exemplary experienced teachers took about 4.5 years. Those who reach this level of behavior in teaching have both an intuitive grasp of the situation and sense the appropriate response to be made in non-analytic and non-deliberative ways. In other words, according to Berliner, expert teachers display automaticity in teaching. Expert teachers engage in chunking behavior and their schemas are richer than those of novice teachers. Consequently, they are able to act with less effort, and conduct more than one teaching task at a time.

Experience alone will not make a teacher an expert, but it is likely that almost every expert teacher has had extensive classroom experience. Besides behaviors, Berliner (1991) posits that expert teachers have three types of knowledge:

Content Knowledge- a teacher's understanding of the structure, concepts, and relations among concepts, and ways of thinking that are characteristic of subject matter

Pedagogical Knowledge- the ability to transform content into the forms needed to be learned by students who are typically developing; and

Pedagogical Content Knowledge- concerned primarily with knowledge about classroom management, the organization of classrooms, assessment methods for motivation of students, personal knowledge about particular students and their families, and social-interactional skills

Dreyfus & Dreyfus' Five Stage Skill Acquisition Model

After Berliner (1994) conducted research on those who wanted to enter teaching (postulants), those who had been teaching for a few years (beginners), and those teachers who were identified by an elaborate process of nomination and classroom observation (experts), he posited a five stage heuristic theory on teacher development that was originally provided by Dreyfus and Dreyfus (1986). The characteristics of the teachers who fit into these characteristics are detailed below.

Novice (0-1 years of experience) – The commonplaces of an environment must be discriminated for learners who are within this stage. According to Berliner (2004), there are four commonplaces: teachers, subject being taught, to whom the subject is being taught, and where the subject is being taught. Within this novice stage, the teacher's practical knowledge includes a limited understanding of these commonplaces as well as some rules needed to begin to teach. These rules are general and are not dependent upon the teacher's classroom context. With regard

to behavior, the novice is usually rational, relatively inflexible, and tends to conform to whatever rules and procedures are set forth by those who are in authority.

Advanced Beginner (1-2 years of experience) – Case knowledge is built within this stage. There are four features of this type of knowledge which include being action-oriented, acquired without direct help from others, specific to the individual teacher and his or her context, and often implicit or tacit. Teachers are not always able to articulate this type of knowledge. Advanced Beginners also learn to label and describe events, follow context-specific rules, and recognize and classify contexts. They cannot, however, reliably determine what will happen through personal agency. In addition to these qualities, the domain-specific knowledge advanced beginners acquire through formal training is contextualized in this stage. In other words, an expert math teacher, for example, would be an expert in the context of an advanced calculus classroom (becoming an expert calculus teacher).

Competent Stage (3-5 years of experience) – The additional experience and motivation to succeed allow advanced beginners to become competent performers in their domain of interest. Competent teachers make conscious choices about what they are going to do. Second, while enacting their skills, competent teachers determine what is and what is not important. Schulman's Pedagogical Content Knowledge (1986) can be displayed by teachers who have reached this level of performance. Teachers stop making timing errors, no longer make targeting errors, and learn to make sensible curriculum and instruction decisions, such as when to stay on a topic and when to move on to another topic. What they are yet to develop is the speed, fluidity, and flexibility in their teaching behaviors.

Proficient level (5-7 years or experience) - According to Berliner (2004), a small number of teachers will move beyond competence. At this stage, intuition, or know-how becomes

prominent. Teachers develop a more holistic way of viewing the situations they encounter. Proficient teachers begin to recognize similarities and patterns in a classroom. Although intuitive in pattern recognition and in ways of knowing, those in this stage are likely to be analytic and deliberative in deciding what to do; however, they have not yet reached the point of displaying automaticity.

Experts – (7 or more years of teaching) - Those who reach this level of behavior in teaching have both an intuitive grasp of the situation and sense the appropriate response to be made in non-analytic and non-deliberative ways. They engage in qualitatively different ways than do novices or competent performers. Expert teachers are not consciously choosing what to attend to and what to do. They are, in fact, acting effortlessly, fluidly; they display automaticity in their ability to teach.

Other Research on Expert Teachers

Teaching is a complex cognitive process. One way to make sense out of this complexity is to analyze one of the three phases of teaching described by Artzt and Armour-Thomas (1999). These phases include the pre-active or planning phase, the interactive or monitoring and regulating phase, and the post-active or evaluative and revising phase. Several researchers have chosen to compare novice and expert behaviors during one or more of these phases to compare and contrast behaviors. As noted earlier, research on expert performance included novice-expert contrasts that have proven fruitful in the study of complex cognitive tasks such as playing chess (Chase & Simon, 1973) and solving physics problems (Champagne, Gunston & Klopfer, 1982; Chi, Feltovich, & Glaser, 1981).

When considering the interactive phase, researchers have argued (Borko & Putnum, 1996; Carter, Cushing, Sabers, Stein, & Berliner, 1988) that expert teachers have a richer, more

complex schema and are able to notice and remember subtle classroom events, focus on individual student learning, and adjust instructional strategies accordingly. Novices, by comparison, hold a less complex schema and focus on short-term planning. They also tend to demonstrate few instructional strategies that are linked to the abilities of the class as a whole. Novice teachers also weigh more heavily the interest of the class toward a given topic to design instructional strategies than emphasize student achievement or understanding.

When considering the interactive phase, Leinhardt and Greeno (1986) found that expert teachers teach in three stages that include classroom discussion, public shared work, and independent seatwork. Routines for novices tended to be new each year with no clear effective pattern emerging. Meyer (2003) found that for novice teachers, students' prior knowledge was the result of prior teaching and could be defined by what students formally knew about a concept; a teacher would want to be sure that the proper information foundation was in place before new learning could take place. If students had misconceptions, then the teacher could replace the faulty information brick with a new one before going on in their teaching. On the other hand, the expert teachers emphasized the role of students' ideas and explanations as central to prior knowledge. Therefore, prior knowledge was important in learning because it revealed how students put their ideas together. If the student had misconceptions then the expert teacher became responsible for enabling the student to think of a new way about the concept. Novice teachers did not plan far ahead and admitted to being only pages or a section ahead of the students.

In a study about student comprehension, Leinhardt and Greeno (1986) observed and interviewed eight expert teachers who were selected on the basis of past student achievement, and four novices, identified as strong candidates from a mathematics methods course. During a

period of three and a half months, the researchers observed both expert and novice teachers in an elementary school. A portion of observations took place during mathematics instruction. Findings revealed that experts, when compared to novices, spent less time shifting from one class activity to the next, presented more concepts and ideas within a shorter amount of time, and were more consistent and efficient in probing for student comprehension through the use of questions and discussion. Additionally, experts used more guided and monitored practice during the lesson than did the novice and spent less class time completing these tasks.

Leinhardt (1989) investigated the elements a teacher needed to construct expert mathematics lessons. She conducted research on two novice (student teachers) and four expert elementary mathematics teachers. The experts were identified by reviewing the achievement growth scores of students in the district where students' growth scores were in the top 15% for at least 3 years in a 5-year period. She found that expert teachers employed rich agendas, flexible lesson structures, and explanations that clarified concepts and procedures. Novice teachers delivered fragmented lessons with long transitions between lesson segments, displayed frequent confusion caused by missing signals, and displayed ambiguous systems of goals that often appear to be abandoned rather than achieved. Novices demonstrated significant subject matter competence but did not access that knowledge while teaching. Their lessons did not fit well together within or across topic boundaries.

Borko and Livingstion (1989) conducted observation and interview research to investigate the nature of pedagogical expertise by comparing the planning, teaching, and post-lesson reflections of three student teachers and (two secondary and one elementary) with those of the cooperating teachers with whom they were placed. In regards to planning, novice teachers demonstrated more time-consuming, less efficient planning, and encountered problems when attempts to be

responsive to students led them away from scripted lesson plans. The novice teachers also reported more varied, less selective post lesson reflections than experts. The novice teachers' cognitive schemata were less elaborate, interconnected, and accessible than experts' and that their pedagogical reasoning skills were less well-developed.

To determine how well each teacher could decode student understanding, Stader, Colyar and Berliner (1990) devised and administered tests to determine student knowledge and watched videotapes of students to compare the students' results to nine novice, ten advanced beginner, and ten expert teachers. They found that accuracy in decoding student comprehension is trainable; the teachers' classroom knowledge and knowledge of the student increases the accuracy of determining student comprehension.

In a literature review conducted by Hogan, Rabinowitz & Craven (2003), novices tended to focus on short-term planning whereas expert content specialists focus on both long- and short-term curriculum developments during the planning phase of teaching. Novices concentrated on short-term planning and tended to generate highly scripted and mentally well-rehearsed instructional strategies. Expert curriculum plans (long-term) and lesson plans (short-term), however, were largely unrehearsed and unscripted. Specifically, experts were found to engage in various tiers of curriculum development including yearly, unit, and daily planning. Additionally, the amount of written planning was kept to a minimum, highlighting the main components of the lesson while the remaining part of the lesson was stored mentally. These mental operations included the timing and pacing of the presentation and the number and types of the examples used to teach the mathematical concept. Novice teachers also incorporated this type of mental planning but to a more specific degree, such as scripting introductions or parts of the lesson and determining ahead of time the types of questions they would ask during the lecture.

Criticisms of Studying Teaching Expertise

The study of expert teachers is complicated by two factors. In general, it is hard to identify expert teachers because there is no test of widely accepted standards to determine the existence of teaching expertise. To resolve this problem, Berliner (2004) identified National Board Certification (NBCT) as a qualifier of an expert teacher. Additionally, although it is often hypothesized that the outcomes of instruction for students of expert teachers include higher motivation to learn and higher feelings of self-efficacy, higher levels of achievement, and deeper rather than a surface understanding of the subject matter, it was challenging to document whether the behavior of expert teachers has positive effects on student achievement, although NBPTS has claimed that their teachers have a positive effect on their students. The current study will address both of these issues by determining malleable factors that determine expert teaching in a particular context as well as linking these factors to student achievement.

Another problem that arises when researching expert teachers is the finding that teacher behavior is connected to actions and to places; that is, they are situated. This situation was presented by Berliner (1988) when he conducted an experiment where experts, advanced beginners, and novice teachers were asked to teach a 30 minute lesson on probability. Although the experts were judged to be better at teaching, they noted not having enough time to plan, being pulled out of their own classrooms to a laboratory setting, and a lack of familiarity of the students. One would expect an expert to be an expert in any setting in which he or she had to perform. But in research conducted by Bullough and Baughman (1997) highly accomplished teachers who changed the school in which they taught and struggled greatly to find success in the classroom. Stader, Colyer and Berliner (1990) found teachers who watched video recordings of students with whom they were unfamiliar could not decide whether the students comprehended

lesson materials. Finally, Schemp, Manross, Tan and Fincher (1998) studied physical education experts in and out of their areas of expertise. They found that the same teacher who was judged to be proficient at teaching fitness activities struggled when it came to teaching racket sports.

Mathematical Knowledge for Teaching (MKT)

According to Ball (2002), the notion of pedagogical content knowledge has brought about questions on the content and nature of teachers' subject matter understanding. Knowing mathematics content for teaching requires a transcendence of the tacit understanding that characterizes much personal knowledge (Polanyi, 1958). It also requires a unique understanding that combines the aspects of teaching and learning with content.

In their study, Ball & Bass (2003) mobilized an interdisciplinary group representing expertise in teaching practice, in disciplinary mathematics, in cognitive and social psychology, and in educational research. Citing a report from the National Commission on Teaching and America's Future (NCTAF), Ball asserts that teachers must know the content thoroughly in order to be able to present it clearly, to make ideas accessible and toe engage students in challenging work. NCTAF had reached this conclusion based on studies that show that teacher knowledge make a substantial contribution to student achievement. Using this framework for examining practice, Ball focused on mathematics as it emerges within the core task domains of teachers' work.

In developing the framework for Mathematics Knowledge for Teaching (MKT), Ball used a large longitudinal NSF-funded database, documenting an entire year of the mathematics teaching in a third grade public school classroom during 1989 -1990. The records collected across that year include videotapes and audiotapes of the classroom lessons, transcripts, copies of students'

written class work, homework, and quizzes, as well as the teacher's plans, notes, and reflections. The research team looked both at specific episodes as well as instruction over time to examine the work of developing both mathematics and students across the school year.

What is MKT?

Mathematics Knowledge for Teaching (MKT) is a framework that seeks to identify the work of teachers and to analyze what these reveal about the content demands of teaching. Edward Begle (1979) is often credited with conducting the earliest attempts to investigate the relationship between teachers' mathematics knowledge and their students' achievement. In his research, he analyzed how the number of math courses teachers had taken beyond calculus affected student performance and found that taking advanced mathematics courses produced marginal positive main effects on students' achievement (only 10%) and negative main effects in 8%.

But the quality of teaching is affected by the teachers' understanding of and agility with math content. Eisenhart, et al (1993) conducted observational studies of beginning and experienced teachers. In particular, one teacher was asked by a child to explain why the invert-and-multiply algorithm for dividing fractions works. After an attempt to explain, she stopped working on the problem- and her explanation- and told the children to "just use our rule for right now."

In 1996, the National Commission on Teaching and America's Future (NCTAF) released its report which proposed a series of strong recommendations for improving the nation's schools. The report claimed teachers' thorough knowledge and ability to utilize that knowledge is the most important influence on student learning. Perhaps most importantly, the report argues that differences in teacher qualifications accounted for more than 90% of the variation in student achievement in reading and mathematics (Armour-Thomas, Clay, et al., 1989, as cited in National Commission on Teaching and America's Future, 1996).

Ball and colleagues (2002) were guided by the overall hypothesis that teachers' opportunities to learn mathematics for teaching could be improved if the components of the job could be articulated more clearly. Additionally, if mathematical knowledge required for teaching is indeed multidimensional, then professional education could be organized to help teachers learn the range of knowledge and skill they need in focused ways. If, however, the mathematical knowledge required for teaching is basically the same as general mathematical ability, then discriminating professional learning opportunities would be unnecessary. Building on Shulman's assessment of PCK, Ball formulated the structure. MKT is divided into two subgroups: Subject Matter Knowledge and Pedagogical Content Knowledge. Subject Matter Knowledge focuses more on content and Pedagogical Content Knowledge focuses on the knowledge about students.

PCK, MKT & Teaching Expertise

According to Berliner (1987) beginning teachers need expert cases of practice to develop a full understanding of pedagogy. This statement was made again by David Berliner one year after Lee Shulman (1986) spoke it at the American Educational Research Association (AERA) national convention. Both Shulman (1986) and Berliner (1987) posit that the study of teacher behaviors is an important endeavor.

Of the characteristics set forth by Berliner (2004), the ones most related to domain knowledge are: (1) the ability to represent (describes or display) problems in qualitatively different ways than do novices; (2) fast and accurate pattern-recognition capabilities (novice teachers cannot always make sense of what they experience); (3) the ability to perceive meaningful patterns in the domain in which they are experienced; and (4) the ability to bring richer and more personal sources of information to a problem they are trying to solve. Therefore, Shulman's Pedagogical Content Knowledge (PCK) and Ball's MKT can be found in the

Knowledge of Content and Teaching (KCT) as displayed in the competent stage of Berliner's Skill Acquisition model.

It is important to note that expertise is operationalized from constructs in cognitive psychology and PCK and MKT derived from researchers in teacher (and mathematics) education. Although cognitive psychology is often thought of from a positivistic perspective (holds the scientific method, or quantitative inquiry, is the best approach to uncovering the processes by which both physical and human events occur) and teacher education from a more interpretive perspective (gaining insights through discovering meanings by improving comprehension of the whole through qualitative inquiry), these two areas of study can be considered simultaneously from a constructivist epistemology and observed using qualitative inquiry. Experts are experts because they see information differently than do other people and express their knowledge in qualitatively different ways than do non-experts.

Research indicates that what teachers do in the classroom has an effect on the academic performance of their students (Berliner, 1991). What is lacking from this research is a qualitative description of the effective pedagogical behaviors teachers practice in the classroom. By combining what is known about expertise in general and teaching expertise, as well as PCK and MKT, this project will demonstrate expert mathematics teachers of African American students will have a rich content knowledge in mathematics and display automatic behaviors. Further it is hypothesized that because expert teachers have tacit knowledge, they will have a difficult time articulating their practices. This project will codify these behaviors and potentially contribute to closing the research gap about expert mathematics teachers and their African American students.

The Intersection of Teaching Expertise and African American Learner

The final literature that informed the current study includes a brief explanation of the African American learner in the American public school setting. In the well-known Brown vs Board of Education class action suit of 1951, 13 parents filed against the Board of Education of the City of Topeka, Kansas in the United States District Court. On May 17, 1954, the Court unanimously (9–0) decided that African American students did not have equal rights and protection under the law (14th Amendment) when they attended segregated schools; the doctrine of separate but equal in public school systems had been challenged and ultimately overturned.

Nearly three years later on October 4, 1957, Soviet scientists put Sputnik, the first man-made satellite, into orbit. A Time magazine article (Winkle-Wagner, 2009) noted that if the Soviets had rockets powerful enough to launch a 184.3 pound satellite into orbit, they were capable of propelling nuclear warheads to the American heartland. The New York Times response was a series of articles suggesting that one of the primary reasons for the U.S. losing the race to space was the failure of the federal government to invest in technical and scientific education (Klein, 2003).

Congress responded to this criticism by passing the 1958 National Defense Education Act to increase the number of science, math, and foreign language majors, and to contribute to school construction and to improve instruction in those areas considered crucial to national defense and security. This move illuminated the lack of performance of American students in mathematics and science. Some attribute Sputnik's launch as one of the catalysts to what came to be known as the mathematics wars (Klein, 2003) which often left poorer, African American students to learn mathematics in a traditional way (involving memorization of algorithms) and White students to benefit from a more constructivist approach to learning mathematics—thus affecting African

American students' performance in mathematics in a negative way. This difference was due to the type of teachers that African American and White students had.

Between 1958 and 1964 President Lyndon Johnson took over for the slain John F. Kennedy and signed the Civil Rights Act on July 2, 1964. As part of this Act, James Coleman, Ernest Campbell, Carol Hobson, James McPartland, Alexander Mood, Frederick Weinfeld, and Robert York were commissioned to conduct the first large-scale study of public schooling in the United States. The final product was entitled Equality of Educational Opportunity, but it has been more commonly referred to as the Coleman Report.

The study found that school quality had very little effect on achievement; the student's background was most influential, followed by teacher quality, with school quality and school resources coming in as the least important factors related to the academic achievement (Gooden, 2004). It also argued that because of this consistent test gap, schooling provided few opportunities for African American students to overcome this initial inequality. In fact, given the one standard deviation difference in test scores, the study suggested that the cumulative effects of this test score gap actually increased for African American students as they progressed through schooling. In other words, the effects of this gap in test scores would become greater for African American students in the upper grades.

These findings had a major impact on research and policy. From a policy standpoint, this finding undermined the rationale for requesting increased funding for schools from the federal government (Wong & Nicotera, 2004). In addition, the finding that school quality was barely related to academic achievement had consequences for the way African American students were studied and discussed in research. Some began to speculate about the difference in intelligence between African American and White students claiming that if schools were not able to

overcome inequalities in achievement it was because some students (African American students in this case) had lower intelligence than others (White students).

In addition, because the findings of the Coleman Report shifted away the responsibility of closing the gap from the school in terms of their quality resources, provoking a new emphasis on the family offering interventions in home environments as being the way to overcome inequality. Many subsequent studies in education began to explore students' racial and socioeconomic background that attempted to offer suggestions for ways that students' backgrounds could affect academic achievement (Heckman & Neal, 1996). Thus, there was a shift in research and a national discussion toward blaming students, students' families, and students' general background for the achievement gap between African American and White students.

Since the Coleman report, the achievement gap in both mathematics and reading has improved. When comparing the early 1970s to 2012, non-White students demonstrated increases in standardized test performance; African American students scored 36 points higher (or 15 percentile points) on the NAEP mathematics test and about 25 points higher (or 20 percentile points) in reading than African American learners did 30 years before. Similarly, Latino students made improvements by 17 percentile points on the NAEP mathematics test and 10 percentile points in reading.

From the early 1970s to the late 1980s, these gaps closed. The change in the mathematics achievement gap over this period showed 48 percent decline. These trends resulted in the achievement of African American students increasing while that of White students remained constant. Since cognitive skills were moderately strong predictors of adult wages in the mid-1980s (Murnane, Willett and Levy, 1995; Neal and Johnson, 1996) these trends were hopeful

predictors of progress towards closing racial gaps in economic outcomes that had plagued the United States for decades.

Summary

This chapter reviewed the existing literature on expertise, expert teaching, Pedagogical Content Knowledge (PCK) and Mathematical Knowledge for Teaching (MKT). Further, the intersection of public school desegregation, the USSR launch of Sputnik, the Coleman Report and trends in the achievement gap was discussed, and reasons why the gap persists were presented. Although there is a massive amount of information about these various subjects, scholarly studies that discuss the behaviors of expert mathematics teachers of African American students are noticeably lacking. This project serves to help close this gap.

CHAPTER 3

RESEARCH METHODS

Theoretical Framework

The purpose of this study is to examine the expert math teachers' tacit (or not easily expressed) knowledge with respect to their pedagogy, behaviors and routines utilizing semi-structured interviews.

This study is epistemology based in constructivism. Constructivists are guided by the belief that knowledge is constructed by those who are acquiring the knowledge. Constructivists assert that connecting previous experiences and knowledge to new concepts enhances learning (Crotty, 1998). Because the theories of expertise posit that expertise is not innate, but that experts develop expert performance after years of contextual experiences in their fields, it is logically sufficient to posit that expert knowledge is constructed.

The expression "Constructivist Epistemology" was first used by Jean Piaget in 1967, in the well-known article from the "Logic and Scientific knowledge", an important text for epistemology. Because Piaget believed that children needed to construct an understanding of the world for themselves, his stage theory became known as Constructivism. Constructivism is in contrast with behaviorism (learning theory) in which development is a result of different forms of learning. Here, the learner responds to stimuli; he is a passive recipient of environmental influences that shape behavior. This is also different from social learning theory which focuses on learning by observation as opposed to the constructivist method of learning by interaction.

My theoretical perspective is social constructivism. Often attributed to Lev Vygotsky, social constructivism extends constructivism by including the role of other individuals as well as culture in development. While Piaget's work focuses on self-initiated discovery, motor reflexes and sensory abilities of learners, Vygotsky placed more emphasis on the social contributions to the process of development as well as on the learner's Elementary Mental Functions including concepts such as the More Knowledgeable Other (MKO) and the Zone of Proximal Development (ZPD). Vygotsky (1976) summarized social constructivism in the following basic tenants:

- Through interaction within the socio-cultural environment, a person's Elementary Mental Functions develop into more effective mental processes which he refers to as Higher Mental Functions.
- These cognitive functions, even those carried out alone, are affected by the culturally determined beliefs, values and tools of intellectual adaptation (such as memory mnemonics, mind maps, memory chunks).
- These tools vary from culture to culture (Vygotsky, 1978).

Working within a Social constructivism perspective the researcher discusses meaning in terms of the subjective meaning the participants give their actions. While conducting the study, the researcher focuses primarily on the participants' views of actions, being careful to be mindful that the social nature of knowledge, and the belief that knowledge is the result of social interaction and language usage, and is a shared (and not an individual) experience (Prawatt & Floden, 1994). Further, being guided by this perspective allows me to always be present to the notion that social interaction always occurs within a socio-cultural context, resulting in knowledge that is bound to a specific time and place (Gergen, 1995; Vygotsky, 1978). In other words, for he social constructivist, knowledge is subjective. The goal of seeing the situation or

event from the participants' perspective. With this goal researchers must take care not to impose their own meaning onto the situation or experience when analyzing the data.

The research process I followed for my dissertation reflects my epistemological stance and theoretical perspective. The interview guide was designed to be open and flexible so that participants were not guided in their answers, but could provide their subjective truths. My interview guide is provided in Appendix A. Finally, in addition to informing the design of my study, my constructivist view of the world also significantly influenced how I have presented my findings. Coming from a constructionist viewpoint, I am sensitive to the notion that the meaning ascribed is culturally mediated. The themes I uncovered regarding the relationships among expert teacher and student were shaped by the myriad of aspects that up the total teaching environment. This realization shaped my thinking and the discussion of my findings.

Methodology

Participants & Data Collection

A pool of Georgia's Nationally Board Certified Middle and High School math teachers were recruited to participate in the study via email invitation. Fifteen of these teachers responded and agreed to be a part of the study. A letter formally explaining the study was forwarded to the participants, along with documentation that needed signatures (to be collected at the times of the interview) (see appendix B&C). Interviews were recorded using a recording device, and later transcribed. Novice teachers were recruited via personal invitation at a local area high school. They were forwarded the documentation to sign as were the expert teachers.

The expert teachers who participated in this study met the following criteria: Teachers who volunteered to participate in this study were Nationally Board Certified (McColskey, et al, 2006)

having taught mathematics in middle or high school – and have done so for at least seven years. Middle and high school teachers who were chosen for this study were required to have certification in mathematics; consequently, these teachers possessed sufficient knowledge and training within the domain. National Board Certification is a requirement in the study, because these teachers are thought to possess behaviors that are closely related to the qualities found in expert teachers (Berliner, 1986). Seven years of experience was chosen as a criterion based on David Berliner's theory (2004) that teachers do not reach this level until they have been in the classroom for five years. Additionally, participants taught in a non-rural school district (the district must have more than 100,000 residents residing in the county, or is adjacent to a county with at least 100,000 residents) (Cromartie, & Bucholtz, 2008). The criteria for non-rural has been defined by the US Department of Agriculture. Teachers in this study were be employed in a Title I school (40% or more of the students in this school receive free or reduced lunch).

Novice teacher participants taught no more than 2 years.

Below is a table of the study's participants, along with pertinent demographic information. All names below are pseudonyms, but the demographic information about the participants is factual.

Table 1 - Participants

	Race	Gender/Sex	Years Taught
Mr. Johns	White	Male	20
Mrs. Davis	White	Female	18
Ms. Paglio	White	Female	9
Ms. JamesJohn	White	Female	33
Mrs. Mathis	White	Males	18
Ms. Stephens	African American	Female	Over 20
Ms. Roberts	White	Female	23
Mr. Smith	African American	Male	9
Ms. Ronello	White	Female	26
Mrs. Richards	White	Female	23
Mrs. Chaney	African American	female	8
Mrs. Wright	white	female	19
Ms. Rogers	white	female	Over 20
Mrs. Dorsey	African American	female	12
Mrs. Hardy	white	female	27
Mr. Jonas	African American	Male	1
Ms. Bing	White	Female	1
Ms. Hankerson	White	Females	1
Ms. Vanderbilt	Asian	Male	1
Ms. Ronin	White	Female	1

Data Analysis

The objective of this study was to identify factors relevant to three research questions as reflected in the interview data from 15 expert teachers and five novice teachers. Each interview was a single incident. In other words, each was considered individually in the analysis. Common themes were identified across the data to answer the research questions.

According to Creswell (2009), the process of data analysis involves making sense out of text and data and preparing the data for analysis, conducting different analyses, moving deeper and deeper into understanding the date, representing the data, and making an interpretation of the larger meaning of the data. I searched for patterns, themes, and dimensions in the data through analysis of the interviews, coding of the data, through this process, further analysis as themes and patterns emerged. My goal was to describe the participants' subjective experiences and views.

The first level of identification occurred during the initial review of each interview transcript. Upon receiving the transcripts, the researcher read each transcript, analyzed the data for each interview, and then conducted open coding utilizing NVivo software, which is an analytic tool to facilitate the coding process.

I used open coding, which utilizes a brainstorming technique described by Corbin and Strauss (2008) to be open to analyzing data with all potentials and possibilities contained within them. In open coding, the researcher thoroughly reviews the data contained within the data set before beginning to group and label concepts. The process of coding is taking the raw data and pulling out concepts and then further developing them in terms of their properties and dimensions, and grouping them into themes.

The data analysis process included the following steps:

1. Review all interview transcripts
2. Import the data into NVIVO
3. Code the data in NIVIVO using open coding and key words
4. Define the properties of the dominant themes.
5. Code all data using identified themes and subthemes.
6. Examine results for expert teachers
7. Examine results for novice teachers
8. Compare results for expert and novice teachers.

The resulting themes were described in the summary of the research findings found in chapter four of this study. The findings are described with regard to the themes across the data for expert teachers, for novice teachers, and the comparison between the results for expert and novice teachers.

Validity, Trustworthiness, and Reliability

Qualitative validity, according to Creswell (2009), means that the researcher checks for the accuracy of the findings by employing certain procedures. Validation of findings in qualitative research occur throughout the steps in the process of the research (Creswell, 2009). I did a continual check during the coding process to ensure that coding did not drift from the original intent as the coding process evolved.

I used an electronic codebook within NVivo to code the data. As only one researcher was responsible for analyzing the data; there was no need to cross check for intercoder agreement.

I interviewed 20 teachers who volunteered for the study. The expert teachers had to have been teaching at least seven years and had to have obtained National Board Certification.

Interviews took place both in person and via telephone and were audio recorded and then transcribed. Data was analyzed to determine the teachers' perception of their behaviors, and to establish themes for this data.

Establishing Quality

According to Roulston (2010), quality in interviewing ensures that (1) the use of interview data is an appropriate means to inform the research questions posed; (2) the interaction facilitated by interviewers within the actual interview generated "quality" data – for example, interviewers asked questions in effective ways to elicit the data required to respond to research questions, and both speakers adequately understood one another's intended meanings; (3) "quality" has been addressed in research design, the conduct of the research project, and the analysis, interpretation and representation of research findings; and (4) the methods and strategies used to demonstrate the quality of interpretations and representations of data are consistent with the theoretical underpinnings for the study. Consistency was ensured by developing an interview guide that was based on research that fueled this study.

I adapted Strauss and Corbin's (1990) thematic coding as a technique for coding participants' teaching behaviors. The development of categories was an ongoing process that allowed me to generate emerging. As each set of transcriptions were coded, both the codes and the categories were defined.

Researcher Subjectivities

Peshkin (1988) states that subjectivity is not a badge of honor paraded around on special occasions for all to see. Whatever the stance of one's persuasion is at a given point, one's subjectivity is like a garment and cannot be removed." It is present in both the research and non-research aspect of our lives. Although the idea of a researcher being subjective is often viewed as

a negative part of his or her make-up, one's subjectivity can be monitored and controlled and perhaps contributed to the research. My approach to this study is viewed through several subjective lenses.

Teacher Lens – After some time in Corporate America, I decided that I wanted to do my part to improve my community by entering the field of education. Upon near completion of my master's degree in School Psychology, I began teaching in a Title I elementary school. Among the many surprises that this transition provided for me, I was very shocked as to how my colleagues viewed their students' reading skills as paramount to their mathematics skills. Perhaps because the teachers lacked strong mathematics skills of their own, the school at which I taught seemed to ignore the fact that their students often did not display the most basic skills (multiplication facts, understanding concepts such as addition, subtraction and division).

Cultural Lens-I am African American. I study cognitive psychology- and not math. Consequently, I am often asked why a Cognitive Psychologist would be concerned with pursuing research about expert teachers of African American math students. I respond with the following:

"All children need to know how to do math. Disadvantaged students (African Americans in particular) score four grades below their white peers in mathematics (Thernstrom & Thernstrom, 2003) and only half of African American students demonstrate basic math skills (NAEP, 2009). Their chances of gaining acceptance into the college or university of their choice will probably be dashed because of their math Scholastic Aptitude Test (SAT) scores. Pursuits of technical and professional careers are greatly diminished, if not destroyed, simply because affected students did not develop the basic math skills necessary to perform adequately in middle and high school. Therefore, math education serves as a gatekeeper to a more economically

productive future. Echoing Robert Moses (2001), obtaining an adequate education in math is both an academic and a civil right."

Summary

The purpose of this study is to examine the expert math teachers' tacit (or not easily expressed) knowledge with respect to their pedagogy, behaviors and routines utilizing semi-structured interviews. The participants are expert and novice teachers form middle and high school within the state of Georgia.

Additionally, this chapter described the constructivist approach to collecting and analyzing the data in this study. The steps that were taken to collect and analyze data gathered during the present study were also detailed here. Finally, the researcher's subjectivities were described. The next chapter will describe the findings of the data described in the current chapter.

CHAPTER 4

ANALYSIS OF THE DATA

Introduction

The purpose of this qualitative study is to examine the expert math teachers' pedagogy, behaviors and routines when teaching African American middle and high school students. To assist in better understanding these teachers, 15 expert teachers and 5 novice teachers of mathematics took part in semi-structured interviews. Including data collected from novice participants in this study is important to the study's findings, because they provided insight that (absent some sort of incorporation of a comparison [novice] group in this study) it could be assumed that the reported behaviors of expert teachers are that of those who have not demonstrated any expert behaviors at all. Including novice data in this study eliminates any such uncertainty. Additionally, David Berliner (2004) – a pioneer of studying teaching expertise in the field of educational psychology - often compared expert teaching behaviors to those of novices.

David Berliner conducted much of the seminal research on expert teachers (2006). He defined an expert teacher is one who has completed a minimum of 7,000 hours, or 7 years of classroom teaching (Berliner, 2006). In this instance the term "expert teacher" considers the qualities tacit knowledge, chunking, deliberate practice, and content knowledge). In Australia, Berliner (2004) found that non-exemplary experienced teachers took about 2.5 years to reach this level (displaying the ability to codify knowledge so as to draw on it again- and not be surprised in one's work environment) while exemplary experienced teachers took about 4.5 years. Those who reach this level of behavior in teaching have both an intuitive grasp of the situation and sense the appropriate response to be made in non-analytic and non-deliberative ways. In other

words, according to Berliner, expert teachers display automaticity in teaching. Expert teachers engage in chunking behavior and their schemas are richer than those of novice teachers. Consequently, they are able to act with less effort, and conduct more than one teaching task at a time.

The research questions that guide this study are:

1. What strategies, routines and behaviors do expert teachers use to teach African American middle and high school students in mathematics?
2. How do expert teachers describe ensuing comprehension among African American learners?
    a. Do expert teachers tailor their instruction based on their students'' culture?

The information gathered through this study's interview process was organized into meaningful units of analysis. The primary behavior, routine and pedagogy that emerged from the data were remediation, planning, and introducing a new concept. Additionally, the majority expert teachers report that they teach their students' the same, regardless of their cultural background in this study. The findings are summarized below in table 2.

Table 2- Summary of Findings

	Percentage of Expert Teachers Mentioning the theme	**Percentage of Novice Teachers Mentioning this theme**
Remediation		
Use tools	67%	40%
Questioning	20%	60%
Peer scaffolding	40%	40%
One on one	53%	80%
Move on	67%	60%

Back up or clarify	80%	80%
Planning		
Uses State Standards	53%	80%
Planning as you move along	7%	60%
Plan with others	47%	80%
Plan ahead	80%	40%
Lesson plan	20%	0%
Introduce a New Concept		
Using tools	87%	40%
Use previous knowledge	53%	0%
Identify errors and misconceptions	27%	20%
Be hands on	33%	20%
Ensuring Comprehension		
Assessments	93%	100%
Use of Tools	67%	0
Develop Respectful Relationships	53%	40%
Group Work and Collaboration	33%	40%
Discussion	26%	40%
Connect to Other Material	20%	20%
Tailor Instruction To Student's Culture		
Teach them all the same	69%	40%
Tailor to gender	40%	20%
Tailor to African American boys	40%	0
Tailor to ethnicity	13%	20%
Try to reach them	20%	0
Difficulty addressing culture	0	40%

Remediation

This study found that one of the most prevalent teacher behaviors is remediation. Remedial education is formally defined as an instruction designed for students who have deficiencies in reading, writing and math. In the state of Georgia, this program provides individualized basic skills instruction as mandated by Georgia Law in the areas of reading, mathematics and writing (Lee, 2002). According to Nicole Beurkens (2008), informal remediation takes place when a

teacher applies an approach to correct the problem that is preventing the student from being functional in the content area. Remediation takes place to get to the problem and overcome the issues that are preventing successful performance. Many teachers provide informal remediation to students who display gaps in their content knowledge. In this study, the participants remediated using several methods. Among expert mathematics teachers of African American teachers who practiced remediation, one of six types of remediation was used. These specific types of remediation are back up and clarify, move on, use tools, one-on-one, peer scaffolding, and questioning.

Back up or clarify refers to backtracking to help students understand the material and clarifying math concepts that some students did not grasp. Move on refers to moving on to new concepts when some students still do not understand the concepts. Use tools refers to using tools during remediation. One on one refers to the use of one-on-one interaction with the teacher to remediate. Peer Scaffolding refers to the use of peers to help clarify concepts that students do not understand. This can include one-on-one work with another student or working in a larger group. Questioning refers to questioning students to understand where remediation needs to occur and what concepts students do not understand.

During the study, teachers gave many examples of remediating through back up and clarify. Mr. Smith, a nine year African-American teacher describes his practice of beginning each lesson with a skill that should have been previously acquired and incorporating the skill with his lesson if students continue to struggle.

> "Just to give me an idea who understands what ….Or understand what they want to know about a topic. And if it's a fundamental skill that they should have prior to doing the lesson for the day, I typically open my lessons up with some type of activity, a warm-up, a problem solving moment where students participation in getting the work done with give me indication as to what skills they are struggling with. If there's some are real critical, that's necessary to doing the concept for the day, I'll take time from the regular

> lesson to repeat that skill, that concept, that prerequisite skill, to make sure that they're strong enough in that. So they can be successful on what I'm teaching them next".

Ms. Ronello, a White teacher of 26 years commented on her similar approach to 'back up and clarify'…

> "So, I just kind of revisit some of these things. Like you say, using them as warm-ups, or you know, like, in my-, with the other teachers that I have to collaborate with, sometimes we'll say, 'Let's put one of those questions on this next test.' Or, maybe we'll make it a bonus question on the test."

Planning

The next theme the data yields was the routine of planning. A lesson plan is developed by a teacher to guide instruction (John, 2006). The lesson plan traditionally includes the name of the lesson, the date of the lesson, the objective on which the lesson focuses, the materials that will be used, and a summary of all the activities that will be used. Within the current study, the participants mention five ways in which they plan their lessons: (by) planning ahead, using state standards, planning with others, planning as they move along, and the utilization of daily lesson plans.

Plan ahead refers to long-term planning curriculum in advance. Use of state standards refers to the use of state standards to guide the teacher in planning their lessons. Plan with others refers to planning collaboratively with other teachers. Planning as you move along refers to planning ahead for a short period of time (e.g., the next class, or a week to a month in advance). Utilizing Lesson plan refers to using formal and informal lesson plans on a daily basis.

Ms. Davis, a White teacher of 18 years, explains how her ability to deliver content effectively developed in conjunction with her planning.

> "My planning has kind of evolved over time. When I was a new teacher, I planned probably a week at a time. And I was pretty much learning as I was going. I knew the content pretty well, but I didn't really know how to teach the content. …And as I became more experienced, I started planning in longer periods of time, like units. Now, sometimes I would teach, if I had a preparation that I taught year after year, then it was easier for me to plan a year at a time. But, I typically wouldn't plan more than a semester at a time just because I wanted to be able to have a flexible".

Mrs. Dorsey, African American teacher of 12 years explains her method of planning ahead at the beginning of the year.

> "I would do a lot of the big stuff, big ideas, at the beginning of the school year or over the summer. And then I would tailor each of the lessons as I needed to. So, sometimes I would sit up in the middle of the night, and come up with what concept I could teach the students. And then I would begin that concept (what came to my mind in the middle of the night) the next day. But it depends on what I'm teaching, where I am. Because I try not to explain things the same way every time. I probably give a variety mix because there's all types of learners. And so I would, you know, make some adjustments. Whenever the moment or mood came across me, I would plan."

Introducing a New Concept

Math is abstract and can be difficult for students to understand. Consequently, the National Council of Teachers of Mathematics (NCTM) has urged teachers to focus on students understanding and conceptualization (NCTM, 2012). Additionally, students need instruction that helps them develop conceptual understanding and provides them with opportunities to practice procedures that are meaningful for them (Gauthier et al, 2014).

Within this study, the third primary pedagogical approach of the expert participants was Introducing a New Concept. The participants described four ways in which they went about introducing a new mathematical concept to their students: using tools, use previous knowledge, be hands on, and identify errors and misconceptions. Using tools refers to using a variety of tools to introduce a new concept. Using previous knowledge refers to using or building upon students' previous knowledge when introducing a new concept. Being hands on refers to allowing students to be "hands on" when learning a new concept. Identify errors and misconceptions refers to teachers identifying specific errors and misconceptions when introducing a new concept.

Mr. Johns, a white male teacher of over 20 years explained how he used a memory tool, or pneumonic to teach math:

> "And there is, there's a memory skill called "Please excuse my dear Aunt Sally." Which-, which gives you the order of the operations, the arithmetic operations that you do when you have a combined problem. So, so you start with the powers, which is "please". And then exponents, and then multiply, divide, add, subtract".

Ms. Hardy, a white female teacher of 27 years explained how she would introduced a concept with another tool.

> "And after the activity, you will get your vocabulary and then you start your word wall going. And you, you know, and you get your little product for they already have something going so you give them a grade."

Ensuring Mathematical Comprehension

Research question two states "What methods do expert teachers employ to ensure mathematical comprehension amongst African-American Math middle and High school students?" A teacher ensures comprehension when he or she employs a method in an effort to understanding their students' thinking This often requires listening to and watching the strategies students use solve problem. Research shows that when students are expected to describe their strategies in detail with the teacher and with each other, they demonstrate higher mathematical achievement (Carpenter et al, 1989).

The expert teachers in this study described many ways in which they ensured comprehension: use of assessment, Assessment, Use of Tool, Develop Respectful Relationships, Group Work and Collaboration, Discussion Connect to Other Material. Additionally participants in this study described how they incorporated (or didn't incorporate) their students' ethnic background in the teaching.

Use of Assessment

The most frequently occurring theme for Research Question 2 is *use of assessment*, which refers to using a variety of assessment tools (e.g., quizzes, tests) to teach math. The next theme is *develop relationships*, which is defined as developing respectful and trusting relationship with students to facilitate the teaching of math. The next theme was *use of tools*, which is defined as using of a variety of tools to teach math. The next theme was *group work and collaboration*, which refers to using group work and peer collaboration when teaching math. The next theme was *discussion*, which is defined as using discussion to teach math. The next theme was *connect to other material*, which refers to connecting math concepts to other material to make math more relevant.

Mrs. Cheney, African American female teacher of 8 years discusses several ways to assess knowledge below.

> "We would do verbal assessments at times, you know, when we were in the classroom, by their verbal responses. They would model, sometimes, on the board for everybody. I utilized individual little marker boards, like little, in the classroom. And they could work a problem and show me the answers so I could monitor who was getting it. They would, there were times that I would assess my, as they were working, I would look at their responses and seeing what they had."

Ms. Mathis, white female teacher of 18 years describes being clever to assess student knowledge.

> "We usually, for each unit I have already developed a prerequisite skills check. It's, like, I tell them it's a quiz, it does go in the grade book. They think it counts, but it really doesn't. You know what I mean? The only reason I tell them it counts is because I have to, I want them to see this is where I am and either we've got to do some remediation, or we've got to figure out how we're going to do that. Whether it's one of your online resources, what do you really not know, or did you just not take this seriously. So, I usually have a pretty good feel after that, for things that they don't know. And then usually what I follow up with the next day, I'll do, I do quick quizzes at the beginning of most classes. Four or five questions on that particular skill. And they know it's coming. So, if they don't master it overnight, don't take the time to look at it, then it's going to pop up again. And I continue to hit it on a daily quiz until everybody gets it.

In a final exemplar, Ms. Roberts white female teacher of 9 years mentioned verbal assessments,

> "We would do verbal assessments at times, you know, when we were in the classroom, by their verbal responses."

Do Experts Ensure Comprehension by Tailoring To Culture

Perhaps the most interesting finding in the entire study was the data that emerged when expert teachers were asked if they had a special approach to the way they taught any particular group of students. The data, or theme, was codified "tailoring to Culture." The majority of the expert teachers claimed to teach their students the same and not tailor to their cultural background.

Mr. Johns, white male teacher of 20 years shared that he teaches students the same irrespective of their cultural background:

> All right, when I do it, there is rarely a difference. Because what I'm trying to do is go all the way down to where I think I'm actually, I'm actually below where their knowledge level is. So-, so that I've got agreement-, if-, if I get agreement with everybody that this is how we do it, once, once we go to the new thing, it doesn't matter whether they don't know it, whether they shouldn't know it, because if they, if it's unknown to them it doesn't matter whether it's below level, at level or above level. And, so a lot of times what I do is that we'll start down where everybody's in agreement and I'll take them all the way up to the highest level that I can in that skill. And they don't know that we should have actually stopped 15 minutes ago. But, but the complexity that I added was junior and senior level of, of the same skill. And because they didn't know anything about it, they didn't know that, that, that the whole thing was above their grade level. And the majority of them could pick it up

Mrs. Richards, white female teacher of 23 years felt similarly. She shared:

> I really do not think that I feel that there is any difference in a student based on their gender or their color. Because so often, and I don't know why, but so often I have heard the conversation, especially being about African American males . . .It just is. But, to say that I would look at a group of, of, of African American males and white males and treat them differently, I don't think so. Because I have found that students don't come that way. Really, I'm-, I'm just being totally honest about this.

Mrs. Wright, white female teacher of 19 years explained her approach to teaching them all the same:

> The boys-, and see, I'm not-, I don't-, I'm not-, I don't just differentiate in my mind. It's, it's boys and girls. Whatever the mix is. I mean, seriously, it's not going to be, it's not going to be, you know, I'm not looking at, okay give me a group of boys. I'm not going to be thinking a group of white boys, I'm going to be thinking of a mix.

Ms. JamesJohn, white female teacher of 33 years explained her colorblindness below.

> Maybe I've never really put it in the context like that. I don't think about my children as being African American children, if that makes sense. These are just my kids, this is who I work with." Expert Teacher 11 indicated that she uses the same strategies for all students, "…I don't see the strategies I use being different for different kids. If that makes sense.

Ms. Roberts white female teacher of 23 years explained why she taught her students the same and blames student performance differences on socioeconomic background and not race:

> I would have given them an activator introduction, or whatever. And I would have given them samples, or examples, and progress framework. The only difference with my students would be, most of the differences were economic. Because, in my experience I had white, white girls that had just as many problems as my black males. I had black males that were just as smart as my smartest white females. And so, part of it, t-, I'm really messing your question up, aren't I?"

In a final example illustrating this subtheme, Ms. Ronello stated,

"I basically think that I introduce the concepts the same to different students."

Summary

Two research questions were explored in this analysis. Research question 1 is, "What methods do expert teachers use to teach African American middle and high school math students?" The primary themes for this research question are remediation, planning, and introduce a new concept. Of these, most expert teachers utilized 'Back up and clarify" when remediating, utilized lesson plans to plan their instruction, and used tools to introduce a new concept

Research Question 2 is “What pedagogical methods do expert teachers use to ensure comprehension of African American middle and high school math students?” The seven primary themes related to this research question were assessments, develop relationships, use of tools, discussion, tailor to culture, group work and collaboration, and connect to other material. The majority of the participants in this study did not tailor their instruction based on their students race. Chapter 5 will compare this study’s finds with existing findings in research.

CHAPTER 5

FINDINGS, CONCLUSIONS, AND IMPLICATIONS

Introduction

The purpose of this study is to examine the expert math teachers' perceptions about their pedagogy, behaviors and routines. Additionally, this study aims to examine the pedagogical approach utilized when teaching African American students by interviewing 15 expert teachers and 5 novice teachers of mathematics. These participants teach in one of Georgia's urban middle or high schools and all have at least 10 years of experience in the classroom environment. The expert teachers' behaviors are salient in three areas: pedagogy, routines, and behaviors (Berliner, 2004). Of these, the prevailing themes that emerged from the data are remediation (behaviors), planning (routines), and introducing a new concept (pedagogy).

This research uses semi-structured interviews to collect qualitative data. Participants in this study included 15 expert teachers and five novice teachers. The data were coded, analyzed, and organized first by research question and then by categories and finally by themes. The study is based on the following three research questions:

The research questions that guide this study are:

1. What strategies, routines and behaviors do expert teachers use to teach African American middle and high school students in mathematics?

2. How do expert teachers describe ensuing comprehension among African American learners?
    a. Do expert teachers tailor their instruction based on their students'' culture?

The purpose of this chapter is to provide interpretive insights into the findings presented in chapter four. As a secondary level of analysis, the relevant research are tied in, as these findings are compared and contrasted to issues raised by literature. Whereas the last chapter separated data to tell the story of the research, this chapter provides a more holistic understanding of this study's findings. The discussion section takes into consideration the literature on teaching expertise and the African American learner. The implications of these findings intend to augment the understanding of the behaviors of expert math teachers who instruct African American learners. The chapter concludes with a reexamination of the first chapter and a summary that incorporates a note regarding the effect of the possible researcher's bias in interpreting the findings.

Summary and Interpretation of Findings

The findings of the study can be summarized below. Below each finding is an interpretation of what these finds may mean.

In regards to teaching behaviors, almost 75% of the expert teachers in this study claim to expert teachers often remediate or re-teach material through tutoring before or after school. In spite of the teachers' expert status, students do not comprehend the subject matter initially.

The next finding showed that a third of the expert teachers plan as they move along. While approximately 40% of the expert teachers plan ahead, so as early as one year. Approximately one-half (33%) of expert teachers mentioned using state standards to plan. Novice teachers described planning ahead, but not as far in advance, but the vast majority of novice teachers (80%) use state standards. Another theory that seemed to emerge is that expert participants seem to think about their teaching more deeply, and independently than do novice teachers. Further, the experts interviewed in this study reported planning even when school was not in session. Besides simply having foreknowledge of the complexities of the classroom environment, and a knowledge of the need to plan ahead, perhaps expert teachers are more engaged in their teaching and therefore think about teaching even when they are not involved in the practice, or obligated to plan their instruction; they think about teaching "on their own time." Still another theory is that expert teachers are more confident (than are novice teachers) that they knew the required math curriculum, and relied less on the state prescribed curriculum to plan instruction.

When introducing new concepts, many (87%) expert teachers described using tools or some sort of manipulative to aide in introducing a new mathematical concept while only 40% of the novice teachers describe the use of educational tools. Additionally, the most striking difference between the two groups is the use of strategies to build on a student's previous knowledge to teach mathematics. Approximately half of expert teachers (53%) described using this technique; no novice teachers described its use. It may be theorized that expert teachers do not rely solely

on their ability to deliver effective instruction but employed the use of aides and the student's previous knowledge to increase students' mathematics comprehension.

To ensure comprehension of African American learners, expert teachers utilized several methods to ensure comprehension among their students that included observing studies while working and questions students. Conversely, novice teachers utilize traditional methods of formal assessment to ensure comprehension. Further, many experts and novice teachers report that they "teach all (their) students the same" regardless of the students' race. Sixty-seven percent of the participants acknowledged percent of experts, however, tailor their lesson to African American males and 20% of novices tailor their lesson to African American males. Perhaps the most interesting study is that a respectable amount of expert teachers believe that African American males are those who need a special approach to teaching.

Context of Findings – How These Findings Fit into the Literature

The present study found that expert teachers reteach math through tutoring, is indirectly supported by Hogan and Rabinowitz's (2009) literature review. In it, expert teachers were found to focus on each student as an individual. It would follow that teachers would remediate math, and not "move on" if a student does not understand the subject matter. Further, Berliner's (2004) research supports this finding as well. In it, expert teachers describe how the strong relationship between the teacher and student promoted better performance. In a study by Leinhardt and

Greeno (1986), experts were more consistent and efficient in probing for student comprehension through the use of questions and discussion.

The current study's findings with respect to planning, are in agreement with existing literature. It is important to note here that there is very limited research where the study operationalized expert teachers as those who are Nationally Board Certified. In fact, the research to which this study is compared used experience and improved student achievement (Leinhardt and Greeno, 1986), and/or supervisor recommendations (Borko & Livingston, 1989; Swanson, O'Connor & Cooney, 1990) to define their expert teacher population.

In Hogan et al's (2003) literature review, as well as the present study, expert teachers were found to establish yearly goals and objectives through curriculum planning to guide the development of weekly and daily lesson plans. The expert teachers' ability to plan was attributed to the expert teachers' complexity of schema. Also, in keeping with the present study's findings, novices tended to focus on short-term, highly scripted, and well-rehearsed planning. According to research (John, 2006; Borko & Putnum, 1996; Carter et.al., 1987; Leinhardt & Greeno, 1986; Livingston & Borko, 1989; Peterson & Comeaux, 1987) the difference in planning can be attributed to the complexity of the schema each educator has acquired for teaching.

According to Housner and Griffey (1985) while planning instructional strategies (lesson planning), novice teachers tend to regard the class as a whole. That is, novice teachers do not

think in terms of individual students. Rather, they think in terms of “a class” of thirty-five (or so) students.

Expert content specialists, on the other hand, perceive the classroom as comprised of unique individuals as we see illustrated above by an expert teacher (Berliner, 2004). Perceiving the classroom on these two levels impacts the requisite analysis needed by the expert and novice to solve the problem of curriculum planning.

In another study, Borko and Livingston (1989) found distinctions among expert and novice mathematics teachers in both the processes of mentally scripting lessons and in the development of both long range and short range goals for instruction. Novices tend to focus on short-term planning while expert content specialists focus on both long-term and short-term curriculum development. With a concentration on short-term planning, novices tend to generate highly scripted and mentally well-rehearsed instructional strategies. Expert curriculum plans (long-term) and lesson plans (short-term), however, were largely unrehearsed and unscripted. Specifically, experts were found to engage in various tiers of curriculum development, including yearly, unit, and daily planning. Additionally, the amount of written planning was kept to a minimum, highlighting the main components of the lesson while the remaining part of the lesson was stored mentally. These mental operations included the timing and pacing of the presentation and the number and types of the examples used to teach the mathematical concepts. Novice teachers also incorporated this type of mental planning but to a more specific degree, such as

scripting introductions or parts of the lesson, and determining ahead of time the types of questions they would ask during the lecture. Unlike the experts, the novices did not plan far ahead and admitted to being only pages or a section ahead of the students.

Clements & Sarama (2007) conducted research for the National Council of Supervisors of Mathematics (NCSM) that supports this study's findings. This research centers on the importance of the use of tools or manipulatives when introducing new concepts. NCSM found that that in order to develop every student's mathematical proficiency, leaders and teachers must systematically integrate the use of concrete and virtual manipulatives into classroom instruction at all grade levels.

In a study conducted by Clermont and colleagues (1994), expert and novice instructors explained abstract chemical principals in different ways. Experts offered a greater number of alternative demonstrations that were used to teach the same principle. Novices could only discuss one alternative. The researchers pointed to the teachers' content knowledge as the reason why greater demonstrations were offered. This finding differs from that of the present study. The expert teachers in this study did not report using multiple tools or manipulatives to convey as concept.

In regards to ensuring comprehension, this study's participants used assessments to ensure that students understand their subject matter. Ellen Stader and colleagues (1990) conducted four studies to see how well teachers at various stages of development can interpret a student's cues as

an indication of a lack of comprehension. Participants in the studies were nine novice teachers, ten advanced beginner, and ten expert elementary school teachers. In the first study, the teachers viewed a tape without sound showing fourth-grade students responding to a test. The major findings of this study were that accuracy in decoding student comprehension from nonverbal clues is trainable and that classroom experience and knowledge of the child's personality, typical behavior, and past performance increase the accuracy of a teacher's assessment of a child's nonverbal behavior. In other words, according to this research, a novice teacher is not likely to be able to interpret a student's comprehension without the use of assessments; comprehension is a "trainable" quality. As such, Stader's (1990) study is inconsistent with the current study's findings. If Stader (1990) and her colleagues are correct, the expert teachers that participated in the current study should have had the necessary skills to interpret the students' comprehension without the need to rely on assessments to determine comprehension. This contradiction can be seen below.

The final finding of this study is in regards to teachers tailoring their instruction based on their student's culture. In the present study, many experts and novice teachers initially reported that they "teach all (their) students the same" regardless of race or gender. When prodded further, 40% of experts, however, admitted being knowledgeable about ways in which they may tailor their lesson to African American males and 20% of novices tailor their lesson to African American males.

Based on research by Shaun (2006), this type of feedback is a result of the teachers' frames, or the ideologies teachers hold about African Americans. According to Martin, meaningful attention should be paid to the ways that African American learners experience math. African American students have a preference toward a relational style of learning (Ladson-billings, 1997; Stiff and Harvey 1988). But based on the findings for the present study, the teachers seem to be at a loss for strategies to approach this group of students. Further, according to Milner (2007) "Black male students respect their teachers when their teachers respect them." Data from the present study fails to display a sense of this level of respect from the teachers towards their African American students.

In chapter two, Culturally Responsive Teaching (CRT) was introduced as a concept NOT utilized in the current study. CRT is pedagogy in which teachers display skill at teaching in a cross-cultural or multicultural setting. The instructors enable each student to relate course content to his or her culture. Although this is not a theory at which this study is based, it also is not an approach that any of the expert teachers in the present study utilized. I mention it to emphasize the severe lack of research about effective ways in which teachers can teach math to African American students.

Implications of Findings

In short, four of the five major findings of the present study confirmed the existing literature about expert teachers (Berliner 2004; Putnam & Borko, 20001; Borko & Livingston, 1989).

Expert teachers view their students as individuals and therefore are concerned about each student's development and are willing to re-teach math. Additionally, expert teachers plan well in advance to providing instruction; they use tools and manipulatives to assist their teaching and rely on assessments to confirm that students have comprehended their instruction.

But the last finding presents some very interesting implications. First, it is important here to describe the importance of the final finding in this study. In 2010, the graduation rate among African American males in the state of Georgia (the state in which the present study took place) is 52% (The Schott Foundation for Public Education, 2012). In 2009, the African American/White gap for males in grade eight was 34 points and 20 points for females (National Assessment of Education Progress, 2009). Hence, the final finding of this study is very important. It adds to the existing literature in that to date, there is a very limited amount of research that details the perceptions of the behaviors of expert math teachers of African American students. There is plenty of data that describes the persistent achievement gap (National Center for Education Statistics, 2009) the attitudes and perceptions of teachers (Van den Bergh, 2010)), the attitudes and perceptions of African American students (Martin, 2006), but there is no research that can act as the roadmap Berliner (2004) describes to assist practitioners with providing math instruction for African American learners.

The findings from the current study improve the field's understanding of teacher development by adding a point of comparison between the pedagogical tendencies of expert

teachers and those of novice teachers in regards to their behavior towards African America learners. In spite of the grim statistics as they relate to African American math achievement, it is puzzling as to why researchers and those who fund such research have not commissioned studies to observe, interview, and interpret the behaviors of teachers who are experts in their fields, and have devised, recognized, or endorsed some system of rigor to obtain such recognition. This study is pivotal in that it hears the expert teachers'' perceptions about their behavior in the classroom as well as their perceptions about how they teach African American learners.

Limitations

The limitations of the study were not at all what the researcher expected. Initially, I thought my subjectivities would have the potential to influence my findings. The daughter of a math teacher and as a student who never considered herself a "math person," I thought I would be somehow prejudiced. But instead, the limitations of the study had to do with how I, as an African American researcher, may have influenced the authenticity of the participants. Some of the teachers may have been apprehensive about revealing that they indeed used very different methods of teaching their African American male or female students. Another limitation of the study was that observation were not included to confirm the participants' accounts of their teaching behaviors. Additionally, perhaps this study may have been more effective if it had the same number of novice and expert teachers.

Future Directions

This study clearly illuminates the need for research that closely examines the behaviors of expert teachers of African American students. As previously stated, there is a plethora of antidotal evidence and position papers that postulate the author's position on racial discrimination and the achievement gap. But there is a severe lack of research that analyzes the behaviors of expert teachers of this group of students in spite of the obvious need for a nation to learn how teachers can affect the academic success of such an oft maligned group.

In chapter one, it was stated that what teachers do matters. In fact, the teacher behavior is the greatest in-school influence. The other two major influences are the student's individual intelligence and family and neighborhood experiences. Thusly, more should be done to assist teacher educators and practitioners alike to aide African American students in the civil right of obtaining a quality mathematics education. While Berliner (2004) states that expert teachers are experts in a specific domain here, I would boldly propose that expert teachers of African American learners should be studied and explored. The future of this group of students, neighborhoods and communities, and the nation depend on this exploration.

Conclusion

It cannot be overstated enough: Teacher Behaviors (and the perceptions that teachers have about their behaviors) matter. While much is known about what expert teachers do in the classroom, and that novice teachers have not obtained the skills and experience to yet perform,

not enough is known about what expert teachers do within the context of producing high performing African American math students. The participants in this study have greatly contributed to the beginning of this exploration.

Data gathered from the participants in this study showed that their behaviors associated with remediation, planning (routines) and introducing a new concept (pedagogy) included tutoring before and after school, not always planning lessons ahead and utilizing several methods to ensure comprehensions. The themes that emerged from the data were things such as teachers being determined that their students be exposed to math instruction, them having teachers decoding student thinking to ensure comprehension.

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APPENDIX A: INTERVIEW GUIDE

1. Tell me about your teacher education program.

2. Tell me about your background in mathematics.

3. How well prepared to teach math were you when you began your career ?

4. Think of a time that you were most successful teaching a new topic to your students, describe how you approached it.

5. Tell me about your planning process. How do you go about planning for the year? For a unit? For a lesson? How do you ensure that your planning fits into the curriculum?

6. Walk me through your routine as you introduce a new concept to your class.

5. Think of a time when a student was confused by a new concept, how did you clarify the concept for that particular student?

7. If your student needs remediation in a mathematical concept, do remediate or do you move forward to introduce a new concept? How do you make this decision?

8. Do you give pretests to your students? If not, how do you determine the student's prior knowledge in math?

9. Besides giving a student a written assessment, explain how you determine if a student understands a concept.

APPENDIX B: INVITATION LETTER: EXPERT TEACHERS OF AFIRCAN AMERICAN MATH STUDENTS

Dear Participant,

Greetings! Thank you for your consideration in participating in this very important research study. Currently, as a Doctoral Candidate at The University of Georgia, I am conducting research on Expert Teachers of African American Math Students. I am interested in investigating these teachers to uncover how the expert math teachers' pedagogy, behaviors and routines contribute to the growth in their student's mathematics achievement. Because of your National Board Certification status in math, you have been chosen to participate in this study. Your contact information was obtained from the If you decide to do this, you will be asked to participate in no more than two interviews in which you will describe the ways in which you teach mathematics to your students. Each interview will last no longer than two hours.

Although existing research has identified a variety of qualities for expert teachers, there is little information available about expert math teachers and even less information about expert math teachers of African American students. This project aims to add to the literature by providing a description of the thoughts and behaviors of expert math teachers of middle and high school African American learners. If you take part in this study, you will contribute to adding to the exiting literature.

To protect your identity, your name and the names of anyone that you describe during your interview will be changed.

If you agree to participate in this study please contact me at dmthomas@uga.edu or call me directly ay 912-659-7050. The Principle Investigator for this project is Louis A. Castenell. He can be reached by phone at 706-542-4110 or via e-mail at lcastene@uga.edu. Information on UGA policy and procedure for research involving humans can be obtained from Human Subjects Director Dr. Belinda Pooser (706-542-3199), Chair of the Institutional Review Board.

Sincerely,

D. Michelle Thomas

PhD Candidate

Applied Cognition & Development

The University of Georgia

APPENDIX C: CONSENT FORM FOR PARTICIPATION IN RESEARCH

I agree to participate in the research titled, "Expert Math Teachers of African American Middle and High School Students," which is being conducted by D. Michelle Thomas (912-659-7050) and Dr. Louis Castenell (706-542-0411) Educational Psychology and Instructional Technology Department, University of Georgia. I understand that my participation is entirely voluntary; I can withdraw consent at any time without penalty and have the results of the participation, to the extent that it can be identified as my own, returned to me, removed from the research records, or destroyed.

1. The reason for the research is to assist in the possible improvement in understanding expert math teachers' teaching pedagogy as well as their decision making in regards to their curriculum.
2. There will be no direct benefits to the study participants.
3. The procedures are as follows: The research project will take place over a period of no more than six months. During that time, the researchers will be collecting data by conducting semi-structured interviews to be recorded on audio equipment and later transcribed.
4. No discomforts or stresses are foreseen.
5. No risks are foreseen. My participation is voluntary.
6. The results of this participation will be confidential, and will not be released in any individually identifiable form without the prior consent of myself, unless otherwise required by law.

7. The interviews will be audio taped. Access to the tapes will be restricted to the researchers directly involved with the research project. The tape will be stored in a secure area (e.g., locked filing cabinet) and the tapes will be destroyed one year after the completion of the study. The tapes will be transcribed, and my words may be quoted. If so, a pseudonym will be used to ensure that I cannot be identified in any way.

The researchers will answer any further questions about the research, now or during the course of the project, and can be reached by phone at 912-659-7050.

Please sign both copies of this form. Keep one and return the other to the investigators.

Signature of Researchers _____ Date _____

Signature of Participant _____Date _____

Research at the University of Georgia that involves human participants is overseen by the Institutional

Review Board. Questions or problems regarding your rights as a participant should be addressed to

Human Subjects Office, Institutional Review Board, Office of the Vice President for Research, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-

7411; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu