AN EXAMINATION OF TEACHER QUALIFICATIONS AND STUDENT

ACHIEVEMENT IN MATHEMATICS

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AN EXAMINATION OF TEACHER QUALIFICATIONS AND STUDENT ACHIEVEMENT IN MATHEMATICS

A. Rafael Richardson

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AN EXAMINATION OF TEACHER QUALIFICATIONS AND STUDENT

ACHIEVEMENT IN MATHEMATICS

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VITA

A. Rafael Richardson, born March 26, 1971, is the son of Garnell and Irene Richardson. Rafael earned a Bachelor of Science degree from Alabama State University in May 1996, and began his professional career as a science teacher at Carver Jr. High School in Montgomery, AL that fall. In 1998, he earned a Master of Education from Alabama State University in Science Education. In 2004, Rafael earned certification in educational administration, and enrolled in the doctoral program for educational leadership at Auburn University. While pursuing a doctorate at Auburn University, he completed requirements for an Education Specialist degree. Rafael was a classroom teacher for six years, an assistant principal for two years and is currently employed as a middle school principal. Rafael is married to Janice, his wife of 11 years. He has a one year old son Evan.

DISSERTATION ABSTRACT

AN EXAMINATION OF TEACHER QUALIFICATIONS AND STUDENT ACHIEVEMENT IN MATHEMATICS

A. Rafael Richardson

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(Ed.S., Auburn University, 2006)
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Many researchers have suggested that teacher quality and student achievement, especially in mathematics, are two significant challenges for schools. For example, educational researchers (Ballou & Podgursky, 2000b; Darling-Hammond, 2000; Goldhaber & Brewer, 2000; Monk, 1994; Wenglinsky, 2000a; Wilson, Floden, & Ferrini-Mundy, 2001) have conducted various studies to determine teacher qualifications that impact student achievement. In order to enhance mathematics achievement, it is important for educators in Alabama and across the United States to understand the relationship between teacher qualifications and student achievement in mathematics. The purpose of this study was to assess whether or not there is a statistically significant difference in teacher qualifications that might help to predict the

academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). Using a theoretical framework which suggests that teacher qualifications impact or have a relationship to student achievement in mathematics, this study examined the relationship between the factors of teacher preparation, certification, and teaching experience with the mathematics achievement of their students. Measures of teacher qualifications included four independent variables: (a) the number of mathematics semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school mathematics. Twenty full-time mathematics teachers from 7 of the 8 traditional (non-magnet) middle/junior high schools located in the Montgomery Public School (MPS) District, Montgomery, Alabama participated in this causal-comparative study. All participants completed a *Teacher Background Survey*. The survey results were later matched with student data from the 2007 administration of the Alabama Reading and Math Test (ARMT). The responses to the teacher surveys were analyzed using a t-test. Findings from this study indicated that a significant relationship does exist between teacher qualifications and student achievement. Specifically, the findings revealed that students with mathematics teachers who had 5 or more years experience performed better on the math portion of the Alabama Reading and Math Test (ARMT). This study also found that if the teacher had a traditional secondary mathematics certification then his or her students tended to score higher on the ARMT compared to teachers with alternative certification.

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Last and certainly not least, this dissertation is dedicated to my lovely and beautiful wife, Janice M. Richardson and my amazing son, Evan Rafael Richardson. Without your unconditional love, encouragement, support, and patience, completion of this project would not have been possible. Thank you both for allowing me to achieve this goal for all of us. Above all, I would like to thank GOD ALMIGHTY for helping me through this endeavor.

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I. INTRODUCTION

Overview

For many years, educators and researchers have debated which school variables influence student achievement (Darling-Hammond, 2000). Recently, more than 25 states have enacted legislation to improve teacher recruitment, education, quality, certification, or professional development (Darling-Hammond, 1998). Since new standards for student learning have been introduced across the states, greater attention has been given to the role that teacher quality plays in student achievement (National Commission on Teaching and America's Future, 1996). Ferguson (1991) concluded from his research in Texas and elsewhere, "Good teachers have distinguishable impacts on student exam scores" (p. 465). Similarly, William Sanders (1998) found that the "single largest factor affecting academic growth of populations of students is differences in effectiveness of individual classroom teachers" (p. 27).

The responsibility for student achievement and performance is being more closely assessed through accountability systems that measure the adults, not just the children (Reeves, 2004). Districts and individual schools are held accountable to ensure that all student subgroups reach identified state standards within the designated time frame (Jerald & Haycock, 2002). Ontario's Education Minister, Janet Ecker (1999), indicated that governments must require teachers to have sufficient skills and knowledge in order

to maintain teacher certifications and to provide the highest level of education to students. Due to the increased standards, schools must show evidence of student proficiency in the areas of mathematics, reading, and science in addition to creating a more rigorous curricula (Camphire, 2003; Voke, 2002). The No Child Left Behind Act (NCLB) of 2001 requires that all teachers in core academic subjects be highly qualified by the end of the 2005–2006 school year (U.S. Department of Education, 2004). NCLB stipulates that to be considered highly qualified, teachers must demonstrate that they have sufficient subject-matter knowledge and teaching skills to be effective teachers. Specifically, highly qualified teachers must

- have obtained full state certification as a teacher or passed the state teacher licensing examination and hold a license to teach in the state,
- have demonstrated subject matter competency in each of the academic subjects he or she teaches, and
- hold a minimum of a bachelor's degree.

Despite this emphasis on teacher qualifications in NCLB, surprisingly little research exists that links the qualifications of individual teachers to the performance level of students in their classrooms (Greenberg, Rhodes, Ye, & Stancavage, 2004). Greenberg et al. (2004) found that much of the research in the field has been conducted with state or district level aggregate data on teacher qualifications, rather than with data on individual teachers and their students.

Statement of the Research Problem

In Alabama, the 7–8 grade span has the lowest percentage of students scoring at proficient levels on the math portion of the Alabama Reading and Math Test (ARMT). During the 2007 administration of the ARMT, the percentage of students scoring proficient in grades 6–8 was as follows: Grade 6–73%, Grade 7–60%, and Grade 8–67% (Alabama State Department of Education, 2007b). The ARMT is a criterion-referenced test based on Alabama's academic content standards in reading and mathematics. Test scores reflect student performance compared to the criteria, which is the Alabama Course of Study (Alabama Department of Education, 2007b).

The No Child Left Behind Act requires schools to bring all students to a "proficient" level in reading, math, and science by 2014. According to NCLB, which was signed into federal law in January 2002, all states must administer standardized mathematics tests to all students in grades 3–8 by the 2005–2006 school year (Camphire, 2003). NCLB required criterion-referenced achievement tests to be used for determining adequately yearly progress (AYP) for schools (Alabama State Department of Education, 2007b). School districts and states must provide detailed report cards to the public about their progress towards this goal.

In consideration of these requirements, the Alabama State Board of Education adopted academic achievement standards in a resolution dated July 9, 2002 (Alabama State Department of Education, 2007b). According to the 2006 Interpretive Guide (Alabama State Department of Education, 2007b), the assessments used to determine AYP for NCLB for the 2006–2007 school year were the Alabama Reading and Math Test

(ARMT), the reading and mathematics subject-area tests of the Alabama High School Graduation Exam (AHSGE), and the reading and mathematics subject-area tests of the Alabama Alternate Assessment (AAA).

The ARMT was administered for the first time in Grades 4, 6, and 8 in spring 2004. It was administered for the first time in grades 3, 5, and 7 in spring 2005 (Alabama State Department of Education, 2007a). Results of the ARMT are reported as a percentage of students in each of the four achievement levels: Level IV—Exceeds Academic Content Standards; Level III—Meets Academic Content Standards; Level II—Partially Meets Academic Content Standards; and Level I—Does Not Meet Academic Content Standards. The percent of Alabama students scoring at the proficient level (Level III) and higher (Level IV) in reading is presented in Table 1.

Table 1

Percentage of Students Scoring Proficient in Reading

Grade	Level III or Level IV
3	85%
4	85%
5	85%
6	85%
7	77%
8	72%

The percent of Alabama students scoring at the proficient level (Level III) and higher (Level IV) in mathematics is presented in Table 2.

Table 2

Percentage of Students Scoring Proficient in Mathematics

Grade	Level III or Level IV
3	78%
4	78%
5	77%
6	73%
7	60%
8	67%

(Alabama State Department of Education, 2007a).

The data above indicates that mathematics is an area of weakness for students in grades six, seven, and eighth.

As Alabama's schools attempt to find ways to improve the mathematics performance of students, it is an appropriate time to investigate the relationship between individual teacher type of certification held, mathematics credit hours completed, and years of experience to the performance level of students in their classrooms. Examining

relationships between teacher certification, college/graduate school major, and years of experience and student achievement in mathematics may help teachers and school administrators gain better insights to student performance. According to the Alabama Teacher Equity Plan (2006), a well-prepared teacher is the critical ingredient in student learning.

Purpose of the Study

The purpose of this study was to evaluate whether or not there is a statistically significant difference in teacher qualifications that might predict the academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). Understanding the relationship between teacher qualifications and mathematics achievement is important when it comes to school accountability and making adequate yearly progress (AYP). Using a theoretical framework (see Figure 1), the researcher examined the relationship between four aspects of teacher qualifications (highest degree attained, mathematics credit hours completed, number of years teaching, and number of years teaching experience in the middle/junior high school setting) and student achievement in mathematics as documented in the spring 2007 ARMT results.

This study had four major goals: (1) to determine if a statistically significant relationship exists between teacher certification and student achievement in mathematics; (2) to determine if a statistically significant relationship exists between a teacher's college/graduate school major and student achievement in mathematics; (3) to determine

if a statistically significant relationship exists between a teacher's years of teaching experience and student achievement in mathematics; and (4) to determine if a statistically significant relationship exists between a teacher's years of teaching experience in the middle/junior high school setting and student achievement in mathematics.

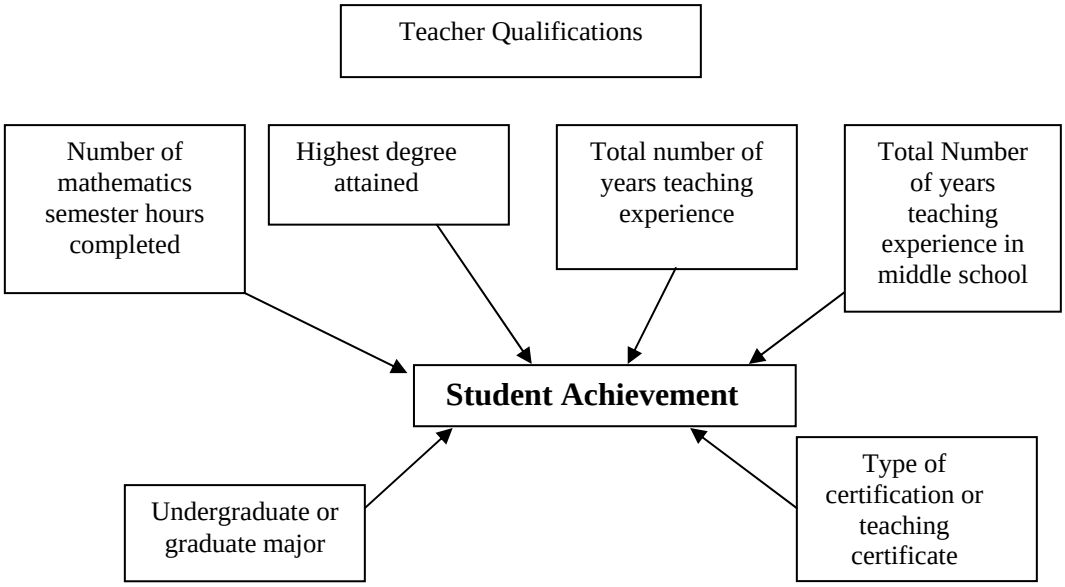

Figure 1. Teacher Qualifications and Student Achievement

Research Questions

The purpose of this study was to evaluate whether or not there is a significant difference in teacher qualifications that might predict the academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). This study investigated the following research questions:

1. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's number of mathematics semester hours completed?

2. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to type of teacher certification?

3. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to a teacher's total number of years teaching mathematics?

4. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to teacher's total number of years teaching middle school mathematics?

Limitations and Assumptions

Limitations

1. This study represented eight middle/junior high schools that are geographically located in southeast Alabama; therefore, generalization beyond the eight schools should be taken with caution.
2. This study was limited to students in 7^{th}-8th grade in traditional schools (nonmagnet) in the Montgomery Public School System which is a combination of rural and urban schools.

3. This study was limited to teachers who taught at the traditional middle/junior high school level.
4. This study was limited to information gained from student performance on the Alabama Reading and Math Test (ARMT)

Assumptions

1. Respondents will understand the self-report instrument and their responses will be honest.
2. Teachers' responses to questions about their certifications, college/graduate school major, years of teaching experience, and teaching experience in the middle/junior high school setting will be honest.

Significance of the Study

The purpose of this study was to compare mathematics teacher preparation and experience to the achievement of seventh and eighth grade students on the mathematics section of the Alabama Reading and Math Test. This study examined the ARMT achievement levels of these seventh and eighth grade students in relation to the qualifications and experience levels of their respective teachers to determine if there were any statistically significant relationships that might predict the academic performance of middle schools students on the mathematics portion of the ARMT. The information from this study may inform teachers, principals, superintendents, colleges of education, and policy makers by identifying potential predictors related to teacher characteristics that may result in higher student achievement in mathematics.

Definitions of Terms

*Achievement Levels***:** The academic levels of the eighth grade students were assessed using the results of the mathematics section of the Alabama Reading and Math Test that was administered in the Spring of 2007.

Alabama Reading and Math Test/ARMT: The Alabama Reading and Mathematics Test (ARMT) is a criterion-referenced test administered in grades 3 through 8 based on Alabama's content standards. The ARMT uses a wide variety of text sources for the reading assessment, as well as multiple-choice questions and open-ended items. In the math section, students respond to multiple-choice questions, open-ended items, and gridded items. Open-ended questions require students to write a narrative explanation of their answer or to show their work in math. Individual students are scored into 4 levels: Level 1 does not meet standard; Level II partially meets standard; Level III meets standard; and Level IV exceeds standard.

*Certification***:** Teachers who have one or more of the following in their main assignment field in the state in which they teach: an advanced professional certificate, a regular or standard state certificate (standard certificate offered in the state), or a probationary state certificate (the initial certificate issued after satisfying all requirements except completion of a probationary period). All other teachers are categorized as not certified. Teachers who have an emergency, temporary, or provisional certification are not considered certified because they do not meet the regular standards for state certification.

*Highest degree***:** Teachers were categorized according to whether or not they had a master's degree or higher, regardless of the field in which the degree was earned. Virtually all teachers have at least a bachelor's degree, so in effect this classification divided teachers into two groups: those with a bachelor's degree and those with higher degrees.

*Teaching experience***:** Teachers were categorized according to whether or not they had more than five years of teaching experience. Teachers were also categorized according to whether or not they had five or more years of experience teaching mathematics.

Chapter Summary

Chapter I provides the introduction of the study, statement of the research problem, purpose, research questions, and definition of terms. Chapter II provides a review of literature regarding teacher certification, teacher attendance, and years of teaching experience and their relationship to student achievement in mathematics. Chapter III presents the procedures used in the study. It includes a description of the population and sample, instrumentation, data collection, and the data analyses. In Chapter IV, the research findings are presented. Chapter V provides a summary of the study, conclusions, implications, and areas for further research.

II. REVIEW OF LITERATURE

Introduction

Today, more than ever before in the history of public K–12 education, schools are expected to increase student achievement for all students. The implementation of the No Child Left Act (NCLB) of 2001 mandate makes high-stakes school reform efforts even more complex as new demands are placed on school districts and school personnel (Kristonis, Herrington, & Salinas, 2006). Urban and poor rural school districts are feeling the impact of NCLB more so than other districts (McDonnell, 2005). Urban and poor rural districts typically have higher concentrations of economically disadvantaged, primarily minority, and at risk populations and as such have a more difficult time recruiting and retaining highly qualified teachers. Rather than take additional courses or tests to become designated as highly qualified, some teachers choose instead to leave the field and perspective teachers elect to pursue different careers. The teacher who remains often have choices about where they teach and the best teachers generally do not select hard to staff schools in urban and poor rural areas (McDonnell, 2005). A goal of NCLB is for every child to be at grade level in mathematics, science and reading by the end of the school year 2013–2014 (Meyer, 2004). The hiring of highly qualified teachers is crucial for promoting and attaining student achievement, especially in urban, hard-to-staff schools (Kristonis, Herrington, & Salinas, 2006, p. 2).

The growing interest in teacher quality and accountability is not a new theme in the educational arena even though one might assume that it is based solely on NCLB requirements which are highly debated among educational policy makers and the general public (Kristonis, Herrington, & Salinas, 2006). At the forefront of these challenges are increased pressures for school accountability in the form of high-stakes testing, and teacher quality (Kristonis, Herrington, & Salinas, 2006). Recently, though, there has been increased interest focused on the certification of teachers (Darling-Hammond, 1998a). Given that urban and rural areas are turning more frequently to alternatively certified teachers in high need areas, it is critical to determine whether the traditional teacher certification route impacts student achievement.

Over the next decade, it will be essential that the nation employ 2.2 million classroom teachers (Chester & Feistritzer, 1998; Howard, 2003, Hussar, 1999; Ingersoll, 2003). This situation is credited to increased student enrollments, reductions in class size, and accelerating teacher retirements among an aging teacher population (Darling-Hammond, 1998b; Ingersoll, 2003). More than a million veteran classroom teachers are nearing retirement in spite of rapidly increasing student enrollments (Ingersoll, 2003). Additionally, schools in high-poverty urban and rural districts are estimated to have a need of 700,000 new teachers (Kristonis,Herrington, & Salinas, 2006). Ingersoll (2003) agrees that higher teacher turnover rates exist in school districts whose students are of high poverty status. NCLB provisions of teacher quality are challenging to such school districts (Coble & Azordegan, 2004).

Student achievement on annual state tests is the accountability tool that will be utilized in schools to determine student knowledge and this is not a new phenomena. The use of student test scores has been utilized since the mid-1880s as a method of allocating rewards or sanctions to schools or teachers based on the outcome of student performance on test measures (Chester & Feistritzer, 1998; Darling-Hammond, 2004). Many states and school districts utilize assessment results as the foundation for promoting students from grade to grade; determining program placements (i.e. gifted and talented), and making graduation decisions (Darling-Hammond, 2004). The enactment of No Child Left Behind (NCLB) Act of 2001 requires more testing and represents a substantial rise in federal regulation, particularly for states that had not chosen to test their students as frequently as is now required (McDonnell, 2005).

The policy implications of the No Child Left Behind Act (NCLB) Act of 2001 have created debates affecting teacher education and certification policies as well as the hiring options available to urban and poor rural school districts. In the past, as teacher demand increased, many urban districts resorted to hiring large numbers of teacher applicants on emergency certificates and teaching waivers because they lacked the formal preparation for teaching (Kristonis, Herrington, & Salinas, 2006). These teachers typically taught low-income and minority students in the most disadvantaged schools (Hammond, Holtzman, Gatlin, & Vasquez-Helig, 2005). According to Anderson and Bullock (2004), under the No Child Left Behind (NCLB) Act of 2001, this practice is no longer an option for schools as there are many changes and controls related to teacher licensure in the provisions and requirements of NCLB.

The literature indicates that there are more than enough prospective teachers produced each year in the United States overall, but there are not sufficient numbers of graduates produced in specific teaching fields (Ingersoll, 2003). Consequently, the teacher shortages are found in the teaching fields of bilingual education, mathematics, science, and foreign languages. It is argued that teacher shortages force school districts to lower their hiring standards by hiring non-certified teachers or alternative certification teacher candidates to fill teacher position vacancies. Many argue that this results in high levels of underqualified teachers and lower school performance (Ingersoll, 2003). To meet the teacher shortage demand, a wide range of initiatives have been developed and implemented to recruit new candidates into teaching in recent years. Among these are programs for degreed individuals who choose to change careers and pursue teacher education as a profession. Some of these career-changing programs are considered to be forms of alternative certification programs (Ingersoll, 2003).

Urban and poor rural districts face significant challenges related to the induction of teachers new to the profession (Feistritzer , 2001). According to Haberman (2003), over 40% of the 3.2 million teachers teach in six states. A critical determinant for new teacher's success is the end-of-year student assessment. NCLB requires all school districts to make annual progress in raising the percentage of students who are proficient in reading and mathematics, and in narrowing the test-score gap between advantaged and disadvantaged students. Furthermore, each teacher's effectiveness will be evaluated on the basis of student scores on particular assessments (Coble & Azordegan, 2004). Student

achievement and teacher quality are undoubtedly at the forefront of debates about the No Child Left Behind (NCLB) Act of 2001 mandate.

Few educators, economists, or politicians would argue with the contention that, all other things being equal, highly qualified teachers produce greater student achievement than comparatively less qualified teachers (Alexander & Fuller, 2005). When classrooms have qualified teachers, students achieve at higher levels (Matson, 1999). All children in the United States, no matter where they live or who they are, deserve qualified teachers. Yet, many do not have a qualified teacher (Wilson, Floden, & Ferrini-Mundy, 2001).

In terms of teacher supply, recent data from the National Center for Education Statistics shows that less than half of the teaching positions across the U.S. were filled by teachers who had just completed teacher education programs (Feistritzer , 2001). Feistritzer (2007) found that, approximately 59,000 individuals were issued teaching certificates through alternative routes in 2005–06, up from approximately 50,000 in 2004–05 and 39,000 in 2003–04.

Although the population of U.S. school-age children is becoming increasingly diverse, our pool of potential teachers is not, furthering the need to prepare teachers to work with students different from themselves (Wilson et al., 2001). As noted by Ingersoll (1999), few educational problems have received more attention in recent times than the failure to ensure that our nation's elementary and secondary classrooms are staffed by qualified teachers. The challenges in improving teacher education programs and practices in the U.S. are enormous, and a qualified teaching force is an unquestionable necessity (Wilson et al., 2001).

William Sanders (1998) found that the effectiveness of teachers has more influence on student achievement than any other schooling factors. This finding is reflected in the newly reauthorized Elementary and Secondary Act, No Child Left Behind, which requires states to have a "highly qualified" teacher in every classroom by the end of the 2005–2006 academic year. "Highly qualified" is a specific term defined by No Child Left Behind. The law outlines a list of minimum requirements related to content knowledge and teaching skills that a highly qualified teacher would meet. The law requires teachers to have a bachelor's degree and full state certification and to demonstrate content knowledge in the subjects they teach (U.S. Department of Education, 2004).

Students, parents and educators intuitively believe that a teacher's knowledge of subject matter is critical if students are going to achieve to high standards. As Sandra Feldman, president of the American Federation of teachers says, "You can't teach what you don't know well." In addition, research shows that teachers who know the subject matter that they teach are more effective in the classroom. Having teachers who know well the content they are teaching is good practice because it leads to improved student learning (U.S. Department of Education, 2004).

Despite the emphasis on teacher qualifications in the No Child Left Behind Act (NCLB), surprisingly little research exists that links the qualifications of individual teachers to the performance level of students in their classrooms (Greenberg et al., 2004). In order to serve students more effectively, educational needs must be met to better serve them. For this reason, educational researchers (Ballou & Podgursky, 2000a; Darling-

Hammond, 2000; Goldhaber & Brewer 2000; Monk, 1994; Wenglinsky, 2000a; Wilson, Floden, Ferrini-Mundy, 2001) have conducted various studies to determine the factors that impact student achievement. This literature review centers around eight areas of research relating to teacher qualifications as they relate to student achievement. The first section contains information about teacher quality. The second section focuses on subject-matter knowledge/preparation. The third area focuses on teacher certification. The other sections in this literature review focus on alternative certification, academic major or minor, highest degree attained, teaching experience, teacher working conditions and student achievement in urban schools.

Teacher Quality

More than two decades of research findings are unequivocal about the connection between teacher quality and student learning. Indeed,(National Commission on Teaching and America's Future (1996), the influential report What Matters Most: Teaching for America's Future, made teaching the core of its "three simple premises" in its blueprint for reforming the nation's schools. They are:

- What teachers know and can do is the most important influence on what students learn.
- Recruiting, preparing, and retaining good teachers is the central strategy for improving our schools.
- School reform cannot succeed unless it focuses on creating the conditions under which teachers can teach and teach well.

(The Center for Public Education, 2006)

Key teacher quality provisions of the No Child Left Behind Act (NCLB) underscore the importance of these premises. Central to NCLB's goal of closing the achievement gap by 2014 is the requirement that all teachers be highly qualified by the end of the 2005–06 school year. For new teachers, this means that they must meet existing state certification requirements and demonstrate mastery of the content area in which they teach, either by passing a content knowledge test or by having majored in the subject in an undergraduate or graduate program (The Center for Public Education, 2006).

In fact, teacher quality is the most important school-related factor influencing student achievement (Rice, 2003). Despite conventional wisdom that school inputs make little difference in student learning, a growing body of research suggests that schools can make a difference, and a substantial portion of that difference is attributable to teachers (Darling-Hammond, 2000). Studies conducted in Tennessee and Texas not only provide insight into the characteristics of good teachers, they reveal how these contribute to student learning and closing achievement gaps. Findings in both states indicated that teachers had a substantial effect on student achievement. In Tennessee, data showed achievement gains associated with smaller class sizes, where a stronger achievement gain is associated with teacher quality (Nye, Konstantopoulos, & Hedges, 2004). In another Tennessee study of the positive effects associated with being taught by a highly effective teacher, defined as a teacher whose average student score gain is in the top 25 percent, researchers found that low-income students were more likely to benefit from instruction by a highly effective teacher than were their more advantaged peers (Nye,

Konstantopoulos, & Hedges, 2004). Another study found that the achievement gains from having a highly effective teacher could be almost three times as large for African American students as for white students, even when comparing students who start with similar achievement levels (Sanders & Rivers, 1996).

In fact, most research suggests that the benefit of improving the quality of the nation's teaching workforce is far greater than other policy interventions, such as lowering class size. However, while we know that good teaching is important, it's far less clear what makes for a good teacher (Goldhaber, 2004). Variables presumed to be indicative of teachers' competence which have been examined for their relationship to student learning include measures of academic ability, years of education, years of teaching experience, measures of subject matter and teaching knowledge, certification status, and teaching behaviors in the classroom. The results of these studies have been mixed; however, some trends have emerged in recent years (Darling-Hammond, 2000).

To meet the challenge of placing a highly qualified teacher in every classroom, some states are strengthening their traditional teacher-preparation programs and developing systems to hold those programs accountable. Such programs often come under fire for curricula marked by a lack of rigor and research-based instruction (Steiner, 2003). The federal government currently requires states to report the pass rates on teacher licensing exams for all of their teacher education institutions. However, the pass rates vary in meaningfulness because the standards for determining pass rates differ from state to state. *Quality Counts 2004* shows that 12 states have taken their accountability systems a step further by holding their teacher-training programs accountable for the performance

of their graduates in a classroom setting. The report also found that, while 39 states and the District of Columbia identify low-performing teacher-training programs, 26 had not yet designated a single program as low-performing for the 2002–03 school year (Education Week, 2004).

Research has consistently found that brand-new teachers make important gains in teaching quality in the first year and smaller gains over the next few career years; however, there is not a consistent linear relationship between years of teaching experience and student achievement after the initial three years of teaching, making it difficult to say whether there are any discernible differences among more veteran teachers—for example, between teachers with 7–10 years of experience and teachers with 20 or more years of experience (Hanushek, Rivkin, & Kain, 2005; Murnane, 1975; Rockoff, 2004) .

In a 1994 study, Ronald Ehrenberg and Dominic Brewer found that students score higher on standardized exams if their teachers attended more selective undergraduate institutions. Likewise, Greenwald (1996) in a meta-analysis concluded that school resources are systematically related to student achievement and that these relations are large enough to be educationally important and resource variables that attempt to describe the quality of teachers (teacher ability, teacher education, and teacher experience) show very strong relations with student achievement. Similarly, Ferguson (1991) concluded from a Texas study, “Good teachers have distinguishable impacts on student exam scores (p. 465). Hawkins, Stancavage, and Dossey (1998) found that the more knowledge eighth-grade teachers reported of the National Council on Teaching and Mathematics

curriculum and evaluation standards, the higher their students' performance tended to be on the NAEP mathematics assessment. More recently, economists Eric Hanushek, John Kain, and Steven Rivkin estimated that, at a minimum, variations in teacher quality account for 7.5 percent of the total variation in student achievement, a much larger share than any other school characteristic (Goldhaber, 2004).

In contrast to the approach used by Darling-Hammond, which equates teacher quality with specific qualifications, Hanushek, Kain, and Rivkin (1999) identify teacher quality in terms of student performance outcomes. Their research identifies teacher quality as the most important school-related factor influencing student achievement. They conclude from their analysis of 400,000 students in 3,000 schools that, while school quality is an important determinant of student achievement, the most important predictor is teacher quality (Rice, 2003). Hanushek (1992) estimates that the difference between having a good teacher and having a bad teacher can exceed one grade-level equivalent in annual achievement growth.

According to the U. S. Department of Education (2004), studies offer compelling evidence that teachers are one of the most critical factors in how well students achieve. For instance studies in both Tennessee and Texas found that students who had effective teachers greatly outperformed those who had ineffective teachers. In the Tennessee study, students with highly effective teachers for three years in a row scored 50 percentage points higher on a test of math skills than those whose teachers were ineffective (Goldhaber, 2004).

Additionally, the 2001 federal education legislation *No Child Left Behind* (NCLB) further underlines the importance of having a high-quality teacher in every classroom in every school. The Bush Administration's proposal, which specifies what defines a "highly qualified" teacher, is based on the premise that teacher excellence is vital to realizing improved student achievement. This legislation, along with typical hiring and compensation systems, assumes that years of teaching experience, teacher certification, engagement in certain types of coursework, and performance on standardized assessments are indicators of high-quality teachers (Rice, 2003).

In general, under No Child Left Behind (U.S. Department of Education, 2004) a highly qualified teacher must have:

- A bachelor's degree
- Full state certification, as defined by the state
- Demonstrate competency, as defined by the state, in each academic core area he or she teaches

The No Child Left Behind Act requires that all teachers in core academic areas be highly qualified by the end of the 2005–2006 school year (Greenberg, Rhodes, Ye, & Stancavage, 2004). According to No Child Left Behind, these subjects are English, reading or language arts, math, science, history, civics and government, geography, economics, the arts and foreign language. Special education teachers and teachers of English language learners must be highly qualified if they teach core academic subjects to their students (U. S. Department of Education, 2004).

Subject-Matter Knowledge

The number of research studies conducted in mathematics education over the past three decades has increased dramatically (Kilpatrick, 1992). Research findings indicate that certain teaching strategies and methods are worth careful consideration as teachers strive to improve their mathematics teaching practices (Kilpatrick, 1992). Although subject matter knowledge is widely acknowledged as a central component of what teachers need to know, research on teacher education has not, in the main, focused on the development of teachers' subject matter knowledge. Researchers specifically interested in how teachers develop and change have focused on other aspects of teaching and learning to teach. Yet, to ignore the development of teachers' subject matter knowledge seems to belie its importance in teaching and in learning to teach (Ball & McDiarmid, 1990).

There is a long history of research, going back to the work of Brownell (1945, 1947), on the effects of teaching for meaning and understanding. Investigations have consistently shown that an emphasis on teaching for meaning has positive effects on student learning, including better initial learning, greater retention and an increased likelihood that the ideas will be used in new situations. In a review of activity-based learning in mathematics in kindergarten through grade 8, Suydam and Higgins (1977) concluded that using manipulative materials produces greater achievement gains than not using them. In a more recent meta-analysis of sixty studies (kindergarten through postsecondary) that compared the effects of using concrete materials with the effects of more abstract instruction, Sowell (1989) found that the long-term use of concrete

materials by teachers knowledgeable in their use improved student achievement and attitudes.

In a report published in 1996, The National Commission on Teaching and America's Future used data collected as part of the School and Staffing Survey (SASS) to draw attention to the fact that 23 percent of all secondary teachers did not have even a minor in their own teaching field. They also pointed out that the percentage of out-of-field teachers was not evenly distributed across all subjects: 56 percent of high school students taking physical science and 27 percent of high school students taking mathematics were taught by out-of-field teachers (Greenberg, Rhodes, Ye, & Stancavage, 2004). Philosophical arguments as well as common sense support the conviction that teachers' subject matter knowledge influences their efforts to help students learn subject matter (Ball & McDiarmid, 1990). Consistent with common belief, several studies showed a positive connection between a teacher's subject matter preparation and both higher student achievement and higher teacher performance on evaluations in mathematics, science, and reading (Wilson, Folden, & Ferrini-Mundy, 2001).

In another study, researchers found that states with a higher proportion of well-qualified teachers, defined as full certification and a major in their field, had higher mathematics and reading test scores in grades four and eight. The same study found a negative relationship between a state's proportion of teachers with less than a minor in the field that they teach and student achievement (Wilson et al., 2001).

Deep content-area knowledge is also an attribute of teachers that seems to have positive impact on student achievement (Monk, 1994). This appears especially true for

science and mathematics teachers. Allen (2003), in a review of research conducted by the Education Commission of the States, found moderate support for the importance that teachers be well–versed in their subjects. The review points out that research is not detailed enough to clarify how much subject matter is critical for teaching specific course levels and grades. However, when teachers possess inaccurate information or conceive of knowledge in narrow ways, they may pass on these ideas to their students. They may fail to challenge students' misconceptions; they may use texts uncritically or may alter them inappropriately. Subtly, teachers' conceptions of knowledge shape their practice and influence the kinds of questions they ask, the ideas they reinforce, and the sorts of tasks they assign (Ball & McDiarmid, 1990).

Regarding subject matter as an essential component of teacher knowledge is neither new nor a controversial assertion. After all, if teaching entails helping others learn, then understanding what is to be taught is a central requirement of teaching. The myriad of tasks of teaching, such as selecting worthwhile learning activities, giving helpful explanations, asking productive questions, and evaluating students' learning, all depend on the teacher's understanding of what it is that students are to learn (Ball & McDiarmid, 1990). Leinhardt and Smith (1985) stated "as teachers increase their conceptual knowledge and become more fluid in connecting their knowledge to lesson presentation, their student mathematical competence should also improve" (p. 243). In a study conducted by these researchers on the subject matter knowledge of eight fourth grade students, they concluded that the subject expertise made a substantial difference in how the content was delivered by the teachers and retained by the students.

What teachers need to know about the subject matter they teach extends beyond the specific topics of their curriculum (Ball & McDiarmid, 1990). Brewer (2003) stated that teachers must find a balance between their subject knowledge and the methods they use to present information effectively to their students. Helping students learn subject matter involves more than the delivery of facts and information. The goal of teaching is to assist students in developing intellectual resources to enable them to participate in, not merely to know about, the major domains of human thought and inquiry (Ball & McDiarmid, 1990). Shulman (1986) argues that "teachers must not only be capable of defining for students what the accepted truths in a domain are. They must also be able to explain how it relates to other propositions" (p. 9)

Early studies of teachers' subject matter knowledge found little empirical evidence of connections between larger amounts of teacher subject matter knowledge and student achievement. Begle (1979) concluded that there are no experts who can distinguish the effective from the ineffective teacher merely on the basis of easily observable teacher characteristics. However, two recent works have begun to uncover connections between teachers' knowledge and student achievement. Goldhaber and Brewer (2000) found that students with teachers with degrees in mathematics had greater gains in achievement than students with teachers with nonmathematic degrees, but the researcher found no such results for science. In a previous study, Goldhaber and Brewer (1996) found that subject-specific training in mathematics and science had a positive impact on student achievement in these areas. This suggests that greater subject-matter

knowledge is associated with increased gains in student achievement in the areas of mathematics and science.

Again, looking at mathematics, other studies have also found a significant relationship between student achievement and teacher knowledge. Monk (1994) found that secondary school mathematics teachers' knowledge has a positive impact on student achievement. Rowan, Chiang, and Miller (1997) found that students taught by teachers with a mathematics degree had greater gains in student achievement, although the effect on student achievement was small. Similarly, Wenglinsky (2000a) conducted a study with 5,000 eighth graders on the National Assessment of Educational Progress (NAEP) and found that mathematics and science teachers with an undergraduate minor or major in their field elicited greater gains in student achievement. Additionally, Wenglinsky noted, "Students whose teachers majored or minored in the subject they are teaching outperform their peers by about 40% of a grade level in both math and science" (p. 7). Similarly, Darling-Hammond (2000) found that percentage of teachers with both a subject-matter major and full state certification was positively associated with a state's reading and mathematics scores on the National Assessment of Educational Progress.

In fields ranging from mathematics and science to vocational education, reading, elementary education, and early childhood education, researchers have found that teachers who have greater knowledge of teaching and learning are more highly rated and more effective with students, especially at tasks requiring higher order thinking and problem solving (Darling-Hammond, 2000). In a pilot study conducted by Hawk et al. (1985), showed that in-field certified math teachers know more mathematics and show

evidence of using more effective teaching practices than their out-of-field counterparts. Further, and most important, students of in-field certified math teachers achieve at higher levels than do students taught by out-of-field teachers. The overall findings from these studies suggest that teacher subject-matter knowledge positively influences student achievement.

Teacher Certification

Does teacher certification really matter? In recent years, the relationship between teacher certification and student achievement has been hotly debated (Greenberg, Rhodes, Ye, & Stancavage, 2004). The policy implications of these debates are far-reaching, affecting teacher education and certification policies as well as policies regarding school funding and educational rights (Darling-Hammond, 2000). The importance of traditional teacher certification is a critical topic for education policymakers to understand, because certification is the primary gate-keeper controlling access to the teaching profession (Greenberg, Rhodes, Ye, & Stancavage, 2004). A brief history of teacher certification is presented below in order to frame our current certification practices.

In the late nineteenth century, a movement to centralize state authority over the certification of teachers was well underway. Though only three states, New York, Rhode Island, and Arizona (a territory), had gone so far as to require that state officials issue all new teaching certificates, the idea of licensing teachers was not new. Parents have always had an interest in assuring that the people to whom they give up their children for tutelage

were of good moral character and qualified for their tasks (Angus, 2001). In colonial America, it was common for communities to require that one or more of the local ministers approve anyone proposing to teach. Such approval was contingent upon “good moral character” and might be withheld from those not holding the same religious views as the minister. But over the course of the nineteenth century, as the authority for licensing expanded from ecclesiastical to civil authorities, the criteria for licensing expanded. It included knowledge of subject matter and knowledge of pedagogy, usually determined by means of an examination (Angus, 2001).

The vast majority of U.S. teachers in the second half of the nineteenth century received their first and perhaps only certificate to teach from local officials on the basis of their performance on an exam. This exam might consist simply of a few questions posed orally by a member of the district board, anxious to be sure that the prospective teacher knew at least as much as the older children he or she would be instructing. Later as state education officials sought to exert more control over the country schools, longer and more detailed written examinations were offered to applicants at the townships or county level, with passing scores resulting in the issuance of certificates to teach within the area organizing the examination for varying lengths of time (Angus, 2001).

After the emergence of the state normal schools and university departments of education, the graduates of these programs received their certificates from a state official or the trustees of the institutions. In some states, college graduates were issued certificates to teach whether or not they had any formal training. By 1897, 28 states certified teachers on the basis of graduation from a normal school or a university without

further examination. Over the next third of a century, the main outlines of today's system of teacher certification would be in place (Angus, 2001).

Woolford (1982) suggested that a person cannot be a good teacher without first knowing the subject matter and that the process of certification is designed to guarantee that teachers have such basic knowledge. No one could argue against the fact that all teachers should be fully qualified (Hawk et al., 1985). However, the research on teacher certification and quality and their effect on student achievement is still inconclusive and debated (Alexander & Fuller, 2004).

Certification or licensing status is a measure of teacher qualifications that combines aspects of knowledge about subject matter and about teaching and learning. Its meaning varies across the states because of differences in licensing requirements, but a standard certificate generally means that a teacher has been prepared in a state-approved teacher education program at the undergraduate or graduate level and has completed either a major or a minor in the field(s) to be taught plus anywhere from 18 to 40 education credits, depending on the state and the certificate area. Most programs include between 8 and 18 weeks of student teaching (Darling-Hammond, 2000). There are only a few states that have requirements outside these parameters; however, individual teacher education programs often require more preparation than the state demands in education, in clinical practice, and in the content area(s) to be taught. Most states now also require one or more tests of basic skills, subject matter knowledge, and/or teaching knowledge or skills as the basis for the initial or continuing license or for admission to teacher education (Darling-Hammond, 2000).

While most states have been increasing their standards since the 1980s, more than 30 states still allow the hiring of teachers who have not met their licensing standards, a practice that has been on the increase in some states as demand has grown in recent years (Darling-Hammond, 2000). Some allow the hiring of teachers with no license. Others issue emergency, temporary, or provisional licenses to candidates who, depending on the state, may or may not have met varying requirements (e.g., a bachelor's degree, a certificate in another teaching field, a basic skills test). More than 40 states have also initiated alternate route provisions for candidates who enter through post baccalaureate programs. Most of these are master's degree programs that offer an education degree that meets all of the normal state requirements but does so in a fashion tailored to individuals, like mid-career entrants, who already have a bachelor's degree (Darling-Hammond, 2000). Some states allow candidates to complete a short summer course of study and assume full teaching responsibilities, with or without completing additional coursework (Darling-Hammond, 2000).

As teacher demand has increased and funding inequities have grown over the past 15 years, many urban and poor districts have hired a growing number of individuals on emergency permits or waivers who lack formal preparation for teaching (Darling-Hammond, 2005). Fuller (2004) found that in the state of Texas between 30,000 and 35,000 public school teachers were not fully certified in each year since 2002. Similarly, Esch, Chang-Ross, Guha, Tiffany-Morales, and Shields (2004) found that in California the number of teachers without a full certificate has declined from approximately 42,000 in 2001 to only 28,000 in 2004. According to the National Commission on Teaching and

America's Future (1996), teachers who are not fully certified typically teach low-income and minority students in the most disadvantaged schools.

Teacher certification was implemented to ensure that every teacher posses the requisite knowledge and skills to instruct students. Essentially, certification is designed to protect the public from harm by identifying which teachers do and do not possess the qualities necessary to teach (Alexander, 2005). On the one hand, advocates of teacher certification standards purport that teacher quality characteristics such as certification status and degree in the field to be taught are very significantly and positively correlated with student outcomes. Characteristics such as education level (percentage of teachers with master's degrees) show positive but less strong relationships with education outcomes (Darling-Hammond, 2000; Goldhaber & Brewer; Monk 1994; Weglinsky, 2000; Wilson, Floden, & Ferrini-Mundy, 2001).

There are several studies whose findings show a positive relationship between teacher certification and student achievement (Betts, Reuben, & Dannenberg, 2000; Darling-Hammond, 2000; Goldhaber & Brewer, 2000). Fuller and Alexander (2004) analysis identified similar students who were taught by Texas math teachers who were also similar except that some were certified and others were not. The study found that the students taught by certified teachers scored better on the state achievement. In another study that examined the mathematics achievement of elementary students also found that students taught by new, uncertified teachers did significantly worse on achievement tests than did those taught by new, certified teachers (Laczko-Kerr & Berliner, 2002). Likewise, Darling-Hammond (1998a) found a significant positive association between

achievement and teacher certification; she also found a significant negative association between achievement and the presence of a high proportion of new or uncertified teachers in school.

Using data from a 50-state survey of policies, state case study analyses, the 1993–94 Schools and Staffing Surveys (SASS), and the National Assessment of Educational Progress (NAEP), Darling-Hammond (2001), found that partial correlations showed significant relationship between teacher quality and student achievement after controlling for student poverty and for student language background. The most consistent highly significant predictor of student achievement in reading and mathematics in each year tested is the proportion of well-qualified teachers in a state: those with full certification and a major in the field they teach (r between .61 and .80, $p < .001$). The strongest, consistently negative predictors of student achievement, also significant in almost all cases, are the proportions of new teachers who are uncertified (r between -.40 and -.63, $p < .05$) and the proportions of teachers who hold less than a minor in the field they teach (r between -.33 and -.56, $p < .05$).

In a comparison study of 36 teachers, 18 of whom were certified in mathematics while 18 were certified in another field, Hawk, Coble, and Swanson (1985) concluded that students who were taught by in-field certified math teachers achieve at a higher level than do students taught by out-of-field teachers. Teacher differences were measured by (a) student achievement, (b) teacher knowledge of subject, and (c) teacher professional skills as observed in the classroom. Students were given a pretest using the Stanford Achievement Test (general math) and the Stanford Test of Academic Skills (algebra).

Pretest scores were not significantly different for students taught by in-field versus out-of-field teachers. However, after receiving five months of mathematics instructions, the 826 students in the study were given the same Stanford Tests as post-tests. Results of the study indicated that student achievement is greater in general mathematics and algebra when the students are taught by teachers certified in mathematics (analysis of covariance: F ratio of 13.98, $p < .001$, for general math and $F = 7.96$, $p < .01$ for algebra). The results of this study lend support to maintaining certification requirements as a mechanism to assure the public has qualified classroom teachers, at least in mathematics. Likewise, Hawkins, Stancavage, and Dossey (1998) found that eighth grade students whose teachers had a teaching certificate in mathematics performed better than other eighth grade students.

On the other hand, opponents of teacher education and certification declare that the available research does not support specific rigorous teacher preparation and certification standards (Alexander, 2005). Ballou and Podursky (2000a) stated that current certification requirements may create barriers to entering the teaching profession and that teacher effectiveness may be as much a function of general academic ability or strong subject matter knowledge as it is to any specialized training in how to teach. Similarly, in his 2002 report on teacher quality, Dr. Rod Paige, the Secretary of Education, argued for the dismantling of teacher certification systems and the redefinition of teacher qualifications to emphasize higher standards for verbal ability and content knowledge and to de-emphasize education training, making student teaching and education coursework optional (Paige, 2002).

Goldhaber and Brewer (2000) conducted a study to investigate whether students' gains in mathematics and science performance between tenth and twelfth grade were related to whether or not the students' twelfth grade mathematics and science teacher had standard teaching certificates in their state. Using data from the 1988 National Educational Longitudinal Study, their model controlled for (a) state licensing requirements, (b) teacher undergraduate and graduate major, (c) teacher experience, and (d) student's family background. The results of the study showed that there was no significant difference in student achievement among tenth and twelfth graders whose teachers had standard, probationary, or emergency certification. Fetler (1999) found that teachers with emergency teaching certificates did not perform as well as teachers who were fully certified, even when controlling for the amount of teaching experience.

Alternative Certification

Over the past 30 years, alternative certification programs have evolved as a response to real and perceived shortages of qualified teachers. These programs are characterized by the opportunity that they offer for individuals to teach without graduating from a traditional teacher-preparation program, fulfilling student teaching obligations, or passing certification exams (Legler, 2002). People with the desire to change careers, including those who have left the military, as well as individuals with previous teaching experience or education can enter alternative certification programs and in a relatively short time be teaching a classroom of students (Legler, 2002).

Research indicates that alternative routes have been successful in recruiting a more diverse pool of teachers but have a mixed record in terms of the quality of teachers recruited and trained (Wilson, Floden, & Ferrini-Mundy, 2001). In a study involving a national sample of over 14,000 teachers, 3.3 percent of the alternatively certified teachers did not have a Bachelor of Art degree. In that same analysis, the researcher found that more alternatively certified teachers were teaching out of field in mathematics and science than English and social science teachers (Wilson et al., 2001). In a case study of the Los Angeles Unified School district, prospective teachers seeking certification through alternative routes had grade point averages that met or surpassed national averages of traditionally certified teachers. However, the study found that alternatively certified teachers' GPAs were lower than traditional recruits in mathematics and science (Wilson, Floden, & Ferrini-Mundy, 2001). In two reports based on the same database, researchers contrasted the knowledge of alternatively certified interns with that of a national sample of teacher candidates from programs across the U.S., researchers found that the secondary and elementary teachers suffered from the same weak mathematical knowledge as that of traditional candidates (Wilson, Floden, & Ferrini-Mundy, 2001).

While the components of alternative certification programs vary widely from state to state and region to region, they typically involve some period of intensive, condensed academic course work or training. In addition, they usually require a period of supervised, on-the-job training in which new teachers are expected to learn their teaching skills in the classroom (Legler, 2002). Supervision ranges from very little to intensive oversight and mentoring on a constant basis for at least the first year. Typically, new

teachers are expected to eventually pass certification tests and become fully certified teachers (Legler, 2002). Since the research literature seldom includes descriptions of the contents and components of these alternative routes, it appears that several features may be important to high quality alternative certification (Wilson et al., 2001), including:

- high entrance standards,
- extensive mentoring and tutoring,
- extensive pedagogical training in instruction, classroom management, curriculum, and working with diverse students,
- frequent and substantial evaluation,
- practice in lesson planning and teaching prior to taking on full responsibility as a teacher, and
- high exit standards

Opponents of alternative certification programs wonder how we can discuss improving education by increasing the quality of teachers at the same time that we allow them to teach with less preparation. These critics wonder about the ethics of handing the responsibility of educating our children to someone who has little training and is learning on-the-job (Legler, 2002). In two studies, researchers found that high percentages of alternatively certified teachers were teaching in urban settings or schools where the majority of the students were from minority populations (Wilson et al., 2001). However, in a study that examined the effects of alternative program status on student achievement, the findings showed no differences in the average student achievement of matched pairs

of alternatively and traditionally certified teaches on their students' performance on the Iowa Test of Basic Skills (Wilson, Floden, & Ferrini-Mundy, 2001).

Middle School Certification

The scarcity of properly trained principals, counselors and teachers has been a source of national and state concern confronting middle schools across the United States (Thistle & O'Connor, 1992). According to the National Middle School Association (NMSA), the number of middle schools in the nation has increased significantly in recent years (McEwin & Dickinson, 1995). For example, the number of grades 5–8 and 6–8 middle schools has increased from 2,434 in the 1970–71 school year to 8, 164 during the 1995–96 academic year while the number of grades 7–9 junior high schools decreased from 4,711 to 1,037 during this same period. When all separately organized public middle level schools are considered, their number currently exceeds 12,000. However, this substantial increase in middle schools has not been accompanied by a similar increase in the number of institutions offering special middle level teacher preparation programs and states requiring special middle level licensure that recognizes the importance of teachers of young adolescents having the specialized knowledge, skills, and dispositions needed to be highly successful (McEwin & Dickinson, 1995).

Instead, many states offer elementary school licenses and high school licenses that include overlaps with the middle grades (e.g., K–8, 6–12). This practice has resulted in most middle level teachers being prepared with a focus on content areas only or on teaching young children. Even in schools with structural components of middle schools

in place, such as common planning time and adjacency of rooms to enable team teachers to plan together, some claim the full benefits of programs designed specifically for young adolescents can not be realized without specially prepared middle level teachers (National Middle School Association, 1996).

Studies on the developmental characteristics and educational needs of young adolescents (aged 10–14) indicate the need for specialized programs to prepare teachers for this age group (Harnett, 1991). Researchers and practitioners alike indicate it is essential to develop a cadre of teachers grounded in the philosophy of middle school education; knowledgeable about the psychological, social, and intellectual development of early adolescents; and possessing the practical skills to work with early adolescents (Silverman, 1990). To achieve such goals, preservice teacher education programs must provide experiences in middle school settings and courses that develop an understanding of the early adolescent's unique needs (Harnett, 1991).

According to middle school researchers Alexander and McEwin (1989), over half of the middle schools surveyed in 1988 described their faculties as ones in which less than 25% of the teachers had any university training specific to teaching young adolescents (Thistle & O'Connor, 1992). The full success of the national movement to make middle level schools more developmentally responsive is dependent upon licensure that requires teachers of young adolescents to demonstrate the special knowledge, skills, and dispositions needed to be successful. The 1991 NMSA position paper on professional certification states the essential elements of a middle level teacher education program as follows:

- Thorough study of the nature and needs of early adolescents
- Middle level curriculum and instruction to include teaming, advisory, and exploratory preparation
- Broad academic background, including concentrations in at least two academic areas at the undergraduate level
- Specialized methods and reading courses
- Early and continuing field experiences in good middle schools.

In 1991, states with middle level licensure or endorsements housed 82 percent of all middle level teacher preparation programs. Fifty-seven percent of the special middle level teacher preparation programs were located in only five states, all of which required special licensure for middle level teaching: Georgia, Kentucky, Missouri, North Carolina, and Virginia (National Middle School Association, 1996). Valentine and Mogar (1992) found in a national licensure study that 33 states reported specialized middle level teacher licensure/certification. Despite a steady but slow growth rate, many states do not require teachers to hold middle level licensure to teach in the middle grades. Overlapping licensure regulations enable teachers trained at the elementary or secondary level to teach middle grades (National Middle School Association, 1996).

An extensive study of 8,300 middle grade teachers in four states found that fewer than 10% of the teachers in grades six through eight were initially certified to work specifically with students in that age group. The majority of the middle grades teachers had an elementary education background, while the remaining teachers were prepared to work in high schools (National Middle School Association, 1996). Middle level teachers

with an elementary focus may be nurturing, but they tend to have insufficient knowledge of advanced subjects; those with high school preparation usually have stronger content knowledge but limited understanding of how to make topics interesting and relevant to young adolescents (Scales & McEwin, 1996).

Data from the 1993–1994 Schools and Staffing Survey (SASS) showed that middle school teachers were less likely than elementary or secondary school teachers to have regular/alternative certification in their main field. Of the departmentalized middle school teachers whose main assignment was mathematics, science, English, or social studies, approximately 7 to 8 percent lacked certification in that field in 1993–1994. In contrast, 2 to 3 percent of such secondary school teachers lacked certification in their core field (Thistle & O'Connor, 1992).

The Making Middle Grades Matter study conducted in the spring of 2000 revealed that teachers wanted to upgrade their content knowledge and learn new methods of teaching content successfully to more students. However, more than 65 percent of the teachers say they have had little or no professional development aimed at expanding their academic content knowledge, and 80 percent of them report having little or no professional development on how to help low-performing students master complex content (Cooney & Bottoms, 1998).

The study of 1,100 middle grades teachers in 28 schools and 13 states, also found that only 30 percent of the teachers surveyed had undergraduate content majors and 43 percent had elementary education majors. Compared with all teachers, the percentage of teachers in academic areas (mathematics, English, science, and social studies) who have

content majors is even lower. In other words, those who teach music or physical education in the middle grades have specialized content degrees. This is significant because teachers without undergraduate content majors are assigned to teach mathematics, English, science and social studies (Cooney & Bottoms, 1998).

There is growing evidence that if educational leaders in schools and districts want to improve achievement for all students in the middle grades, teachers who know what to teach and how to teach it are essential. During the 1990s, only about 20 percent of eighth-graders in the Southern Regional Education Board (SREB) states reached proficiency level in mathematics, and fewer than one-third reached the proficiency level in reading (Cooney & Bottoms, 1998). Further, in a 1998 study involving students in 3,000 Texas schools, researchers found that the most important factor in student achievement was teacher quality (National Middle School Association, 1996).

Researchers have suggested that middle school teachers have specialized training in content knowledge and adolescent development (Thistle & O'Connor, 1992). Similarly, the National Middle School Association recommends that policy makers ensure that all middle level educators have a deep background in the subjects they teach; understand the intellectual, emotional, and physical needs of young adolescents; and use instruction and assessment strategies that research has shown to be effective with this age group (National Middle School Association, 1996). As a part of the Turning Points 2000: Educating Adolescents in the 21st Century, the following prerequisites were given for middle grade teachers:

- A strong conceptual grasp of their academic disciplines and skills in developing and using assessments to guide instructional decisions.
- Instructional knowledge and skills grounded in how people learn best.
- An understanding of how effective interdisciplinary teams work and how they can best contribute to effective teams.
- Substantial comprehension of young adolescents' developmental characteristics and needs.
- Willingness and the preparation to participate actively in the school's governance system.
- Knowledge and skills to support a safe and healthy school environment.
- Capacity to engage parents and community members in support of students and the school. (Jackson & Davis, 2000, p. 96.)

Academic Major or Minor

Does a teacher's college major or minor impact student achievement? The type of academic degree held is one measure often used to determine teacher qualifications (Skandera & Sousa, 2007). According to the Center for Public Education (2005) teacher's knowledge of the content they teach is a consistently strong predictor of student performance, even though studies differ in how strong its effects are. This research typically uses teachers' college degree to represent content knowledge.

During the 1960s the percentage of teachers with advanced degrees began to increase. A majority of public school teachers (56.2 percent in 1996) now have advanced

degrees. Furthermore, heightened awareness regarding teacher education levels has been accompanied by encouraging teachers, particularly those in secondary schools, to have an academic major such as English, math, or history rather than a degree in education (Skandera & Sousa, 2003).

Although there has been a dramatic increase in the number of teachers who hold advanced degrees, in most fields teachers do not hold degrees in the field in which they teach (Skandera & Sousa, 2003). Considering all primary subjects, in 1999, nearly 34 percent of public school teachers in grades 7 through 12 were teaching without a college major or minor in the academic field in which they were teaching. Contrasting the U. S. experience with 38 others that participated in the Third International Math and Science Study, on average 71 percent of eighth-grade math teachers majored in mathematics, compared with only 41 percent of American eighth-grade math teachers (Skandera & Sousa, 2003). Moreover, it appears that the more technical the subject, the less likely it is for the teacher to have advanced preparation in the subject area (Skandera & Sousa, 2003).

Richard Ingersoll (1999) in an article published in the Educational Researcher, studied 7^{th}–12^{th} grade public teachers and found:

- One-quarter of all English teachers did not have a major or minor in English, literature, communications, speech, journalism, English education, or reading education.
- One-third of all life science teachers did not have a major in biology or life science.

- More than half of all history teachers did not have a major or minor in history.
- More than 56 percent of all physical science teachers did not have a major or minor in physics, chemistry, geology, or earth science.

Similarly, Stancavage, Hawkins and Dossey (1998) found that teachers of the large majority of fourth-grade students (83 percent) had college majors in education rather than mathematics or mathematics education, while teachers of over half of eighth-grade students had majors in mathematics or mathematics education.

An ongoing debate surrounds the preparation and qualifications that characterize high-quality teachers. Many agree that teachers should possess a strong basic knowledge of the subjects they teach, but does that knowledge necessarily translate into effective teaching? (Skandera & Sousa, 2003). Darling-Hammond (1998a) found that, although other factors had a strong association with achievement, the presence of a teacher who did not have at least a minor in the subject matter that he or she taught accounted for about 20 percent of the variation in NAEP scores. Goldhaber and Brewer (1996) found that the presence of teachers with at least a major in their subject area was the most reliable predictor of student achievement scores in math and science. They also found that, although advanced degrees in general were not associated with higher achievement, an advanced degree that was specific to the subject area that a teacher taught was associated with higher student achievement. Hawkins, Stancavage and Dossey (1998) found that teachers' college majors appear to have some relationship to students' mathematics performance; however, there are grade-level differences. In fourth grade, students whose teachers had a college major in mathematics education or education

outperformed those students whose teachers had a major in a field other than education, mathematics education, or mathematics. In eighth grade, it was the students of teachers with a college major in mathematics who outperformed students whose teachers had a college major in education or a field other than education, mathematics education, or mathematics.

In 1997, the Southern Regional Education Board (SREB) launched a comprehensive middle grades improvement effort based on years of experience with successful high school reform (Cooney & Bottoms, 1998). The Making Middle Grades Work (MMGW) effort began with research on the status of middle grades education in the southern region of the United States (Cooney & Bottoms, 1998). Using data from a three year span, the study found that each of the 52 original schools raised student achievement in both reading and math. The most-improved schools have teachers with content majors who use engaging activities to increase the rigor of academic courses. This group includes rural and urban schools ranging in size from fewer than 100 students to more than 1,300 students, and schools with minority student populations ranging from zero to 90 percent and between 14 percent and 88 percent of students eligible for free or reduced-price lunches (Cooney & Bottoms, 1998). Making Middle Grades Work found that raising student achievement in the middle grades required sustained effort by local school leaders and teachers who accept responsibility for preparing students for challenging high school studies (Cooney & Bottoms, 1998).

A recent analysis conducted by Wenglinsky (2000a) found that teachers with a major or minor in the subject area they are assigned to teach produce greater gains in

student achievement in both science and math. Using multilevel structural equation modeling to analyze NAEP data, these gains held true after controlling for teacher professional development, teacher classroom practices, class size, and student demographics. Monk (1994) analyzed NAEP data along with other data found that there was a positive relationship between student performance and a teachers' undergraduate coursework in mathematics. In their study, Hawk, Coble, and Swanson (1985), found that students had higher gains when taught by math teachers who taught in-field compared to those who taught out of field. Goldhaber and Brewer (2000) found that twelfth grade students whose mathematics teachers have an undergraduate degree in mathematics have higher levels of mathematics achievement than comparable students whose teachers majored in other fields. Similarly, Hawk, Coble, and Swanson (1985) found that students taught by in-field certified mathematics teachers scored significantly higher in mathematics achievement than out-of-field teachers ($t = 4.23$, $p < .001$). The researchers noted that "This is not an altogether unexpected finding considering the course requirements necessary to become a certified mathematics teacher (p. 14).

Highest Degree Attained

Teachers' education (degree) and experience levels are probably the most widely studied teacher attributes, both because they are easy to measure and because they are, in the vast majority of school systems, the sole determinants of teachers' salaries (Golhaber, 2002). In 1999–2000, the highest degree attained for the majority of teachers (53 percent) was a bachelor's degree. Forty-two percent of teachers had attained a master's degree as

their highest degree, and 4 percent had attained a doctorate, professional, or education specialist degree. Less than 2 percent of all teachers had completed no more than an associate's degree (U.S. Department of Education, 2005).

Research dating back to the 1966 release of *Equality of Educational Opportunity* (known as the Coleman Report) concludes that student performance is only weakly related to school quality. However, among the various influences that schools and policymakers can control, teacher quality was found to account for a larger portion of the variation in student test scores than all other characteristics of a school, excluding the composition of the student body (Goldhaber, 2002). More recently, researchers have sought to isolate teachers' contributions to student performance and assess how much of their overall contribution can be associated with measurable teacher characteristics such as experience and degree level (Goldhaber, 2002).

Although teachers' academic degrees and their average years of experience have been traditional indicators of the qualifications of the teacher workforce, most research has not found the highest degree attained by teachers to be a good predictor of gains in student achievement (Hanushek, Rivkin, & Kain,2005; Greenwald, Hedges, & Laine, 1996). Goldhaber (2002) found that only about 3 percent of the contribution teachers made to student learning was associated with teacher experience, degree attained, and other readily observable characteristics. The remaining 97 percent of their contribution was associated with qualities or behaviors that could not be isolated and identified. Rice (2003) suggests that teachers who have earned advanced degrees have a positive impact

on high school mathematics and science achievement when the degrees earned were in these subjects.

Teacher Experience

Do students reach higher levels of achievement when taught by better qualified and more experienced teachers? In addition to academic major, researchers have found that teacher experience is also a factor for improving student achievement. A comprehensive analysis by Greenwald, Hedges, and Laine (1996) examined data from 60 studies and found a positive relationship between years of teachers experience and student test scores. Hawkins, Stancavage, and Dossey (1998) found that while teachers of fourth-and eighth-grade mathematics span the range of years of mathematics teaching experience, students taught mathematics by teachers with more than five years of teaching experience were more likely to perform better on the NAEP mathematics assessment than students taught by teachers with five or fewer years of experience.

Similarly, the UTD Texas Schools Project showed that students of experienced teachers attained significantly higher levels of achievement than did students of new teachers (those with one to three years of experience) (Hanushek, Rivkin, & Kain, 2005). Using a dataset from the Texas School Microdata Panel to measure teacher quality by the annual growth in each student's scores on the mathematics section of the Texas Assessment of Academic Skills, the dataset links detailed student, teacher, and school characteristics in grades 4 through 8 for the school years 1995–2001 in a major Texas urban district. Their results confirm that good teachers increase student achievement. The

average student who has a teacher at the 85th quality percentile can expect annual achievement gains that are 0.22 standard deviations greater than the average student with a median teacher (Hanushek et al., 2005). The authors found that first-year teachers have a much lower performance on average than other teachers. After that, first-year teacher performance improves markedly, peaking in a teacher's fourth year (Gorman, 2005).

Elizabeth Greenberg, David Rhodes, Xiaolan Ye, and Fran Stancavage (2004), using data from the 2000 math NAEP, conducted a study on several characteristics of teacher qualification which included (a) certification, (b) college or graduate school major, (c) highest degree, and (d) experience. The researchers defined certified teachers as teachers holding a professional, regular, standard, or probationary certificate to teach in their subject field. All other teachers (those with emergency, temporary, or provisional licenses) were defined as uncertified since they did not meet basic certification standards. Teachers were categorized as having a major or minor in the field in which they teach if they had a major or minor in either mathematics or mathematics education. Researchers also divided teachers into two separate degree categories, irrespective of field focus—those with a bachelor's degree, and those with higher degrees (master's degree or doctorate). Finally, the researchers looked at years of teaching experience, both in mathematics and in other fields. They defined experienced teachers as those with five or more years of experience. These researchers found that teacher certification was strongly associated with higher student scores, as was a major or minor in either mathematics or mathematics education. They did not find significant associations between higher degrees of education or teaching experience and student achievement (Laitsch, 2004).

Teacher Working Conditions in Urban Schools

Qualified teachers powerfully influence student achievement (Rice, 2003). However, some schools and some groups of students, namely Latinos, African Americans, and students whose families are poor, have far less access to qualified teachers than other groups (Horng, 2005). Why do some schools have difficulty attracting and retaining qualified teachers? Poor working conditions are at the heart of the problem (The Southeast Center for Teacher Quality, 2004). Facilities that are not clean and safe, poor administrative support, large class sizes, insufficient resources for students, and school policies made without teacher participation discourage qualified teachers from working at some schools (Horng, 2005).

Teaching and learning do not take place within a vacuum; they occur within a context (Horng, 2005). As it relates to teaching, a plethora of factors contributes to this context. Ultimately, the positive and negative aspects of the teaching environment enhance or hinder teacher effectiveness and student performance (The Southeast Center for Teacher Quality, 2004). Teachers' working conditions, especially conditions in urban districts, are largely ignored in the reform literature and research (Taylor & Bogotch, 1993). Yet, a study conducted by Ginsberg, Schwartz, Olson, and Bennett (1987) found that poor working conditions are more the norm than the exception in urban schools. Early studies of teacher working conditions indicated that in some schools teachers face an environment that includes discipline problems (Cassner-Lotto, 1987), neighborhood violence (Ginsberg et al., 1987), a lack of textbooks and supplies (Bacharach, Bauer, & Shedd, 1986; McLaughlin & Yee, 1988), burdensome paperwork that is irrelevant to

student learning (Apple, 1983; Darling-Hammond & Wise, 1985) and dilapidated buildings (Ornstein & Levine, 1989). Elmore (1987) cautions that reform efforts that focus on improving schools and student achievement are improbable if the attempted reforms "fail to take account of the constraints under which teachers work" (p. 66).

Some recent studies have shifted from examining teacher quality out of context to considering effective teaching in the context of where teachers work (Johnson, 2006). These studies have shown clearly that the workplace can enable or constrain good teaching (Bryk & Schneider, 2002; Johnson & the Project on the Next Generation of Teachers, 2004; Mclaughlin &Talbert, 2001; Rosenholtz, 1989). Factors such as whether the school building is well equipped, whether colleagues provide helpful assistance, or whether there are good support services for students all mediate what any teacher, however talented or well trained, can accomplish in the classroom. Thus, improving the conditions of the school as a workplace can increase the capacity of schools to serve all students (Johnson, 2006).

Using data from the Schools and Staffing Survey (SASS), Ingersoll (2001) concluded that teachers were leaving their schools because they were dissatisfied with organizational challenges within their schools. Some moved to different schools; others left teaching entirely. Nationally, in 1999–2000, 27 percent of first-year teachers left their schools. Of those, 11 percent left teaching altogether, and 16 percent transferred to new schools (Smith & Ingersoll, 2003). Large urban districts report even higher rates of attrition. In Philadelphia, for example, one-quarter of teachers new to the district in 1999–2000 left after their first year, and more than half left within four years (Neild et al.,

2003). In Chicago, an analysis of turnover rates in 64 high-poverty, high-minority schools revealed that 23.3 percent of new teachers (those with five years experience or less) left in 2001–2002. From the perspective of the school, the departure of an experienced, effective teacher reduces the school's capacity to do its work. Whether the departing teacher leaves for another career or moves to the school across town because it offers a better workplace, that individual takes away an expertise and accumulated knowledge about the students, their families, the curriculum, and the school's practices. Such turnover severely compromises the chance that all students will be taught by effective teachers (Johnson, 2006). Since school working conditions and student characteristics are often highly correlated, teachers may choose to not work with low-income students, low performing students, and students of color because of the poor working conditions which are often prevalent with these students (Horng, 2005).

Recent studies conducted in California, Texas, New York, and Georgia show that teachers systematically move away from schools with low levels of achievement and high concentrations of poor children of color (Carroll, Reichardt, Guarino, & Mejia, 2000; Hanushek, Kain, & Rivkin, 2003; Lankford, Loeb, & Wyckoff, 2002). Data from the studies suggest that teachers do not avoid particular groups of students; rather they avoid undesirable school environments. Working conditions, not student characteristics, are the more powerful determinant of where teachers choose to work (Horng, 2005).

In another study that examined the tradeoffs teachers would make among ten attributes when selecting a school in which to work: salary, class size, administrative support, input on school-wide decisions, commute time, resources for students, school

facilities, student performance, student ethnicity, and student socioeconomic status, the findings suggests that working conditions are more important to teachers than student ethnicity, socioeconomic status, or performance. Horng (2005) surveyed 547 teachers in a large, urban elementary school district in California. The results of the study show that of the ten attributes, school facilities, administrative support, and class size were the three most important to teachers. Of the attributes, having clean and safe facilities was more than twice as important to teachers as each of the three student demographic attributes and was 30% more important than receiving an additional $8,000 in annual salary. Figure 2 shows the ten attributes teachers preferred when selecting a school listed from most important to least important and the average importance score for each attribute (Horng, 2005, p. 3)

Attributes	Percent
School facilities	13.91
Administrative Support	12.84
Class Size	12.79
Commute Time	11.73
Additional Salary	10.82
Resources for students	10.10
Input on school-wide decisions	8.80
Student SES	6.55
Student Performance	6.52
Student ethnicity	5.95

Figure 2. Ten attributes teachers preferred when selecting a school listed from most important to least important and the average importance score for each attribute.

As a part of this study, the researcher offered policy recommendations. Horng (2005) stated, “Improve working conditions at hard-to-staff schools and collect data on working conditions at all schools. This study demonstrates that when teachers move away from schools serving a large concentration of low-income students, low-performing students, and/or students of color, they are more likely to be moving away from the correlated dismal working conditions than moving away from the student themselves. Consequently, teachers can be encouraged to stay at these schools by providing clean and safe schools, very good administrative support, small class sizes, sufficient resources for students, and opportunities to participate in school policy decision making” (p. 5).

In a similar study, under the leadership of Governor Mike Easley, North Carolina became the first state in the nation to study teacher working conditions. The Teacher Working Conditions Initiative began with a teacher working conditions survey that was developed and piloted by the North Carolina Professional Teaching Standards Commission in 2001 (The Southeast Center for Teacher Quality, 2004). The Commission conducted research and focus groups to develop 30 working conditions standards for schools in five broad categories: time, empowerment, professional development, leadership, and facilities and resources. Focus groups with more than 500 teachers validated the categories or domains. The original survey was made available to every licensed public school educator in 2002, and solicited teacher responses on 39 statements regarding working conditions in these five categories.

The findings from that survey demonstrated a level of dissatisfaction across the state with teacher working conditions, particularly related to the amount of time available

for teachers to perform their jobs. The survey results also indicated that the collective perceptions of principals was far more positive than teachers' collective perceptions. Elementary teachers and teachers in smaller schools were more likely to rate their work environment positively (The Southeast Center for Teacher Quality, 2004).

The summary below presents a brief overview of the six primary findings and implications for the state.

Finding 1: Teacher working conditions are important predictors of student performance

- Survey results for professional development were a significant predictor of AYP status for North Carolina Schools. For every one point increase in satisfaction with professional development, schools are four times more likely to achieve AYP.
- For every one point increase on the survey in all schools on the facilities and resources, schools were three times more likely to achieve AYP.
- Leadership was the greatest predictor of AYP status at the middle school level, more so than school size and teacher retention and school size. For every one point increase in the area of leadership, middle schools were 6.7 times more likely to achieve AYP.

Finding 2: Teacher working conditions make a difference to teacher retention

- Teachers indicated that working in a collegial atmosphere (34%) led by a principal with a strong instructional emphasis (27%) mattered most in teachers decisions about whether or not to stay in the school in which they work.

Finding 3: Perceptions of working conditions are reflective of actual school conditions

- The relationship between teachers' perception of time and the amount of planning time provided are significantly related. Teachers receiving more planning time had more positive views of working conditions. Conversely, those who spent more time outside of the school on school-related activities were more likely to feel negative about time.

Finding 4: Leadership is critical to improving working conditions but principals and teachers perceive these conditions very differently

- Principals were more positive about working conditions in every area, particularly about the amount of time teachers have and how empowered they are to make decisions on education issues.

Finding 5: Teachers, regardless of their background and experience, view working conditions similarly

- Race, gender, highest degree earned, means of preparation (alternative entry versus traditional), and certification status does not appear to affect teacher perceptions of any working conditions domain.
- While background does not appear to influence teacher's perceptions of their working conditions the school level in which they work does. Elementary teachers had more positive perceptions of working conditions than secondary teachers, particularly those at the high school level.

Finding 6: Many aspects of working conditions have “ripple effects”

- Leadership and professional development are strongly correlated. Many of the critical issues within the professional development area involve principals acting as strong instructional leaders, prioritizing, providing resources and allowing teachers to direct their own learning.
- Leadership and empowerment are closely related. Teachers who felt empowered to make decisions about their classroom and school work have positive views of their school leader.

The findings from this study support the importance of identifying and discussing teacher working conditions. Significant and compelling connections between working conditions and student achievement were documented. Ensuring a qualified teacher for every student is not enough to close the achievement gap. Teachers must have the resources and support they need to serve all students well, and without comprehensive and sustained efforts to improve teacher working conditions many school reform efforts could go unfulfilled (The Southeast Center for Teacher Quality, 2004).

Student Achievement in Urban Schools

The movement to reform education in the U.S. is arguably about improving urban public schools. Every debate about standards, testing, governance, busing, vouchers, charter schools, social promotions, class size, and accountability are discussions at their core about public education in the urban areas. These discussions are worth having, for nowhere does the national resolve to strengthen its educational system face a tougher test than in our inner cities. There, every problem is more pronounced; every solution harder

to implement (Snipes, Doolittle, & Herlihy, 2002). The burden of not solving these problems or implementing successful improvement strategies has fallen disproportionately on the African American and Latino children, children with disabilities and those learning English who live in the poverty-stricken cores of America's major cities (Snipes, Doolittle, & Herlihy, 2002). The nation cannot afford to ignore these communities, for urban schools enroll a large share of America's children. While there are 16,850 public school districts in the United States, one hundred of those districts serve approximately 23 percent of the nation's students. These districts, many of which are located in urban areas, also serve 40 percent of the country's minority students and 30 percent of the economically disadvantaged students. Unfortunately, urban school districts face a common set of challenges which make it difficult to ensure all students receive a high quality education. The primary challenges include: unsatisfactory academic achievement; inexperienced teaching staffs; low expectations and lack of a demanding curriculum; lack of instructional coherence; high student mobility; political conflicts, and unsatisfactory business practices (Snipes, Doolittle, & Herlihy, 2002).

Urban students are faced with many extraneous factors that suburban students typically do not need to worry about on a daily basis. Students in urban schools are expected to focus on acquiring skills to help them lead a more prosperous life, while at the same time they are faced with many distractions. The horrendous conditions of the school, such as leaking roofs and sewage problems, are not conducive to learning (Anonymous, 2008). Also, urban students live in crime-infested neighborhoods with violence on the streets. Problems outside the classroom which affects students learning

tends to have a great impact in the classroom in urban schools (Leland & Harste, 2005). These problems directly affect student motivation which then has an unequivocal effect on their achievement. Therefore, unlike suburban students who attend schools in a safe and pleasant environment, where learning is the first priority; learning is not the primary concern for many urban students (Anonymous, 2008).

According to Maslow's hierarchy of needs, individuals have both deficiency and growth needs. Deficiency needs are basic needs for a person's physical and psychological welfare. Growth needs, on the other hand, include the need for knowing, appreciating and understanding. These needs can never fully be satisfied (Slavin, 2005). Growth needs cannot be pursued until all the basic needs of an individual are met. According to Slavin (2005), schools and government agencies need to realize that if a student's basic needs are not met, then learning will suffer.

The majority of students that attend urban schools are from minority families who live below the poverty line). Most often they are from single-parent families where the parent is usually holding more than one job to support the family and so little attention is given to the child (Lee, 1999). Many students have very few positive role models. Often times, their parents may have drug or alcohol addictions, are verbally abusive, neglectful and/or are school dropouts themselves. Many urban children are also deprived of adequate food on a daily basis and come to school hungry. These children often lack proper health care (Lee, 1999). In addition, the child's safety is compromised by living in crime-infested neighborhoods filled with violence. Due to the lack of the child's basic needs being met, more children who attend urban schools start school with a major

disadvantage. Whereas, students of suburban schools, with their basic needs already having been met, are able to focus on learning and satisfying their growth needs. Many urban students are less concerned with learning and achieving a positive self-image than they are about obtaining food or safety. This has a large and lasting affect on their student achievement (Lee, 1999).

Many urban students end up dropping out of school (Lee, 1999). For various reasons, students no longer feel the need to try and so they just quit. Some students feel that teachers are impatient with their lack of understanding and have low expectations. As a result of their failure to comprehend the material, many students skip class. This then becomes a vicious cycle, because children get even more lost in material and eventually give up altogether (Lee, 1999). Some students feel that they receive no encouragement and only end up meeting resistance when they try to advance their education. They end up in a state of learned helplessness where they feel that no matter how hard they try they are going to fail and for this reason many students just give up. In an ethnographic study investigating school failure in urban schools “absenteeism, perceptions of racism, and personal relationships with teachers” were quoted as being the main reasons for student dropouts (Lee, 1999). Students hold school factors responsible as their primary influences on academic achievement. They stated that teacher-centered classrooms, perceived racism and discrimination against students, as well as teacher apathy, lack of caring and low expectations all are factors contributing to the low achievement of students in urban schools (Lee, 1999).

In spite of the overwhelming lack of student achievement in urban schools, there is still a significant number of students that despite the circumstances overcome the obstacles and manage to succeed. Also, due to recent school reforms, many school systems once deemed as beyond repair are now making significant progress in raising student achievement (Anonymous, 2008). Recent studies conducted in Houston, Sacramento, and Charlotte have demonstrated a trend of improved overall student achievement (Snipes, Doolittle, & Herlihy, 2002). The districts involved in the study shared the following elements in common:

- They focused on student achievement and specific achievement goals, on a set schedule with defined consequences; aligned curricula with state standards; and helped translate these standards into instructional practice.
- They created concrete accountability systems that went beyond what the states had established in order to hold district leadership and building-level staff personally responsible for producing results.
- They focused on the lowest-performing schools. Some districts provided additional resources and attempted to improve the stock of teachers and administrators at their lowest-performing schools.
- They adopted or developed district-wide curricula and instructional approaches rather than allowing each school to devise their own strategies.
- They supported these district-wide strategies at the central office through professional development and support for consistent implementation throughout the district.

- They drove reforms into the classroom by defining a role for the central office that entailed guiding, supporting, and improving instruction at the building level.
- They committed themselves to data-driven decision-making and instruction. They gave early and ongoing assessment data to teachers and principals as well as trained and supported them as the data were used to diagnose teacher and student weaknesses and make improvements.
- They started their reforms at the elementary grade levels instead of trying to fix everything at once.
- They provided intensive instruction in reading and math to middle and high school students, even if it came at the expense of other subjects.

Urban schools still have a long way to go, but the sweeping reform is making significant improvements in student achievement. All urban school districts need to apply successful reform efforts to schools in desperate need of them (Lee, 1999). Sandra Feldman, the president of the American Federation of Teachers, says it best:

> While no one would claim that urban school districts have yet achieved universal excellence, no one can deny the progress evident in their accomplishments over the past few years. If we have the guts and patience to work together, we can rebuild these schools into places where teachers can teach and kids can learn and flourish. (American Federation of Teachers, 2005, p. 5)

Recommendations for Improving Mathematics Achievement

Math achievement is improving slightly, but much more work must be done to ensure that our children receive a sound background in mathematics (U.S. Department of Education, 2004). According to the Third International Math and Science Study (TIMSS), U.S. 8th-grade students' mathematics achievement is below average internationally, and it is lower than that of students in many countries that are our economic competitors. Additionally, U.S. 8th-grade students perform relatively better in some mathematics content topic areas than in others. Relative to international averages, U.S. students are about average in the areas of algebra; fractions; and data representation, analysis, and probability; and below average in geometry, measurement and proportionality (U.S. Department of Education, 2004).

Math is a critical skill in the information age. While technology advances with lightning speed, stagnant math performance in schools shortchanges our students' future and endangers our prosperity and our nation's security (U.S. Department of Education, 2005). According to the scores on the 2000 National Assessment of Educational Progress (NAEP), the average math scores of fourth- and eighth-graders, and twelfth-graders have improved only slightly. Only a quarter of our fourth- and eighth-graders are performing at or above proficiency levels in math (United States Department of Education, 2005). Twelfth-grade math scores have not improved since 1996, and a closer look at those scores reveals that the biggest drop occurred with students who already are scoring at the lowest levels of achievement. These are the students who most need our help and who can least afford to lose any more ground (United States Department of Education, 2005).

In order to enhance middle school mathematics achievement and teaching, Edward Silver (1998) makes the following recommendations based on the TIMMS report:

1. Make a serious national commitment to improved mathematics learning by all students.
2. Make the school mathematics curriculum more ambitious and enhance classroom instruction.
3. Invest in professional development and capacity building to support improved mathematics achievement.

In the 2001 text, *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement*, the authors Marzano, Pickering, and Pollock identify nine research-based strategies for increasing student performance. Listed below are descriptions of each of the nine strategies, which can be applied to mathematics as well as other areas of instructions:

- Identifying similarities and differences
- Summarizing and notetaking
- Reinforcing effort and providing recognition
- Homework and practice
- Nonlinguistic representations
- Cooperative learning
- Setting objectives and providing feedback

- Generating and testing hypotheses
- Cues, questions, and advance organizers

If we as a nation adopt the belief that all students can learn mathematics; if we act in consistent, coordinated ways to effect that goal; and if we make the requisite commitment of human and financial resources, there is good reason to think many more students will succeed. Our children deserve nothing less than the best mathematics education in the world (U.S. Department of Education, 2004).

Summary

Of the many disparities evident in the U.S educational system, one of the most glaring is students' access to qualified teachers. Although research has demonstrated that access to qualified teachers is one of the most powerful determinants of student achievement, there is great inequality in access to this critical resource, especially in urban districts (Horng, 2005).

> No matter which study you examine, no matter which measure of teacher qualities you use, the pattern is always the same — poor students, low-performing students, and students of color are far more likely than other students to have teachers who are inexperienced, uncertified, poorly educated, and underperforming. Many of those teachers demonstrate most or all those unfortunate qualities all at the same time. (Carey, 2004, p. 8)

A teacher's qualifications contribute to teacher quality through (a) college majors, (b) teacher preparation, (c) certification, (d) professional work experiences, (e)

examination scores, (f) aptitude, and (g) demographics (Ferguson, 2005). The literature suggests that teacher quality and student achievement, especially in mathematics, are two significant challenges for schools. For this reason, educational researchers (Ballou & Podgursky, 2000b; Darling-Hammond, 2000; Goldhaber & Brewer, 2000; Monk, 1994; Weglinsky, 2000a; Wilson, Floden, Ferrini-Mundy, 2001) have conducted various studies to determine teacher factors that impact student achievement. In order to enhance mathematics achievement, it is important for educators in Alabama and across the United States to understand the relationship between teacher qualifications and student achievement in mathematics.

III. METHODS

Introduction

The purpose of this study was to evaluate whether or not there is a significant difference in teacher qualifications that might predict the academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). This study examined the relationship between the factors of teacher preparation, certification, and teaching experience. Measures of teacher qualifications included the following variables: (a) the number of mathematics semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school mathematics.

There was a need for this study because in the State of Alabama, the 7–8 grade span has the lowest percentage of students scoring at the proficient levels on the math portion of the Alabama Reading and Math Test (ARMT). During the 2007 administration of the ARMT, the percentage of students scoring at the proficient level in grades 6–8 was as follows: Grade 6–73%, Grade 7–60%, and Grade 8–67% (Alabama State Department of Education, 2007a). This study addressed the issue of this problem of low mathematics achievement by examining the relationship between mathematics teacher preparation and experience to the achievement level of middle school students (grades 7–8) on the

mathematics section of the Alabama Reading and Math Test (ARMT). The outcomes of this study may assist teachers, principals, and superintendents by identifying potential predictors related to teacher characteristics that may result in higher student achievement in mathematics.

This study investigated the following research questions:

1. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' number of mathematics semester hours completed?

2. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the type of teacher certification?

3. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's total number of years teaching mathematics?

4. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' total number of years teaching middle school mathematics?

In this chapter, the researcher presents a description of the research process that was used in this study. The research design, the sample selection, data collection procedures, protection of human subjects, development of instrumentation, data coding process, and statistical analysis are also discussed.

Theoretical Framework

The theoretical framework for this study is presented in Figure 3. As illustrated in the diagram, the independent variables of (a) number of mathematics hours completed, (b) type of teacher certification held, (c) teacher's total number of years teaching mathematics, and (d) teacher's total number of years teaching middle school mathematics impact or has a relationship to student achievement in mathematics.

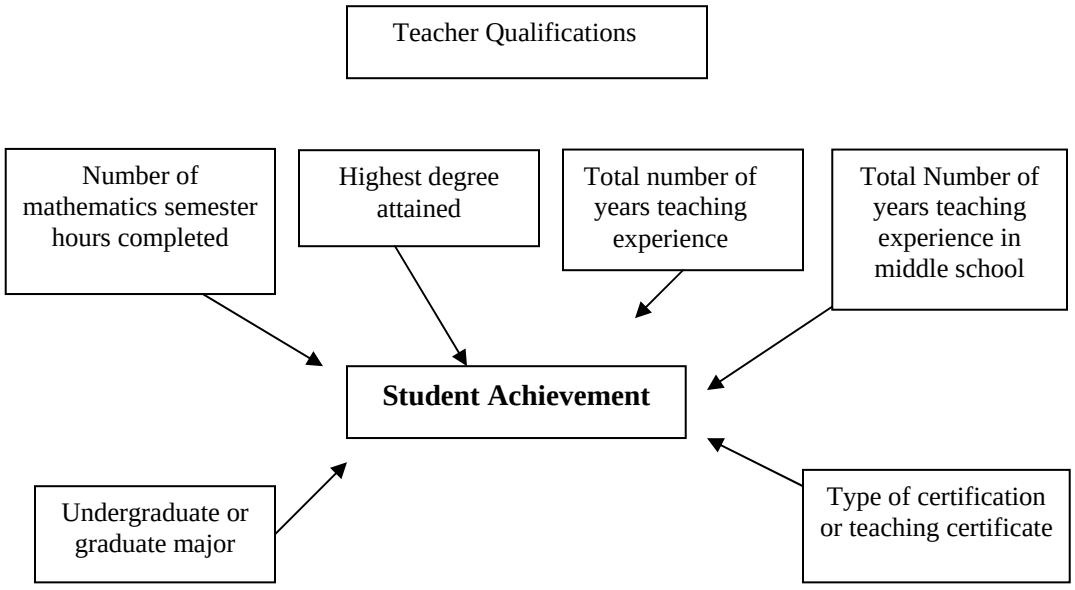

Figure 3. Teacher Qualifications and Student Achievement

Design of the Study

The purpose of this study was to determine the extent to which student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to teachers' qualifications. The researcher used a causal-comparative research

design to determine if a statistically significant relationship exists between teacher qualifications factors and student achievement on the mathematics section of the Alabama Reading and Math Test. This quantitative framework was employed because the groups being studied were already established. Crowl (1996) suggested that causal-comparative research allows the researcher to determine if there are any possible relationships that might exist between the groups that were already created.

The researcher used a researcher-designed survey that was adapted from the 2004 NAEP Mathematics Background Survey. Student test scores from the Spring 2007 ARMT were matched to each of the teacher survey responses. The independent variables for this study were the qualifications of each of the respondents. They included: (a) number of mathematics semester hours completed, (b) type of teacher certification held, (c) teacher's total number of years teaching mathematics, and (d) teacher's total number of years teaching middle school mathematics. The dependent variable was the students' scores on the math section of the Alabama Reading and Math Test for the April 2007 test administration. The survey instrument used for this study was revised and modified from the 2006 National Assessment of Educational Progress (NAEP) Grade 8 Mathematics Teacher Background Questionnaire. The *Teacher Background Survey* was used to collect data regarding the teachers' educational preparation, type of certification held, highest degree earned, and teaching experience. The instrument used in this research consisted of a one-page (front and back) survey. It consisted of 11 questions and was divided into three sections titled: Personal Information, Educational Background, and Teaching Experience.

The first section, Personal Information, included 4 items which asked questions about each participant's background. It included items such as name, school assignment during the 2006–2007 academic year, race, and gender. There were two open-ended questions and two multiple choice questions.

The second section, Educational Background, asked questions about each teacher's college major, type of certification held, highest degree earned, and number of undergraduate or graduate mathematics semester hours completed. It included 4 multiple choice questions.

The final section of the survey, Teaching Experience, collected information regarding each teacher's mathematics teaching experience excluding student teaching and substitute teaching assignments. It consisted of 3 multiple-choice questions that addressed items such as the number of years of teaching experience at the elementary, middle/junior high or secondary levels.

To ensure control of the study, the researcher compared students by classrooms using the mean ARMT score, for the teacher's classroom on the mathematics section of the Alabama Reading and Math Test (ARMT). For the purposes of this study, each teacher's classroom included all students taught by the teacher regardless of the class size. To address the issue of variance, Crowl (1996) suggested that the researcher identify what the variables have in common. For example, one should analyze the similarities that exist amongst the teachers according to the total number of years teaching experience and/or years of experience teaching at the middle/ junior high school level. The students in this study were enrolled in the same mathematics courses during the 2006–2007

academic school year according to their grade level. Seventh graders were enrolled in Mathematics-7 and eighth graders in Pre-Algebra. None of the classes were tracked according to academic ability. A t-test was used to determine any significant differences and relationships between groups. The SPSS statistical analysis program was used to analyze the quantitative data in this study.

Participants

The study was conducted in an urban school district in Alabama and examined the relationships of teacher characteristics and student achievement for 7^{th} and 8^{th} graders. The principals of the selected schools were sent an informational letter that described the purpose of the study and sought to obtain permission to conduct the study. After allowing sufficient time for the principals to review the letters and the survey instrument, the principal investigator received an official letter from each of the principals granting approval to conduct the study (see Appendix B).

The researcher utilized a nonprobability sampling strategy because the students, teachers, and schools in this study are typical of those in most city school districts in Alabama. The population in this study consisted of full-time teachers who were employed as 7^{th} or 8^{th} grade mathematics teachers at one of eight traditional (nonmagnet) middle/junior high schools in Montgomery Public Schools District, Montgomery, Alabama. All potential participants in the study had to have taught at least one math course in the Montgomery School District during the 2006–2007 school year. The courses taught by the teachers were either Mathematics 7 or Pre-Algebra 8. These were

the only two mathematic class offerings for students who did not attend magnet schools in grades 6–8. There were twenty-three teachers in the sample. A total of 20 surveys were returned by the conclusion of the study for a return rate of 86.9%.

All of the schools in the study are located in urban settings in Montgomery, Alabama. The Montgomery Public Schools District has a student enrollment of 32,520 students and 58 schools. There are ten middle/ junior high schools. There are approximately 38 math teachers that are assigned to teach either 7^{th} or 8^{th} grade mathematics. The school district is a mix of mostly city schools with a few schools located in rural areas of the county. The schools in the district have a diverse student population based on ethnicity and economics.

Research Procedures and Data Collection

The procedures used for conducting the research and data collection are presented below.

Step 1: The researcher sent a letter to the Review Committee for Research in the Montgomery Public School System requesting approval to conduct the study (see Appendix A).

Step 2: Upon receiving an approval letter from each participating school's principal, the researcher submitted a *Research Protocol Review Form* to the Office of Human Subjects Research at Auburn University (see Appendix C).

Step 3: Upon receiving an approval letter from each participating school's principal (see Appendix B) and the Office of Human Subjects Research at Auburn University (see Appendix C), the researcher met with the Survey Administrator (math department chairperson or grade level chairperson) at all schools to discuss the study's purpose and procedures for distributing and collecting data. At this meeting, each Survey Administrator received a packet that included a script for administering the survey, informed consent forms, *Teacher Background Surveys*, and return envelopes (see Appendices D, E, and F). The Survey Administrators were requested to distribute the surveys to all 7th and 8th grade math teachers at each school at one time so that they could be completed and returned immediately. Teachers were asked to complete the surveys and return them in the sealed envelope, provided by the researcher. The Survey Administrators were asked to collect the surveys and place them in the large envelope provided and return them to the researcher.

Step 4: The researcher contacted the Director of Assessment and Accountability for the Montgomery Public Schools District. A request was made to obtain a copy of all the Spring 2007 Alabama Reading and Math Test (ARMT) school reports for the traditional (nonmagnet) middle schools in the district. A request was also made to receive the average mean score for each class section taught by the math teachers according to grade level.

Step 5: The researcher compiled and compared the data from the teacher surveys regarding their qualifications. This information was later used to compare and determine relationships to student performance.

Step 6: The researcher analyzed the scores of the students who were taught by teachers of various qualifications to determine any significant differences or relationships.

Data Coding

The surveys were coded by school which was indicated by placing a number in the upper right hand corner. This number matched a number assigned to a particular school on a code list of the middle/junior high schools selected to participate in this study. The teachers were provided an informed consent letter and asked to return the surveys in the sealed envelope provided by the researcher to minimize the risk of breech of confidentiality. Once the surveys were returned, the codes were matched and that particular survey was struck from the code list so that researcher could identify who had completed the survey. One week after each Survey Administrator received a packet that included information letters, scripts, and surveys, a reminder e-mail was sent to remind the teachers who had not returned the survey to do so by the end of the week if they were going to participate in the study. This email offered thanks if the survey had been returned. The email provided phone numbers and an email address to contact the researcher in order to complete the survey online or request another survey due to it being lost or misplaced.

Protection of Human Participants

The initial proposal, informed consent procedures and letters, and survey instruments were carefully reviewed and approved by the researcher's dissertation committee, the principals at each participating school, and Auburn University's Institutional Review Board (see Appendices A, B,C D, and E,). All teachers were provided an informed consent letter inviting them to participate in the study (see Appendix D). The informed consent letters invited participation in the study, communicated that results would be treated as anonymous, and clarified the purpose of study.

Validity and Reliability

Content validity determines whether or not the test and its questions are representative of the content that the investigator intends to measure (Ferguson, 2005). The questions on the survey were developed from the National Assessment of Educational Progress (NAEP) Grade 8 Mathematics Teacher Background Questionnaire and in collaboration with the researcher's dissertation committee members. The researcher piloted the teacher survey with several retired teachers and administrators in order to ensure content validity. By administering the survey to others not involved in the study, the researcher was able to ascertain the face validity to determine readability and clarity of content in order to ensure that the survey was obtaining the desired data desired from the teachers (LoBiondo-Wood & Haber, 1994). Based on feedback, two additional questions were added and formatting was changed on the survey. Additionally, revisions

were made to the questions on the survey instrument in order for them to appear more concise. The reliability of the measure is addressed in Chapter IV.

Data Analysis

A quantitative research design was utilized in this study. Section one of the instrument included demographic information of about the participants. Section two consisted of questions that gathered data about the participants' educational background. Section three of the instrument included statements that related to the teaching experience of the participants. As the surveys were collected from each of the school sites, the researcher entered participant responses into the SPSS 16 computer program.

These data were analyzed by the researcher using a t-test to determine the extent to which student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to teachers' qualifications. Groups were coded and categorized by (a) number of mathematics semester hours completed, (b) type of teacher certification held, (c) teacher's total number of years teaching mathematics, and (d) teacher's total number of years teaching middle school mathematics. Rossman and Rallis (1998) identified coding as a process of organizing the material into chunks or categories before bringing meaning to those chunks. The dependent variable was the students' scores on the math section of the Alabama Reading and Math Test for the April 2007 test administration. Descriptive statistics, including return rates, frequencies, means and standard deviations were presented in charts and tables in Chapter Four along with a short narrative explaining the results.

Situating Self as Researcher

The principal investigator is employed as a middle school principal with the Montgomery Public Schools District in Montgomery, Alabama. He has been an administrator in this school for 2 years. During this time he has been concerned about the low achievement scores earned by students attending the school, particularly in the area of mathematics. He conducted this study to explore whether there is a relationship between teacher qualifications and the academic performance of middle school students on the mathematics section of the Alabama Reading and Math Test (ARMT). In the state of Alabama, the ARMT is the accountability test used at the elementary and middle school to determine Adequate Yearly Progress (AYP). As a middle school principal employed at an under performing school with students who have struggled with math performance, being able to identify potential predictors related to teacher qualifications that may result in higher student achievement in mathematics would be beneficial when hiring math teachers. Additionally, information from a study like this may be useful when designing professional development activities for mathematics teachers in my school.

In order to lessen the researcher's bias as he conducted the study, the survey used to collect teacher background data was distributed and collected by a survey administrator (math department chairperson or grade level chairperson) at each of the eight schools participating in the study. All traditional (nonmagnet) middle schools in the county school district participated in the study except the school where the researcher is employed. Additionally, each respondent completing the survey placed it in an envelope that was sealed to ensure anonymity. By following these procedures, the researcher is

confident that each 7th or 8th grade math teacher at the selected schools had an opportunity to complete the Teacher Background Survey in a non-coercive environment. Further, student achievement data for the Spring 2007 Alabama Reading and Math Test (ARMT) was provided and aggregated by grade level at the district level by Central Office personnel who would have access to student data as part of their normal job responsibilities. While the principal investigator recognized that aggregate student data is not the strongest measure for a study such as this one, it still yielded useful data. The researcher believed that by making the compromise of not utilizing individualized student scores there was a greater degree of protection to teacher and student identities. The researcher strongly believes that protection of study participants' anonymity was of greater concern than having individually identifiable data, even though it was a limitation of the study.

Summary

The purpose of this study was to evaluate whether or not there is a significant difference in teacher qualifications that might predict the academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). This study examined the relationship between the factors of teacher preparation, certification, and teaching experience. Chapter III presented the design of the study, sample selection, participants, data collection procedures, data coding and protection of human participants. The chapter also provided a description of the

instrument used in the study, the validation process, and the pilot testing of the *Teacher Background Survey and data analysis.* Chapter IV presents the findings of the study.

IV. RESULTS

Findings

According to Rice (2003), teacher quality matters. In fact, it is the most important school-related factor influencing student achievement. In an effort to determine if significant relationships exist between teacher factors (preparation, certification, and teaching experience) and student mathematics achievement on the Alabama Reading and Math Test, *The Teacher Background Survey* was designed and served as the basis for this research study. Twenty full-time middle or junior high school mathematics teachers participated in this study. Each of the participants taught 7th or 8th grade mathematics at one of the eight traditional (nonmagnet) middle/junior high schools in the Montgomery Public School District, Montgomery, Alabama during the 2006–2007 school year.

The purpose of this study was to evaluate whether or not there is a significant difference in teacher qualifications that might predict the academic performance of middle school students (grades 7–8) on the mathematics portion of the Alabama Reading and Math Test (ARMT). Measures of teacher qualifications included the following independent variables: (a) the number of mathematics semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school mathematics. This study focused on the middle school mathematics students and teachers in an urban district in

Montgomery, Alabama. Eight of the nine traditional (nonmagnet) middle or junior high schools in the Montgomery Public School District participated in the study. The ninth school was not included in this study since the researcher serves as that school's principal. The researcher examined the Alabama Reading and Math Test (ARMT) achievement levels of these middle school students in comparison to the preparation and experience levels of their respective teachers to identify potential predictors related to teacher characteristics that may result in higher student achievement in mathematics.

This study investigated the following research questions:

1. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' number of mathematics semester hours completed?

2. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the type of teacher certification?

3. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's total number of years teaching mathematics?

4. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' total number of years teaching middle school mathematics?

Chapter IV presents the results of the data analysis. The chapter begins with demographic information of the participants. The second section provides the findings

from the teacher survey. In the third section, the statistical findings related to the four research questions are presented. The fourth section reveals the t-test results. The chapter concludes with a summation of the findings.

Descriptive Statistics for Participants

The sample in this research study included 20 full-time mathematics teachers who were employed at 1 of the 8 traditional (non-magnet) middle/junior high schools located in the Montgomery Public School District, Montgomery, Alabama. Of the participants, 3 (15%) identified themselves as White or Caucasian, and 17 (85%) as Black or African-American. The gender distributions among participants were 8 (40%) males and 12 (60%) females. Table 3 displays the demographic information for the participants.

Table 3

Demographic Information of the Participants

Males		Females	
White	Black	White	Black
1	7	2	10
(12.5%)	(87.5%)	(16.7%)	(83.3%)

Respondents

A master list of the 7th and 8th grade mathematics teachers was acquired from the district's central office. This list included the teachers who taught at least one

mathematics class at one out of eight traditional middle/junior high schools in the selected district during 2006–2007 school year; thus, their students participated in the Alabama Reading and Math Test Assessment. Of the 23 surveys administered, 20 were returned for a return rate of 86.9 %. The data in Table 4 describes the teacher surveys collected by school for the purpose of this study.

Table 4

Teacher Survey Data Collected by School

Schools	Surveys Received	Number of Teachers Completed	Percent Returned
Middle School A	3	3	100
Middle School B	5	5	100
Middle School C	3	2	67
Middle School D	3	3	100
Middle School E	1	1	100
Middle School F	4	3	75
Middle School G	3	3	100
Middle School H	1	1	100
Total	23	20	86.9

$N = 20$

Each teacher was asked to provide their name and the school they taught at in during the 2006–2007 school year in order to match the survey results with the student's test data for the spring 2007 administration. The Teacher Background Survey (see Appendix E) had a total of 11 questions. There were seven multiple choice questions and four fill-in-the-blank questions.

Table 5 provides the number of teachers by school that participated in the study. There were eight schools that participated in the study. However, Middle School H was not included in the analysis since the one teacher who completed the survey was employed at the researcher's school during the 2006–2007 school year. Therefore the results only reflect data from 7 of the schools.

Table 5

Participating Respondents by School

School	Frequency	Percent
Middle School A	3	15
Middle School B	5	25
Middle School C	2	10
Middle School D	3	15
Middle School E	1	5
Middle School F	3	15
Middle School G	3	15
Total	20	100

N = 20

Table 6 provides the survey results for academic major as a part of either the undergraduate or graduate coursework for teachers in the study. The largest number of participants majored in mathematics education. Of the respondents who completed the survey, 50% were mathematics education majors; 30% were mathematics majors; whereas 20% majored in an area other than mathematics education or mathematics.

Table 6

Respondents' Academic Major as Part of Undergraduate or Graduate Coursework

Major	Frequency	Percent
Mathematics Education	10	50
Mathematics	6	30
Other	4	20
Total	20	100

N = 20

The sixth question on the teacher survey focused on the type of certification or teaching certificate held by the teacher. Although the Alabama Department of Education does not offer a middle school mathematics certification, it was offered as a choice on the survey to remain consistent with items asked on the NAEP survey. Additionally, an alternative certifications option was included for those teachers enrolled in an alternative degree program. The levels of certification were coded as: (1) elementary education (K–8

or 1–8), (2) middle/junior high education, (3) secondary mathematics, (4) alternative certification, and (5) other. The coding was based on research which indicated that teachers with secondary mathematics certification produced higher student achievement (Darling-Hammond, 2000: Hawk et al., 1985). Tables 7–9 show the frequencies for each of the certification levels for the 20 teachers in the study. Several of the respondents held more than one type of certification. There were no participants in the study that held an elementary certification.

Table 7

Participating Respondent's with Middle/Junior High Certification

Status	*n*	Percent
Yes	4	20
No	16	80
Total	20	100

N = 20

Of the respondents, 4 (20%) held a middle/junior high certification, and 16 (80%) did not have a middle/junior high certification.

Table 8

Participating Respondent's with Secondary Mathematics Certification

Status	*n*	Percent
Yes	11	55
No	9	45
Total	20	100

N = 20

Of the respondents, 11 (55%) held a secondary mathematics certification.

Table 9

Participating Respondents with Alternative Certification

Status	*n*	Percent
Yes	8	40
No	12	60
Total	20	100

N = 20

Of the respondents, 8 (40%) held an alternative certification.

Table 10 shows the data for the highest degree held by the participants. The choices were Bachelor's Degree, Masters Degree, Educational Specialist Degree, and Doctorate Degree. Of the respondents, 11 (55%) held a Bachelor's Degree, 7 (35%) held

a Masters Degree, and 2 (10%) held an Education Specialist Degree. There were no participants in the study that held .a doctorate degree.

Table 10

Participating Respondent's' Highest Degree Held

Degree Attained	Frequency	Percent
Bachelor's	11	55
Masters	7	35
Educational Specialist	2	10
Doctorate	0	0
Total	20	100

N = 20

Table 11

Respondents Grade Level Taught During 2006–2007

Grade Level	Frequency	Percent
7th	8	40
8th	11	55
7th and 8th	1	5
Total	20	100

N = 20

Of the respondents, 8 (40%) taught 7th grade mathematics, 11 (55%) taught 8th grade mathematics, and 1 (5%) taught both 7th and 8th grade mathematics classes.

Quantitative Data

In this section, the results of the quantitative data statistical findings in relation to the research questions are presented. A t-test was conducted to determine if there was a statistically significant relationship between teacher factors (mathematics course hours completed, type of teaching certificate held, teaching experience at the middle school level, and total years teaching experience) and student achievement in mathematics. A t-test was used to determine group differences because the sample size was small (Kish, 1987). The following sections present findings related to each of the research questions. In this section, the results of the analysis of the data in relation to the research questions are presented.

The first research question, "To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' number of mathematics semester hours completed?", could not be answered. Data analysis could not be completed to answer this research questions because 15 (75%) of the sample had more than 27 hours of mathematics coursework. Therefore, there was not enough variance.

The second research question was "To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the type of teacher certification?" Of the 20 cases, 19 participants had either

secondary mathematics or alternative certification. The sample was divided into two groups (42%/58%). A *t*-test was conducted to determine group differences between secondary and alternative certification using the participant's mean student mathematics score. The assumption of equal variance was not violated, $F = 3.37$; $p = .08$, which means the assumption of homogeneity was met. The mean mathematics score for the participants with secondary certification was 663.73 with a standard deviation of 19.89. For the participants with alternative certification, the mean mathematics score was 647.64 with a standard deviation of 7.51. There was a statistically significant difference between the two certification groups, $t(17) = 2.17$; $p = .05$. Thus, teachers with secondary mathematics certification had students with average test scores that were 16 points higher than teachers with alternative certification.

The third research question, "To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's total number of year's experience teaching mathematics?", could not be answered. A bivariate correlation was conducted to determine the relationship between the total years of teaching experience and the years of experience at the middle school level. Data analysis could not be completed to answer this research question. The results indicate r = .98 which indicates a near perfect correlation. Thus, based on the sample, there was not enough variance.

The fourth research question asked, "To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ

according to the teachers' total number of years teaching middle school mathematics?" Descriptive statistics revealed that for the total years of teaching experience the range was from 2–30 years. The group was split 45% (0–5 years of experience) and 55% (5 or more years experience) and on the median score of years taught. The result suggests a very strong relationship. Thus, teachers having more than 5 years experience had average test scores that were 14 points higher than teachers with 5 or less years experience.

Summary

The findings were presented in Chapter IV. Two of the research questions were answered and the other two were not answered due to a lack of variance based on the small sample size. Chapter V presents implications for this study and areas for further research., and a discussion of the study's significance.

V. DISCUSSION, IMPLICATIONS, AND AREAS FOR FURTHER RESEARCH

The purpose of this chapter is to discuss findings and the conclusions that were drawn based on the analysis of data collected throughout this study. The restatement of the purpose for examining teacher qualifications and student achievement is reviewed followed by a restatement of the study procedures. A discussion of the research findings is presented. Finally, implications and recommendations for future research are discussed.

Restatement of the Study's Purpose

Those who know and care about public education in the United States agree that having a good teacher is a key to students' success (Johnson, 2006). In recent years, researchers have carefully tracked students' achievement over time and confirmed what parents have long known—that the quality of their child's teacher can have lifelong consequences (McCaffrey & others, 2003; Rowan, Correnti, & Miller, 2002; Sanders & Rivers, 1996). The primary purpose of this study was to evaluate whether or not there is a statistically significant difference in teacher qualifications that might predict the academic performance of middle school students (grades 7–8) on the mathematics portion of the Alabama Reading and Math Test (ARMT). Educational researchers (Ballou & Podgursky, 2000a; Darling-Hammond, 2000; Goldhaber & Brewer 2000;

Monk, 1994; Wenglinsky, 2000a; Wilson, Floden, & Ferrini-Mundy, 2001) have conducted various studies to identify the teacher factors that impact student achievement. In a review of literature, Byrne (1983) reviewed 30 studies that focused on the relationship between subject-matter knowledge and student achievement. He found that a majority of the studies showed a positive relationship. Likewise, Wenglinksy (2000a) tried to determine the relationship between student achievement and teacher knowledge. He suggested that teacher knowledge, assessment, and instructional methods had a greater impact on student achievement than class size. Similarly, Hawkins, Stancavage, and Dossey (1998) found that the more knowledge eighth-grade teachers reported of the National Council on Teaching and Mathematics curriculum and evaluation standards, the higher their students' performance tended to be on the NAEP mathematics assessment. Greenwald, Hedges, and Laine (1996) found that teaching experience had a significant effect on student achievement.

Using a theoretical framework (see Figure 3) which suggests that student achievement is impacted by the following teacher qualifications: (a) the number of mathematics semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school, this study attempted to better understand the relationship between factors of teacher preparation, certification, and experiences in order to assist teachers, principals, and superintendents by identifying potential predictors related to teacher characteristics that may result in higher student achievement in mathematics. Measures of teacher qualifications included the following

independent variables: (a) the number of mathematics semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school mathematics.

This research had four major goals: (1) to determine to what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' number of mathematics semester hours completed; (2) to determine to what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the type of teacher certification; (3) to determine to what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's total number of years teaching mathematics; and (4) to determine to what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teachers' total number of years teaching middle school mathematics.

Restatement of Study Procedures

Upon school district authorization to conduct the study, it was determined that a survey would be the best method to conduct this study. The researcher designed a questionnaire that was adapted from the survey used by the National Assessment of Educational Progress (NAEP) which is given to 4^{th} and 8^{th} grade teachers annually in the United States. The questionnaire only included quantitative questions. After

receiving an approval letter from the principals of each of the participating schools, 23 surveys, which were accompanied by a consent form, were distributed during a faculty/grade level meeting during December 2007. Twenty surveys were returned within a two-week period. The percentage of surveys returned was 86.9 percent. The data from the surveys were entered into the SPSS program and analyzed using descriptive statistics which were later used to compare subgroups and determine if there were relationships to student performance.

Discussion of Findings

The two data sources in this research study included student data and teacher survey responses. A total of 20 full-time mathematics teachers from 7 of the 8 traditional (non-magnet) middle/junior high schools located in the Montgomery Public School (MPS) District, Montgomery, Alabama participated in this study. All participants had to have taught at least one mathematics class in the MPS district during the 2006–2007 school year. Of the participants, 3 (15%) identified themselves as White or Caucasian, and 17 (85%) as Black or African-American. The gender distribution among participants was 8 (40%) males and 12 (60%) females.

Each of the participating middle school teachers completed a *Teacher Background Survey* based on their educational preparation, type of certification held, highest degree earned, and teaching experience. The survey consisted of 11 items and was divided into three sections titled: Personal Information, Educational Background, and Teaching Experience. Part I of the survey consisted of personal information. It

included items such as name, school assignment during the 2006–2007 academic year, race, and gender. There were two fill in the blank questions and two multiple choice questions. Part II of the survey explored educational background. It included items about each teacher's college major, type of certification held, highest degree earned, and number of undergraduate or graduate mathematics semester hours completed. This section included four multiple choice questions. Part III of the survey explored teaching experience. It included items about each teacher's mathematics teaching experience excluding student teaching and substitute teaching assignments. It consisted of three multiple-choice questions that addressed items such as the number of years of teaching experience at the elementary, middle/junior high or secondary levels.

The survey results were matched with student data from the 2007 administration of the Alabama Reading and Math Test (ARMT). Four research questions were addressed in this study and findings were presented in Chapter IV. The following sections provide a brief review of key findings. This section reveals the findings from the data analysis.

Research Question One

Data analysis could not be completed to answer this research question. Seventy-five percent of the sample had more than 27 hours of mathematics coursework.

Research Question Two

The results of the *t*-test indicated that there was a significant difference between the participant's students' mean mathematics score based upon whether the teacher held a secondary or alternative certification. Teachers with secondary mathematics

certification had students with average test scores that were 16 points higher than teachers with alternative certification.

Research Question Three

A bivariate correlation was conducted to determine the relationship between the total years of teaching experience and the years of experience at the middle school level. Data analysis could not be completed to answer this research question. The results indicate r = .98 which indicates a near perfect correlation. Thus, based on the sample, everyone's teaching experience was at the middle school level.

Research Question Four

The results of the descriptive statistics revealed that for the total years of teaching experience the range was from 2–30 years. The group was split 45% (0–5 years of experience) and 55% (5 or more years experience) and on the median score of years taught. The result suggests a very strong relationship. Thus, teachers having more than 5 years experience had average test scores that were 14 points higher than teachers with 5 or less years experience.

Significance of the Study

Findings from this study indicated that a significant relationship does exist between teacher qualifications and student achievement. Specifically, the findings revealed that mathematics teachers who had 5 or more years experience students' performed better on the math portion of the Alabama Reading and Math Test (ARMT). These findings are unlike those from the Rosenholtz (1986) study which found that the

benefits of years of teaching experience tended to drop off after five years of teaching. He attributed this to the fact that teachers may stop growing professionally and become tired of the teaching profession.

This study also found that if the teacher had a traditional secondary mathematics certification then his or her students tended to score higher on the ARMT compared to teachers with alternative certification. Additionally, the findings also indicate that teachers with qualifications associated with higher mathematics achievement (traditional certification and more years teaching experience) were not equitably distributed among all students. Only 55% of the students in the study had teachers with both more than 5 years teaching experience and a traditional secondary mathematics certification. These findings support Johnson's (2006) claims that equal access to teachers of quality is not something all students have. Carey (2004) stated that

> No matter which study you examine, no matter which measure of teacher qualities you use, the pattern is always the same—poor students, low-performing students, and students of color are far more likely than other students to have teachers who are inexperienced, uncertified, poorly educated, and underperforming. Many of those teachers demonstrate most or all those unfortunate qualities all at the same time. (p. 8)

However, when these students at-risk of educational failure had teachers with traditional secondary mathematics certifications versus alternative certifications, they scored significantly higher on the math section of the Alabama Reading and Math Test (ARMT). Every child deserves a highly qualified and high quality teacher, but this is

especially important for those children considered to be at risk. By understanding how teacher qualifications are related to student performance, researchers can inform educators and policy makers about the most effective ways to increase the capacity of schools and districts to improve student achievement (Alexander & Fuller, 2005).

Recommendations

Based on the literature review and results of this study, the following recommendations are made.

When hiring mathematics teachers, principals and human resource directors may want to strongly consider candidates with a traditional secondary mathematics certification. The results of this study indicated that teachers with traditional secondary mathematics certification had students with average test scores that were 16 points higher than teachers with alternative certification.

Alternative certification programs might increase the number of methodology or instructional classes to help future teachers become more proficient at delivering effective instruction. As noted by Silver (1998), the methodology for presenting the mathematics might be more closely related to student performance than the content hours in calculus and trigonometry which are required for secondary mathematics education majors. Additionally, colleges of education might offer additional training and field experiences for their program participants who are entering teaching through an alternative route.

School districts should provide financial incentives to recruit and retain more qualified mathematics teachers with more years of teaching experience. Scores and analyses from items relating to each teacher's years of experience indicate that teachers with more than 5 years experience had students who scored 14 points higher on the math portion of the Alabama Reading and Math Test (ARMT).

Working conditions should be improved at hard-to-staff schools and data should be collected on working conditions at all schools. Researchers found that teachers in schools designated as "high poverty" and "high minority" experienced much more challenging working conditions" on a variety if indicators, including student behavior, induction support, school safety, access to resources, and parental involvement (Park 2003, p. 17).

Teaching talent should be redistributed by moving some of the better mathematics teachers to some of the low performing schools. However, any plan to transfer well-trained teachers should take into account the impact of working conditions on a teacher's effectiveness and job satisfaction.

For newly hired teachers, districts should establish and maintain intensive, long-term induction programs that focus on helping new teachers meet challenging professional performance standards. District recruiters could assess the rigor of teacher preparation programs by closely examining transcripts and other records that identify and describe the actual courses that teacher candidates have taken in order to be certified. This information could prompt K–20 discussions between districts and

institutions of higher education regarding ways to ensure that teacher preparation programs explicitly address the districts' needs for high quality, well-prepared teachers.

Limitations of Study

The teacher data collected in this study were collected using a self-reported survey which could be considered a limitation. Information regarding the number of mathematics semester hours completed, years of teaching experience, and the type of certification held could have been obtained from the school district's human resource department.

Another limitation to the study was the timing of collecting teacher data as compared to student data. The student data were the results from the Spring 2006–2007 Alabama Reading and Math Test (ARMT); but the teacher data were not collected until Fall 2007–2008. Therefore, some of the teachers were no longer employed in the school district. This limitation had a significant effect on the sample size.

Areas for Further Research

There were several limitations to this study. Future studies that address those limitations would further add to the research in this field. Additionally, further research should examine teacher's methodology and instructional methods to determine if there is any significant relationship to student achievement.

Research examining teacher qualifications and student achievement could be expanded and replicated by examining elementary or high school teachers'

qualifications and potential relationships to student achievement in mathematics. This research could be expanded to include other core subject areas like reading, science, and English.

Further research might include comparative studies examining differences among elementary, middle school and high school as it relates to teacher qualifications and student achievement in mathematics and other core subjects. A study could be conducted to examine the impact of mathematics professional development for teachers to see if student performance would be significantly improved. Additionally, a study could be conducted on the perceptions of teachers' satisfaction with working conditions and student achievement in mathematics.

Finally, a study could be conducted to determine if college-level mathematics education programs offer classes providing teachers with appropriate training to teach middle school mathematics in order to improve student achievement on state assessments. A multi-state study on this topic would be especially beneficial.

Summary

The purpose of this study was to evaluate whether or not there is a statistically significant difference in teacher qualifications that might predict the academic performance of middle school students on the mathematics portion of the Alabama Reading and Math Test (ARMT). This study examined the relationship between the factors of teacher preparation, certification, and teaching experience. Measures of teacher qualifications included the following variables: (a) the number of mathematics

semester hours completed, (b) type of teacher certification, (c) the teacher's total number of years teaching mathematics, and (d) the teacher's total number of years teaching middle school mathematics.

This study investigated the following research questions:

1. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to the teacher's number of mathematics semester hours completed?

2. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to type of teacher certification?

3. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to a teacher's total number of years teaching mathematics?

4. To what extent do student scores on the mathematics section of the Alabama Reading and Math Test (ARMT) differ according to teacher's total number of years teaching middle school mathematics?

A total of 20 full-time mathematics teachers from 7 of the 8 traditional (non-magnet) middle/junior high schools located in the Montgomery Public School (MPS) District, Montgomery, Alabama participated in this study. All participants completed a *Teacher Background Survey*. The survey results were later matched with student data from the 2007 administration of the Alabama Reading and Math Test (ARMT).

Findings from this study indicated that a significant relationship does exist between teacher qualifications and student achievement. Specifically, the findings revealed that students with mathematics teachers who had 5 or more years experience performed better on the math portion of the Alabama Reading and Math Test (ARMT). This study also found that if the teacher had a traditional secondary mathematics certification then his or her students tended to score higher on the ARMT compared to teachers with the alternative certification.

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APPENDICES

APPENDIX A

INSTITUTION PERMISSION LETTERS

AUBURN
UNIVERSITY

EDUCATIONAL FOUNDATIONS
LEADERSHIP AND TECHNOLOGY

INFORMED CONSENT
for a Research Study Entitled
"An Examination of Teacher Qualifications and Student Achievement in Mathematics "

You are invited to participate in a research study that examines mathematics teachers' preparation and experience in relationship to the achievement of 7th and 8th grade students on the Alabama Reading and Math Test (ARMT). This study is being conducted by A. Rafael Richardson, a doctoral candidate in educational leadership at Auburn University, under the supervision of Dr. Cynthia Reed, Director of the Truman Pierce Institute and Associate Professor, Auburn University. You are invited to participate because you teach at one of the schools selected by the researcher to participate in this study and are age 19 or older. All math teachers from eight of the nine traditional middle/junior high schools in the Montgomery Public School District, Montgomery, Alabama are being invited to participate in the study.

The purpose of this study is to correlate teacher qualifications with student achievement on the mathematics portion of the ARMT. You will receive no direct benefits. However, we will correlate your responses with your student's math achievement scores over last year. Information learned in this study may help teachers, principals, and superintendents by identifying potential predictors related to teacher characteristics that may result in higher student achievement in mathematics.

You are being asked to complete a survey asking questions about your background and academic preparation. The survey should take about five minutes to complete. All responses are strictly confidential. Your name will never be identified when data are reported. You are encouraged to be honest with your responses. After completing the survey instrument, you will be asked to place it in an envelope provided by your Survey Administrator. This envelope will be sealed and returned to the researcher once all teachers who choose to participate have completed the survey.

Any information obtained in connection with this study will remain confidential. Information collected through your participation will be used as data for a dissertation, may be presented at a professional meeting, or published in a professional journal. As a participant, you may withdraw from participation at any time, without penalty. However, after your information has been provided and data are aggregated, there will be no way to identify the data you provided and it will no longer be able to be withdrawn.

Participant's initial_____

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Participation is voluntary. Your decision whether or not to participate will not jeopardize your employment at Brewbaker Jr. High School, current or future relations with the Truman Pierce Institute, Auburn University, or the Montgomery Public Schools.

If you have any questions or concerns, please feel free to contact A. Rafael Richardson at (334) 294-6303 (rafael.richardson@mps.k12.al.us) or Dr. Cynthia Reed at (334) 844-4488 (reedcyn@auburn.edu).

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Participant's Signature Date	Rafael Richardson 11/29/07 Investigator obtaining consent Date
Printed Name	Rafael Richardson Printed Name
	Co-Investigator Date
	Printed Name

4036 HALEY CENTER
AUBURN, AL 36849-5221

TELEPHONE:
334-844-4460

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INFORMED CONSENT
for a Research Study Entitled
"An Examination of Teacher Qualifications and Student Achievement in Mathematics"

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Printed Name	Rafael Richardson
	Printed Name
	Co-Investigator Date
	Printed Name

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APPENDIX B

INFORMATION LETTERS

Montgomery Public Schools
mps

Superintendent
John Dilworth

Board Members
Mary Briers, *Chairwoman*
Vickie Jernigan, *Vice Chairwoman*
Eleanor Dawkins
Charlotte Meadows
Beverly Ross
Melissa Snowden
Henry A. Spears

307 South Decatur Street
Post Office Box 1991
Montgomery, AL 36102-1991

(334) 223-6700
www.mps.k12.al.us

September 4, 2007

Mr. A. Rafael Richardson
3488 South Court Street
Montgomery, Alabama 36105

Dear Mr. Richardson:

The Review Committee for Research in the Montgomery Public School System has reviewed your proposal entitled *"An Examination of Teacher Qualifications and the Relationship to Student Achievement in Mathematics"* and has approved your proposal as written.

I appreciate your patience and look forward to you sharing the published results of your findings.

Sincerely yours,

Dan Aude
Education Specialist

DA:vksl

Brewbaker Jr. High School

October 12, 2007

A. Rafael Richardson
Bellingrath Junior High School
3488 South Court Street
Montgomery, Alabama 36105

Dear Mr. Richardson:

Recently, I received a letter of request for assistance in your dissertation research. Thus, permission is granted to survey the 7th and 8th grade(s) mathematics teachers at Brewbaker Junior High School. Barbara Sankey will be your point of contact in this process.

I wish you much success in this endeavor.

Sincerely,

Cheryl Fountain

Cheryl Fountain, Principal
Brewbaker Junior High School

4425 BREWBAKER DR. • MONTGOMERY, AL 36116 • 284-8008

Capitol Heights Junior High School

116 Federal Drive
Montgomery, AL 36107
(334)260-1000

Melissa Williams
Assistant Principal

Undrea Johnson
Principal

Robert Price
Assistant Principal

October 18, 2007

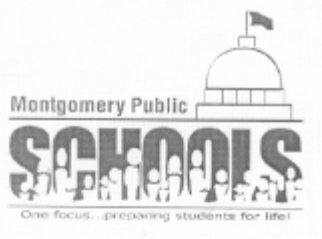
To Whom It May Concern:

I give Rafael Richardson permission to conduct a school research survey of the 7th and 8th grade Math teachers at Capitol Heights Junior High School.

Respectfully,

Undrea Johnson

Undrea Johnson
Principal



GEORGIA WASHINGTON JUNIOR HIGH SCHOOL
Deirdre Gulley, Principal
Keith Ledyard, Assistant Principal

October 22, 2007

Dear Mr. Richardson,

I grant you approval to conduct a research study at Georgia Washington Jr. High for 7th and 8th grade math teachers.

Sincerely,

Deirdre Gulley

Deirdre Gulley
Georgia Washington Junior High
Principal

Goodwyn Junior High

October 16, 2007

Dear Mr. Richardson:

As Principal of Goodwyn Junior High School, I am giving permission to do your school research with our faculty (7th and 8th grade math teachers).

Sincerely,

Vince L. Johnson, Principal
Goodwyn Junior High

HOUSTON HILL JUNIOR HIGH SCHOOL
215 Hall Street * Montgomery, Al 36104
334-269-3694 Office 334-269-3956 Fax

Dr. Ennis McCorvey, Principal — Orlean Baldwin, Assistant Principal

Dr. Ennis J. McCorvey, III.
215 Hall Street
Montgomery, Al 36104

Mr. Rafael Richardson
Bellingrath Junior High School
3488 S. Court Street
Montgomery, Al 36105-1699

10/10/07

Dear Mr. Richardson:

It is truly a pleasure to write this letter of approval for surveying seventh and eighth grade math teachers at Houston Hill Junior High School. You should be commended for your accomplishments thus far with your pursuit. Please be certain that all questioning is within the guidelines set forth by Montgomery Public Schools Policies and Procedures.

Sincerely,

Ennis J. McCorvey, III. EdD

Ennis J. McCorvey, III. EdD
Principal, Houston Hill Junior High

McIntyre Middle School

October 10, 2007

To: Principal Rafael Richardson

From: Principal Edward McDonald

Re: Survey of 7th and 8th Grade Math Teachers

Principal Edward McDonald grants approval of Principal Rafael Richardson's request to survey 7th and 8th grade mathematics teachers at McIntyre Middle School. Principal Richardson, please provide me with a copy of the results of your research. If you have any further questions you may reach me at 334-269-3755.

Edward McDonald
Principal

SOUTHLAWN MIDDLE SCHOOL
5333 Mobile Highway
Montgomery, Alabama 36108-5399
334-284-8086

Ferlisa M. Ross
Principal

Ronald L. Ashley, Sr.
Assistant Principal

October 12, 2007

Rafael Richardson, Principal
Bellingrath Junior High School
3488 S. Court Street
Montgomery, AL 36105

Dear Mr. Richardson:

I have reviewed your request to survey the 7th and 8th grade math teachers at Southlawn Middle School. I am granting you authorization to complete the survey. If I can be of further assistance, please let me know.

Sincerely,

Ferlisa M. Ross

Ferlisa M. Ross
Principal

Walter T. McKee Junior High School
4017 McInnis Road
Montgomery, Alabama 36116
PH: 334-284-7528
FX: 334-284-7615

Bobby E. Abrams, Jr.
Principal

Tisha Scott-Addison / Patrick Nelson
Assistant Principals

To All Parties Concerned:

Please accept this letter as my approval for Rafaeal Richardson to survey 7th and 8th grade teachers at Walter T. McKee Junior High School. If there are any further questions, please feel free to contact me via email at bobby.Abrams@mps.k12.al.us or by phone at (334) 284-7528.

Sincerely,

Bobby E. Abrams, Jr.
Principal

APPENDIX C

INSTITUTIONAL REVIEW BOARD

AUBURN

UNIVERSITY

Office of Human Subjects Research
307 Samford Hall
Auburn University, AL 36849

Telephone: 334-844-5966
Fax: 334-844-4391
hsubjec@auburn.edu

November 26, 2007

MEMORANDUM TO: A. Rafael Richardson
Education Foundation Leadership Technology

PROTOCOL TITLE: "An Examination of Teacher Qualifications and Student Achievement in Mathematics"

IRB AUTHORIZATION NO: 07-209 EP 0711

APPROVAL DATE: November 26, 2007
EXPIRATION DATE: November 25, 2008

The above referenced protocol was approved by IRB Expedited procedure under 45 CFR 46.110 (Categories #5 and #7):

> "Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment of diagnosis).
>
> Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies."

You should report to the IRB any proposed changes in the protocol or procedures and any unanticipated problems involving risk to subjects or others. Please reference the above authorization number in any future correspondence regarding this project.

If you will be unable to file a Final Report on your project before November 25, 2008, you must submit a request for an extension of approval to the IRB no later than November 11, 2008. If your IRB authorization expires and/or you have not received written notice that a request for an extension has been approved prior to November 25, 2008, you must suspend the project immediately and contact the Office of Human Subjects Research for assistance.

A Final Report will be required to close your IRB project file. You are reminded that you must use the stamped, IRB-approved informed consent (enclosed) when you consent your participants. Please remember that you must keep signed informed consents for three years after your study is completed.

If you have any questions concerning this Board action, please contact the Office of Human Subjects Research at 844-5966.

Sincerely,

Niki L. Johnson, JD, MBA, Director
Office of Human Subjects Research
Research Compliance Auburn University

Enclosure

cc: Dr. Jose Llanes
Dr. Cynthia Reed

APPENDIX D

ADMINISTRATORS' SCRIPTS

Dear Chairperson (Survey Administrator),

This envelope contains:

_____ Letter of Information/Informed Consent Forms to Participants
_____ Script for Administrator
_____ Teacher Background Survey
_____ Return Envelopes

Distribute the *Informed Consent* to all potential participants prior to administering the survey and allow time to read. Participants are to sign and return consent before receiving the survey.

Once consent forms have been collected, distribute the Teacher Background Survey to the participants.

Read the instructions to the participants as directed in the *Administrator Script. Remind all teachers that participation is voluntary.*

After all participants have completed the *Survey,* place all data in the envelope, including any unused materials. Seal the envelope and contact the principal investigator so that he can come to pick it up.

If there are any questions, please contact A. Rafael Richardson at (334) 294-6303 or rafael.richardson@mps.k12.al.us.

Sincerely,

A. Rafael Richardson
Principal Investigator

Administrator Script for Recruiting Teachers

Distribute the Teacher Background Survey to 7th and 8th grade math teachers who taught at least one math class in the Montgomery Public School District during the 2006-2007 academic year.

Say: You are being asked to participate in a study regarding teacher qualifications and student achievement in mathematics. Remember, *your participation is voluntary*. The purpose of this study is to explore whether or not there is a significant difference in teacher qualifications that might provide insights about the academic performance of middle school students on the mathematics section of the Alabama Reading and Math Test (ARMT).

You will be asked to complete a short survey based upon your educational background and teaching experience.

Your responses will be kept confidential, identified only by the code number found at the upper right –hand corner of the survey. Please answer each item honestly and to the best of your ability. Your name will never be identified when results are reported.

The survey should take approximately 3-5 minutes to complete. If you need assistance, please raise your hand and I will help you. When you have completed the survey, I will collect it.

Once all participants have finished their survey, collect them. Place them (along with extra materials) in the envelope provided labeled *Teacher Background Surveys* and seal it immediately. Contact the researcher so that he can pick it up.

APPENDIX E

TEACHER BACKGROUND SURVEY

Code #_____

Teacher Background Survey

General Directions: The survey will take approximately 5 minutes to complete. The results will be used for research analyzing the relationship of teacher experience and preparation to student achievement on the ARMT in grades 7 and 8. By participating in this study, you may help educational and policy leaders better meet the needs of math teachers, students, and principals. You are encouraged to be honest with your answers. All responses are strictly confidential.

Personal Information

1. Name: _____

2. School taught at during 2006-2007 academic year: _____

3. Which of the following best describes you? Circle only **one** answer.
   (1) White
   (2) Black or African American
   (3) Asian
   (4) American Indian or Alaska Native
   (5) Other

4. What is your gender? Circle only **one** answer
   (1) Male
   (2) Female

Educational Background

5. As a part of either your undergraduate or graduate coursework, which of the following was your major? Circle only **one** answer.
   (1) Mathematics education
   (2) Mathematics
   (3) Education (including secondary education)
   (4) Other mathematics-related subject such as statistics
   (5) Other _____

6. What type of certification or teaching certificate do you have? Circle **all** that apply.
   (1) Elementary Education (K-8 or 1-8)
   (2) Middle/Junior High School Education (5-8)
   (3) Secondary Mathematics
   (4) Alternative Certification (Enrolled in certification program)
   (5) Other _____

7. What is your highest degree type attained?
   (1) B.S.
   (2) M.Ed/M.S.
   (3) Ed.S
   (4) Ph.D/Ed.D

8. How many graduate and undergraduate mathematics semester hours have you completed? (Do not include methods courses.)
   (1) Less than 9 hours
   (2) 9-15 hours
   (3) 16-21 hours
   (4) 22-27 hours
   (5) More than 27 hours

Teaching Experience

9. How many years (including this year) have you taught?
   (1) Elementary School _____
   (2) Middle/Junior High School _____
   (3) Secondary _____
   Total _____

10. How many years (including this year) have you taught **middle school or junior high Mathematics**? (Include any permanent, full-time, or part-time assignments in grades 5-8, but not substitute assignments or student teaching.)

    (1) Total number of years_____

11. What grade level were you assigned to teach during the 2006-2007 academic year? Circle only **one** answer
    (1) 7^{th}
    (2) 8^{th}
    (3) 7^{th} and 8th