Factors that Predict Student Achievement in Georgia Public Schools

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ABSTRACT

Because of a recent decline in educational funding, state and local departments of education have been compelled to evaluate all of their expenditures in terms of cost versus benefit to student achievement. The purpose of this study was to examine five characteristics of teachers and schools believed to contribute the most to student success—Title I status, teachers' education level, teachers' average years of experience, class size, and computer to student ratio—and their relationship to the achievement of fifth-grade students in 106 Georgia public schools. Student achievement was measured by the percentage of these students receiving scores of *Does Not Meet, Meets*, and *Exceeds* on the reading and mathematics portion of the Criterion-Referenced Competency Test.

Incorporating data compiled from the Georgia Department of Education Web site, a multiple regression analysis was conducted and findings revealed designation as a Title I school to be the strongest predictor of student achievement. Regression analysis of each of the scores of *Does Not Meet, Meets,* and *Exceeds* in reading and mathematics revealed that being a Title I school results in an increase of the percentage of students receiving scores of *Does Not Meet* in both reading and math and a decrease in the percentage of students receiving scores of *Exceeds* in both reading and mathematics. However, according to the study's findings, designation as a Title I school also resulted in an increase in the percentage of students receiving a score of *Meets* on both the reading and mathematics portion of the CRCT. In the absence of individual student data, Title I status was broken down by school. Based on the findings of this study, future research using data from individual students categorized as being from low socioeconomic backgrounds may be beneficial.

One of the more significant findings of this research related to class size reduction. This study did not show smaller class size to play a role in higher student achievement as had been previously hypothesized. Instead, class size seemed to have very little relationship to the overall achievement of fifth-grade students.

Teacher quality revealed mixed, though generally positive results when correlated with student achievement. Given that previous literature produced similar results, it may be beneficial to conduct a mixed methods study observing several teachers in classes where students consistently score well on standardized tests to determine what characteristics they possess that makes them excel.

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Chapter I

INTRODUCTION

The recent downturn in our nation's economy has caused both national and state government agencies to begin seeking ways to cut budgets (Johnson, Oliff, & Williams, 2011). According to the Center on Budget and Policy Priorities (Johnson et al., 2011), at least 46 states and the District of Columbia have enacted spending cuts affecting state services since 2008. Of these, 34 states and the District of Columbia have chosen to cut spending in the area of K-12 education—Georgia is one of these states.

In the 2011 fiscal year, the state of Georgia cut K-12 educational funding by 5.5% from fiscal year 2010 or $403 million (Johnson et al., 2011). On behalf of the Center on Budget and Policy Priorities, Johnson et al. (2011) also reported that this decrease in funding has caused local school boards to seek ways to reduce spending while still providing a quality education for each student. They also advised that in order to accomplish this task, stakeholders must weigh expenditures in terms of the ratio of cost versus benefit to the overall learning experience and evaluate academic programs to assess their contribution to students' achievement.

The Georgia Department of Education (GaDOE) currently uses an assessment test called the Criterion-Referenced Competency Test (CRCT) to evaluate the quality of education in their public schools (GaDOE, 2012c). According to the GaDOE (2012c), the CRCT measures students' acquisition of the skills and knowledge taught in the Georgia Performance Standards. The GaDOE (2012c) believes the results of this assessment demonstrate not only student achievement at the student, class, school, system, and state levels; but also gauges the value of the educational programs within each school. With such a strong emphasis placed on students' outcome on the CRCT, stakeholders can assume that the measure of educational expenditures in Georgia will be their contribution to the success of students on these tests (Maninger, 2006).

The purpose of this study was to examine five characteristics of the school setting believed to play an important role in student learning and determine which of these characteristics had a significant relationship to the student achievement of fifth-graders in Georgia public schools. There are differing views on exactly which aspects of education contribute the most to student learning (Nye, Hedges, & Konstantopoulos, 2004; Page, 2002; Wayne & Youngs, 2003). While some argue that teacher characteristics (Wayne & Youngs, 2003) or class size (Nye et al., 2004) make the most difference, according to Page (2002), findings revealed that placing computers in classrooms has positive results on student achievement. The study sought to determine the relationship between student achievement as measured by the percentage of fifth-grade students receiving *Does Not Meet, Meets*, or *Exceeds* scores on the CRCT in reading and mathematics and five school characteristics that may affect these scores—Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio—in both Title I and non-Title I schools in the state of Georgia.

Justification of the Study

Because of recent budget cuts, Georgia educators and stakeholders must consult previous research and prioritize which factors they believe contribute the most to student learning so that they may disperse funds appropriately (Johnson et al., 2011). This study will examine five of those characteristics in light of their contribution to the achievement of students.

As Wayne and Youngs (2003) pointed out, when policymakers begin to look for ways to improve K-12 education, they typically focus on teachers because their salaries consume the largest portion of any K-12 budget. However, researchers who asserted teachers' characteristics contribute to student achievement cannot seem to agree on exactly which characteristic makes the most difference (Borman & Kimball, 2005; Nye et al., 2004). The U.S. Department of Health, Education, and Welfare and the Office of Education (1966) jointly conducted one of the first research reports on teacher quality. The report, later referred to as the Coleman Report of 1966 because James Coleman of Johns Hopkins University played a significant role in the design of the study, contended that teacher characteristics contributed to more variation in levels of student achievement than any other factor (U.S. Department of Health, Education, and Welfare & Office of Education, 1966). Borman and Kimball (2005) pointed out that this belief prompted the passing of the No Child Left Behind Act of 2001 which stressed that quality teachers were critical to student learning but did not clearly define quality (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012).

Another school of thought asserted that class size or teacher to student ratio relates to student achievement to a greater degree than any other factor (Chatterji, 2005; Nye et al., 2004; Tennessee State Department of Education, 1990). Chatterji (2005) reported positive results of smaller class size on student achievement in early grades due to the ability to individualize instruction. Nye et al. (2004) gathered information from their research demonstrating that class size has positive effects on student learning, not only in the participating school year but for several years afterward. According to these researchers, the effects of smaller class size in the early grades will endure for at least five years. But they are also quick to point out that class size reduction appeals to educators and policymakers because, given available funding, this policy can be implemented and controlled with little or no change to the methods of teaching or the curriculum used, therefore balancing the cost of implementation (Nye et al., 2004).

In one of the largest and most successful studies of class size reduction, the Tennessee Department of Education (1990) conducted the Student/Teacher Achievement Ratio Project (Project STAR). Project STAR incorporated 79 schools and approximately 6,500 kindergarten students in a longitudinal study of smaller class size and its effects on student achievement. For the purpose of their study, the researchers defined a small class as a class with an enrollment of 13-17 students and a regular class as one that had an enrollment of 22-25 students. Throughout the four year study, students in smaller classes consistently outperformed those in regular classes (Tennessee Department of Education, 1990).

In recent years, educators and stakeholders have viewed technology in the classrooms as a valuable tool for learning and differentiation of instruction (Becker, 2000; Judge, 2005; Page, 2002; Suhr, Hernandez, Grimes, & Warschauer, 2010). No Child Left Behind addressed technology integration as a means to enhance student understanding of academic content and increase student achievement (No Child Left Behind Act of 2001: National Education Technology Plan, 2012). In compliance with No Child Left Behind, the U.S. Department of Education developed the Enhancing Education Through Technology program to address and report on technology integration in schools (U.S. Department of Education, Office of Planning, Evaluations and Policy Development, & Policy and Programs Studies Service, 2009). The U.S. Department of Education disperses funds from the Enhancing Education Through Technology program to districts and schools to help meet the goal of technology integration.

Although some aspects of this study have been explored in other studies (Boyd, Lankford, Loeb, Rockoff, & Wycoff, 2008; Chatterji, 2005; Ding & Sherman, 2006; Heck, 2009; Ohlson, 2009; Shapley, Sheehan, Maloney & Caranikas-Walker, 2010; Southworth, 2010), this research specifically addressed teacher characteristics, including level of certification and years of experience; and the school characteristics of class size and computer to student ratio; and the relationship these characteristics have to student achievement in schools that receive Title I funding and those that do not. Determining if a relationship exists among these factors is especially important given the recent budget cuts to Georgia's K-12 educational funding and the need to determine the distribution of those funds (Johnson et al., 2011).

Definition of Terms

Understanding of some of the terms used in this study occurs only within the context of an educational setting. Even within the educational setting, the meanings of these terms may vary slightly. Therefore, it is important to address exactly how these terms were defined within this particular study. For the purpose of this study, these terms had the following definitions:

Class Size Reduction. Though often used interchangeably with terms such as pupil-teacher ratio, teacher-student ratio, and average class size, discrepancies in meaning occur in the context of different research projects (Achilles, 2005). According to

Achilles (2005), some studies define teacher-student ratio as the number of students divided by the number of teaching professionals within the school or district including administrators and support staff. In contrast to this method of calculating teacher to student ratio, this study used *class size* and *teacher-student ratio* interchangeably and defined these terms as the number of students divided by the number of actual classroom teachers. The results were reported as the numerical quotient of this division.

Computer to Student Ratio. For the purpose of this study, the ratio of computers to students referred to the number of students within a school divided by the number of computers available for their use. The results were recorded as the numerical quotient of this division.

Criterion-Referenced Competency Test. The GaDOE Web site explains that the design of CRCT is to "measure how well students acquire, learn, and accomplish the knowledge and skills set forth in a specific curriculum or unit of instruction" (GaDOE, 2012c, para. 5). Because of this, the GaDOE (2012c) endorses a CRCT designed to assess students' knowledge of curriculum and units of instruction relative to the Georgia Performance Standards.

Education Level. The education level of a teacher measures the years of education that they have successfully completed such as a bachelor's, master's, specialist, or doctorate. According to the Georgia Professional Standards Commission Web site at http://www.gapsc.com/, these degrees correspond with Level Four (bachelor's degree), Level Five (master's degree), Level Six (specialist degree), and Level Seven (doctorate) certificates and are contingent upon the educator holding a valid certificate from an accredited institution in an accepted degree or major. The GaDOE Web site reports these degrees using the numerical designation assigned to them by the Georgia Professional Standards Commission such as 4, 5, 6, or 7 (GaDOE, 2012a). For the purpose of analysis, these numbers were converted to the number of years typically required for a student to actually complete that degree which is four for a bachelor's, six for a master's, seven for a specialist, and eight for a doctorate. The resulting numbers were averaged for each school. Throughout the review of literature, certificate level and education level were defined in the same way since they both referred to a teacher's years of education. Within the context of this study, education level was used interchangeably with average years of post-secondary education.

Student Achievement. For the purpose of this study, student achievement was indicated by the scores of fifth-grade students on the reading and mathematics portion of the CRCT. The GaDOE (2012d) categorizes scores into three performance levels—*Does Not Meet, Meets,* and *Exceeds.* These performance levels correspond with a score of less than 799 for *Does Not Meet*, a score of 800-849 for *Meets*, and a score 850 or above for *Exceeds* (GaDOE, 2012d). Performance levels were based on a student's overall performance in a specific curriculum area and whether they meet the standard set for students at their grade level in that curriculum area. The GaDOE considers achievement of a student in a given curriculum area to be demonstrated by an overall score of 800 or above which would designate that the student either *Meets* or *Exceeds* the expectations for their grade level.

Title I School. As a part of No Child Left Behind, Title I Part A provides federal funds to public schools with the highest percentage of poor students to help ensure that they meet educational standards and levels of achievement (U.S. Department of

Education, 2011). According to the U.S. Department of Education (2011), a Title I school is a school that has met the qualifications to receive these funds. Title I status was recorded as a dichotomous variable with a Title I school being coded as 1 and a non-Title I school being coded as 0.

Years of Experience. For the purposes of this study, *years of experience* referred to the number of years a teacher has been a teaching professional and the experience acquired in that position during that time (Harris & Sass, 2008).

Assumptions and Limitations

Public schools from two separate areas of Georgia were used in this study as a cluster sampling of schools statewide. Schools served by one of the Regional Educational Service Agencies in south Georgia and schools from a district in the northern part of the state were chosen. These schools were selected because of the ratio of Title I schools to non-Title I schools within their groupings, with the southern district having the largest majority of Title I schools and the northern district having the largest number of non-Title I schools (GaDOE, 2012b). The GaDOE (2012b) Web site provided data on each of the selected schools as reported in the school year 2009-2010.

The GaDOE data reporting site also provides CRCT scores for fifth-grade students in each of these schools for the school year 2009-2010 (GaDOE, 2012a). A comparison of each of the five teacher and school characteristics with the dependent variables of reading and mathematics CRCT scores, will indicate if a relationship exists. It is assumed that the data provided to the state by each of the selected schools was answered to the best of the respondent's ability and that the independent variables are fixed and were measured and reported without error.

Brief Overview of Study

An examination of two separate groups of schools within the state of Georgia—one in south Georgia and one in north Georgia—revealed that these two areas would provide a cluster sample of both Title I and non-Title I schools within the state of Georgia (GaDOE, 2012b). Only those schools that served fifth-grade students within the 2009-2010 school year were included in the study.

Data reported publicly on the GaDOE Web site provided background information on each of the selected schools. This data included Title I status and grade levels served. Collection of data on teacher characteristics such as education level and years of experience and school characteristics such as class size (GaDOE, 2012a) and computer to student ratio (GaDOE, 2012e) appeared here as well.

After the compilation of needed data occurred, a multiple regression analysis was conducted to determine what relationship, if any, each of the independent variables had on student achievement in Georgia public schools.

Research Hypotheses

The purpose of this study was to investigate certain teacher and school characteristics and their relationship with the achievement of fifth-grade students in Georgia public schools. To this end, an examination of the relationship of five independent variables—Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio—to student achievement as indicated by reading and mathematics scores of fifth-grade students on the CRCT in Title I and non-Title I Georgia public schools took place. The study addressed the following research hypotheses:

1. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who did not meet CRCT reading standards (score of 799 or below). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

2. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who met CRCT reading standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

3. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who exceeded CRCT reading standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

4. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who did not meet CRCT mathematics standards (score of 799 or below). The expected relative importance for prediction is

Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

5. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who met CRCT mathematics standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

6. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentages of fifth-grade students who exceeded CRCT mathematics standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

Chapter II

REVIEW OF LITERATURE

As schools, districts, and states examine ways to provide a quality education on a limited budget, it is important to understand the groundwork that went into No Child Left Behind and the goals it was to achieve.

No Child Left Behind Act of 2001

In January of 2002, President Bush signed the No Child Left Behind Act of 2001 into law (GaDOE, 2012b). According to the GaDOE (2012b) Web site, this act required that all states institute statewide academic standards and incorporate a state testing system in accordance with federal requirements. These guidelines placed pressure on schools and school districts to improve student learning and to seek ways to demonstrate excellence within their individual schools. The purpose of No Child Left Behind was to provide a fair and equal education to all students while giving them the opportunity to reach at least a proficient level on state achievement tests (No Child Left Behind Act of 2001: Statement of Purpose, 2012). In a natural progression, evaluation of curriculum began and decision making became more data driven (U.S. Department of Education, 2004). In Georgia, Adequate Yearly Progress became the standard to measure student achievement based on the results from annual state-wide assessments (GaDOE, 2012b).

No Child Left Behind included policies to deal specifically with characteristics of the school setting believed to most affect student learning (No Child Left Behind Act of 2001: Statement of Purpose, 2012; No Child Left Behind Act of 2001: Qualifications for

Teachers and Paraprofessionals, 2012). Some of the characteristics included, but were not limited to, low socioeconomic status (Baker & Johnston, 2010; Harding, Harrison-Jones, & Rebach, 2012; Rouse & Barrow, 2006; Sirin, 2005), employing high quality teachers (Southworth, 2010), reducing class size (Milesi & Gamoran, 2006), and integrating technology (U.S. Department of Education et al., 2009). This act made funds available for schools with a high percentage of poor students through Title I of the Elementary and Secondary Education Act (No Child Left Behind Act of 2001: Statement of Purpose, 2012; U.S. Department of Education, 2011). These funds were used to provide these students with an education comparable to those of students in more economically advantaged areas. Funds dispersed to schools because of the Title I section of No Child Left Behind were called Title I funds and schools that received this funding were referred to as Title I schools.

In response to previous studies on teachers and their importance in the classroom, the objective of No Child Left Behind was to improve teacher quality with an emphasis on those teachers who were employed in Title I schools (Borman & Kimball, 2005). For the first time, No Child Left Behind established guidelines for teacher certification and licensing instead of each state establishing their own guidelines as they had in the past (DeAngelis, White, & Presley, 2010). These guidelines called for high quality preparation and training for teachers and significant opportunities for teachers to participate in staff development while assigning teachers with greater responsibility and accountability for student performance (No Child Left Behind Act of 2001: Statement of Purpose, 2012). No Child Left Behind also required that the principal in each school receiving Title I funding verify their school's compliance with these guidelines and file their written verification in the school office to be made available to both government agencies and the general public upon request (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012).

While the Bush administration promoted placing a good teacher in each classroom, they did not believe that this was the only change needed in order to enhance student performance (Rockoff, 2009). According to Rockoff (2009), the Bush administration also supported class size reduction because they reasoned that it led to more individualized instruction for students. This belief became Title II of No Child Left Behind and provided funding to those schools that would agree to a program of Class Size Reduction (Milesi & Gamoran, 2006). Through No Child Left Behind, the Secretary of Education agreed to work with state and local educational agencies to determine ways that low-performing schools could access resources and funding through government programs such as the Class Size Reduction program (No Child Left Behind Act of 2001: Statement of Purpose, 2012). No Child Left Behind provided help to identify ways to make effective use of these resources in order to improve students' performance as well.

In addition to raising teacher quality and reducing class size, the U.S. Department of Education required schools to effectively incorporate technology into the curriculum and demonstrate this integration (No Child Left Behind Act of 2001: National Education Technology Plan, 2012). In the National Education Technology Plan, No Child Left Behind specifically addressed increasing access to technology in schools that served large percentages of students from families below the poverty level. The U.S. Department of Education measured compliance with these guidelines by recording the percentage of school districts receiving Enhancing Education Through Technology funding (U.S.

Department of Education et al., 2009). However, in the final report on the Enhancing Education Through Technology program by the U.S. Department of Education et al. (2009), it was stated that the federal guidelines allowed states to determine their own criteria for effective technology integration instead of setting forth specific criteria for measurement.

For the first time in the history of education, the requirements of No Child Left Behind forced local schools, school districts, and state departments of education to establish state standards and a state testing system that met federal requirements (GaDOE, 2012c). Receipt of federal funding hinged on these standards and tests and student achievement became the measure of compliance (GaDOE, 2012b).

Title I

In an effort to combat the effects of low socioeconomic status on student achievement, No Child Left Behind made funds available for schools with a high percentage of poor students through Title I of the Elementary and Secondary Education Act (No Child Left Behind Act of 2001: Statement of Purpose, 2012; U.S. Department of Education, 2011). As Harding et al. (2012) point out; policymakers of No Child Left Behind predicted that limited resources would make achievement of state and national standards difficult for some schools. A recent study by Baker and Johnston (2010) supported this prediction. In a study involving over 14,000 eighth-grade students during the 2006-2007 school year, Baker and Johnston revealed Title I schools to greatly underperform non Title I schools on standardized tests. No Child Left Behind attempted to address this imbalance by making federal funds available to schools serving a large percentage of students from low socioeconomic backgrounds to provide these students with an education comparable to that of students in more economically advantaged areas and help them perform well on state-wide standardized tests (Harding et al., 2012).

Teacher Quality

One of the primary goals of No Child Left Behind involved the staffing of all schools with high quality teachers (Borman & Kimball, 2005; U.S. Department of Education, 2004). With this purpose, No Child Left Behind dealt with the qualifications and distribution of teachers that would ensure that this occurred (DeAngelis et al., 2010). Beliefs that quality teachers truly affected student learning and were a powerful predictor of student success had been supported in research both before and since the inception of No Child Left Behind in January 2002 (Januszka & Dixon-Kane, 2008; Kane, Rockoff, & Staiger, 2006; Wong, 2004). However, the introduction of No Child Left Behind required schools to report certain teacher characteristics to verify compliance (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012).

The pivotal study on teacher quality and student achievement occurred in 1966 and was conducted jointly by the U.S. Department of Health, Education, and Welfare and the Office of Education (Borman, 2005; Boyd, 2008; Rivkin, Hanushek, & Kain, 2005; Southworth, 2010). The Coleman Report of 1966 asserted that teacher characteristics contributed to more variation in levels of student achievement than any other factor (U.S. Department of Health, Education, and Welfare & Office of Education, 1966). During a time of segregation in public schools, this report sought to determine if schools offered equal educational opportunities based on certain characteristics believed to be good indicators of quality education. The study began with a survey of public schools requested by the Congress of the United States and conducted by the National Center for

Educational Statistics on educational opportunities within public school systems. Hundreds of school officials at every level of education and over 20,000 teachers administered the survey in their schools and classrooms. The survey included questions relating to tangible school characteristics such as the number of desks, text books, libraries, curriculum offered, and administration of achievement tests and tracking of a student's results. Another aspect of this survey dealt specifically with teacher characteristics such as education, teaching experience, salary, and attitude. Coleman and his colleagues gathered data from 4,000 public schools and more than 645,000 students for analysis. Although the researchers' main goal was to determine whether there was equality in education, they also hoped to establish which school characteristic or characteristics accounted for the most variation in student achievement. Their findings showed that characteristics relating to the facility or curriculum resulted in very little variation in student achievement. Instead, they found that teacher characteristics resulted in the greatest contribution to student achievement and actually increased in the upper grades. Of the teacher characteristics explored, the teacher's educational experience ranked among the highest of those affecting the achievement of students.

Clotfelter et al. (2006) stressed the difficulty in identifying which teacher characteristic was most important and measuring its contribution effectively and exclusively. In their conclusions, they raised questions as to whether an identified factor from one research study would have the same relationship to achievement with a different group of students (Clotfelter et al., 2006). Clotfelter et al. believed that if we really wanted to determine the relationship between teacher quality and student success we would need to randomly assign teachers with different qualifications to schools and classrooms and review the results from student test scores in these conditions. In a later study, Clotfelter et al. (2010) continued their previous examination of the effects of teacher quality on student achievement and suggested that a better grasp of the relationship between teacher credentials and student achievement would help districts screen teachers for recruitment of those who held these essential credentials for recruitment. They also believed that an understanding of this relationship would encourage the adoption of policies for employment and retention of quality teachers within each school district.

Referencing six years of data on students and teachers in New York public schools, Kane et al. (2006) studied the effectiveness of newly hired teachers. Although they believed the initial certification of teachers had little relationship to their classroom performance, their study showed the performance of new teachers during their first two years in the classroom was a greater indicator of future performance. Agreeing with Clotfelter et al. (2010), Kane et al. stressed districts would benefit from policies that encouraged employment and retention of high quality teachers. Based on their research findings, they believed these policies would ultimately result in benefits to overall student achievement.

In support of the No Child Left Behind policy of placing high quality teachers in schools, Southworth (2010) defined teacher quality as relating to teacher qualifications such as licensing test scores, certification level, and years of experience and not personal attributes such as gender, race or socioeconomic background. However, she, as well as many others (Boyd et al., 2008; Clotfelter, Ladd, & Vigdor, 2006; Jennings & DiPrete, 2010; Wayne & Youngs, 2003; Wong, 2004), pointed out that while researchers agree on the importance of teacher quality, there is disagreement on exactly which characteristics teachers possess that signify quality and are most important. In Southworth's study of North Carolina schools, she found teacher characteristics such as years of experience, licensing, and advanced degrees had an effect on student achievement. However, she stressed that an understanding of these factors and their effect is imperative given many schools use these characteristics to devise their teacher pay scales and these salaries encompass the largest portion of a school's budget. Agreeing with Clotfelter et al. (2006), Southworth claimed some of the effects attributed to teacher characteristics may instead be a result of other conditions such as the students or schools involved in the research. Ding and Sherman (2006) agreed other factors may play a role in student achievement. They pointed out the students enrolled in a class may influence teacher effectiveness.

Jennings and DiPrete (2010) speculated on the extent that a teacher's reported attributes such as licensing test scores, certification level, education level, and years of experience could predict a teacher's performance. Using published data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999, they examined teacher effects on both social and behavioral skills of kindergarten students and their academic achievement. Although they concluded that their results demonstrated that teacher effects or characteristics did indeed affect academic achievement, like Southworth (2010), they believed they were unable to isolate the exact characteristic contributing the most to student success.

Disagreement does exist, however, as to the role of teacher quality in the success of students (Borman & Kimball, 2005; Clotfelter et al., 2010; Guarino, Hamilton, Lockwood, & Rathbun, 2006; Heck, 2009; Staiger & Rockoff, 2010). In a study of Nevada schools, Borman and Kimball (2005) asserted very little evidence existed to support a relationship between teacher quality and student achievement. Although their findings did lead them to conclude that better teaching led to better learning, they did not agree that reported teacher characteristics such as education level and years of experience resulted in better teaching. Instead, they considered knowledge of content, association of that content to students' previous knowledge, and individualized instruction to constitute better teaching and learning. Staiger and Rockoff (2010) revealed a disparity in the relationship between teachers and student achievement as well. Agreeing with Borman and Kimball, Staiger and Rockoff believed there was really no way to select high quality teachers at the point of hiring but instead careful observations and data analysis over their first few years of teaching would reveal the most effective teachers. They also suggested one teacher characteristic taken independently of all other variables cannot predict teacher effectiveness and policymakers may have misdirected their focus on self-reported attributes as a measure. In their study of data provided by the National Center for Education Statistics relating to the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999, Guarino et al. (2006) agreed with Borman and Kimball (2005) and Staiger and Rockoff by concluding that no evidence of a direct relationship between teacher qualifications and student achievement existed.

Heck (2009) suggested that, in order to demonstrate whether a relationship between teacher qualifications and student achievement exists, a link between student and teacher data must occur. Heck also thought linking these two factors would increase accountability in the school setting. His study revealed mixed results that qualifications such as level of education and years of experience correlate to student learning. Clotfelter et al. (2010) agreed with Heck that the two most important teacher characteristics to correlate to student achievement were a teacher's certificate level and years of experience. They considered these two characteristics essential because they are typically referenced in public school salary schedules. Agreeing with previous research (Clotfelter et al., 2006; Jennings & DiPrete, 2010; Southworth, 2010), both Heck (2009) and Clotfelter et al., pointed out that further research was needed to support a relationship between teacher characteristics and a positive increase in student achievement while stressing that they believed the most relevant of these characteristics to be the teacher's certificate level and years of experience.

Teachers' Education Level. The No Child Left Behind Act of 2001 did not specifically target teachers' methods of certification (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012). While it did state that a *highly qualified* teacher should have a bachelor's degree, it also allowed each state to define certification according to its own needs (U.S. Department of Education, 2004). Due to this law, the state of Illinois chose to identify which teachers acquired full certification through a traditional teaching program at an accredited institution and which achieved certification through an alternate method within their state school system (DeAngelis et al., 2010). DeAngelis et al. (2010) reported that Illinois viewed teachers' certification status as an academic characteristic relating to student success and sought to improve teaching throughout their schools. Before their study and the No Child Left Behind legislation, Illinois had teachers in their systems who were not fully certified. While conducting their research, DeAngelis et al. (2010) examined over 4,000 public schools and 125,000 public school teachers throughout Illinois each year from 2001 to 2006. Urban schools were divided into two groups, non-Chicago schools and Chicago schools, for the simple reason that, during the years studied, Chicago urban schools made up "roughly 57% of all urban schools in Illinois" (DeAngelis et al., 2010, p. 10). During the period of their study, non-Chicago personnel not fully certified decreased by approximately 30% while Chicago personnel not fully certified decreased by over 70%. The researchers attributed this large gain in fully certified personnel in Chicago schools to the fact there was more room for improvement in this location. Because of these changes, statewide achievement scores also increased, therefore leading the researchers to believe certification status of teachers did play a role in the success of their students. Although they reported positive results to student achievement, their findings posed a problem for schools like those in the Chicago study that could not seem to improve both teacher qualifications and experience levels simultaneously.

In a comparison of data compiled from the New York City Department of Education, the New York State Education Department, the College Board and programs that provided alternate certification for teachers from 2000 to 2005, Boyd et al. (2008) showed a significant increase in student achievement as the percentage of certified teachers employed rose. Although some of the positive gains in student achievement could be attributed to policy changes, Boyd et al. stressed the largest increase appeared to be from the elimination of the policy allowing schools to hire uncertified teachers and providing a program to mentor and retain new teachers. These researchers concluded that employing teachers who were fully certified did indeed make a difference in student achievement in New York.

However, other studies (Harris & Sass, 2007; Kane et al. 2006; Ohlson, 2009) disagreed that certification status made an academic difference. Unlike Boyd et al.'s (2008) later study, Kane et al.'s study (2006) focused on only mathematics and reading teachers in grades four through eight in New York City schools during the academic years between 1998-1999 and 2004-2005. In a review of data on teachers who were certified, uncertified, and alternatively certified, Kane et al. reported there was very little impact on student achievement based on certification status during the first few years of teaching. They argued this did not mean the selection of teachers was not important but instead, that the longevity of qualified teachers within the system showed more impact on student achievement.

At the beginning of the 2007-2008 school year, Ohlson (2009) conducted a study of 23 public elementary schools in Florida. Ohlson's study supported Kane et al.'s (2006) previous findings that advanced degrees and certification status did not seem to influence achievement in the first few years of teaching. Ohlson pointed out a teacher who has more experience may be better equipped to handle everyday challenges that may arise in the classroom and therefore, have more time to spend on actual teaching activities. He believed this result had positive implications for those wishing to enter the teaching field through alternate programs.

Harris and Sass (2007) conducted a study on teacher quality through the National Center for Analysis of Longitudinal Data in Education Research, also known as the CALDER Institute. Their study used a statewide database from Florida and was conducted in a manner that allowed them to link student data with a particular teacher and therefore, with that teacher's college coursework and training. In their results, they stressed previous studies revealed inconsistent results of teacher training on student outcomes and concluded there was no relationship between the quality of elementary school teachers and advanced academic degrees. They reported the only level at which they found evidence that an advanced degree enhanced student achievement was in the case of middle school mathematics. At all other levels, they found little or no evidence that advanced degrees resulted in higher student achievement and mixed, but generally positive results, that years of experience had an impact. Because of their findings, they asserted schools districts should revise current salary schedules that incorporated advanced degrees as a factor by which to compensate teachers (Harris & Sass, 2007).

Although No Child Left Behind allowed states to define certification status and make their own determination of what constituted a highly qualified teacher (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012), states such as Illinois chose to define certification status as teachers who acquired full certification through a traditional teaching program at an accredited institution and those who achieved certification through an alternate method within their state school system (DeAngelis et al., 2010). Illinois chose this method because they viewed teachers' certification status as an academic characteristic relating to student success and sought to improve teaching throughout their schools. Boyd (2008) found this to be the case in an earlier study of New York City public schools that showed a significant increase in student achievement as the percentage of certified teachers employed rose. DeAngelis et al.'s (2010) findings in Illinois supported the employment of certified teachers as a method of increasing student achievement although they did concede that years of experience had a positive impact as well. Kane et al. (2006) disagreed, however, claiming, instead of certification status as a measure of student achievement, classroom performance during the first few years of teaching better indicated the effectiveness of a teacher and that effectiveness only grew with experience in the classroom, bringing experience into the students' achievement equation once again. Harris and Sass (2007) concurred with Kane et al.'s finding that experienced teachers are more effective teachers.

Teachers' Years of Experience. Clotfelter et al.'s (2006) study of data from the North Carolina Education Research Data Center not only dealt with teacher certification but also with teachers' experience and the effect they had on student achievement. Data relating to teachers' qualifications was compiled from a state-maintained archive of personnel records and the measure of achievement came from scores from statewide achievement tests. Analysis of this data pinpointed two characteristics, teachers' experience and licensure test scores, as strong predictors of fifth-grade students' successful achievement on standardized tests by showing these factors produced consistently improved student outcomes. From their findings, Clotfelter et al. asserted very little evidence existed that any characteristics other than teachers' experience and licensure test scores were responsible for this increase. These findings differed from those of previous studies (Kane et al., 2006; Wong, 2004), which indicated that other teacher characteristics or a combination of characteristics resulted in increased student achievement.

Although a majority of the studies agreed that a teacher's years of experience had a positive impact on student achievement (Boyd et al., 2008; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004), differences in beliefs existed on exactly how many years a teacher must be in the classroom before exhibiting the positive attributes associated with experience. Although Boyd et al.'s (2008) study, mentioned in the previous section, dealt mostly with teacher certification, their findings did lead them to believe students of first year teachers learned less than students of teachers with more than one year of experience and included this in their list of areas for future research. In an attempt to explain why this may be the case, Gere and Berebitsky (2009) pointed out a teacher's years of experience represented not only the number of years a teacher has taught but the wealth of experience acquired during those years. They stated the participation in professional development, support from colleagues, and the stability of the school context in which those years took place all contributed to the positive impact of experienced teachers. Ohlson (2009) believed the advantage of all of these factors prepared a teacher to more effectively deal with any situation that might arise in the classroom to interrupt instruction thereby making instructional time more productive.

Using panel data obtained by the University of Texas at Dallas Texas Schools Project, Rivkin et al. (2005) were able to match each student's performance with the quality of a specific teacher. In agreement with Boyd et al. (2008), they suggested that even one year of experience made a difference in a teacher's impact on students and that developing policies to retain teachers that are more experienced was crucial. In a side note to their findings, Rivkin et al. disclosed that they believed the positive results of experience to be a combination of two occurrences—the adjustment period that new teachers go through at the beginning of their teaching experience and the discovery some teachers make that they are not suited for this profession and exiting the field during the first few years.

Wong (2004) supported the retention of more experienced teachers in his study on incorporating induction programs for new teachers. He reported experience to be positively correlated with student achievement and that a training and support program would ensure the success and retention of new teachers in the classroom. Fry (2009) referenced Wong's study in his research on effective induction programs for new teachers and the retention of those teachers in the field of education. After reviewing previous research on the effect of teacher experience on achievement, Fry believed experience to play a significant role in achievement and carried that belief one step further by conducting a qualitative study to identify what factors led to successful teacher retention. Her study followed four teachers over a three-year period. At the end of that period, only two remained in the profession. These findings supported Rivkin et al.'s (2005) contention that some teachers leave the field early on when they find it is not suited to them and Wong's belief that strong support and induction programs are imperative for the retention of teachers.

Harris and Sass (2007) estimated the positive results of teacher experience on student achievement more cautiously. In their review of data from the statewide administrative database in Florida, they found the correlation of teacher experience and student achievement produced mixed although generally positive results. They concluded during the first few years, new teachers in both elementary and middle schools showed a substantial increase in productivity. They agreed with Rivkin et al. (2005) that this view may be slightly biased by less effective teachers leaving the profession early in their careers. However, in a comparison of cost versus benefits, Harris and Sass claimed the benefits of retaining experienced teachers could outweigh the cost of hiring new teachers. Kukla-Acevedo (2006) agreed with this statement. In a study of why teachers leave the profession or move from one school to another, Kukla-Acevedo found the cost of retaining experienced teachers was worth the benefits students received. She stated that while replacing a teacher always required costs such as interviewing and training, the true cost of losing an experienced teacher was that student learning would suffer.

The most aggressive response to the effect of experienced teachers on student achievement came from Staiger and Rockoff (2010). In their study of schools in Los Angeles and New York City, they devised a formula to calculate what they believed to be the true cost to a system losing an experienced teacher. In agreement with Harris and Sass (2007) and Kukla-Acevedo (2006), Staiger and Rockoff determined students in classes with novice teachers lost approximately .10 standard deviations in achievement over that teacher's first two years of teaching. Using another of their formulas, they calculated a difference in pay for an experienced teacher over a novice teacher of $10,000 to $25,000 which, when multiplied times an average number of 20 students per class, resulted in the true cost to a system losing an experienced teacher of $200,000 to $500,000. They surmised that even after these calculations, the true cost of teacher turnover is not monetary as in the cost of hiring and firing but the compromise to the achievement results of a student who is taught by a novice teacher over the student who is taught by a teacher with several years of experience.

Based on review of the literature on the relationship between teacher experience and student achievement, there appears to be a consensus that at least one year of experience in the classroom shows mixed though generally positive results in student achievement (Boyd et al., 2008; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004). Research has also shown in a comparison of cost to benefit of retaining experienced teachers, that the retention of experienced teachers resulted in benefits to student achievement (Harris & Sass, 2007; Kukla-Acevedo, 2006; Staiger & Rockoff, 2010). However, differences in beliefs still exist on exactly how many years a teacher must be in the classroom before exhibiting the positive attributes associated with experience (Boyd et al., 2008; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004).

Class Size Reduction

Of all of the factors believed to affect student achievement, teacher to student ratio or class size reduction has been the most studied (Milesi & Gamoran, 2006; Rockoff, 2009). One of the most extensive and referenced class size reduction studies, Project STAR, began in 1985 in Tennessee (Tennessee Department of Education, 1990). According to the final report on Project STAR, during the years leading up to this research, members of the Tennessee legislature became interested in investigating class size reduction as a way to increase student achievement. One of the main proponents of this research was Steve Cobb, a member of the Tennessee House of Representatives who argued that previous research suggested smaller class size benefits student achievement but were not conclusive. Cobb endorsed participating in "a well-designed study of class size before investing in a costly new program" (Tennessee Department of Education, 1990, p. 1).

At its inception, Project STAR incorporated 79 schools and approximately 6,500 kindergarten students to take part in a longitudinal study (Tennessee Department of Education, 1990). According to the final report on Project STAR, these schools provided a sufficient number of classes of varying size to meet the research design of approximately 100 classes of each of three types—small, regular, and regular with a teacher aide. This research defined a small class as a class with an enrollment of 13-17 students and a regular class as one that had an enrollment of 22-25 students. The study followed students in each of the three class types over the next four years and used a comprehensive method of collecting data relating to gender, race, and socioeconomic status as well as test scores. Collection of data on teacher characteristics and classroom factors that might affect the outcome of class size reduction also took place. At the conclusion of the kindergarten school year, students in the smaller classes already demonstrated an advantage over those in the regular classes, both with and without a teacher aide. At the end of the first and second-grade school years, students in the smaller classes consistently outperformed those in the regular classes. By the end of third-grade, researchers believed that success of class size reduction to be well-established (Tennessee Department of Education, 1990).

Researchers believed Project STAR to be credible because of its large scale (Milesi & Gamoran, 2006) and other studies have corroborated its findings. In a separate review of the data from Project STAR to study the long-term effects of smaller class size on the achievement of minority students, Nye et al. (2004) supported the validity that class size reduction played a part in increased student achievement over the subsequent school years. Their findings demonstrated the effects of smaller class sizes were not only positive but statistically significant as well. The results of their analysis of student data also led Nye et al. to assert the effects of class size reduction in the early grades endured for at least five years after a student's participation in a smaller class.

However, some of studies conducted since Project STAR did not credit class size reduction as the single factor influencing student achievement, but instead credited some of the other class characteristics that might occur within a smaller class (Achilles, 2009; Folmer-Annevelink, Doolard, Mascareño, & Bosker, 2010; Milesi & Gamoran, 2006; Rockoff, 2009). According to Rockoff (2009), previous studies on the degree that class size matters to student success may have resulted in slightly inflated outcomes because most of these studies relied on statistical and observational methods that addressed causal relationships but did not take into account any other factors. He argued student success may be associated with any number of other factors such as community support, parental support, and increased funding as well as smaller class size. Rockoff (2009) reported teachers in smaller classes may be able to incorporate alternate methods of teaching to raise the quality of instruction. In his review of 24 field experiments, he revealed the increase in student achievement, while instigated by lowering class size, was actually accomplished by employing alternate methods of instruction made possible through smaller class size.

Using data obtained from the Early Childhood Longitudinal Study—Kindergarten Class of 1998-1999, Milesi and Gamoran (2006) examined classroom characteristics that may affect student achievement and whether they considered these affects generalizable to different groups of students. Instead of the randomized experimental approach used in Project STAR, Milesi and Gamoran chose to study students within a non-experimental, naturally occurring class group. Because they chose this approach, they argued that their claims of causal relationships between teacher characteristics and student achievement may not be as strong as those generated by experimental studies but they contended that their results were more representative of typical classroom conditions. Although they found the effects of class size may be different for different groups of students, they considered these differences insignificant. They did find evidence, however, of the positive effect of classroom instruction on student achievement leading to the conclusion that what happens inside the classroom is more important than the physical makeup of the class, which supported the goal of No Child Left Behind to place a highly qualified teacher in each classroom (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012). Milesi and Gamoran also observed a teacher's attitude toward the students and teaching appeared to change when class size was reduced although they were swift to concede that they had no evidence to corroborate this belief.

Folmer-Annevelink et al. (2010) supported the idea of a change in teacher's behaviors when class size was smaller. Folmer-Annevelink et al. observed kindergarten and first-grade classes in 46 Dutch primary schools with the goal of examining student-teacher interactions. During a 30-minute observation of each class, researchers recorded the size of the class and the number and type of student-teacher interactions that occurred. They also recorded whether the teacher or the student instigated the interaction and whether it was general, instructional, or personal in nature. Their findings revealed that more student-teacher interactions occurred in smaller classes and that interactions were more individualized for each student. They suggested that smaller classes allowed teachers to tailor their instruction to the needs of the individual students. Building on that theme, Folmer-Annevelink et al. reasoned that a teacher in a smaller class could devote less time to classroom management and in return, devote more time to educational content and the needs of the students.

Other researchers shared the belief that the benefits of a smaller class came from the ability to have more control of the students (Achilles, 2005; Milesi & Gamoran, 2006). According to Achilles (2005), some studies defined pupil-teacher ratio and class size as the number of students divided by the number of teaching professionals within the school or district including administrators and support staff. He instead defined class size as the number of students a teacher has in her class or on her classroom roll that she is responsible for that school year. Using this as his definition, Achilles found in smaller classes, a greater percentage of students were engaged in on-task activities and less time was required for classroom management. He believed the smaller class setting made it more difficult for students to withdraw from student-teacher interactions. However, he also pointed out students do not simply need a smaller class but also a competent teacher for a positive effect to occur. In their review of Project STAR referenced earlier, Milesi and Gamoran (2006) agreed with this assessment by stating a teacher who did not incorporate good classroom management techniques could negate the benefits of a smaller class size by suppressing the positive effects of this situation.

From the standpoint of stakeholders, class size reduction is a very appealing policy (Nye et al., 2004). Implementation of this strategy can occur with adequate resources and does not require changes in curriculum or instructional methods. Administrators can easily instigate and control its implementation. However, as Nye et al. (2004) pointed out, knowing the number of students in a class does not provide an understanding of the instruction taking place within its walls. Without knowledge of these instructional practices, Nye et al. also stressed one can never really know how the dynamics of this smaller class may have changed from that of its previous larger size class to bring about an increase in achievement.

Chatterji's (2005) study of the effects of smaller class size on the achievement of students with relation to their ethnicity, gender, or poverty subgroups supported Nye et al.'s (2004) belief that class size effects may be more complex than is indicated by only the number of students involved. Chatterji used a subset of student data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999, which examined data from 2300 students in 182 schools. One of the questions addressed in her study was the extent to which certain identified school factors including class size, affected student achievement. She stated she found class size to be one of the factors which had a significant effect on student achievement. However, she did point out that studies rarely address what schools and teachers actually do to facilitate student outcomes within smaller classes and instead deal with what they believe to be the cost-effectiveness of this strategy. In a study of Texas schools, Rivkin et al. (2005) attempted to address the issue of cost versus benefit of class size reduction. They hypothesized that, due to the cost of teachers required to implement smaller class sizes, the cost of class size reduction would exceed the proportional increase in student achievement. At the conclusion of their research, they claimed an increase in the individual teacher quality resulted in more positive benefits than reducing class sizes by ten students, which they considered a costly approach.

However, Januszka and Dixon-Krauss (2008) did not agree with Chatterji's (2005) statement that studies on class size reduction only address the cost-benefit ratio, and concurred with Rivkin et al.'s (2005) beliefs that the cost of class size reduction exceeded the benefits received by its implementation. Januszka and Dixon-Krauss argued there is more literature that supports instructional quality than a cost versus benefit approach to accountability and when addressed in class size reduction studies, a cost-benefit analysis of this approach generally yield positive results. In their analysis of class size reduction for the state of Florida, Januszka and Dixon-Krauss re-examined previous class size studies and used the results from that analysis to carry out a cost-benefit analysis of class size reduction for the state of Florida. Their findings suggested the most cost-effective resolution to increasing student achievement would be to provide funds for both reducing class size and increasing teacher training to raise teacher quality.

However, not all class size reduction studies yielded positive results, (Milesi & Gamoran, 2006; Sims, 2008). According to Milesi and Gamoran (2006), when California initiated a class size reduction program beginning in 1996 aimed at reducing class sizes in kindergarten through third-grade over the next three years, the results were not as promising. Sims (2008) reported that the insignificant results occurred because California spent billions of dollars to reduce their class sizes without first understanding the dynamics of class size reduction that affect student outcomes. In an explanation of how California promoted smaller class size, Sims (2008) explains how schools received monetary incentives for classes with a limited number of students. However, a *combination class* containing students from two grade levels counted toward this goal, so

California chose combination classes as their method of accommodating the requirements of smaller classes. Sims (2008) illustrates this process:

> Consider a school that had 60 students, 30 in one first-grade and 30 in one second-grade class, prior to the program. Without combination classes this school would have to implement the program for first and second-graders by hiring two new teachers and providing four classes with 15 students each…However, if the school is allowed to count combination classes toward its goal it can hire one new teacher and have three classes of 20 students (p. 459).

Based on the results of Sims' research, instead of providing the positive results of previous class size reduction experiments, combination classes had a definitively negative effect on student achievement and this type of class skewed data on the effects of class size reduction within the California study.

Research of class size reduction has shown that smaller classes do have a positive impact on student achievement but researchers agree that the positive effects do not only come from lowering the number of students in a class but in the naturally occurring factors that may accompany this change (Achilles, 2009; Chatterji, 2005; Folmer-Annevelink et al., 2010; Milesi & Gamoran, 2006; Rockoff, 2009; Tennessee Department of Education, 1990). Researchers have credited employment of alternate methods of instruction (Rockoff, 2009), a change in teacher attitudes toward students and the workload (Folmer-Annevelink et al., 2010; Milesi & Gamoran, 2006), more student-teacher interactions (Folmer-Annevelink et al., 2010), and better classroom management (Achilles, 2005) as dynamics that may occur in smaller classes and contribute to the success of class size reduction. Large-scale studies conducted in Texas and California after Project STAR in Tennessee, have demonstrated that it is not only smaller classes that are important but the method employed to reduce the class size as well (Rivkin et al., 2005; Sims, 2008). Rivkin et al. (2005) discovered quality teachers were an important aspect of the success of this plan in Texas and in California, Sims (2008) learned positive results were negated when students of different grade levels were enrolled in the same class to simply meet the smaller class size requirement.

Computer to Student Ratio

In his book, *The World is Flat,* Friedman (2007) argued for the importance of students using technology in the classroom. He believed a well-rounded education involved teaching students to be productive global citizens once they leave the classroom and preparing them to compete in an ever-changing technological world. He stressed the importance of students not only succeeding on state-mandated tests but also competing at a global level once they moved into the workforce. Friedman emphasized as educators we cannot continue to educate students in the same ways we have always employed if we want them to succeed in life. Others support Friedman's assertion that technology access and use is a necessary part of the education of today's students but our methods of instruction need to constantly evolve (Judge, 2005; Page, 2002; Suhr et al., 2010).

Using data derived from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), Judge's (2005) study defined computer to student ratio as the total student enrollment of a school divided by the total number of computers in the school available for student use. Although the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 was a national study which followed a group of students from Kindergarten through eighth grade, Judge chose to analyze a sample of students from the original study. Her sample consisted of 1,601 African American students who attended kindergarten and first-grade in 274 public schools in 1998-1999. For her study, collection of data on the accessibility and adequacy of technology resources took place using questionnaires completed by parents, teachers, and administrators. Judge reported there was a positive relationship between student achievement and computer use in kindergarten when students had access to computers both in their classroom and at home; however, she also found this increase in student achievement leveled out in first-grade and attributed this to the low computer to student ratio in the participating first-grade classrooms. Further research by Judge showed as the number of computers within the classroom increased, student achievement increased, leading her to conclude there was a significant correlation between achievement and computer to student ratio.

However, Means (2010) reported mixed results when correlating technology access and student achievement. Means identified the dilemma of technology integration in schools when she alleged that technology use within schools had changed little since the mid-twentieth century although teachers and students alike were using technology more outside of the school environment. Using a subset of the schools sampled during the nation-wide study of the Effectiveness of Educational Technology Interventions in 2007, Means analyzed 13 schools for gains in achievement after implementation of various instructional software. This analysis employed a method of coding for observations and interviews of the selected Effectiveness of Educational Technology Interventions study participants. In her results, she concluded that the practice of a skill and not just the frequent use of technology led to gains in achievement. She also suggested educators should weigh each instructional activity using technology within its own context for its educational value.

The research of Huang and Russell (2006) examined the *digital divide,* or the gap between those students who have access to technology and those who do not, in Oklahoma City public schools. Their study examined three schools in the Oklahoma City school district, the accessibility of computers for 163 fifth-grade students within these schools and the effect this access had on their academic success. Huang and Russell, like Judge (2005), found a link between technology access and student achievement but considered that link to be interrelated with other factors as well. They argued that factors which may have played a role in the effect of technology on student achievement included student characteristics, curriculum areas taught, and differing methods of technology use. From this, they concluded that teachers and students must have access to technology but that in order for it to have an impact, they must also learn how to use it effectively.

Maninger (2006) agreed with the assessment of Huang and Russell (2006). He pointed out that as educators strived to help their students achieve success on state-mandated tests, technology use as an educational practice faded to the background. With student achievement as the goal and statewide testing as the measure, Maninger suggested that educators should find ways to incorporate technology as a tool for test preparation in new and innovative ways for students. He demonstrated how using technology for test preparation could work in his study of at-risk high school students in Texas. His results correlated the students' technology use with their grades on the state-mandated reading test and found a positive outcome.

According to Howley, Wood, and Hough (2011), teachers' attitudes toward technology in the classroom also influenced its use. In a study of rural schools in Ohio, Howley et al. surveyed more than 50 third-grade teachers on their attitudes toward technology and their level of technology integration in the classroom. Using a method of coding for each of the responses disclosed that teacher attitudes toward technology as a learning tool affected not only technology integration in the instructional setting, but also student attitudes toward technology. Their results compelled them to advise districts to provide teachers with technology training and support so they could become more confident users of technology thereby changing their attitudes toward it. Bebell and Kay (2010) agreed that one of the biggest challenges facing technology integration in the classroom is the inability of educators to keep up with technology's rapid and constant evolution. The training and support suggested by Howley et al. could provide the first step in correcting this problem.

Other researchers (Becker, 2000; Page, 2002; Shapley et al., 2010; Suhr et al., 2010) also advocated the use of technology to increase student achievement. Page (2002) conducted a comparison of elementary students in five low socio-economic schools in rural Louisiana. After categorizing the classes in these schools into the two separate categories of *technology-enriched* classrooms which included a variety of technology and traditional classrooms that did not incorporate technology, he examined the affect of computer use on the mathematics scores of 211 students in terms of student achievement, self-esteem, and classroom interaction using a quasi-experimental approach. Based on his findings, Page (2002) asserted a technology-enriched classroom is more conducive to gains in student achievement.

In an earlier study of computer to student ratio, Becker (2000) demonstrated that a 4:1 computer to student ratio could make a difference in the use of technology in the classroom. Later researchers, such as Howley et al. (2011) and Judge (2005) referenced Becker's ratio of computers to students as a beginning point in their studies. Even though Becker's study took place during a time when a 4:1 computer to student ratio provided an increase of technology in most classrooms, his findings revealed teachers were more likely to incorporate technology into their instruction if given easy accessibility within their classroom. He also stated the value of technology to instruction does not come from its use for whole class instruction on a regular daily basis but instead in the spontaneous use of technology for locating information and communicating and collaborating with others that having computers nearby affords.

Suhr et al. (2010) and Shapley et al. (2010) both reported the outcome of 1:1 laptop initiatives in a special edition of *The Journal of Technology, Learning, and Assessment* devoted to addressing educational outcomes from these experiments and providing empirical evidence to educators of the effectiveness of these programs. Suhr et al. described a laptop program launched in a southern California school district in the fall of 2004. The purpose of this initiative was to determine the effect of a concentrated placement of technology on fourth-grade students' reading scores on the English Language arts portion of California's standardized test over a two year period. Similar to Page (2002), Suhr et al. used a quasi-experimental approach, dividing the participants into either a treatment or a control group with the intention of analyzing the effects of this intervention. They hypothesized that students who had access to laptops would show gains in student achievement. Suhr et al.'s final analysis of the data showed that access to laptops predicted gains in these students' test scores for English Language Arts, literary responses and writing thus corroborating Page's earlier findings that technology access did effect student achievement.

In a second report included in the special edition on laptop initiatives, Shapley et al. (2010) reported on a one-to-one laptop initiative in Texas and confirmed Becker's (2000) theory of access to technology influencing its use. Shapley et al. reviewed data from 21 schools over a three-year period. Though they considered teacher attitudes toward technology to be important, Shapley et al. found instances where schools showed that high levels of technology access in the classroom led to high levels of use, despite the teacher's level of technology implementation in her lessons. They also learned, when provided with laptops, students' use of this technology outside of school to complete homework and play educational games became a strong indicator of student success. They concluded technology needed to be readily available to students and teachers for utilization (Shapley et al., 2010).

Based on the findings from previous studies (Becker, 2000; Judge, 2005; Page, 2002; Shapley et al., 2010; Suhr et al., 2010), there is a correlation between technology and student achievement. However, the question arises as to whether placing computers in a classroom is enough (Howley et al., 2011; Huang & Russell, 2006; Maninger, 2006; Means, 2010). Howley et al. (2011) suggested that a teacher's attitude toward technology influences its use in the classroom and Maninger (2006) carried this one step further by asserting teachers should not only encourage technology use in their classrooms but incorporate new and innovative methods for its use as a tool for test preparation and instruction. Means (2010) agreed with Howley et al. (2011) and Maninger (2006) by stating educators should not just use technology for the sake of using technology but educators should weigh each activity that includes the use of technology within its own instructional context for its educational value. Huang and Russell (2006) agreed that technology use was important, but argued other factors played a role in its success such as characteristics of students, curriculum areas taught, and differing methods of technology use. Huang and Russell (2006) emphasized that teachers and students must be taught how to use technology effectively in order for it to have an impact on achievement. Like Becker (2000), those researchers with questions relating to a correlation between technology and student achievement (Howley et al., 2011; Huang & Russell, 2006; Maninger, 2006; Means, 2010) did concede any impact technology could have must start with accessibility to students.

Criterion-Referenced Competency Test (CRCT)

The Elementary and Secondary Act of 1965 required schools to adopt appropriate objective assessments of student achievement and report these to state departments of education on an annual basis in order to qualify for federal educational funding (Elementary and Secondary Education Act, 1965). Each state's department of education verified the reports relating to the educational achievement of their students and approved each school's application for federal funding based on the information reported. However, in order to provide documentation of educational achievement, educators had to create a standard for testing and measuring achievement with which to make these reports (Gallagher, 2003). In an effort to standardize the methods used for assessment, the Clinton administration passed the Goals 2000: Educate America Act (1994) which sought to provide valid and reliable mechanisms for the development and certification of assessments that measured student performance (Goals 2000: Educate America Act: Purpose, 1994). Richard W. Riley, President Clinton's Secretary of Education, also insisted nationwide assessments at certain grade levels should be initiated as a method to improve student achievement (Gallagher, 2003). His suggestion later became of a part of the Bush administration's plan for school accountability in the No Child Left Behind Act of 2001 (No Child Left Behind Act of 2001: Statement of Purpose, 2012). As part of the Statement of Purpose, No Child Left Behind "ensur[ed] high quality academic assessments, accountability systems…aligned with challenging State academic standards so that students, teachers, parents, and administrators can measure progress against common expectations for student academic achievement" (para. 2). According to Gallagher (2003), Riley's advice and No Child Left Behind led to annual achievement testing of third- through tenth-grade students.

According to Wiliam (2010), the reasoning behind achievement testing for accountability was simple--when analyzing test results, schools where students have high achievement scores must be high quality schools while schools where the overall student achievement average is low must be lower quality schools. He stated this view of accountability is central to No Child Left Behind. According to Wiliam, if this view is correct then students in high quality schools would be higher achieving than students in low quality schools. This would mean that students' educational outcomes could only be attributed to the quality of education provided by the school in exclusion of any other extraneous factors. He conceded, however, it is reasonable to assume there is a relationship between some variation in student achievement and the quality of the education provided within a school. Wiliam reported history has shown that when policy turns its focus to an evaluation of performance, the natural progression is for the test results to increase because educators begin to focus on mastery of the test as their educational goal. Following through with this observation, Wiliam asserted the goal of policymakers should be to create a test aligned with standards in a way that promotes the desired educational outcomes. He concluded, in order for achievement testing to be effective, tests must be designed so scores can be reported in a manner in which each student's mastery of a curricular area can be reviewed and addressed based on that individual child's needs.

Moss, Girard, and Haniford (2006) agreed with Wiliam (2010) that the goal of any educational institution is to promote student learning and the methods used to assess learning should provide professionals with the information they need to enhance this process. They also asserted that standardization of these methods allowed for comparison of students and their achievement based on their similarity within a larger group. Standardization also provided the means to evaluate the validity and reliability of the testing method within many different contexts and environments by basing findings on common evidence and related findings. Moss et al. claimed evaluating assessments in this manner not only provided information on exactly what standards a test measured but also knowledge of which standards were not addressed and how a test aligned with the desired educational outcomes for the user.

According to the GaDOE, the state of Georgia has chosen the CRCT as its method of evaluating student success in its schools. Implementation of the CRCT took place in the spring of 2002 as a way to identify individual students' strengths and weaknesses and evaluate the quality of education in Georgia schools (GaDOE, 2012c).

In contrast to a norm-referenced test such as the Iowa Test of Basic Skills which measured standards commonly taught throughout the United States, criterion-referenced tests measured how well a student had acquired knowledge taught in a specific curriculum area (GaDOE, 2012c). As a standardized assessment, the CRCT seeks to evaluate a student's knowledge of the skills taught in the Georgia Performance Standards.

Before adopting the CRCT as a measure of achievement, the GaDOE sought the advice of an external team of experts on educational standards and assessments to judge its reliability (GaDOE, 2012c). The team of experts, formed by the U.S. Department of Education, reported to them on "content and academic achievement standards; technical quality; alignment; inclusion; and scoring and reporting" (GaDOE, 2012c, para. 8). The state of Georgia also reviewed educational research on assessment testing and considered the testing methods that other states employed before concluding the CRCT met federal requirements for assessment and deciding on the CRCT as Georgia's method of assessment (GaDOE, 2012c). After much consideration, the GaDOE determined the CRCT best fit the needs of Georgia schools to demonstrate student achievement as defined in No Child Left Behind.

Wiliam (2010) asserts assessment plays a key role in education and while there may be disagreement as to whether education leads to successful assessment or assessment drives education (Gallagher, 2003; Moss et al., 2006; Wiliam, 2010), No Child Left Behind requires schools be held accountable for the achievement of their students and demonstrate this progress through annual assessments such as Georgia's CRCT (No Child Left Behind Act of 2001: Statement of Purpose, 2012).

Georgia's Educational Report Card

Governor Sonny Perdue initiated Georgia's Education Scoreboard in 2008 and created the Governor's Office of Student Achievement as a way to communicate the level of student achievement throughout Georgia. Georgia's Education Scoreboard, or *report card*, shared all aspects of each district and school that affected students and their achievement from pre-kindergarten through post-secondary education with all educational stakeholders (Governor's Office of Student Achievement, 2007a).

As the reporting and accountability agency for education in Georgia, the Governor's Office of Student Achievement (Governor's Office of Student Achievement, 2007a) examines academic records of educational institutions within the state to ensure compliance with federal guidelines (Governor's Office of Student Achievement, 2007b). In 2008, the GaDOE added an academic auditing program to the responsibilities of the Governor's Office of Student Achievement. The academic audit conducted by the Governor's Office of Student Achievement reviews all data on student assessments and other school records reported to the GaDOE to establish validity and reliability in both the methods used to collect data and the methods used to report it (Governor's Office of Student Achievement, 2007b). The data collected annually by Governor's Office of Student Achievement becomes a part of Georgia's Education Scoreboard and is available on the GaDOE Web site (Governor's Office of Student Achievement, 2007a).

At the point of inception, the Governor's Office of Student Achievement scrutinized the report card using findings from studies on educational performance indicators, along with recommendations and input from national and state educational agencies as a frame of reference. Finally, they obtained feedback from the state's educational leaders, incorporating their suggestions into the final report (Governor's Office of Student Achievement, 2007a). After approval of the report card, the Governor's Office of Student Achievement established a method for sharing the information compiled by linking it to the GaDOE homepage (http://www.doe.k12.ga.us/Pages/Home.aspx). The link to the report card provides a search feature to access each report by state, district, individual school, and school year. The information provided in this report card includes student and school demographics, personnel and fiscal data, and information on performance on standardized tests (GaDOE, 2012a). In a separate document, accessed through the Instructional Technology page of the GaDOE Web site, the Governor's Office of Student Achievement reports information on the technology at the district and school levels in an annual technology inventory (GaDOE, 2012e). Because the Governor's Office of Student Achievement collects and reports this information, the technology inventory undergoes the same strenuous measures to assure reliability and validity.

Summary

With the signing of the No Child Left Behind Act in 2002, states were required to institute state-wide academic standards and implement state-wide academic testing (GaDOE, 2012c). Although the purpose of this act was to provide a fair and equal education to all students, it also encouraged schools, districts, and state departments of education to evaluate their curriculum and seek out ways to improve student learning and demonstrate excellence within their schools. Through No Child Left Behind's Title I program, funds were made available to those schools serving a large population of poor students in an effort to provide those students with an education comparable to those students in less economically challenged areas (No Child Left Behind Act of 2001: Statement of Purpose, 2012; U.S. Department of Education, 2011). Other sections of No Child Left Behind sought to set forth guidelines on teacher qualifications (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012), class size reduction (No Child Left Behind Act of 2001: Statement of Purpose, 2012), and technology integration (No Child Left Behind Act of 2001: National Education Technology Plan, 2012). No Child Left Behind forced local schools, districts, and state departments of education to establish educational standards and a state testing system that met federal requirements and schools who received federal funding for education were required to verify their compliance with these guidelines. Results of the newly established state-wide student achievement tests became the measure of this compliance (GaDOE, 2012b).

Georgia's Education Scoreboard or report card was initiated in 2008 by Governor Sonny Perdue and created by the Governor's Office of Student Achievement as a way to communicate the level of student achievement throughout Georgia (Governor's Office of Student Achievement, 2007a). As the reporting and accountability agency for education in Georgia, the Governor's Office of Student Achievement examines academic records of educational institutions within the state to ensure compliance with federal guidelines (Governor's Office of Student Achievement, 2007b). This agency also reviews all data on student assessments and other school records reported to the GaDOE to establish validity and reliability in both the methods used to collect data and the methods used to report it (Governor's Office of Student Achievement, 2007b). Information on all aspects of each district and school that affects students and their achievement is made available to all educational stakeholders through the report card that can be accessed through a link on the GaDOE homepage (http://www.doe.k12.ga.us/Pages/Home.aspx) in an effort to comply with the requirements of No Child Left Behind.

Chapter III

METHODOLOGY

The purpose of this study was to examine whether a relationship exists between five school characteristics and student achievement. The objective was to determine which of these characteristics had the strongest relationship with the student achievement of fifth-grade students in Georgia public schools. With this purpose in mind, the relationship between student achievement as measured by the percentage of fifth-grade students in Georgia public schools receiving scores of *Does Not Meet*, *Meets,* or *Exceeds* on the CRCT in reading and mathematics was linked to five school characteristics related to CRCT scores—Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio. Although approval was requested from the Institutional Review Board for this research, it was deemed unnecessary since no human subjects were involved.

Description of the Research Design

According to Creswell (2009), "quantitative research is a means for testing objective theories by examining the relationship among variables" (p. 4). Adopting a quasi-experimental approach to quantitative research, an examination of each of the predictors or independent variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio occurred to determine if a relationship exists between the independent variables and the dependent variables of student achievement as indicated by reading and mathematics scores of fifth-grade students on the CRCT in Title I and non-Title I Georgia public schools. Scores of *Does Not Meet, Meets* and *Exceeds* on the reading portion of the test and scores of *Does Not Meet, Meets* or *Exceeds* on the mathematics portion of the test were analyzed resulting in six dependent variables. A direct multiple regression, where all the independent variables were entered simultaneously and assessed in terms of how each accounts for variability in the dependent variables, was used for this study.

Description of the Sample

The Research Methods Knowledge Base (Trochim, 2006) defines external validity as the degree to which the findings of a study are generalizable to other populations. In an effort to enhance the generalizability of this study, the accessible population included all public schools in Georgia. This population was accessible because of the reporting methods of the Governor's Office of Student Achievement as discussed in the previous section and the availability of this data from the GaDOE (2012a). From this accessible population, a cluster sample of schools began with schools served by one of the Regional Educational Service Agencies in the southern portion of the state. Cluster sampling continued by locating a school district within the northern part of the state that, when combined with the previously chosen cluster, provided a relatively balanced number of Title I to non-Title I schools.

According to Mertler and Vannatta (2005), the reliability of a research equation lies in the ratio of the sample size (n) to the number of predictors (k). Agresti and Finlay (1997) recommended the sample size should be at least ten times larger than the number of independent variables of the study. Based on this recommendation, the five independent variables of this study required that data from at least 50 schools be included, far less than the 106 actually chosen as a cluster sample of public schools from two areas in Georgia. The sample provided a relatively equal number of Title I ($n = 58$) and non-Title I ($n = 48$) schools from the accessible population of public schools in Georgia. According to Jones and Kottler (2006), a cluster sample utilizes a naturally occurring group as the study participants. The cluster sample of schools included were those served by one of the Regional Educational Service Agencies in South Georgia and schools from a district in the northern part of the state. Since this study addressed the achievement of fifth-grade students during the 2009-2010 school year, only the elementary schools serving fifth-grade students during that school year were included. Data from the GaDOE Web site provided information on both the schools and the students within these districts (GaDOE, 2012a).

During the 2009-2010 school year, the south Georgia district included 30 Title I schools and 3 non-Title I schools (GaDOE, 2012b). In the same 2009-2010 school year, there were 28 Title I schools and 46 non-Title I schools in the north Georgia district included in this study (GaDOE, 2012b). However, one of the non-Title I schools in the northern district served fifth-grade students but is a facility for students with specials needs age 3-21 years old and therefore did not utilize the CRCT as a measure of their students' progress. Because of the special nature of this school and unavailability of CRCT scores for their students, this school was not included in the sample and therefore, the number of non-Title I schools included in this district was 45.

Combining these two areas of Georgia in a sample of Georgia public schools provided a target population of 58 Title I schools and 48 non-Title I schools and CRCT results for over 16,000 fifth-grade students from the designated time period (GaDOE, 2012a).

Procedures

A list of schools from both the South Georgia and the North Georgia districts was sorted by individual grade level to focus on only those schools that served fifth-grade. The GaDOE Web site contained data pertinent to the 106 sample schools included in this study and the independent and dependent variables that were analyzed. The GaDOE prepares an annual report for each of their schools providing information on the school's Title I status; the demographic makeup of the school; the student enrollment including a breakdown according to gender, race, and socioeconomic background; and, the student enrollment in special programs such as special education, early intervention, and gifted. The report card supplies CRCT scores, categorized by grade level and subject (reading, English/language arts, mathematics, social studies, and science), used as the dependent variable. Based on students' performance on this Georgia Performance Standards based assessment, scores are categorized as *Does Not Meet Expectations* if they are below 799, *Meets Expectations* if they are 800 to 849, and *Exceeds Expectations* if they are 850 or above. For the purpose of this study, only data pertaining to the subjects of reading and mathematics collected from students who were in fifth-grade during the 2009-2010 school year were collected.

One page of the state report card also supplies data on Title I status, teachers' education levels, teachers' years of experience, and class size (GaDOE, 2012a), which were four of the independent variables of the study. The fifth independent variable, computer to student ratio, was collected by accessing the statewide technology survey that each school within the state of Georgia completes annually, detailing the technology available throughout their school (GaDOE, 2012e). In compliance with No Child Left Behind (No Child Left Behind Act of 2001: National Education Technology Plan, 2012), the Office of Technology Services, a division of the GaDOE, reports the technology housed in each of Georgia's public schools by location and type including computers, interactive whiteboards, digital projectors, assistive devices, etc (GaDOE, 2012e) and the overall computer to student ratio.

Description of Variables

In order to better understand the design of the study, each of the variables are described including how and what they measure. The five independent variables in this study are:

Title I Status. As a part of No Child Left Behind, Title I Part A provides federal funding to public schools serving the highest percentage of poor students. The purpose of this funding is to ensure these students receive an education comparable to the education received by students in more economically advantages areas and to help them meet educational standards and levels of achievement (U.S. Department of Education, 2011). According to the U.S. Department of Education (2011), a Title I school is a school that has met the qualifications to receive these funds. Title I status was reported as a dichotomous variable with Title I schools being coded as 1 and non-Title I schools being coded as 0.

Teachers' Education Level. The education level of a teacher measures the years of education that they have successfully completed such as a bachelor's, master's, specialist, or doctorate. According to the Georgia Professional Standards Commission

Web site at http://www.gapsc.com/, these degrees correspond with Level Four (bachelor's degree), Level Five (master's degree), Level Six (specialist degree), and Level Seven (doctorate) certificates and are contingent upon the educator holding a valid certificate from an accredited institution in an accepted degree or major (Georgia Professional Standards Commission, 2012). These degrees are reported on the GaDOE Web site using the numerical designation assigned to them by the Georgia Professional Standards Commission such as 4, 5, 6, or 7 (GaDOE, 2012a). For the purpose of analysis, these numerical designations were converted to the number of years typically required for a student to actually complete that degree which is four for a bachelor's, six for a master's, seven for a specialist, and eight for a doctorate. The resulting numbers were averaged for each school. For the purpose of this study, education level and average years of post-secondary education will be used interchangeably.

Teachers' Years of Experience. According to Harris and Sass (2008), *years of experience* refers not only to the years a teacher has been a teaching professional but also the experience they have acquired in that position during that time. Since knowledge acquired based on years of service is relative, this study will simply deal with the numerical representation of how many years a teacher has been a teaching professional. For ease of use, the Report Card on the GaDOE Web site provides a quick reference chart showing the years of experience of the teachers within a given school in increments of 10 with the categories being < 1, 1-10, 11-20, 21-30, and > 30 (GaDOE, 2012a). However, the creators of the Report Card also averaged the actual years of experience reported by each teacher and reported the average as a single numerical value. The average number of years of experience of teachers within a given school as reported on the Report Card was one of the independent variables of this study.

Class Size. According to Achilles (2005), some studies defined pupil-teacher ratio or class size as the number of students divided by the number of teaching professionals within the school or district including administrators and support staff. In contrast to this method of calculating teacher to student ratio, *class size* will be defined as the number of students divided by the number of actual classroom teachers. The ratio of students to teachers or class size has already been calculated and was provided as part of the Report Card accessed through the GaDOE Web site (2012a).

Computer to Student Ratio. Each school year, all public schools within the state of Georgia complete a technology inventory survey to report all technology housed within their school. As with other data reported to the GaDOE, the Governor's Office of Student Achievement compiles this information and makes it available on the GaDOE Web site (2012e). As a part of this report, the Governor's Office of Student Achievement calculates the number of students within a school divided by the number of computers available for their use and reports it as a numerical ratio. This study used that numerical data as a representation of the computer to student ratio within the schools.

The dependent variable for this study is the student achievement of fifth-grade students in Georgia public schools during the 2009-2010 school year.

Student Achievement. For this study, student achievement was defined as the percentage of students receiving a score of *Does Not Meet*, (799 or below); *Meets*, (a score of 800-849); or *Exceeds*, (a score of 850 or above) on the CRCT in reading and mathematics. Students who received scores of *Meets* or *Exceeds*, (800 or above), were considered to have demonstrated adequate knowledge of the curriculum according to the standards held by the GaDOE. The GaDOE provides data on these scores on each school's annual Report Card as compiled and reported by the Governor's Office of Student Achievement (2007a). The dependent variable is represented by six different measures:

- percentage of students receiving a score of 799 or below, defined as *Does Not Meet* on the reading portion of the CRCT;
- percentage of students receiving a score of 800-849, defined as *Meets* on the reading portion of the CRCT;
- percentage of students receiving a score of 850 or above, defined as *Exceeds* on the reading portion of the CRCT;
- percentage of students receiving a score of 799 or below, defined as *Does Not Meet* on the mathematics portion of the CRCT;
- percentage of students receiving a score of 800-849, defined as *Meets* on the mathematics portion of the CRCT; and
- percentage of students receiving a score of 850 or above, defined as *Exceeds* on the mathematics portion of the CRCT.

Research Hypotheses

Based on a review of the literature and previous research findings, it is believed that a relationship exists between certain teacher and school characteristics and the achievement of fifth-grade students in Georgia public schools. The purpose of this study was to examine the relationship of five independent variables—Title I status, teachers' education level, teachers' years of experience, class size and computer to student ratio—

to student achievement as indicated by reading and mathematics scores of fifth-grade students on the CRCT in Title I and non-Title I Georgia public schools. The study analyzed the following research hypotheses:

1. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentage of fifth-grade students who did not meet CRCT reading standards (score of 799 or below). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

2. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentage of fifth-grade students who met CRCT reading standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

3. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentage of fifth-grade students who exceeded CRCT reading standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

4. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed

variance in the percentage of fifth-grade students who did not meet CRCT mathematics standards (score of 799 or below). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

5. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentage of fifth-grade students who met CRCT mathematics standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

6. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for a significant amount of the observed variance in the percentage of fifth-grade students who exceeded CRCT mathematics standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

Chapter IV

ANALYSIS AND PRESENTATION OF DATA

The purpose of this study was to investigate whether teacher characteristics and school characteristics are related to student achievement of fifth-grade students in Title I and non-Title I Georgia public schools. For this study, the unit of analysis was individual schools and the values for the five predictor variables are school aggregates and percentages. The predictor variables selected were:

- Title I status
- Teachers' average years of post-secondary education
- Teachers' average years of teaching experience
- Class size
- Computer to student ratio

The dependent variable for this study was the student achievement of fifth-grade students in Georgia public schools during the 2009-2010 school year as represented by six different measures:

- percentage of students receiving a score of 799 or below, defined as *Does Not Meet* on the reading portion of the CRCT;
- percentage of students receiving a score of 800-849, defined as *Meets* on the reading portion of the CRCT;
- percentage of students receiving a score of 850 or above, defined as *Exceeds* on the reading portion of the CRCT;

- percentage of students receiving a score of 799 or below, defined as *Does Not Meet* on the mathematics portion of the CRCT;
- percentage of students receiving a score of 800-849, defined as *Meets* on the mathematics portion of the CRCT; and
- percentage of students receiving a score of 850 or above, defined as *Exceeds* on the mathematics portion of the CRCT.

Results-Bivariate Correlations

Bivariate correlations were conducted for the five predictor variables and the CRCT reading and mathematics scores of *Does Not Meet, Meets,* and *Exceeds*.

Title I Status and CRCT Reading and Mathematics Scores. Although Title I status was not the primary interest in this research design, a review of the literature revealed designation as a Title I school to be highly correlated with outcomes on standardized tests such as the CRCT (Baker & Johnston, 2010; Harding et al., 2012; Rouse & Barrow, 2006; Sirin, 2005). The results of the preliminary correlations which included all predictors and all CRCT outcomes supported the review of literature indicating that being a Title I school is an important predictor of the overall outcome of CRCT scores in both reading and mathematics.

Title I Status and CRCT Reading Scores. A Pearson's correlation coefficient was computed to assess the relationship between Title I status and the percentage of students receiving CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds*. The results revealed a positive correlation between the Title I status and the percentage of students receiving a score of *Does Not Meet* for CRCT reading, $r = 0.473$, $n = 106$, $p < 0.001$. A correlation between Title I status and the percentage of students receiving a score of

Meets for CRCT reading showed a strong positive correlation, $r = .718$, $n = 106$, $p < .001$. The final correlation between Title I status and the percentage of students receiving a score of *Exceeds* for CRCT reading resulted in a negative correlation, $r = -.732$, $n = 106$, $p < .001$. In all three of the correlations, a strong relationship between schools designated as Title I schools and CRCT reading scores was demonstrated. Being a Title I school results in an increase in the percentage of students receiving *Does Not Meet* and *Meets* scores on the reading portion of the CRCT and a decrease in the percentage of students receiving *Exceeds* scores on the reading portion of the CRCT.

Title I Status and CRCT Mathematics Scores. A correlation between Title I status and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds* was conducted. The Pearson's correlation revealed a positive relationship between schools designated as Title I and the percentage of students receiving a score of *Does Not Meet* for CRCT mathematics, $r = .520$, $n = 106$, $p < .001$. The correlation between Title I status and the percentage of students receiving a score of *Meets* for CRCT mathematics also showed a positive correlation, $r = .623$, $n = 106$, $p < .001$. The final correlation between Title I status and the percentage of students receiving a score of *Exceeds* for CRCT mathematics resulted in a negative correlation, $r = -.634$, $n = 106$, $p < .001$. Overall, each of the three correlations demonstrated a strong relationship between schools designated as Title I and CRCT mathematics scores. Being a Title I school results in an increase in the percentage of students receiving *Does Not Meet* and *Meets* scores on the mathematics portion of the CRCT and a decrease in the percentage of students receiving *Exceeds* scores on the mathematics portion of the CRCT.

After determining that a strong relationship existed between designation as a Title I school and CRCT reading and mathematics scores, a bivariate correlation was conducted to determine if a relationship existed among the four remaining predictors and outcomes in CRCT reading and mathematics.

Remaining Predictors and CRCT Reading Scores. The four remaining predictors were correlated to CRCT reading scores to determine if a relationship existed among these predictors and the percentage of students receiving CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds*.

Teachers' Education Level and CRCT Reading Scores. A Pearson's correlation coefficient was computed to assess the relationship between teachers' education level and the percentage of students receiving CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds*. Results of the correlation between the variables of teachers' education level and the percentage of students receiving a score of *Does Not Meet* for CRCT reading were not significant with $r = -.111$, $n = 106$, $p = .259$. The correlation between teachers' education level and the percentage of students receiving a score of *Meets* for CRCT reading showed $r = -.309$, $n = 106$, $p = .001$. The final correlation between teachers' education level and the percentage of students receiving a score of *Exceeds* for CRCT reading resulted in a correlation of $r =.293$, $n = 106$, $p = .002$. An increase in teachers' education level results in a decrease in the percentage of students receiving *Meets* scores on the reading portion of the CRCT and an increase in the percentage of students receiving *Exceeds* scores on the reading portion of the CRCT.

Teachers' Years of Experience and CRCT Reading Scores. A Pearson's correlation coefficient was computed to assess the relationship between years of experience and the CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds*. Results of the correlation between the variables of years of experience and the percentage of students receiving a score of *Does Not Meet* for CRCT reading were shown to be r = -.209, n = 106, p = .032. The correlation between years of experience and the percentage of students receiving a score of *Meets* for CRCT reading showed r = -.253, n = 106, p = .009. The final correlation between years of experience and the percentage of students receiving a score of *Exceeds* for CRCT reading resulted in a correlation of r = .279, n = 106, p = .004. An increase in the teachers' years of experience result in a decrease in the percentage of students receiving *Does Not Meet* and *Meets* scores on the reading portion of the CRCT and an increase in the percentage of students receiving *Exceeds* scores on the reading portion of the CRCT.

Class Size and CRCT Reading Scores. A Pearson's correlation was performed to determine the relationship between class size and the percentage of students receiving CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds*. The results of this correlation revealed a negative correlation between the variables of class size and the percentage of students receiving a score of *Does Not Meet* for CRCT reading, r = -.344, n = 106, $p < .001$. A correlation between class size and the percentage of students receiving a score of *Meets* for CRCT reading also showed a negative correlation, r = -.248, n = 106, p = .011. The final correlation between class size and the percentage of students receiving a score of *Exceeds* for CRCT reading resulted in a positive correlation, r = .310, n = 106, p = .001. Larger class size results in a decrease in the percentage of students receiving *Does Not Meet* scores on the reading portion of the

CRCT and an increase in the percentage of students receiving *Meets* and *Exceeds* scores on the reading portion of the CRCT.

Computer to student Ratio and CRCT Reading Scores. A correlation performed between computer to student ratio and the percentage of students receiving CRCT reading scores of *Does Not Meet, Meets,* and *Exceeds* was conducted using a Pearson's correlation coefficient. Results of the correlation between the variables of computer to student ratio and the percentage of students receiving a score of *Does Not Meet* for CRCT reading were shown to be $r = -.024$, $n = 106$, $p = .810$. The correlation between computer to student ratio and percentage of students receiving a score of *Meets* for CRCT reading showed $r = .119$, $n = 106$, $p = .223$. The final correlation between computer to student ratio and the percentage of students receiving a score of *Exceeds* for CRCT reading resulted in a correlation of r = -.084, n = 106, $p = .393$. In this case, none of the relationships were shown to be significant.

Remaining Predictors and CRCT Mathematics Scores. Bivariate correlations were conducted to determine if a relationship existed among the four remaining predictors and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds.*

Teachers' Education Level and CRCT Mathematics Scores. A Pearson's correlation coefficient was computed to assess the relationship between teachers' education level and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds*. Results of the correlation between the variables of teachers' education level and the percentage of students receiving a score of *Does Not Meet* for CRCT mathematics were shown to be $r = -.195$, $n = 106$, $p = .045$. The correlation between teachers' education level and the percentage of students receiving a score of *Meets* for CRCT mathematics were not significant, *r* = -.167, *n* = 106, *p* = .087. The final correlation between teachers' education level and the percentage of students receiving a score of *Exceeds* for CRCT mathematics were not significant, *r* = .159, *n* = 106, *p* = .103. An increase in teachers' education level results in a decrease in the percentage of students receiving *Does Not Meet* scores on the mathematics portion of the CRCT.

Teachers' Years of Experience and CRCT Mathematics Scores. A Pearson's correlation coefficient was computed to assess the relationship between years of experience and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds*. Results of the correlation between the variables of years of experience and the percentage of students receiving a score of *Does Not Meet* for CRCT mathematics were shown to be *r* = -.209, *n* = 106, *p* = .032. The correlation between teachers' years of experience and the percentage of students receiving a score of *Meets* for CRCT mathematics were not significant, *r* = -.083, *n* = 106, *p* = .400. The final correlation between years of experience and the percentage of students receiving a score of *Exceeds* for CRCT mathematics were not significant, *r* =.121, *n* = 106, *p* = .218. An increase in teachers' years of experience result in a decrease in the percentage of students receiving *Does Not Meet* scores on the mathematics portion of the CRCT.

Class Size and CRCT Mathematics Scores. A Pearson's correlation was performed to determine the relationship between class size and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds*. The results revealed a correlation between the variables of class size and the percentage of students receiving a score of *Does Not Meet* for CRCT mathematics of r = -.416, n = 106, p < .001. A correlation between class size and the percentage of students receiving a score of *Meets* for CRCT mathematics also showed a correlation of r = -.261, n = 106, p = .007. The final correlation between class size and the percentage of students receiving a score of *Exceeds* for CRCT mathematics resulted in a correlation of r = .336, n = 106, p < .001. Larger class size results in a decrease in the percentage of students receiving *Does Not Meet* scores on the mathematics portion of the CRCT and an increase in the percentage of students receiving *Meets* and *Exceeds* scores on the mathematics portion of the CRCT.

Computer to Student Ratio and CRCT Mathematics Scores. A correlation was performed between computer to student ratio and the percentage of students receiving CRCT mathematics scores of *Does Not Meet, Meets,* and *Exceeds* was conducted using a Pearson's correlation coefficient. Results of the correlation between the variables of computer to student ratio and the percentage of students receiving a score of *Does Not Meet* for CRCT mathematics were shown to be r = .060, n = 106, p = .545. The correlation between computer to student ratio and percentage of students receiving a score of *Meets* for CRCT mathematics showed r = .177, n = 106, p = .070. The final correlation between computer to student ratio and the percentage of students receiving a score of *Exceeds* for CRCT mathematics resulted in a correlation of r = -.167, n = 106, p = .087. In this case, none of the relationships were shown to be significant.

Bivariate Correlations Among All Predictors. According to Mertler and Vannatta (2005), when attempting to establish the best predictor or combination of predictors that result in a certain dependent variable, multiple regression is used. Initial bivariate correlation among the five predictors indicated that none of the intercorrelations reached

.80. Six of the paired correlations were significant. These significant correlations ranged from a low of -.231 to a high of .633. Additional collinearity diagnostics were examined through a Tolerance index. A Tolerance value of .01 or less is indicative of multicollinearity. Tolerance statistics for predictors ranged from a low of .429 to a high of .704. All Tolerance values were well above .01.

Multiple Regression Models

After completing the bivariate correlations and tests for multicollinearity, analysis was then conducted to test the unique contribution of each of the remaining variables in relation to the dependent variable of student achievement. Six regression models were conducted to account for the percentage of students receiving scores of *Does Not Meet, Meets,* and *Exceeds* on the reading portion of the CRCT and the scores of *Does Not Meet, Meets,* and *Exceeds* on the mathematics portion of the CRCT. In these models, each variable was analyzed in relation to its contribution to each of the six dependent variables while controlling for the other predictors within the model.

Does Not Meet CRCT Reading Model. A direct multiple regression was conducted to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of the percentage of students receiving a score of *Does Not Meet* on the reading portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 9.69$, $p < .001$. The multiple correlation estimates were $R = .571$, $R^2 = .326$, and adjusted $R^2 = .293$. The model accounted for 32.6% of the overall variance to *Does Not Meet* CRCT reading scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = .360, β = 0, $p < .001$; Title I status, B = 3.018, β = .396, $p < .001$; teachers' education level, B = 3.360, β = .233, $p = .043$; teachers' years of experience, B = -.549, β = -.357, $p = .005$; class size, B = -.579, β = -.263, $p = .009$; and computer to student ratio, B = .004, β = .004, $p = .968$.

Within this model, four of the five variables had a significant correlation to the outcome of *Does Not Meet* CRCT reading scores with Title I status being the strongest of the predictors with a beta weight of .396. Teachers' education level, years of experience, and class size contributed to the remaining variance for *Does Not Meet* CRCT reading scores. Based on the absolute value of the beta weights of these three remaining significant predictors, the relative importance of their contribution to the model falls in the following order: teaching experience, class size, and teachers' education level. However, only the variable of years of experience demonstrated a positive contribution to the outcome of *Does Not Meet* CRCT reading scores with every year of teacher experience gained resulting in a decrease in the percentage of students receiving a score of *Does Not Meet* on the reading portion of the CRCT of .549%. In this model, Title I status contributed negatively to *Does Not Meet* scores on CRCT reading with results showing that for Title I schools, *Does Not Meet* CRCT reading scores increased by 3.018%. The variable of teachers' education level also contributed negatively to *Does Not Meet* CRCT reading scores with an increase in this predictor variable resulting in an increase in the percentage of students receiving *Does Not Meet* CRCT reading scores of 3.360%. The model showed that when class size increased, the percentage of students receiving scores of *Does Not Meet* on CRCT reading decreased by .579%. The remaining variable of computer to student ratio displayed no significance in this model.

Meets CRCT Reading Model. A direct multiple regression was performed between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of the percentage of students receiving a score of *Meets* on the reading portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 23.25$, $p < .001$. The multiple correlation estimates were $R = .733$, $R^2 = .538$, and adjusted $R^2 = .514$. The model accounted for 53.8% of the overall variance to *Meets* CRCT reading scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = 65.387, β = 0, $p < .001$; Title I status, B = 12.875, β = .687, $p < .001$; teachers' education level, B = 1.229, β = .035, $p = .713$; teachers' years of experience, B = -.688, β = -.182, $p = .082$; class size, B = -.148, β = -.027, $p = .737$; and computer to student ratio, B = .044, β = .019, $p = .821$.

In this model, Title I status resulted in a significant correlation to the outcome of *Meets* CRCT reading scores with an absolute value of its beta weight of .687. Being a Title I school was shown to increase the percentage of students receiving scores of *Meets* in CRCT reading by 12.875%. The remaining variables of teachers' education level, years of experience, class size, and computer to student ratio showed no significance in this model.

Exceeds CRCT Reading Model. A direct multiple regression was conducted to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Exceeds* on the reading portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 27.37$, $p < .001$. The multiple correlation estimates were $R = .571$, $R^2 = .326$, and adjusted $R^2 = .293$. The model accounted for 32.6% in the overall variance to *Exceeds* CRCT reading scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = 32.106, β = 0, $p = .124$; Title I status, B = -15.676, β = -.679, $p < .001$; teachers' education level, B = -4.176, β = -.096, $p = .289$; teachers' years of experience, B = 1.228, β = .265, $p = .009$; class size, B = .719, β = .108, $p = .167$; and computer to student ratio, B = -.038, β = -.013, $p = .869$.

Title I status and years of experience showed a significant amount of variance in the outcome of *Exceeds* CRCT reading scores with Title I status being the strongest of the predictors with a beta weight of -.679 and years of experience contributing to the remaining variance with a beta weight of .265. In this model, being a Title I school contributed negatively to *Exceeds* scores on CRCT reading with results showing that for Title I schools, the percentage of students receiving *Exceeds* CRCT reading scores decreased by 15.676% but years of experience resulted in a positive increase of *Exceeds* CRCT reading scores showing that for every year of experience gained, the percentage of students receiving a score of *Exceeds* on the reading portion of the CRCT increased by 1.228%. The remaining variables of teachers' education level, class size, and computer to student ratio displayed no significance in this model.

Does Not Meet CRCT Mathematics Model. A direct multiple regression was carried out to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Does Not Meet* on the mathematics portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 12.56$, $p < .001$. The multiple correlation estimates were $R = .621$, $R^2 = .386$, and adjusted $R^2 = .355$. The model accounted for 38.6% in the overall variance to *Does Not Meet* CRCT mathematics scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = 17.896, β = 0, $p = .112$; Title I status, B = 3.537, β = .343, $p = .001$; teachers' education level, B = 2.271, β = .116, $p = .285$; teachers' years of experience, B = -.728, β = -.351, $p = .004$; class size, B = -1.078, β = -.362, $p < .001$; and computer to student ratio, B = .136, β = .104, $p = .272$.

Within this model, three of the five variables accounted for a significant amount of variance in the outcome of *Does Not Meet* CRCT mathematics scores with class size being the strongest of the predictors with a beta weight of -.362. Between the two remaining significant predictor variables, years of experience demonstrated the next strongest contribution with a beta weight of -.351 followed by Title I status with a beta weight of .343. Based on the unstandardized coefficients of each of the significant variables, years of experience is the only variable that contributed positively to *Does Not Meet* CRCT mathematics scores by demonstrating that for every year of experience gained, the percentage of students receiving a score of *Does Not Meet* on CRCT mathematics decreased by .728%. The remaining two significant variables—Title I status and class size—contributed negatively to this outcome by demonstrating that being a Title I school resulted in an increase in the percentage of students receiving scores of *Does Not Meet* on CRCT mathematics of 3.537% and when class size increased, the percentage of students receiving scores of *Does Not Meet* on CRCT mathematics decreased by 1.078%. The remaining variables of teachers' education level and computer to student ratio displayed no significance in this model.

Meets CRCT Mathematics Model. A direct multiple regression was conducted between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Meets* on the mathematics portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 12.94$, $p < .001$. The multiple correlation estimates were $R = .627$, $R^2 = .393$, and adjusted $R^2 = .362$. The model accounted for 39.3% of the overall variance to *Meets* CRCT mathematics scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = 28.100, β = 0, $p = .241$; Title I status, B = 13.541, β = .611, $p < .001$; teachers' education level, B = 2.994, β = .071, $p = .509$; teachers' years of experience, B = -.269, β = -.060, $p = .613$; class size, B = -.256, β = -.040, $p = .668$; and computer to student ratio, B = .136, β = .048, $p = .607$.

In this model, only Title I status resulted in a significant correlation to the outcome of *Meets* CRCT mathematics scores with a beta weight of .611. Being a Title I school was shown to increase the percentage of students receiving scores of *Meets* in CRCT mathematics by 13.541%. The remaining variables of teachers' education level, years of experience, class size, and computer to student ratio showed no significance in this model.

Exceeds CRCT Mathematics Model. The final direct multiple regression was carried out to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Exceeds* on the mathematics portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 15.09$, $p < .001$. The multiple correlation estimates were $R = .656$, $R^2 = .430$, and adjusted $R^2 = .402$. The model accounted for 43.0% in the overall variance to *Exceeds* CRCT mathematics scores. The estimates for unstandardized coefficients (B), standardized coefficients (β), and *p* values were as follows: intercept, B = 66.065, β = 0, $p = .032$; Title I status, B = -16.557, β = -.568, $p < .001$; teachers' education level, B = -7.710, β = -.140, $p = .183$; teachers' years of experience, B = 1.130, β = .193, $p = .098$; class size, B = 1.329, β = .158, $p = .083$; and computer to student ratio, B = -.354, β = -.096, $p = .295$.

In this model, Title I status resulted in a significant amount of variance to the outcome of *Exceeds* CRCT mathematics scores with a beta weight of -.568. These results showed that being a Title I school contributed negatively to *Exceeds* scores on CRCT reading with every Title I school resulting in a decrease in the percentage of students receiving *Exceeds* CRCT reading scores by 16.557%. The remaining variables of teachers' education level, years of experience, class size, and computer to student ratio showed no significance in this model.

Summary of Results

Based on the six multiple regression models conducted, Title I status is the strongest predictor of student achievement as represented by scores on the reading and mathematics portion of the CRCT by fifth-grade students in Georgia public schools. However, these analyses also demonstrated that being a Title I school is not always related to scores in a positive manner. Results revealed that being a Title I school increased the percentage of students receiving scores of *Does Not Meet* in CRCT reading and *Does Not Meet* in CRCT mathematics by 3.018% and 3.537% respectively and decreased the percentage of students receiving scores of *Exceeds* in CRCT reading and *Exceeds* in CRCT mathematics by 15.676% and 16.557%, respectively. When controlling for the other predictors in this model, the unique contribution of Title I status indicated that being a Title I school resulted in a 12.875% increase in students who received a score of *Meets* on the reading portion of the CRCT and a 13.541% increase in the number of students receiving a score of *Meets* on the mathematics portion of the CRCT.

An analysis of teachers' education level that controlled for the remaining predictors showed that every increase in the level of education attained by a classroom teacher resulted in a 3.360% increase in students who received a score of *Does Not Meet* in CRCT reading. In a similar multiple regression analysis where other predictor variables were controlled for, the unique contribution of years of experience was examined. Results of this analysis revealed that each additional year of teacher experience, there was a decrease of .549% in students receiving *Does Not Meet* CRCT reading scores and an increase of 1.228% in students receiving *Exceeds* CRCT reading scores. A comparison of years of experience and CRCT mathematics scores revealed that for each additional year of experience, the percentage of students receiving a score of *Does Not Meet* on the mathematics portion of the CRCT decreased by .728%.

In a multiple regression analysis of the predictor variable of class size that controlled for the remaining predictor variables, it was revealed that each student added to the total number of students in a class resulted in a .579% decrease in the number of students receiving a score of *Does Not Meet* in CRCT reading and a decrease of 1.078% in the number of students receiving a score of *Does Not Meet* in CRCT mathematics. These results were contrary to the hypothesis that smaller class size would result in positive outcomes in student achievement.

When controlling for the other predictors in this model, computer to student ratio was shown to be the least significant of the predictors. Computer to student ratio was not demonstrated to be significant in relation to CRCT test scores at any level.

An overall review of the data shows that of the five variables, two demonstrated a significant positive increase in the number of students receiving passing scores in CRCT reading and mathematics—Title I status and teachers' years of experience. Of these two, designation as a Title I school contributed a significant increase in the percentage of students receiving both *Meets* CRCT reading and *Meets* CRCT mathematics scores. However, this correlation may be negated by the significant relationship that designation as a Title I school had on the increase in the percentage of students receiving scores of *Does Not Meet* in reading and *Does Not Meet* in mathematics and the decrease in the percentage of students receiving scores of *Exceeds* in reading and *Exceeds* in mathematics. In relation to CRCT scores where years of experience had significant relationship, the results were consistently positive. According to the models, every categorical increase in a teacher's years of experience resulted in a decrease in the percentage of students receiving both *Does Not Meet* CRCT reading and *Does Not Meet* CRCT mathematics scores and an increase in *Exceeds* CRCT reading scores of fifth-grade students in Georgia public schools.

Chapter V

SUMMARY AND CONCLUSIONS

(As per instruction, this chapter is written as a manuscript for publication.)

In January of 2002, President Bush signed the No Child Left Behind Act of 2001 into law (GaDOE, 2012b). No Child Left Behind required all states to implement state-wide academic standards and increase accountability for student learning (No Child Left Behind Act of 2001: Statement of Purpose, 2012). As reported by the GaDOE (2012b) Web site, this act also required that each state incorporate a testing system in accordance with federal requirements to enforce state's compliance. In a natural progression, evaluation of curriculum began and decision making became more data-driven (U.S. Department of Education, 2004). In Georgia, Adequate Yearly Progress became the standard to measure student achievement based on the results from annual state-wide assessments (GaDOE, 2012b). The GaDOE chose the CRCT as the assessment to be used in its schools (GaDOE, 2012c).

Recent budget restraints imposed due to our nation's failing economy have caused states to begin looking for ways to cut spending, with thirty-four states and the District of Columbia choosing to cut spending in the area of K-12 education (Johnson et al., 2011). Georgia is included in this number. In a report for the Center on Budget and Policy Priorities, Johnson et al. (2011) stated that the decrease in educational funding has caused local school boards to seek ways to reduce spending while still providing a quality education for each student as required by No Child Left Behind. In order to accomplish this task, stakeholders must weigh educational expenditures in terms of the ratio of cost versus benefit to the overall learning experience and evaluate academic programs to assess their contribution to student achievement.

In light of the need to determine the cost versus benefit ratio of educational expenditures, the purpose of this study was to investigate certain teacher and school characteristics and their contribution to the achievement of fifth-grade students in Georgia public schools. An analysis of the relationship of five independent variables—Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio—to student achievement as indicated by reading and mathematics scores of fifth-grade students on the CRCT in Title I and non-Title I Georgia public schools was conducted. Specifically, the study addressed the following research hypotheses:

1. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who did not meet CRCT reading standards (score of 799 or below). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

2. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who met CRCT reading standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

3. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who exceeded CRCT reading standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

4. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who did not meet CRCT mathematics standards (score of 799 or below). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

5. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who met CRCT mathematics standards (score of 800-849). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

6. Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio will account for the observed variance in the percentages of fifth-grade students who exceeded CRCT mathematics standards (score of 850 or above). The expected relative importance for prediction is Title I status, computer to student ratio, class size, teachers' years of experience, and teachers' education level.

Related Literature

The goal of No Child Left Behind was to provide a fair and equal education to all students allowing them to reach at least a proficient level on state achievement tests (No Child Left Behind Act of 2001: Statement of Purpose, 2012). The legislation also included polices to address characteristics in the school setting believed to most affect student learning (No Child Left Behind Act of 2001: Statement of Purpose, 2012; No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012; No Child Left Behind Act of 2001: National Education Technology Plan, 2012). Some of these characteristics were employing high quality teachers (Southworth, 2010), reducing class size (Milesi & Gamoran, 2006), and integrating technology in education (U.S. Department of Education et al., 2009).

Title I. As legislators discussed the ramifications of No Child Left Behind, they anticipated that some schools and districts would not be able to meet the standards set without assistance (Harding et al., 2012). In a study of over 14,000 eighth graders during the 2006-2007 school year, Baker and Johnston (2010) confirmed that Title I schools scored significantly lower than non-Title I schools on standardized tests. In an attempt to help these students achieve the same high academic standards as their more economically advantaged counterparts and ensure equality in education, the Title I section of No Child Left Behind provided federal funds to schools serving a large percentage of students from low socioeconomic backgrounds (No Child Left Behind Act of 2001: Statement of Purpose, 2012; U.S. Department of Education, 2011). These funds provided resources and instructional services so that at-risk students would not fall behind academically.

Schools receiving these funds became known as Title I schools (U.S. Department of Education, 2011).

Teacher Quality. After review of previous studies on teachers and their role in successful student achievement, one of the objectives of No Child Left Behind was to staff all schools with high quality teachers with an emphasis on improving the quality of those teachers employed in Title I schools (Borman & Kimball, 2005; U.S. Department of Education, 2004). Research on teacher quality both before and since No Child Left Behind showed that quality teachers affected student learning and were a powerful predictor of student success (Januszka & Dixon-Kane, 2008; Kane, Rockoff, & Staiger, 2006; Wong, 2004). Before this legislation, states had been allowed to establish their own guidelines for teacher certification and licensing. No Child Left Behind set guidelines for high quality preparation and training for teachers and assigned teachers greater responsibility and accountability for the success of their students (No Child Left Behind Act of 2001: Qualifications for Teacher and Paraprofessionals, 2012). Schools receiving Title I funds were required to file written verification of their compliance in the school office to be made available to both government agencies and the public upon request (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012).

In 1966, the U.S. Department of Health, Education, and Welfare and the Office of Education completed the pivotal study on teacher quality and student achievement that later came to be known as the Coleman Report (Borman, 2005; Boyd, 2008; Rivkin, Hanushek, & Kain, 2005; Southworth, 2010). During a time of segregation, these two government agencies sought to determine if schools offered equal educational opportunities based on certain teacher and school characteristics believed to be good indicators of quality education. In schools and classrooms nation-wide, hundreds of school officials and over 20,000 teachers administered the provided survey that included questions relating to tangible school characteristics such as the number of desks, text books, libraries, curriculum offered, administration of achievement tests, and tracking of a student's results; and teacher characteristics such as education, teaching experience, salary, and attitude. Coleman and his fellow researchers gathered data from 4,000 public schools and more than 645,000 students for analysis. Though their goal was to determine if there was equality in education, they also hoped to establish which characteristics of the school setting contributed the most to student success. Their research showed that teacher characteristics contributed more variation in levels of student achievement than any other factor and of the teacher characteristics explored, a teacher's educational experience ranked among the highest of those affecting student achievement (U.S. Department of Health, Education, and Welfare & Office of Education, 1966).

However, a more recent study by Clotfelter et al. (2006) stressed the difficulty in identifying exactly which teacher characteristic contributed the most to student achievement and measuring that contribution to the exclusion of other characteristics. They have even questioned whether an identified factor in one research study would have the same relationship in a different study with a different group of students (Clotfelter et al., 2006). In agreement with Clotfelter et al. (2006), Southworth (2010) and others (Boyd et al., 2008; Clotfelter, Ladd, & Vigdor, 2006; Jennings & DiPrete, 2010; Wayne & Youngs, 2003; Wong, 2004) pointed out that while they can agree on the importance of teacher quality to student success, disagreement exists on exactly which characteristics teachers possess that signify quality and are most important. Southworth stressed, however, that an understanding of these characteristics and their effect is vital since many schools use these factors to establish their pay scales and teacher salaries encompass a large portion of school budgets. Heck (2009) carried Southworth's beliefs a step further by suggesting that, in order to demonstrate the true effect of teacher quality on student success and increase accountability, a link between student and teacher data must occur. In his study, he found that a teacher's certificate level and years of experience contributed the most when linked with student achievement.

Teachers' Education Level. While No Child Left Behind stated that a *highly qualified* teacher should hold at least a bachelor's degree, it did not specifically target methods of certification, allowing each state to define certification according to its own needs (No Child Left Behind Act of 2001: Qualifications for Teachers and Paraprofessionals, 2012; U.S. Department of Education, 2004). Believing that full certification through a traditional teaching program at an accredited institution was important, the state of Illinois choose to compare teachers who had attained full certification through this traditional route and those who had acquired certification through an alternate method (DeAngelis et al., 2010). While conducting this research, DeAngelis et al. (2010) examined over 4,000 public schools and over 125,000 public school teachers from the year 2001 to 2006 by dividing urban schools into two groups of non-Chicago schools and Chicago schools. During the period of this study, non-Chicago personnel not fully certified decreased by approximately 30% while Chicago personnel not fully certified decreased by over 70% resulting in an increase in state-wide achievement score. These findings lead the researchers to believe that teacher education did play a role in student achievement.

Comparing data compiled from the New York City Department of Education, the New York State Education Department, the College Board and programs that provided alternate certification for teachers from 2000 to 2005, Boyd et al. (2008) reported a significant increase in student achievement as the percentage of certified teachers employed rose. Although Boyd et al. believed some of the positive gains in student achievement could be attributed to policy changes, they stressed the largest increase appeared to be from the elimination of the policy allowing schools to hire uncertified teachers and providing a program to mentor and retain new teachers. These researchers concluded that employing teachers who were fully certified did indeed make a difference in student achievement in New York.

However, other studies (Harris & Sass, 2007; Kane et al., 2006; Ohlson, 2009) have failed to demonstrate that the education status of teachers makes a difference in student success. In 2007, Harris and Sass conducted a study on teacher quality through the National Center for Analysis of Longitudinal Data in Education Research. Using the Florida state-wide database, they were able to link student data with a particular teacher and that teacher’s college coursework and training. Their study revealed inconsistent results of a link between teacher training and student outcomes, leading them to conclude that there was no relationship between the quality of elementary school teachers and advanced academic degrees. They did report, however, that a teacher’s years of experience showed mixed but generally positive results.

During the 2007-2008 school year, Ohlson (2009) conducted a study of 23 public elementary schools in Florida. Ohlson's study supported the previous findings of Kane et al. (2006) in New York City schools showing that advanced degrees and certification status did not seem to influence student achievement in the first few years of teaching. Ohlson believed his findings demonstrated that a teacher who has more experience may be better equipped to handle the classroom challenges than a teacher who has more education. Kane et al., agreed with Ohlson's assessment by stating that a teacher's classroom performance during the first few years of teaching was a better indicator of effectiveness and that a teacher's effectiveness grew with experience.

Teacher's Years of Experience. Though a majority of studies on teacher characteristics agree that a teacher's years of experience have a positive impact on student achievement (Boyd et al., 2008; Clotfelter et al., 2006; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004), disagreement exists on exactly how many years of experience a teacher must have before exhibiting the positive attributes associated with this characteristic. In an effort to explain why teacher experience is so important, Gere and Berebitsky (2009) pointed out that a teacher's years of experience is not simply represented by a number but by the wealth of experience acquired through professional development, support from colleagues, and the stability of the school context. Ohlson (2009) believed the advantage of these factors helped an experienced teacher to deal with situations that might occur to interrupt instruction thereby making instructional time more productive.

Rivkin et al. (2005) used panel data obtained by the University of Texas at Dallas Texas Schools Project, to examine each student's performance in comparison to the quality of a specific teacher. From their findings, they suggested that even one year of experience made a difference in a teacher's impact on student success. Rivkin et al. disclosed that they believed the positive results to be a combination of two occurrences—the adjustment period that new teachers go through at the beginning of their teaching experience and the discovery some teachers make that they are not suited for this profession and exiting the field during the first few years.

Wong (2004) reported experience positively correlated with students' achievement in his study and stressed that a training and support program would help in the retention of experienced teachers within the schools. Fry (2009) concurred with Wong's research that years of experience was a significant factor in student achievement and conducted a qualitative study following four teachers over a three year period to identify what factors led to successful retention of experienced teachers. When only two of the four teachers remained in the profession at the end of the three-year period, Fry's conclusions agreed with Rivkin et al.'s that some teachers leave the field early on when they discover that it is not what they expected.

In their studies, both Harris and Sass (2008) and Kukla-Acevedo (2009) believed that a comparison of the cost versus benefits of retaining experienced teachers revealed that the benefits of retaining experienced teachers far outweighed the cost of hiring new and inexperienced teachers. Kukla-Acevedo stated that while replacing a teacher always required the cost of interviewing and training, the true cost of losing an experienced teacher was that student learning would suffer.

In a study of Los Angeles and New York City schools, Staiger and Rockoff (2010) took the most aggressive approach to weighing the cost to benefit of experienced teachers. These researchers devised a formula by which they could calculate what they believed to be the true cost to a school system of losing an experienced teacher. Based on their research, Staiger and Rockoff determined students in classes with novice teachers lost approximately .10 standard deviations in achievement over that teacher's first two years of teaching. Using another of their formulas, they calculated a difference in pay for an experienced teacher over a novice teacher of $10,000 to $25,000 which, when multiplied times an average number of 20 students per class, resulted in the true cost to a system losing an experienced teacher of $200,000 to $500,000. Even though their monetary results were staggering, they surmised that the true cost was not monetary but instead in the compromise to the achievement results of students taught by novice teachers over those taught by a teacher with several years of experience.

After reviewing the literature on the relationship between teacher experience and student achievement, there appears to be a consensus that at least one year of experience results in positive student success (Boyd et al., 2008; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004) and that the benefit of keeping an experienced teacher outweighs the cost of hiring and training a novice teacher (Harris & Sass, 2007; Kukla-Acevedo, 2006; Staiger & Rockoff, 2010).

Class Size Reduction. One of the most studied factors believed to affect student achievement is teacher to student ratio or class size (Milesi & Gamoran, 2006; Rockoff, 2009) and one of the most extensive studies on class size reduction was Project STAR which began in Tennessee in 1985 (Tennessee Department of Education, 1990). Before Tennessee's schools embarked on a plan to reduce class size, Steve Cobb, a member of the Tennessee House of Representatives, argued that Tennessee should conduct its own study on the relationship between class size reduction and student achievement because he believed that previous research suggested its benefits but were inconclusive. Project STAR categorized classes as small, regular, and regular with a teacher aide and defined a small class as having 13-17 students and a regular class as one having 22-25 students. Employing a longitudinal design, Project STAR began with approximately 6,500 kindergarteners in 79 schools and followed them over the next four years collecting data relating to gender, race, socioeconomic status, and test scores as well as teacher characteristics and classroom factors that might affect achievement. At the end of this study, the Tennessee Department of Education (1990) reported that smaller class size did have a positive impact on student achievement and began incorporating it throughout their schools. Nye et al. (2004) supported these findings in a later study showing that the results of class size reduction were not only positive but statistically significant and the effects of this intervention lasted for at least five years after the student's participation in a smaller class.

Although later studies did not refute the claims of the Tennessee Department of Education (1990) and Nye et al. (2004), they instead asserted that the positive impact of class size intervention may be a result of other factors that take place within the classroom when class size reduction occurs (Achilles, 2009; Folmer-Annevelink, Doolard, Mascareño, & Bosker, 2010; Milesi & Gamoran, 2006; Rockoff, 2009). Factors that these researchers believed may contribute to the success of class size reduction were community support, parental support, increased funding, and alternate methods of instruction (Rockoff, 2009); change in teachers' attitudes toward students and a change in teaching methods (Milesi & Gamoran, 2006); a change in teachers' behaviors, increase in student-teacher interactions, more individualized instruction, and less time spent on classroom management (Folmer-Annevelink, 2010). Chatterji (2005) concurred that class size reduction increased student achievement, however, she was quick to point out that studies on this characteristic rarely addressed what schools and teaches actually do within these smaller classes to facilitate student success and introduced this as a topic for future research.

Some studies on class size reduction yielded less than positive results (Milesi & Gamoran, 2006; Sims 2008). In 1996, California began a program class size reduction in kindergarten through third-grade classes over the next three years (Milesi & Gamoran, 2006). Because of the monetary incentives provided for schools willing to participate in a program of class size reduction (No Child Left Behind Act of 2001: Statement of Purpose, 2012), California spent billions of dollars to reduce class size without first understanding the dynamics of successful smaller classes (Sims, 2008). California implemented class size reduction by using combination classes, placing a priority on the number of students in a class and not the grade level. Sims (2008) stated that this method of reduction not only led to negative results but also skewed data on the effects of class size reduction on student achievement. Based on the research of Sims (2008) and others (Achilles, 2009; Folmer-Annevelink, Doolard, Mascareño, & Bosker, 2010; Milesi & Gamoran, 2006; Rockoff, 2009), it is important for schools to understand the dynamics of class size reduction before implementing this program to increase student achievement.

Computer to Student Ratio. Another factor addressed in No Child Left Behind was the integration of technology into education (No Child Left Behind Act of 2001: National Education Technology Plan, 2012). In a study using a sample population from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), Judge (2005) defined computer to student ratio as the number of students within a school divided by the number of computers available for their use. While reviewing data on the accessibility and adequacy of technology available to her sample population of students, Judge found a positive relationship between student achievement and computer use. Further research by Judge demonstrated that when the number of classroom computers increased, student achievement also increased. From this, she concluded that there was a significant correlation between computer to student ratio and student success. Other researchers such as Becker (2000) and Page (2002) agreed with Judge's findings. Page examined classes in Louisiana public schools by categorizing them as either technology-enriched or traditional classrooms and investigating the effects of computer use on mathematics scores of 211 students in these classes. From his findings, he concluded that a technology-enriched classroom is more conducive to student gains in achievement. At a time when a 4:1 computer to student ratio showed an increase in technology in most classrooms, Becker agreed with Page by demonstrating that this ratio led to an increase in student achievement. Becker found that teachers were more likely to implement technology in their instruction if they were provided with easy accessibility for their students' use.

In two separate reports completed for a special edition of *The Journal of Technology, Learning, and Assessment*, Suhr et al. (2010) and Shapley et al. (2010)

reported on the outcomes of 1:1 laptop initiatives. Suhr et al. examined the effects of a concentrated placement of laptops on fourth-graders reading scores against those of a control group who received no laptops while Shapley et al. reviewed the hypothesis that access to technology influences its use. Shapley et al. discovered that high levels of technology access within a classroom led to high levels of use, despite the teacher's level of implementation in lessons, confirming Becker's (2000) belief that easy accessibility led to more use. Suhr et al. provided reasoning for the importance of accessibility and use by reporting that their final analysis of data from the laptop initiative had demonstrated that access to laptops predicted gains in student test scores for the reading portion of California's standardized test. Based on the findings from these studies and past research (Becker, 2000; Judge, 2005; Page, 2002), there is adequate data to show that there is a correlation between technology and student achievement.

Criterion-Referenced Competency Test. The Elementary and Secondary Act of 1965 required schools to adopt methods of assessment and report to state departments of education annually on student achievement in order to qualify for federal educational funding (Elementary and Secondary Education Act, 1965). In 1994, the Clinton administration passed the Goals 2000: Educate America Act in an effort to standardize methods used for assessment by providing valid and reliable mechanisms for the development and certification of the assessments that measured student performance (Goals 2000: Educate America Act: Purpose, 1994). Under the Bush administration, No Child Left Behind sought to ensure that assessments would be aligned with state academic standards so that students, parents, teachers, and administrators could measure the progress of students against a common standard (No Child Left Behind Act of 2001:

Statement of Purpose, 2012). These steps led to annual achievement testing of third through tenth-graders in public schools (Gallagher, 2003).

In an effort to comply with the requirements of No Child Left Behind, the state of Georgia has chosen as its method of assessment the criterion-referenced competency test (Georgia Department of Education, 2012c). Implementation of this assessment took place in 2002 after consulting an external team of experts on educational standards and assessments to judge its reliability. Before adopting the criterion-referenced competency test, the state of Georgia also reviewed educational literature on assessment testing and considered the testing methods employed by other states. After much deliberation, the state of Georgia believed the criterion-referenced competency test to best evaluate a student's knowledge of the skills taught in the Georgia performance standards and demonstrate student achievement as defined in No Child Left Behind.

Georgia's Education Scoreboard or report card was initiated in 2008 by Governor Sonny Perdue and created by the Governor's Office of Student Achievement as a way to communicate the level of student achievement throughout Georgia (Governor's Office of Student Achievement, 2007a). As the reporting and accountability agency for education in Georgia, the Governor's Office of Student Achievement examines academic records of educational institutions within the state to endure compliance with federal guidelines (Governor's Office of Student Achievement, 2007b). This agency also reviews all data on student assessments and other school records reported to the Georgia Department of Education to establish validity and reliability in both the methods used to collect data and the methods used to report it (Governor's Office of Student Achievement, 2007b). Information on all aspects of each district and school that affects students and their achievement are then shared with all educational stakeholders through the report card that can be accessed through a link on the Georgia Department of Education homepage (http://www.doe.k12.ga.us/Pages/Home.aspx). The information provided in this report card includes student and school demographics, personnel and fiscal data, and information on performance on standardized tests (Georgia Department of Education, 2012a). The Governor's Office of Student Achievement also reports information on the technology at the district and school levels in an annual technology inventory accessed through the Instructional Technology page of the Georgia Department of Education Web site (Georgia Department of Education, 2012e). All of these reports are made available to educational stakeholders in an effort to verify compliance with the requirements of No Child Left Behind.

Using data retrieved from the GaDOE Web site, the present analysis extends prior research by examining the correlation of each of the identified predictors of Title I status, teachers' education level, years of experience, class size, and computer to student ratio and their unique contribution to student achievement as represented by CRCT scores of fifth-grade students in Georgia public schools on the reading and math portion of the state-wide assessment in both Title I and non-Title I schools.

Method

Sample. Data for the 2009-2010 school year came from the GaDOE Web site providing an accessible population of all public schools serving fifth-grade students within the state of Georgia. In an attempt to provide a relatively balanced number of Title I schools to non-Title I schools, a cluster sample was taken from two separate school districts within the state with one being schools served by one of the Regional

Educational Service Agencies in the southern portion of the state and the other, a school district in the northern part of the state. Combining these two areas resulted in a target population of 58 Title I schools and 48 non-Title I schools for a total of 106 schools and criterion-referenced competency test scores for over 16,000 fifth-graders during the 2009-2010 school year.

Procedures. The GaDOE Web site contains data pertinent to each of the 106 schools included in this study and the independent and dependent variables to be analyzed. Through an annual report card, the GaDOE reports information for each school pertaining to Title I status, personnel data such as teachers' education level and years of experience, and school demographics such as class size. A separate state-wide technology survey also linked to the GaDOE Web site provides data on technology within each school including the overall computer to student ratio. From these reports, data on each of the independent variables of Title I status, teachers' education level, years of experience, class size and computer to student ratio was compiled on the 106 sample schools to be analyzed for its correlation to the dependent variables. Results from reading and mathematics section of CRCT are also reported on the GaDOE Web site annually and were compiled for the 106 sample schools for the 2009-2010 school year.

The five independent variables of this study represented characteristics believed to play an important role in student achievement. Trends in the literature had shown that low socioeconomic background adversely affected scores on standardized tests (Baker & Johnston, 2010; Harding, Harrison-Jones, & Rebach, 2012; Rouse & Barrow, 2006; Sirin, 2005). Based on this, Title I status was considered an important variable to include in the present study. Since information is not provided for individual students, Title I and non-

Title I status was broken down by school and recorded using a dichotomous variable, coding status as a Title I school as a 1 and status as a non-Title I school as a 0. Teachers' education level was coded using a numerical scale representative of the number of years that it typically takes to obtain a specific degree with four for a bachelor's, six for a master's, seven for a specialist, and eight for a doctorate. These numbers were then combined to provide the average years of post-secondary education or average education level representative of the teachers in each of the schools. The GaDOE calculates the average years of experience of the teachers within a school from information provided to them through each school's annual report and shares this average on the personnel tab of the report card. Class size or the teacher to student ratio within a school is shown as a ratio of classroom teachers to students. For the purpose of analysis, this ratio was converted to its single numerical quotient. The last of the independent variables, computer to student ratio, was also recorded by converting the ratio provided by the GaDOE Web site into a single numerical quotient that could be analyzed using bivariate correlations and direct multiple regressions.

Charts and graphs on the GaDOE Web site relating to the percentage of students receiving scores of *Does Not Meet, Meets*, and *Exceeds* on the reading portion of the CRCT and scores of *Does Not Meet, Meets*, and *Exceeds* on the mathematics portion of the CRCT supplied the information needed for the six dependent variables.

Results

Initial bivariate correlation among the five predictors indicated that none of the intercorrelations reached.80. Six of the paired correlations were significant. These significant correlations ranged from a low of -.231 to a high of .633. Additional collinearity diagnostics were examined through a Tolerance index. A Tolerance value of .01 of less is indicative of multicollinearity. Tolerance statistics for predictors ranged from a low of .429 to a high of .704. All Tolerance values were well above .01.

Multiple Regression Models. Upon completion of the bivariate correlations among the five predictor variables, multiple regression models were conducted to test the unique contribution of each of the predictor variables in relation to the dependent variable of student achievement. Six regression models were conducted to account for the scores of *Does Not Meet, Meets,* and *Exceeds* on the reading portion of the CRCT and the scores of *Does Not Meet, Meets,* and *Exceeds* on the mathematics portion of the CRCT.

Does Not Meet CRCT Reading Model. To test the hypothesis that Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio would account for the observed variance in the percentages of fifth-grade students who did not meet CRCT reading standards (score of 799 or below), a multiple regression model was conducted between the five predictor variables and the dependent variable of the percentage of students receiving a score of *Does Not Meet* on the reading portion of the CRCT. The model containing all five predictors was shown to be statistically significant, $F(5, 100) = 9.69$, $p < .001$ and accounted for 32.6% of the overall variance to *Does Not Meet* CRCT reading scores. As expected, results of this regression analysis revealed designation as a Title I school to be the strongest of the predictor variables with a beta weight of .396. However, in this case, being a Title I school contributed negatively to *Does Not Meet* scores on CRCT reading with results showing that for every Title I school, *Does Not Meet* CRCT reading scores increased by 3.018%. These findings are contrary to the goal of the Title I section of No Child Left Behind that provided funding to schools serving a large percentage of poor students in order to help them perform well on state-wide standardized tests (Harding et al., 2012).

Teachers' education level, years of experience, and class size contributed to the remaining variance for *Does Not Meet* CRCT reading scores and based on the absolute value of the beta weights for these three remaining significant predictors, the relative importance of their contribution to the model falls in the following order: teaching experience, class size, and teachers' education level. Of these three, only years of experience contributed to an increase in the percentage of students receiving a score of *Does Not Meet* on CRCT reading. The multiple regression analysis suggests that for every year of experience that a teacher acquires, the percentage of student receiving a score of *Does Not Meet* on CRCT reading decreases by .549%. Although years of experience may only demonstrate a small increase in achievement, this finding does support previous research (Boyd et al., 2008; Fry, 2009; Harris & Sass, 2007; Rivkin, Hanushek, & Kain, 2005; Staiger & Rockoff, 2010; Wayne & Youngs, 2003; Wong, 2004) showing that a teacher's years of experience have a positive impact on student achievement.

Teachers' education level and class size contributed the remaining variance to the percentage of students receiving scores of *Does Not Meet* on the reading portion of the CRCT. For every increase in a teacher's education level, *Does Not Meet* scores increased by 3.36% and for every increase of one student to the overall class size, these scores decreased by .579%. These results did not support the hypothesis that higher academic degrees and smaller class size would impact student achievement positively.

Meets CRCT Reading Model. A direct multiple regression was carried out to determine the test the hypothesis that the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio would account for the observed variance in the percentages of fifth-grade students who met CRCT reading standards (score of 800-849). The model containing all five predictors was statistically significant, $F(5, 100) = 23.25$, $p < .001$ and accounted for 53.8% of the overall variance to *Meets* CRCT reading scores. As expected, designation as a Title I school resulted in a significant correlation to the outcome of *Meets* CRCT reading scores with an absolute value of its beta weight of .687. Review of the multiple regression showed that being a Title I school increased the percentage of students receiving a score of Meets on CRCT reading by 12.875%. This finding does support the beliefs of the Title I section of No Child Left Behind stating that increased federal funding can help to provide students from low socioeconomic backgrounds with an education equal to that of their more economically advantaged counterparts (No Child Left Behind Act of 2001: Statement of Purpose, 2012; U.S. Department of Education, 2011).

Exceeds CRCT Reading Model. Based on the hypothesis that the five predictor variables would account for the observed variance in the percentages of fifth-grade students who met CRCT reading standards (score of 800-849), a direct multiple regression analysis was conducted. The model containing all five predictors was shown to be statistically significant, $F(5, 100) = 27.37$, $p < .001$ and accounted for 32.6% of the overall variance to *Exceeds* CRCT reading scores. The variables of Title I status and years of experience showed a significant correlation to the outcome of *Exceeds* CRCT reading scores with designation as a Title I school being the strongest of the predictors with a beta weight of -.679 and years of experience contributing to the remaining variance with a beta weight of .265. In this model, Title I schools contributed negatively to *Exceeds* scores on CRCT reading with results showing that for every Title I school, *Exceeds* CRCT reading scores decreased by 15.676%. However, for every year of experience attained by a teacher, the percentage of *Exceeds* scores on CRCT reading increased by 1.228%.

Does Not Meet CRCT Mathematics Model. The multiple regression model carried out to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Does Not Meet* on the mathematics portion of the CRCT was shown to be statistically significant, $F(5, 100) = 12.56$, $p < .001$. The model accounted for 38.6% in the overall variance to *Does Not Meet* CRCT mathematics scores. Within this model, three of the five variables had a significant correlation to the outcome of *Does Not Meet* CRCT mathematics scores with class size being the strongest of the predictors with a beta weight of -.362. Of the two remaining significant predictor variables, years of experience demonstrated the next strongest variance with a beta weight of -.351 followed by Title I status with a beta weight of .343.

Results of this analysis revealed that designation as a Title I school and class size contributed negatively to these outcomes with Title I designation resulting in an increase in the percentage of students receiving scores of *Does Not Meet* on the mathematics portion of the CRCT of 3.537% and every one student added to the overall class size resulting in a decrease of these scores by 1.078%. Of the remaining variables, years of experience decreased the percentage of students receiving scores of *Does Not Meet* on the mathematics portion of the CRCT by .728%.

Meets CRCT Mathematics Model. The hypothesis that Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio would account for the observed variance in the percentages of fifth-grade students who did not meet CRCT mathematics standards (score of 799 or below) was tested using a direct multiple regression. The model containing all five predictors was statistically significant, $F(5, 100) = 12.94$, $p < .001$ and accounted for 39.3% in the overall variance to *Meets* CRCT mathematics scores. As in the *Meets* CRCT reading model, only designation as a Title I school resulted in a significant correlation to the outcome of *Meets* CRCT mathematics scores with a beta weight of .611. Being a Title I school resulted in an increase of student receiving scores of Meets in the mathematics section of the CRCT by 13.541%.

Exceeds CRCT Mathematics Model. The final direct multiple regression was carried out to determine the relationship between the five predictor variables of Title I status, teachers' education level, teachers' years of experience, class size, and computer to student ratio and the dependent variable of a score of *Exceeds* on the mathematics portion of the CRCT. The model containing all five predictors was statistically significant, $F(5, 100) = 15.09$, $p < .001$ and accounted for 43.0% in the overall variance to *Exceeds* CRCT mathematics scores. In this model, only designation as a Title I school resulted in a significant correlation in the outcome of *Exceeds* CRCT mathematics scores with a beta weight of -.568. These results showed that being a Title I school contributed negatively to *Exceeds* scores on CRCT mathematics with every Title I school decreasing *Exceeds* CRCT mathematics scores by 16.557% contrary to the hypothesis posed.

Discussion

The results of this analysis reveal that designation as a Title I school is the strongest predictor of the observed variance in scores on the reading and mathematics portion of the CRCT by fifth-grade students in Georgia public schools. However, multiple regression analysis of this predictor variable showed that being a Title I school does not always impact scores in a positive manner. In Title I schools, analysis revealed an increase in the percentage of students receiving scores of *Does Not Meet* in CRCT reading and *Does Not Meet* in CRCT mathematics by 3.018% and 3.537% respectively and a decrease in the percentage of students receiving scores of *Exceeds* in CRCT reading and *Exceeds* in CRCT mathematics by 15.676% and 16.557% respectively. When controlling for the other predictors in this model, designation as a Title I school resulted in a 12.875% increase in students who received a score of *Meets* on the reading portion of the CRCT and a 13.541% increase in the number of students receiving a score of *Meets* on the mathematics portion of the CRCT. Consequentially, the hypothesis that Title I status would account for a portion of the observed variance in CRCT scores was confirmed; however, the expectation that being a Title I school would impact all of the scores in a positive manner was not shown to be the case.

Based on these results and a review of previous literature on Title I status and low socioeconomic status (Baker & Johnston, 2010; Harding, Harrison-Jones, & Rebach, 2012; Rouse & Barrow, 2006; Sirin, 2005), these findings suggest that funding may not be the only obstacle that needs to be addressed when dealing with students from low-socioeconomic backgrounds. An implication of this study, supported by previous research, is that there may be other factors that affect the education and learning of students identified as being from low-socioeconomic backgrounds such as parental education level, parental support and encouragement of their child's education, and access to educational opportunities and preparation outside of the school setting (Baker & Johnston, 2010). Another factor to consider is that this research had no baseline of low-socioeconomic schools without federal funding to compare with Title I schools. Instead this research evaluated achievement of students in Title I schools against that of students in non-Title I schools assuming that, excluding low-socioeconomic status as a factor, all other characteristics of students in these two settings would be similar. Without a baseline of low-socioeconomic schools receiving no federal monies to compare, it is difficult to determine the actual correlation of Title I funding to the achievement of students from low income homes.

Previous literature on teacher quality has shown that while many researchers agree on the importance of teacher quality, disagreements exist on the role of teacher quality in the success of students (Boyd et al., 2008; Clotfelter, Ladd, & Vigdor, 2006; Jennings & DiPrete, 2010; Southworth, 2009; Wayne & Youngs, 2003; Wong, 2004). The results of this study did not definitively refute those claims. An analysis of teachers' education level showed that every increase in the level of education attained by a classroom teacher resulted in a 3.360% increase in students who received a score of *Does Not Meet* in CRCT reading after controlling for the other predictor variables within this model. Although these findings indicate that a teacher's years of post-secondary education may contribute negatively to student achievement, they do not reflect any changes in the percentage of students receiving scores of *Meets* or *Exceeds* on either the reading or the mathematics portion of the CRCT in either a positive or negative manner. When reviewing the data on teachers' education level as reported to the GaDOE, no distinction is made between teachers attaining higher degrees in the field of education and those who hold higher degrees in other fields. There is also no distinction between teachers who were certified by traditional means through accredited teaching programs and those who received certification through alternate methods. In this case, it may be beneficial to evaluate the educational program that makes up the years of post-secondary and determine if that program actually contributes to the teachers' knowledge of more effective classroom strategies and practices.

In a similar multiple regression analysis where other predictor variables were controlled for, the unique contribution of years of experience was examined. Results of this analysis revealed that each additional year of teacher's experience led to a decrease of .549% in students receiving *Does Not Meet* CRCT reading scores and an increase of 1.228% in students receiving *Exceeds* CRCT reading scores. A comparison of years of experience and CRCT mathematics scores showed that for each additional year of teacher experience, the percentage of students receiving a score of *Does Not Meet* on the mathematics portion of the CRCT decreased by .728%. An implication of this analysis is that teacher experience contributes positively to student achievement. However, when looking at the overall picture, the results show that for each additional year of teaching experience, approximately 1 student in every 200 will no longer make a score of *Does Not Meet* on CRCT reading and mathematics and approximately 1 student in every 100 will make a score of *Exceeds* in reading. When viewed in this manner, the contribution of a teacher's years of experience is minimal although generally positive. As suggested by Southworth (2009), it could be that some of the effects attributed to the characteristics of teacher quality such as years of post-secondary education and years of experience may be intercorrelated with other teacher characteristics or instead be a result of other school conditions such as the students being taught.

One of the more significant findings to emerge from this research was related to class size reduction. Previous research on class size reduction, such as Project STAR, had demonstrated that smaller classes have a positive impact on student achievement (Tennessee Department of Education, 1990). However, results of this investigation revealed that as class size increased, the percentage of students receiving scores of *Does Not Meet* in CRCT reading and *Does Not Meet* in CRCT mathematics decreased by .579% and 1.078%, respectively. In general, it seems that smaller class size does not contribute to student success, in contradiction to the hypothesis. Some explanations for this discrepancy may include small group instruction within the classroom and peer to peer tutoring providing students with the benefits of a smaller class environment within the larger class structure.

The hypothesis that computer to student ratio played a significant role in student achievement when this predictor variable was not demonstrated to be significant to CRCT test scores at any level in either reading or mathematics. Although these results were highly unexpected, Becker's study (2000) had shown a 4:1 ratio to be the pivotal point at which student success was impacted. However, this study occurred during a time when a 4:1 ratio of computers to students was an increase in technology in a majority of schools. Since that time, studies such as those conducted by Suhr et al. (2010) and

Shapley et al. (2010) have shown that a 1:1 ratio of computers to students results in the strongest contribution to student achievement. When each child has a computer of their own, then they have an equal opportunity to reap the benefits that technology can provide to education. When sharing a computer, whether at a ratio of 2:1 or 10:1, students cannot realistically be provided with equal access to that educational resource and its benefits.

Implications and Future Research

The most important limitation to the current research lies in the fact that all data was compiled from the GaDOE Web site and therefore, the assumption was made that it was reported by the schools and recorded by the Governor's Office of Student Achievement on each school's report card accurately. The study also used a cluster sample of schools from the accessible population of all public schools within the state of Georgia that served fifth-grade student during the 2009-2010 school year. Although the sample size of 106 schools was far greater than the sample size recommended by Agresti and Finlay (1997), the results may be affected by conducting the same study using only Title I schools or only non-Title I schools throughout the state instead of a combination of the two.

Another limitation of the study was that Title I status was broken down by school in the absence of individual data for students. The current research was not specifically designed to evaluate factors related to the characteristics of a student resulting in a classification of low socioeconomic status. Based on the findings of the current research in relation to Title I status, future research might explore characteristics of students identified as Title I such as the students' home life and the parents' education level, and the impact these characteristics have on these students' achievement.

The findings of this research suggest that designation as a Title I school is strongly related to results on CRCT reading and mathematics; however, being a Title I school does not always positively affect the outcomes on these tests. One implication that can be made is that Title I funding is making a difference when related to student achievement but stakeholders may need to determine exactly which programs or curriculum purchased with this funding is making the most positive difference and make every effort to implement those into the educational setting.

Teacher quality as evidenced by teachers' education level and years of experience, showed mixed results when related to student achievement similar to results of previous research (Harris & Sass, 2007; Kane et al., 2006; Ohlson, 2009). Before discounting teacher quality as an indicator of student success, it may be informative to conduct a qualitative study of teachers in classes where students consistently score well on the CRCT to try to determine what other factors may contribute to teacher quality. More information on exactly what characteristics a quality teacher possesses might result in a more accurate picture of those factors and their impact on achievement.

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