

FACTORS IN SEVENTH GRADE ACADEMICS ASSOCIATED WITH PERFORMANCE LEVELS  
ON THE TENTH GRADE BIOLOGY END OF COURSE TEST IN SELECTED MIDDLE AND  
HIGH SCHOOLS IN NORTHWEST GEORGIA

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## ABSTRACT

This study attempted to identify factors in seventh grade academics that are associated with overall success in tenth grade biology. The study addressed the following research questions: Are there significant differences in performance levels in seventh grade Criterion Referenced Competency Test (CRCT) scores in science, math, reading, and language arts associated with performance categories in tenth grade biology End of Course Test (EOCT) and the following demographic variables : gender, ethnicity, socioeconomic status, disability category, and English language proficiency level? Is there a relationship among the categorical variables on the tenth grade biology EOCT and the same five demographic variables? Retrospective causal comparative research was used on a representative sample from the middle schools in three North Georgia counties who took the four CRCTs in the 2006-2007 school year, and took the biology EOCT in the 2009-2010 school year. Chi square was used to determine the relationships of the various demographic variables on three biology EOCT performance categories. Two-way ANOVA determined relationships between the seventh grade CRCT scores of students in the various demographic groups and their performance levels on the biology EOCT. Students' performance levels on the biology EOCT matched their performance levels on the seventh grade CRCTs consistently. Females performed better than males on all seventh grade CRCTs. Black and Hispanic students did worse than White and

Asian/Asian Indian students on the math CRCT. Students living in poverty did worse on reading and language arts CRCTs than students who were better off. Special education students did worse on science, reading, and language arts CRCTs than students not receiving special education services. English language learners did worse than native English speakers on all seventh grade CRCTs. These findings suggest that remedial measures may be taken in the seventh grade that could impact performance levels on the biology EOCT.

## DEDICATION

This dissertation is dedicated to my husband, Stuart, my girls, Kate and Amelia, and my parents, Larry and Patsy Henry. I am so blessed to have you all in my life as a constant source of strength and encouragement.

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I would like to extend a heartfelt thank you to all of the teachers, mentors, and friends who have given me support along the way in my educational journey. Thanks to those of you (and you know who you are) who have listened to me talk about my doctorate and about my future plans with both excitement and frustration.

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procrastinator, and I know that if it were not for Becca McCashin, I would have had a hard time meeting paperwork deadlines. She is a true gem in the EDD program.

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## CHAPTER 1

### INTRODUCTION

#### **Background**

President George W. Bush signed the No Child Left behind (NCLB) Act into law on January 8, 2002. According to the United States Department of Education, this act was structured around four principles: accountability for results, more choices for parents, greater local control and flexibility, and an emphasis on doing what works based on scientific research. NCLB encompassed all of the core subject areas of language arts, mathematics, social studies, and science.

Since the inception of this act, educators in the United States have been required to re-evaluate their teaching practices to make sure that they are in compliance with NCLB and that they promote academic success for all of their students. According to an article published by the United States Department of Education on April 22, 2008, United States Secretary of Education Margaret Spellings announced proposed regulations to strengthen and clarify No Child Left Behind. These regulations focused on improved accountability and transparency, uniform and disaggregated graduation rates, and improved parental notification for supplemental educational services and public school choice.

In a recent article, Hanegan and Johnson (2006) wrote that the purpose of stronger accountability measures is to help educators identify where the problems were that cause the achievement gap between students. This was done by giving states and school districts report

cards to publicize their progress. According to the authors, schools that failed to make adequate yearly progress were required to make adjustments to instructional practices and provide sufficient evidence that they are making every effort to bring their schools up to standards. These authors further explained that the NCLB Act requires that all teachers be highly qualified. This means that they need a bachelor's degree, full state certification, and the ability to demonstrate competence in any core subject area taught. According to Hanegan and Johnson (2006), even though it is a struggle for some students, testing is a normal way of determining what they have learned. The purpose of state mandated assessments which are required by NCLB was to give educators insight into the progress of each individual student and school.

### **Statement of the Problem**

Since the passing of NCLB, teachers and students across the United States have encountered a great deal of pressure to perform at a certain level. When considering student achievement, particular emphasis has been placed on science. According to the Georgia Department of Education, the first administration of end of course tests (EOCT) in Georgia occurred in 2004. The Georgia Department of Education reported that since then, there have always been those students who have not passed the biology test. In an effort to find out why some students do not pass the biology EOCT, the following problem will be the focus of this research: What are some factors in seventh grade academics that may be associated with overall success on the tenth grade biology EOCT?

## **Purpose of the Study**

The focus of this study was to analyze student performance on criterion referenced competency tests (CRCTs) in reading, language arts, mathematics, and science taken by students in seventh grade. Due to the fact that information presented on the seventh grade science CRCTs deals with some of the same concepts that are presented on the tenth grade biology EOCT, analysis of seventh grade reading, language arts, math, and science CRCT scores of students who went on to take the tenth grade biology EOCT allowed researchers to pinpoint factors that could possibly contribute to different performance levels on the tenth grade biology EOCT. For the purposes of this study, the seventh grade CRCT scores and the tenth grade biology EOCT scores were analyzed in terms of gender, race, socioeconomic status, and disability level. Establishing a relationship between the independent variables and performance levels on the tenth grade biology EOCT can allow school leaders to develop possible intervention strategies for seventh grade life science students who will eventually take the tenth grade biology EOCT. Performance levels on the tenth grade biology EOCT were categorized as exceeds, meets, or does not meet Georgia proficiency levels.

## **Research Questions**

This study investigated factors in seventh grade academics associated with overall success on tenth grade biology EOCT. Responses to the following research questions will shed light upon the connection, if any, between criterion referenced competency (CRCT) tests in science, math, reading, and language arts taken in seventh grade and performance on the tenth grade biology EOCT.

1) Were there significant differences in performance levels in seventh grade CRCT scores in science, math, reading, and language arts associated with performance categories in tenth grade biology EOCT and the following demographic variables?

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

2) Was there a relationship among the categorical variables on the tenth grade biology EOCT and the following demographic variables

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

## **Theoretical Framework**

### **Introduction**

The passing of the federal No Child Left Behind Act (NCLB) has caused a great deal of concern in the field of education. This act has caused educators in the United States to re-evaluate their teaching practices to make sure that they are in compliance with NCLB and that they promote academic success for all of their students. As a result of NCLB, standardized testing has become more significant in all of the schools in the United States as

part of an initiative to insure that all students are performing at appropriate levels. Although the federal government expects every student in the United States to perform satisfactorily on standardized tests, this does not always occur. This research study focused on why some students do not perform at a satisfactory level on the Biology EOCT. It was important to consider that there are certain aspects of education that have an impact on how students perform academically. Educational policies, teaching strategies, and learning theories are factors which affect the academic achievement of students through the way that they are developed and implemented in school systems across the United States.

### **Policies**

Teachers are held accountable for their students' achievement based on standardized tests. According to Templin (2008), this has placed an intense pressure on educators in the past few years. Templin also explained that according to some of his colleagues, the use of standardized tests for accountability was necessary for educational progress. He asserted that teachers who administered these tests were "political actors" (p. 415) who were responsible for making progress happen at the command of the government. On a deeper political level, Templin pointed out that the pressure placed on students and teachers to succeed on these standardized tests deprived students of developing their individuality and potential in the classroom by requiring teachers to be political actors who were only focused on progress.

Science education is at the forefront of educational reform in the United States, and in a recent article, Allen and Wild (2009) explained that science curriculum that was based on best practices in science education was a big priority in Congress. They further reported that the U.S. Department of Education felt that teachers must know the programs and strategies

that were the most effective in improving student achievement. The issue at hand, according to Allen and Wild, was that while there was a great deal of emphasis placed on familiarity with these strategies, there were not enough research based science education practices directed toward students with disabilities. This was identified as a problem because students with disabilities were expected to pass these standardized tests at the same level as students without disabilities. Allen and Wild explained that the Federal Government should provide more support for best practices in science education for all students.

### **Teaching Strategies**

Educational policies are not the only element that presents challenges in the field of education. It is also important to analyze effective teaching strategies that can help educators improve student achievement on standardized tests. In a recent article, Dave Pushkin (2008) focused on how future science teachers were taught at the college level. According to Pushkin, it was important for universities to “model effective teaching/learning approaches in courses for prospective teachers” (p.14). By doing this, all of the students in lower, middle, and upper level science courses would be exposed to appropriate science content and pedagogy.

Assessment for learning is a teaching strategy that is explored by Gioka (2007). According to Gioka, this type of assessment was, “any assessment for which the first priority in its design and practice is to promote learning” (p. 113). Gioka also wrote that this type of assessment provided useful feedback to student questions that could be used to help students figure out how they might improve in a certain area as opposed to merely listening to teacher lectures and taking notes. Her study found that this assessment for learning was not practiced

as frequently as it should be. She also asserted that this might be a reason for a lack of student achievement in science courses and standardized tests. Gioka offered some possible solutions to these problems as they related to assessment for learning. She said that in order for this type of assessment to be effective, science teachers needed to be trained so that they could be more confident in their “pedagogical content knowledge” (p. 116). She also wrote that science teachers should be provided with a sustained in-service program that would give them the knowledge and skills they needed to understand and put assessment for learning into practice. By arming science teachers with this knowledge, teachers would be able to “help students take responsibility for, and improve their own learning” (p.116).

In a recent article, Bateman, et al. (2010) discussed the effectiveness of peer-teaching programs. These types of programs involved having students teach other students important knowledge and skills. In their study, the authors analyzed a train the trainer program in which first aid skills were taught to students by their peers. Findings of the study suggested that this type of teaching practice increased student performance in first aid administration. Implications of the study were that peer teaching was an effective teaching method which promoted learning and achievement. Because of these findings, it could also be inferred that if peer teaching strategies were employed more frequently in science classrooms, science achievement would improve, as would standardized test scores.

### **Learning Theories**

Deron Boyles (2009) wrote that “schooling in the U.S. is increasingly understood through the lenses of science and accountability” (p. 125). He noted that because of this, academic institutions had been commissioned to employ practices that adhered to scientific



management and accountancy principles. Boyles described the learning theory developed by research professor Lorraine Code as centering on the teacher's responsibility for understanding and working with how students learn. The author asserted that using standardized testing caused students to become bound to a uniform approach to content and method. This was directly contrary to Code's ideas which stated that "specifically located, multifaceted analyses of knowledge production and circulation in diverse biographical, historical, demographic, and geographic locations generate more responsible knowing," (p.129). According to Boyles, a Code learning environment was a site for exploration and understanding. In these environments, context and student backgrounds and interests were central to the learning process.

Neo, et al. (2010) have done extensive research into the use of Gagne's 9 Events of Instruction into a classroom in an effort to increase student learning and test scores. These 9 Events of instruction are as follows:

1. Gaining attention
2. Informing learners of the objectives
3. Stimulating recall of prerequisite learning
4. Presenting the content
5. Providing learning guidance
6. Eliciting the performance
7. Providing feedback
8. Assessing performance
9. Enhancing retention and transfer (pp. 22, 23).

The authors conducted their research in a multimedia classroom employing these instructional events and found that students were able to interact and explore the content freely in a way that was fun. The presence of the teacher in the classroom as a facilitator to answer their questions gave the students confidence to pursue learning on their own. Following the use of these instructional events, the authors identified an increase in student test scores in the class which caused them to conclude that this type of learning environment is conducive to student success.

Edmund Marek (2008) described the learning cycle as a way to shape inquiry in school science classes into sequential phases. These phases were exploration, concept development, expansion, engagement, and evaluation. Exploration involved teachers gathering, organizing, and presenting important information that is needed to conduct classroom activities. Teachers also monitored students to make sure that they collected good data, and answered questions that arose during the activities. The student responsibilities during the exploration phase involved gathering good data, answering appropriate questions, and assimilating collected data. Concept development involved teachers leading scripted discussions about the information that was gathered during the course of the exploration phase. This discussion was designed to be both mentally and physically engaging in order to allow students to construct science concepts. The expansion phase was designed to encourage students to apply the concepts they had just learned in different situations. The act of applying newly learned concepts to other situations served to allow students to deepen or develop their understanding of new concepts. Marek described engagement and evaluation as phases that could be used in conjunction with other phases of the learning cycle. He wrote that engagement could be used in the exploration phase to insure that students were active

participants in the exploratory activities. Furthermore, teachers could employ evaluation throughout the learning cycle by asking essential questions to assure that students were grasping key concepts and assimilating information properly. According to Marek, the learning cycle was very useful in science education because it has aided students in making sense of scientific ideas, improving their scientific reasoning, and increasing engagement in science classes.

In the United States, it is often easy for educators to become overwhelmed with all of the pressures that are placed on students and teachers to perform at a certain level. When faced with this pressure, it is important to consider that regardless of what policies are in place or what laws are passed, the success of each individual student is the most important factor in education.

### **Definition of Terms**

Accountability – Holding schools, teachers, and students responsible for academic progress.

Adequate Yearly Progress- Measure of school success determined by student achievement according to No Child Left Behind Act.

Alternative Schools – Schools designed to meet special behavioral, educational, and/or medical needs of students that are not met in traditional schools.

Assessment for Learning - “Any assessment for which the first priority in its design and practice is to promote learning.” ( Gioka, 2007, p. 113).

Assessment Principle – Principle stating that assessment is key to the teaching and learning of mathematics. (Berry et al., 2002)

Biology End-of-Course Test (EOCT) – Standardized test that is aligned with the Georgia biology curriculum standards and includes assessment of specific content knowledge and skills.

Biology Performance Level (BPL) – Performance categories of the biology end of course test; *does not meet*, *meets*, and *exceeds*.

Criterion Referenced Competency Test (CRCT) – Test that gives Georgia educators information about how well students gather knowledge and skills set forth by the Georgia Performance Standards in elementary school and middle school.

Disability Category – Receives special education services or does not receive special education services.

English Learner (EL) – Student who speaks a different language at home and is not proficient in English. (Pacheco, 2010)

English Language Learner (ELL) – A students whose first language is not English, and is either just beginning to learn English or is proficient in the English language (Pacheco, 2010)

End of Instruction Biology I test – State mandated test that is given to students after they have taken biology I. (Angle & Moseley, 2009)

English Language Proficiency Level (ELPL) – Level at which a student can speak and understand English. (ELPL1- Native English language speaker ELPL2- English language learner)

End of Course Test (EOCT) – Test that gives Georgia educators diagnostic information to help them identify strengths and weaknesses in high school mathematics, social studies, science, and language arts.

English as a Second Language – Describing students who are not native English speakers.  
(Curtin, 2005)

English for Speakers of Other Languages (ESOL) - English language instruction designed for non-native English speakers. (Kim & Sturtevant, 2010)

Ethnicity – Caucasian, African American/Hispanic, or Asian/Asian Indian.

Individuals with Disabilities Education Act (IDEA) – Legislation that insures that children with disabilities get a free, appropriate education in public schools. (Essex, 2005)

Limited English proficient (LEP) - Describes individuals who do not speak or read English fluently. (Kim & Sturtevant, 2010)

No Child Left Behind (NCLB) – Federal act passed in 2002 that stresses accountability for students and teachers in order to increase academic achievement.

Standard American English (SAE) - Language used for most educational publications in which grammar and spelling are uniform. (Craig et al., 2009)

Socioeconomic Factors – Factors such as parent education and household income. (Curtis & Toutkoushian, 2005)

Socioeconomic Status – Receives free and reduced lunch or does not receive free and reduced lunch.

Test Accommodations – Changes made in testing situations in response to student disabilities.

Traditional Schools - Schools that adhere to a conventional, non-innovative approach to education.

Visual Impairment – Disability resulting in vision problems. (Curtis et al., 2010)

## **Assumptions**

For any research study, there will be some assumptions that should be made in order to provide some continuity to the study. For the purpose of this study, the assumptions were as follows:

1. The sample population received consistent instruction from teachers who were using Georgia Performance Standards as guidance throughout the seventh, eighth, ninth, and tenth grades.
2. The students in the study had the capacity to perform adequately on the seventh grade CRCTs and the tenth grade biology EOCT.
3. Students were diligent in doing their best on the seventh grade CRCTs and the tenth grade biology EOCT.
4. Teachers consistently adhered to best practices when delivering instruction.
5. There was uniformity in student progression from seventh grade to tenth grade.

## **Limitations**

The limitations of this study were as follows:

- 1) The researcher had no control over the demographics of the students.
- 2) The research was limited by the willingness of school districts to participate in the study.
- 3) The researcher had no control over the amount of student effort put into taking the tests.

## **Delimitations**

The scope of the study was narrowed by two delimitations. First, data was only collected from school districts in Northwest Georgia due to geographical constraints of the researcher. Another delimitation was that only traditional public schools were used in the study. Two of the districts used in the study have alternative schools, but only students from the traditional schools were used.

## **Rationale**

There has been a great deal of pressure placed on teachers and students across the United States to perform at a certain level. Particular emphasis has been placed on science when considering student achievement. There has always been a sizeable percentage of students who do not pass the biology EOCT. The members of the science departments, as well as administrators at the middle schools in the State of Georgia, have spent many hours trying to determine ways to improve student performance on this test. However, year after year, a high percentage of students did not pass this test. It was important for educators to dig deeper to determine how to improve student performance on these assessments. By doing this, they may improve student achievement, assist schools to achieve adequate yearly progress (AYP), and reduce the pressure felt by educators to increase the academic achievement of their students.

## **Significance**

Through information obtained from this study, there is a possibility of determining where improvements and interventions can be made in seventh grade content area courses to aid students in improving overall performance on the biology EOCT. This study could serve

to enhance the education of students in Georgia by giving educators information that they might use to help students improve biology EOCT scores and, in turn, improve overall achievement in science.



## **CHAPTER 2**

### **REVIEW OF THE LITERATURE**

#### **Introduction**

Accountability has become a national standard. As a result of this, states have implemented policies and procedures that have remained in place regardless of the past presidential election results. Because accountability for educators was an important part of No Child Left Behind (NCLB), assessment has emerged as a major focus in schools in the United States. In a perfect world, all students in all schools would succeed, meet benchmarks, and consistently achieve adequate yearly progress (AYP) status. Unfortunately, however, this did not always occur. According to Guthrie and Peng (2010) two areas in which the United States educational system fell short were childhood literacy and students completing high school. Furthermore, according to McCallumore and Sparapane (2010), the increased use of standardized tests to measure school performance and exit tests to earn diplomas has made completing high school increasingly difficult for students. Due to these factors, McQuillan and Salomon-Fernandez (2008) asserted that many states were challenged with enhancing academic achievement in low-performing schools. A recent study by Coppola, et al. (2008) revealed that the disaggregation of student test scores by race and socioeconomic status could lead to certain students being removed from schools in order to maintain good standing according to NCLB. The potential for the removal of low performing students from schools has highlighted the increased pressure on educators in the age of NCLB. When evaluating the

additional impact of the emphasis on accountability, it has become important to remember that differences exist in students and that these differences should have always been considered. These disparities could have contributed to differences in test scores on standardized tests. Four categories that have been previously investigated to determine their effects on academic performance are gender, ethnicity, socioeconomic status, and disability category.

## **Testing**

Standardized testing in the State of Georgia is a direct result of the A+ Education Reform Act of 2000. The purpose of these assessments was to make sure that all of the students in Georgia have access to an academically rigorous curriculum and to give educators information that will improve student achievement by offering effective instruction of Georgia Performance Standards.

In terms of validity and reliability of these tests, the State of Georgia employs a test development process that follows national professional standards. The first step of the process is to determine the purpose of the test. After the purpose of the test is established, the Department of Education finds a reputable test development company to facilitate test development. A selection committee made up of Georgia educators is formed to work with the test development facilitators to decide how concepts and skills will be assessed and to develop a test blueprint. Following this, content domain specifications are developed to specify how curriculum elements are categorized in order to establish test parameters. Test items are then written by Georgia educators and submitted to review committees for approval. Following approval, the test items are field tested by embedding them in an already

operational test and giving them to a group of highly motivated students. These items are reviewed by another review committee to determine how the students performed on the field test. Once the items are accepted by the committee, they are placed in a test bank from which test items for actual tests are obtained. Two tests that are written by this process are Criterion Referenced Competency Tests (CRCTs) and End of Course Tests (EOCTs).

### **Criterion Referenced Competency Tests (CRCTs)**

According to the Georgia Department of Education, the purpose of the CRCT is to measure how well students gather knowledge and skills set forth by the Georgia Performance Standards. The information obtained from the tests is used to identify the strengths and weaknesses of individual students in terms of Georgia Performance Standards.

CRCTs were first administered in the spring of 2000 to students in grades four, six, and eight in language arts and mathematics. Students in grades three through eight were tested in the spring of 2002 in science and social studies. Students in grades one, two, three, five, and seven were tested for the first time reading, language arts, and mathematics in the spring of 2002. These end-of-year assessments are made up of selected-response questions. These tests measure how well students acquire, learn, and accomplish the knowledge and skills in a specific curriculum or unit of instruction. The intent of the CRCT is to test content standards outlined in the Georgia Performance Standards (GPS).

According to the Georgia Department of Education, in order to obtain the most reliable and accurate test results from students, the state of Georgia examined how other states assessed their students and at the procedures that were seen by educational research as the most important to follow. Specific factors that were taken into consideration included the

number of answer choices, breaks during testing, and incidences when the teacher read certain aspects of the assessments to the students. In order to meet federal requirements for state standards and assessments, the CRCT was peer reviewed by a team of external experts in the fields of standards and assessments. This team was convened by the United States Department of Education and was authorized to consider evidence in the areas of content and academic achievement standards, technical quality, standard alignment, inclusion, and scoring and reporting. According to committee reports, the CRCT met nationally recognized professional and technical standards for assessment programs.

In terms of scoring, the number of test items that students get correct is converted to a scaled score. This enables standardization of score reporting of all sections of the CRCT. In terms of the seventh grade Reading CRCT, the scores are reported on a scale of 650 to 920. Students who do not meet the CRCT standard have scores ranging from 650 to 799. Students who meet the CRCT standard have scores ranging from 800 to 849. Students who exceed the CRCT standard have scores ranging from 850 to 920.

In terms of the seventh grade Language Arts CRCT, the scores are reported on a scale of 650 to 930. Students who do not meet the CRCT standard have scores ranging from 650 to 799. Students who meet the CRCT standard have scores ranging from 800 to 849. Students who exceed the CRCT standard have scores ranging from 850 to 930.

In terms of the seventh grade Math CRCT, the scores are reported on a scale of 650 to 950. Students who do not meet the CRCT standard have scores ranging from 650 to 799. Students who meet the CRCT standard have scores ranging from 800 to 849. Students who exceed the CRCT standard have scores ranging from 850 to 950.

In terms of the seventh grade Science CRCT, the scores are reported on a scale of 650 to 960. Students who do not meet the CRCT standard have scores ranging from 650 to 799. Students who meet the CRCT standard have scores ranging from 800 to 849. Students who exceed the CRCT standard have scores ranging from 850 to 960.

### **End of Course Tests (EOCTs)**

According to the Georgia Department of Education, the purpose of the EOCT is to give educators useful diagnostic information to help them identify strengths and weaknesses in the areas of mathematics, social studies, science, and language arts. The identification of strengths and weaknesses can improve student performance in high school courses. The focus of the Georgia Department of Education is to improved teaching and learning. The EOCTs are aligned with Georgia curriculum standards and are composed of test items that assess specific content knowledge and skills. These test items provide diagnostic information to help educators identify students strengths and weaknesses in terms of learning. According to the Georgia Department of Education, the identification of these strengths and weaknesses will improve performance in all high school courses and on other assessments. The EOCTs also provide data to evaluate the effectiveness of classroom instruction at the school and system levels.

The Georgia Department of Education says that the EOCT is administered when students complete courses in the following areas: mathematics, social studies, science, and language arts. Mathematics EOCTs are divided into tests that deal with algebra, geometry, and statistics on the Mathematics I EOCT, and geometry, algebra II, and statistics on the Mathematics II EOCT. Social studies EOCTs are separated into the United States History

EOCT and the Economics, Business, Free Enterprise EOCT. Language Arts EOCTs are separated into the Ninth Grade Literature EOCT and the American Literature and Composition EOCT. The Science EOCTs are separated into the Physical Science EOCT and the Biology EOCT.

Beginning with the 2004-2005 school year, a student's EOCT score was averaged in as 15% of the final course grade. The student must have a final course grade of 70 or above to pass the course and earn credit toward graduation. If a student repeats a course to earn credit for graduation, they would participate in the EOCT at the end of the repeated course.

The EOCTs are given in the Winter, Spring, and Summer. The tests are also administered in an on-line format in the middle of the month in August, September, October, November, February and March. The EOCTs can be taken in a paper-and-pencil or an on-line format. Paper-and-pencil assessments can only be taken during the main administrations. Online assessments are available for all administrations. Each test is administered in two 60 minute sections.

According to the Georgia Department of Education, in terms of scoring, the number of test items that students get correct is converted to a scaled score. This enables standardization of score reporting of all sections of the EOCT. In terms of the Biology EOCT, the scores are reported on a scale of 200 to 650. Students who do not meet the EOCT standard have scores ranging from 200 to 399. Students who meet the EOCT standard have scores ranging from 400 to 449. Students who exceed the EOCT standard have scores ranging from 450 to 650.

## **Gender**

Gender has been the focus of a number of national studies which dealt with math and science skills of children and young adolescents. According to Harris-Britt, et al. (2008), a small number of gender differences in math and science abilities of students over the last thirty years have been identified. For example, the authors asserted that as males entered late adolescence and young adulthood, they were more likely to take higher level math courses and pursue careers in engineering, computer science, and physical sciences.

Ding, et al. (2006) conducted a study to determine whether or not gender differences were evident in student performance in mathematics. Findings revealed that “females did not show statistically low math test scores, and that the growth rate over time remained the same for both males and females” (p.8). The authors speculated that the educational environment played a part in the gender difference because the same growth rate existed in boys and girls in mathematics from third grade to twelfth grade. The authors suggested that expectations were an important factor in student achievement. Furthermore, when they were expected to perform as well as boys, girls performed as well in math in today’s schools.

Park and Reis (2001) found that fewer girls and women pursued careers in math and science in the previous ten years. They indicated that this was caused by a decrease in self-esteem among young girls and increasingly negative attitudes toward both mathematics and science. According to Park and Reis, “stereotypes influence perceptions and performance in school and in life and are often cited as contributing heavily to girls’ shortcomings in schools” (p.2). In a related article written by Barnes et al. (2005), the authors surmised that there were apparent differences in enrollment among boys and girls in the areas of biology, chemistry and physics. According to Barnes, et al., these differences in enrollment were a

direct result of the way boys and girls viewed themselves and what performance expectations were placed on them in the areas of physics, chemistry, and biology.

A study conducted by Miles and Reborn (1999) affirmed the notion of a gender gap and attributed the problem to test bias against girls, male genetic superiority, more score variability among boys, the timed nature of the test, girls being less mathematically inclined, lower parental expectations for girls, and different teacher expectations for girls. Although the authors focused on the gender gap in terms of SAT scores, they indicated that the same ideas applied to other math and science tests as well. In terms of gender, research done by the authors showed that there were differing views about the role of gender in academic performance. As a result, these research studies may have led others to develop their own studies about gender differences in student performance and reach their own conclusions.

A recent article written by Bailey and Whitmire (2010) reinforced the notion of a gender gap that existed in the area of academic achievement. The authors wrote that boys have always lagged behind girls in terms of literacy. Despite this difference, girls were making strides in the areas of math and science by outperforming boys on assessments in these areas. The authors further explained that this gap in achievement was seen in boys and girls as individuals rather than as a group. Bailey and Whitmire asserted that the best way to bridge this achievement gap was to create a school culture in which high academic achievement was a goal for all students. In a related article, Miller, et al. (1996) tackled the notion of SAT bias against female test takers. Findings from the article revealed no existence of gender bias. Furthermore, the authors attributed differences in SAT scores among males and females to individual personality traits and communication skills.



The concept of a gender gap in academic achievement had been studied in different school programs. Cobb et al. (2005) conducted a study about the effects of block scheduling on overall student achievement. During the course of this research, Cobb, et al. found that girls who were enrolled in block scheduled classes showed higher gains in reading than boys. Virtual reality classrooms have also been studied in terms of gender differences. Ausburn, et al. (2009) described females as not being comfortable, confident, or capable in virtual learning environments that were highly technical and visually complex. Students with ADHD were studied by DuPaul, et al. (2006). This research revealed that boys and girls with ADHD were at similar risk for deficiencies in academic, emotional, and social functioning. However, additional research revealed that ADHD symptom severity was greater in boys, and girls were more likely to exhibit internalizing behavior problems.

In terms of single sex schooling and the gender gap, Clark (2004) wrote that in single sex classes, girls performed better in math and science classes and had higher levels of social adjustment. He noted that girls in single sex classrooms felt more confident in math classes and found those classes more enjoyable. Austin and Thompson (2010) made a case for single sex schooling and described the benefits for boys and girls. They asserted that in coed schools, teachers showed preference to boys, and girls were not as heavily encouraged to take upper level math and science courses. According to Austin and Thompson, boys in coed schools struggled with reading comprehension, had greater discipline problems, lacked male role models, and got bad grades. The researchers noted that students would have been better served in single gender schools which helped students of both genders develop confidence, academic achievement, and leadership skills.

In a recent article by Arms and Herr (2004), the authors indicated that the implementation of high stakes testing and increased accountability that have resulted from NCLB have spawned the development of experimental programs to increase student achievement. One such program has been the single sex academy (SSA). According to the authors, the academy was created to raise the confidence of students and increase test scores. A study by Arms and Herr indicated that the mere existence of the SSA was not guaranteed to level the playing field in terms of academic achievement. It also was not guaranteed that gender stereotypes would be squelched as a result of participation in this academy.

Other studies have found that academic performance can be affected by emotional and psychological issues. These have shown that gender differences existed in the manifestations of these issues. Sinclair and Smith (2005) asserted that females had significantly higher scores than boys on tests for depression, anxiety, stress, and test anxiety. The authors went on to say that these differences were directly related to student achievement. Brendgen, et al. (2002) focused on the effects of relationships on academic adjustment. Their findings revealed that having a romantic relationship during early adolescence had a negative effect on the academic performance of girls because they had a tendency to become more emotionally involved than boys.

As far as gender differences were concerned, evidence was found by various researchers which supported the existence of an achievement gap. There was also evidence that supported the idea that boys and girls were equal in terms of academic achievement. The important thing to remember when analyzing the effect of gender on student achievement was that there was much more research that should be done and that previous research could be used as a stepping stone to new findings that would serve to improve student achievement.

## **Ethnicity**

Along with gender, ethnicity has been a topic of interest for some time with regard to whether or not an achievement gap existed among students of different ethnic backgrounds. In 1997, William F. Tate discussed this achievement gap as it related to mathematics achievement. Tate found an achievement gap between Caucasian and minority students in mathematics achievement, and this gap only narrowed for African American students on items that reflected the mastery of low-level and basic skills. Between the years of 1973 and 1992, “the racial-ethnic trends in mathematics achievement improved, but the level of improvement varied greatly across race and ethnicity” (p. 4). Furthermore, “large differences remain between the achievement of white students and that of African American or Hispanic students at each age level” (p. 4).

While Tate described a great difference in the achievement levels of White students and African American students, Jeremy D. Visone (2009) offered another perspective about ethnicity and student achievement as they related to standardized testing in science. Visone described a study done on reading and its relation to science achievement. This study was done in 90/90/90 schools, schools which had greater than ninety percent of students eligible for free and reduced lunch, ninety percent identified as ethnic minorities, and ninety percent meeting high academic standards on test achievement. According to Visone, “these schools made deliberate decisions to trade content area time for reading comprehension and nonfiction writing instruction” (p.50). The results of the study showed an increase in student achievement on all standardized test scores in all student groups. This, in turn, led to the conclusion that achievement was not based on ethnicity but was, rather, a result of effort. In a related article, Fargo, et al. (2010) explained a study which had been conducted to

determine the effects of professional development programs for science teachers on standardized test scores of White students and African American students. Findings of this study revealed improved achievement for both student groups as a result of teacher participation in this professional development. This study reinforced the absence of an achievement gap among White students and African American students.

The achievement gap between White students and African American students was further researched in a study conducted by Gallant and Moore (2008). This study involved first grade students and focused on the impact of ethnicity-based teacher ratings of African American students and Caucasian students on the language and literacy portion of a curriculum-embedded assessment. Findings of the study revealed that, compared to White students, African American students received lower performance ratings on assessments. Gallant and Moore attributed this gap to changes in socioeconomics, family conditions, youth culture, and school conditions. A study by Barnard-Brak et al. (2010) investigated the potential of African American students enrolled in gifted programs. Their findings revealed that when math and reading proficiency were the only criteria considered, fewer African American students qualified for gifted services. The authors attributed this gap to low test scores, lack of teacher referrals, tracking, and poor learning environments. Adeleke et al. (2009) discussed the idea of culturally relevant pedagogy and suggested a possible solution to bridging this achievement gap. They suggested that teachers of African American students should develop new classroom norms, behaviors and standards related to the culture of these students.

Literacy issues among African American students have been the focus of recent research in terms of narrowing the achievement gap that existed between White students and

African American students. A study conducted by Craig et al. (2009) focused on students who spoke African American English (AAE) and how these students performed on reading assessments. The authors used the dialect-shifting reading hypothesis as a possible method for improving reading achievement. The results of the study indicated that students who spoke AAE and then learned to use standard American English (SAE) exhibited marked improvement on reading assessments in comparison to those who did not make the transition.

According to Ariet, et al. (2001), research had consistently shown that students enrolled in more difficult high school courses performed better on standardized tests. Furthermore, Bahr (2010) asserted that African American students who were placed in low achieving groups in grade school were more likely to be placed in remediation programs at the postsecondary level. An article by Adams, et al. (2010) described the theory of positionality as it related to student performance in math and science classes. According to Adams, et al. (2009), school counselors sometimes lowered their expectations for African American girls, thereby discouraging them from taking higher level math and science classes. Teachers also discouraged these students from entering careers in mathematics and science. Adams et al. suggested that the role of school counselors was crucial for the improvement of math and science performance in African American girls. They asserted that by paying more attention to the needs of these students, counselors could become more culturally responsive to the needs of students. This, in turn, could improve academic progress and encourage more students to consider careers in math and science.

Interventions were another factor deemed very important in narrowing achievement gaps among student groups. This was evident in a study conducted by Bruce et al. (2009) using group counseling services for African American students who took the Georgia High

School Graduation Test in rural high school in Georgia. Results of this study revealed a significant increase in test scores among African American students who participated in the group counseling sessions. This increase in test scores represented a significant narrowing of the achievement gap between White students and African American students reinforcing the notion that student success was a result of student effort and motivation.

An additional important factor in the educational performance of students was parental involvement according to Howard and Reynolds (2008). In a recent article, these authors examined the impact of parental involvement on the education of African American students. They found that middle class African American parents were faced with racism as they attempted to serve as advocates for their children. Howard and Reynolds also found that some African American parents did not want to make waves in predominantly White schools and therefore declined to be involved in schools. The authors asserted that it was important for African American parents to be diligent in their involvement in schools and not wait until they were asked by school officials to take leadership roles in schools.

With the enactment of NCLB, accountability became a crucial focus for all schools. Assessment has become an accountability measure that was often frowned upon by teachers and students across the country. Pappamihel and Walser (2009) indicated that one reason standardized assessments were frowned upon was that they were not appropriate for ELL students. The authors used the complexity theory as the basis for their argument. They said that the process of learning English as a second language was a complex system that was ever changing. According to Pappamihel and Walser, current assessment practices did a disservice to ELL students by limiting the ways they could demonstrate content and idea mastery.

Research about how to improve academic achievement of students whose native language was not English identified the primary issue as the reading ability of these students. Regardless of the fact that these students were limited English proficient (LEP), they were still expected to do well in their academic courses and pass standardized tests which were typically administered in English rather than in the students' first languages. Kim and Sturtevant (2010) reported that it was common for many ESOL students to enjoy read aloud experiences but to have difficulty with science and social studies textbooks. The authors attributed this to a lack of student motivation. In a related article, Hargrove (2005) described a study done by a teacher in a teacher in a bilingual classroom. The focus of this study was how to improve learning and self discipline of gifted, underachieving Hispanic boys. The study produced results which indicated that student motivation and individualized teacher attention involving supportive learning environments were essential for student success. Curtin (2005) expanded on the idea of the improvement of academic achievement among ESL students when she described the results of her research. She noted that ESL students benefited greatly from instruction that involved ESL teachers who employed an interactive teaching style which provided cooperative learning opportunities for students.

Aviles de Bradley and Davila (2010) conducted research in the Chicago Public Schools (CPS) to explore educational inequities that existed for Latino students. The authors described the schools attended by Latinos as segregated and less well-equipped than other schools. The foundations for this research were the critical race theory (CRT) and the critical Latino theory (LatCrit), theories that served to uncover educational injustices that were being done in minority student communities. Aviles de Bradley and Davila wrote that increased accountability had placed a great deal of pressure on Latino students in terms of standardized

assessment. CRT and LatCrit shed light on the issue that English is the primary language in the CPS. ELL students often fell behind due to the language barrier and the authors further asserted that in order to continue to level the educational playing field, it was important for school officials, parents, and community members to work together to address common concerns and goals.

Another study by Pacheco (2010) asserted that ELL students benefited greatly from peer academic support groups. He also wrote that teachers of ELL students should have employed strategies that acknowledged the expertise of family and community members while building their languages, cultures, histories, and intellectual capabilities. Additional research by de la Piedra (2010) shed light on the idea that ELL students came to school with languages and other cultural elements given to them by family and peer groups. The author wrote that Mexican youth practiced English literacy at school and they used Spanish literacy at home. Because of this, De la Piedra suggested that teachers of these ELL students should become familiar with different literacies practiced and should focus on what students could contribute instead of what they lacked in the classroom. He further asserted that teachers of ELL students should facilitate more effective student engagement and enhance student learning. Dennis (2010) expanded this idea by noting that if reading interventions were going to effectively serve struggling readers, teachers must consider abilities that students bring and focus on them to provide meaningful instruction.

In order for reading interventions for ELL students to be properly implemented, reading difficulties in these students must be accurately identified. Geva and Limbos (2001) analyzed the accuracy of teacher assessments for reading difficulty in ELL students. Their results indicated that the most effective screening method for reading difficulty was one that



employed teacher rating scales and teacher recommendations. Use of this mixed method of screening provided an increased sensitivity to at risk students and led to increased referrals for intervention and assessments. Along with proper identification of reading difficulties, it was also important that teachers of subjects such as social studies and science were willing to participate in reading comprehension instructional strategies (Ness, 2009). Ness also found that many teachers of science and social studies viewed reading comprehension as a time consuming detraction from content instruction.

Recent research on reading interventions for minority students was by Wexler et al. (2010) and used Tier 1 and Tier 2 interventions. The results of this study indicated that Tier 2 interventions, which involve word study, fluency, vocabulary, and comprehension, were the most successful in increasing reading proficiency for study participants. Although the study yielded positive results, Wexler et al. acknowledged the challenge faced by school psychologists to determine which reading interventions would be the most effective. They went on to assert that more intensive interventions may be needed for ELL students.

Writing ability for ELL students was the focus of another study by Campbell et al. (2008). The authors analyzed the effectiveness of curriculum-based measurement (CBM) in determining how well ELL students performed on statewide standardized writing tests. Curriculum-based measures were designed to assist teachers in making instructional decisions based on weekly comprehension assessments in content areas. Results of the study indicated that CBMs were effective in helping teachers make instructional decisions, and they were also useful in assisting ELL students who were not proficient English writers but were relatively fluent English speakers.

In order for linguistically diverse students to succeed in school, it was important for them to master vocabulary associated with academic courses. Faller, et al. (2010) wrote that if literacy instruction was going to be effective, classroom based interventions should include multifaceted methods of vocabulary instruction. The authors went on to say that interventions should keep ELL students in mind while remaining appropriate for those students whose primary language was English. Faller et al. also asserted that vocabulary instruction should be text based. This meant that a short piece of text would be used to identify key terms to teach word knowledge. Findings from the study suggested that methods of vocabulary instruction that were effective for primary English speakers could also prove effective for ELL students.

Another research effort by Rupley and Slough (2010) led them to assert that ELL students possessed only half the vocabulary of their English speaking, middle class classmates. This was especially true in the area of science education. The authors suggested five educational steps that needed to take place in order to enhance science vocabulary mastery in ELL students: reading skill development, working with existing student strengths, connecting with student families and cultures, use of engaging instruction, and using varied assessment strategies. According to Rupley and Slough, science education of ELL learners depended on curriculum as well as the extent to which they were engaged in the curriculum. Student experiences extended, reinforced, and stimulated deeper engagement and processing of science concepts.

Yet another study by Fisher and Frey (2008) investigated content literacy and analyzed ways to improve academic performance for ELL students. The study involved surveys and interviews of students and teachers and focused on five themes that emerged from the

research: course content influenced effectiveness of content literacy; sustained focus was a requirement for the success of content literacy; teaching for metacognition and content proficiency was essential for students; there was a necessity for an understanding of the difference between adult knowledge and adolescent learning; and great value was found in student perspectives in developing teacher development committees.

### **Socioeconomic Status**

The effects of socioeconomic factors on student achievement in high school were analyzed by Taylor Curtis and Robert K. Toutkoushian (2005). The authors asserted that the most influential and consistent factors related to student performance were socioeconomic status and the percentage of students in the school who came from low-income families. In addition, “student performance on standardized tests was affected by the income level and ethnic diversity of the community” (p. 2). Beilke and Burney (2008) defined socioeconomic status as “one’s relative standing in regards to income, level of education, employment, health, and access to resources” (p. 2). They also noted that poverty could be the most important factor in determining whether or not students were high achievers because all schools had at least some students living in poverty.

Poverty was a limiting factor as far as student achievement was concerned.

According to Bracey (2004), children living in poverty were at risk from the moment that they were born. In “Setting the Record Straight,” Bracey wrote:

“Poor kids are more likely to be physically and/or emotionally abused. They are three times more likely to have stunted growth. They are twice as likely to have physical or mental disabilities. Poor children are more likely to have serious illnesses. They are more likely to drown, suffocate, or die in a fire. The death rate for poor children is three times that for other kids” (pp. 43-44).

Bracey (2004) further asserted that poverty could be a reason for poor student performance in school and on standardized high stakes tests. He described traits that affluent schools possessed that the majority of poverty stricken schools did not have. More affluent schools had faculty who frequently put forth a great deal of effort, plenty of money for resources, more uninterrupted instructional time, small class sizes, and selectivity. A related article written by Geneseo and Granger (2008) further reinforced the inequalities described by Bracey. The authors touched on the subject of failing schools, those that do not make AYP according to NCLB. According to Geneseo and Granger, in 2006 in New York State, 506 schools in 56 districts needed improvement. Furthermore, 83% of these were poor urban and rural schools that served students of color. They went on to say that in the United States, 8,000 public schools that needed improvement. Geneseo and Granger asserted that the more diverse a school's population was, the less likely it was to make AYP. They called this the "diversity principle" (p. 210), and identified this principle as the reason that school officials were not interested in diversifying their populations.

A 2009 study by Farmer-Hinton and Holland reinforced the notion that students who attended large schools in urban areas made up of primarily low-income African American and Latino students were not as likely to have access to educational resources needed to prepare them for college. According to the authors, these students were also less likely to enroll in college preparatory classes and develop relationships with school guidance counselors who might direct them on a collegiate path. Another finding of this study revealed that students attending small schools took part in more engaging college preparatory activities, and were given more encouragement and support. Farmer-Hinton and Holland (2009) asserted that social support and personal attention were the most useful tools in

college planning. The authors suggested that in order for students to successfully plan for college, all public schools should provide an accessible “college culture”, create learning environments that were small and manageable, and provide opportunities for faculty and students to get to know one another in order to help students take the necessary steps in preparing for college.

Public schools were not the only schools facing issues with student achievement. Achievement issues faced by high poverty African American students attending two different types of Catholic middle schools were described by Domingues and Fenzel (2009). The study centered on Nativity schools which were smaller and were operated by Catholic communities, and larger, more traditional Catholic schools which were operated by the diocese. According to the authors, students attending the Nativity school exhibited higher levels of achievement on seventh grade standardized tests in reading and math than students in traditional Catholic middle school. The authors surmised that the differences in achievement were due to the type of school that the students attended. The Nativity schools were smaller, with a smaller student-teacher ratio and extended school days and summer programs to enhance student learning.

The impact of culture was studied by Dekker and Fischer (2008) to determine the impact of culture on academic motivation. As a result, they found that values in society as well as socioeconomic status were directly linked to academic achievement. Dekker and Fischer suggested that it is important to understand the impact of society on student achievement because many educators used this information to better understand different motivations for academic achievement and, in turn, developed new techniques for motivating students in ways that were culturally relevant.

Mathematics instruction and student achievement in mathematics (as they relate to socioeconomic status) have been the focus of recent research. Sciarra (2010) noted that students in lower socioeconomic environments were not as likely to complete mathematics courses as those in higher socioeconomic environments. This difference was attributed to a lack of resources. However, Sciarra went on to say that if students in low SES schools were doing well in their academic courses, the likelihood that they would take higher level mathematics courses increased by fifty percent. Berry, et al. (2009) conducted research that focused on the importance of mathematics education for all students. The authors emphasized standards set forth by the National Council of Teachers of Mathematics (NCTM)'s Principles and Standards for School Mathematics (PSSM). These standards centered around five principles: the equity principle, curriculum principle, teaching and learning principles, assessment principle, and technology principle. According to Berry, et al., effective mathematics teachers should facilitate student learning through the use of these principles. The authors went on to say that implementation of these principles was less common in high poverty school districts because of the importance placed on high stakes testing. Teachers in these schools were more likely to use prepared curricula and pacing guides in order prepare students for the tests. Furthermore, some teachers at high poverty schools were more likely to find a school where they could have more autonomy in the classroom. This led to higher attrition rates in high poverty schools.

Gifted education was another area that was affected by poverty. Beall, et al. (2009) examined the effects of poverty on gifted students in rural schools. According to Beall et al., persistent poverty had severe and long lasting effects on the lives and education of gifted students. Beall wrote that gifted students in rural, high poverty areas had difficulty travelling

to programs and services, limited resources, and limited opportunity for interaction with other gifted students. Initial recognition of gifted students was also an issue because of limited resources and the need to serve the basic educational needs of all students.

Although there had been a great deal of research done about the negative effects of poverty on student achievement, other studies had shown that poverty had little effect on student achievement. A study by Cantrell, et al. (2006) revealed that when students of any SES were engaged in engineering design experiences that required them to use tools and materials, they were given opportunities that would enhance learning. Angle and Moseley (2009), in a study about science teacher efficacy found that student scores on End-of – Instruction Biology I tests were directly related to teacher expectations for students, regardless of SES. Their results showed that those teachers who had high achievement expectations assumed the responsibility for their students’ learning. This, in turn, resulted in teachers exhibiting behaviors that served to increase student learning. Ray (2000) conducted a study that analyzed the home schooling process and its overall effects on student learning. He found that there were no relations between family income and student achievement, and that typically those home schoolers from low income families tended to score above average on standardized tests.

### **Disability Category**

The Individuals with Disabilities Education Act was created to “define clearly the responsibilities of schools districts regarding children with disabilities and to provide a measure of financial support to assist states in meeting their obligations” (Essex, 2005, p. 107). According to Cawthon (2009), the most recent revision to this act required schools to

identify the strengths and weaknesses of each student who had a disability. Cawthon also wrote that these schools were required to produce an individualized education program (IEP) to ensure that students with disabilities would receive services and opportunities tailored to his or her needs. This revision to IDEA dealt with testing modifications as they relate to standardized testing in high schools.

Standardized testing could cause a great deal of stress in students. This stress could prove to be disabling and may have caused some students to perform poorly on tests. Juola-Rushton and Rushton (2008) described several ways that educators could remedy this problem. The authors asserted that teachers needed to be sensitive to the needs and stress levels of individual students. They also suggested that if teachers built a strong classroom community that made students feel safe and valued, students would develop trust in their teachers and thus activate their natural responses to want to learn.

According to the No Child Left Behind Act, all students were expected to pass standardized tests. This included students with disabilities. In order to accommodate these students, teachers worked to develop more modifications in already existing inclusive classrooms. Although every classroom had its own unique characteristics, some features were common in all inclusive classrooms. “These considerations include reflective teachers, flexibility, individualization, caring, natural supports, and fairness” (p.28). The primary goal of an inclusive classroom was to immerse students with disabilities in typical classrooms while making modifications based on the individual learning needs of students. According to Shank, et al., these modifications were designed to reduce curriculum roadblocks. This would, in turn, level the playing field for students and foster student success. Campbell and Rosas (2010) indirectly made a case for inclusive classrooms. The authors conducted a study



to determine the amount of mathematical knowledge held by those who taught math to special education students. The results of the study indicated that the majority of these teachers had a very limited mathematics background. Campbell and Rosas went on to say that the math knowledge of teachers was a very important factor in student achievement. Therefore, it could be concluded that students would have more success in an inclusion math class with a teacher who had a great deal of math knowledge as opposed to a pullout math class in which the teacher had a limited math background.

In another study, McLaughlin et al. (2002) compared achievement outcomes for students in inclusive classrooms and pullout programs. The findings in this study revealed that students in inclusive classroom performed better than those in pullout programs. McLaughlin also uncovered five essential findings. Students with learning disabilities (LD) got better grades in language arts, mathematics, science, and social studies courses taught in inclusive classrooms as opposed to pullout programs. Students with LD in inclusive classrooms also scored higher on ITBS subtests than those students in pullout programs. Furthermore, LD students in inclusive classrooms showed comparable scores to students in pullout programs on reading, writing, and mathematics subtests of state proficiency tests. Students with LD in inclusive classrooms did not experience more in-school or out-of-school suspensions than students in pull-out programs. Finally, school attendance among LD students in inclusive classrooms was higher than for LD students in pullout programs.

An article by Elliott, Kratochwill, et al. (2001) asserted that one assumption of standardized tests was that they allow “comparability across students because the test is administered in the same way, under the same conditions for all students” (p.1). Furthermore, the validity of these inferences was called into question when aspects of a disability inhibited

performance on the test and scores did not reflect the outcomes the test was supposed to measure. The authors advocated test alterations to “remove irrelevant barriers to performance and allow a person with a disability to demonstrate his or her ‘true abilities’ ” (p. 1).

Although the authors were proponents of test accommodations to level the playing field for disabled students, findings from their study showed that not all students benefited from testing accommodations. According to Elliott, Kratochwill, et al., one third of students with and without disabilities had lower scores in the accommodated condition than in situations where no accommodations were made.

Curriculum modification was one accommodation commonly provided students with LD. In terms of teacher behavior, Lee et al. (2010) asserted that in the presence of curriculum modifications, teachers engaged in fewer classroom management activities.

Extended time on tests was another accommodation often made for students with disabilities. Elliott and Marquart (2004) said that extended time had a differential effect for students with disabilities and students without disabilities. They also wrote that students without disabilities showed similar levels of performance under timed and untimed testing conditions. However, students with disabilities improved their scores when extended time was given.

Testing modifications were another accommodation often made for students with disabilities. A study by Hishinuma (1998) used the Wechsler Adult Intelligence Scale-Revised (WAIS-R) to determine how modifications should have been made for individuals with disabilities who took these standardized tests. According to Hishinuma, certain guidelines should have been followed by those who administered these tests to diagnose disabilities. These guidelines were as follows:

- 1) determining the purpose of the test
- 2) choosing instruments that measured constructs without interference
- 3) determining when tests measured desirable and undesirable constructs
- 4) analyzing limits of the tests
- 5) considering all information gathered about the client when interpreting test results

In order to correctly serve students with LD, it was important to be able to correctly and efficiently diagnose disabilities. Antshel, et al. (2009) described the use of direct observation form (DOF) to diagnose ADHD in children. The DOF involved classroom observations of students by trained psychologists to determine the presence of LD. According to Antshel, et al., the DOF was a practical instrument that could be used in a number of ways. Using the DOF, professionals could screen for behavior problems that were indicative of ADHD. High scores on the DOF could be used to corroborate parent and teacher assessment reports. Furthermore, DOF scores could be used to monitor and evaluate interventions that were being done for ADHD students.

Recent research has indicated that there was an increased need for intervention services for students with emotional and behavior disorders in order to help them succeed in the age of NCLB. Kendall, et al. (2010) asserted that adjustment and appropriate functioning in classroom settings was more difficult for students who had high anxiety. According to Mason, et al. (2009), students with emotional and behavior disorders (EBD) generally performed below grade level and their education was greatly impacted by AYP standards. It was for this reason that Mason et al. suggested a series of interventions that should improve academic performance of these students. These intervention strategies dealt with the areas of reading, spelling, math, general instruction, geography, and test taking skills. The research

conducted by Mason et al. revealed that these strategies resulted in academic gains. However, the authors indicated that there is always room for improvement.

Students with hearing and visual impairments were the focus of research to determine what types of educational interventions were needed to improve their academic performance. Chiu et al. (2009) analyzed the effects of parent reports on determining the vocabulary and word knowledge of a child with severe hearing impairment. Results indicated that the reports of parents were very useful in determining vocabulary and word knowledge. These reports proved to be very helpful to interventionists who developed strategies for academic improvement in HI children. Curtis et al. (2010) researched the effects of access technology on standardized test scores of students with visual impairments. They found that the use of this technology was not as effective as it was thought to be in the past. Curtis et al. suggested that the technology was ambiguous in terms of definition, quality, timing, extent, and quantity of the services that it provided. The authors concluded that academic progress for youths with visual impairments should have been closely monitored as access technologies developed, in order to insure that the academic playing field was leveled for these students.

## **Conclusion**

Education is a vital component of society that necessary for an individual's advancement. There are many different types of students who are in many different types of educational situations. Due to the accountability requirements of No Child Left Behind, these students will always be assessed to measure their academic progress. Furthermore, there will continue to be ongoing efforts to try to improve student performance based on results of

these assessments. The use of past and current research about academic performance of different types of students will open the door to future research and developments of new strategies that could improve overall student achievement.

## **CHAPTER 3**

### **METHODOLOGY**

#### **Introduction**

The purpose of this study was to investigate relationships between the seventh grade math, reading, language arts, and life science CRCT scores and the tenth grade biology EOCT performance levels of the same students in terms of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level. An attempt was made to determine whether or not predictors existed that would allow school leaders to develop possible intervention strategies for seventh grade life science students who will take the biology EOCT in the tenth grade. The introduction of the federal No Child Left Behind Act has raised the bar for educators in the United States. As a part of this raising of the bar, educator accountability has become a major issue. Findings from this study could assist educators by giving them information that they need to develop interventions for seventh grade life science students to succeed on the tenth grade biology EOCT. This, in turn, could increase student achievement, and help schools achieve adequate yearly progress (AYP).

#### **Research Questions and Hypotheses**

As it has been previously stated, the problem for this research study was : What factors in seventh grade academics were associated with overall success in tenth grade biology EOCT? The score on the biology EOCT was separated into three categories. These

categories were *exceeds*, *meets*, and *does not meet* the requirements determined by the state of Georgia. There were eight independent variables and one dependent variable. The independent variables were seventh grade CRCT scores in reading, math, language arts, and science, gender, ethnicity, socioeconomic status, and disability category, and English language proficiency level.

The two research questions were written as composite research questions and they needed to be separated into their constituent parts as the hypotheses were written. This was illustrated with the first research question demonstrating how the hypotheses were written for only one of the variables (science CRCT scores). The other hypotheses were a repetition of this hypothesis for each of the other variables. The hypotheses were spelled out in full in Chapter 4 where they were tested.

Composite research question 1 asked: Were there significant differences in performance levels in seventh grade CRCT scores in science, math, reading, and language arts associated with performance categories in the tenth grade biology EOCT and the following demographic variables?

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

The corresponding hypotheses were:

Hypothesis 1a: There was a significant difference in seventh grade science scores based on gender and tenth grade biology EOCT performance levels.

Hypothesis 1b: There was a significant difference in seventh grade science scores based on ethnicity and tenth grade biology EOCT performance levels.

Hypothesis 1c: There was a significant difference in seventh grade science scores based on socioeconomic status and tenth grade biology EOCT performance levels.

Hypothesis 1d: There was a significant difference in seventh grade science scores based on disability level and tenth grade biology EOCT performance levels.

Hypothesis 1e: There was a significant difference in seventh grade science scores based on English language proficiency level and tenth grade biology EOCT performance levels.

Composite research question 2 asked: Was there a relationship between the different performance levels on the tenth grade biology EOCT and the following demographic variables?

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

The corresponding research hypotheses were:

Hypothesis 2a: There was a significant relationship between the performance categories on the biology EOCT and gender.

Hypothesis 2b: There was a significant relationship between the performance categories on the biology EOCT and ethnicity.

Hypothesis 2c: There was a significant relationship between the performance categories on the biology EOCT and socioeconomic status.



Hypothesis 2d: There was a significant relationship between the performance categories on the biology EOCT and disability category.

Hypothesis 2e: There was a significant relationship between the performance categories on the biology EOCT and English language proficiency level.

Finding answers to these questions could shed further light on what was causing achievement gaps in middle schools and high schools. Furthermore, the answers to research question number two described the results of the study in terms of how the students were distributed across all of the various demographic categories. Through the course of this chapter, the research design, sampling, variables, and data analysis have been described. These tools were used by the researcher to further assist educators in their endeavors to improve student achievement.

## **Research Design**

This was an ex post facto study employing retrospective causal comparative research as the main research design. Causal comparative research was designed “to investigate whether one or more pre-existing conditions have possibly caused subsequent differences in the groups of subjects,” (McMillan and Shumacher, 2006, p. 241). Retrospective causal comparative research examined the different performance levels on the biology EOCT in light of student performance on seventh grade CRCTs and the demographic groups of gender, ethnicity, socioeconomic status, and disability level. Causal comparative research was used to determine what relationships exist between students who *exceeded, met, or did not meet* Georgia standards on the biology EOCT and seventh grade reading, language arts, math and science CRCT scores of students. The demographic categories of gender, ethnicity,

disability level, and socioeconomic status were also factored in to determine what effect, if any, they had on the seventh grade CRCT performance.

### **Sample Selection**

The sample used in this study was a representative sample reflecting gender, ethnicity, disability level, and socioeconomic status. This consisted of all of the students from the North Georgia middle schools in County A, County B, and County C who took the math, reading, language arts, and life science CRCTs in the 2006-2007 school year and subsequently took the biology EOCT in the 10<sup>th</sup> grade in the 2009-2010 school year. In 2006-2007, County A tested 850 students, County B tested 579 students, and County C tested 696 students. The CRCT information for the study was obtained from a census sample of seventh grade life science students who fell into the previously mentioned groups and who attended middle schools in the North Georgia counties of County A, County B, and County C. These middle schools are A1 Middle School, A2 Middle School, and A3 Middle School in County A, B1 Middle School and B2 Middle School in County B, and C1 Middle School, C2 Middle School, and C3 Middle School in County C.

The EOCT score information was obtained from the high school records of the same students who took the life science and other CRCTs in the seventh grade at the previously mentioned feeder middle schools. These high schools are A1 High School, A2 High School, and A3 High School in County A, B1 High School and B2 High School in County B, and C1 High School, and C2 High School in County C.

Following the Institutional Review Board (IRB) approval at the University of Tennessee at Chattanooga, the researcher contacted the Curriculum Directors in County A,

County B, and County C. The curriculum directors worked with the researcher to select students who took the life science CRCT in 2007 at the previously mentioned middle schools, and went on to take the biology EOCT in 2010 at the previously mentioned high schools. Also collected was the demographic information of these students including gender, ethnicity, socioeconomic status, and disability level.

### **Variables in the Study**

For the purposes of this study, the biology EOCT score was the independent variable that is categorized into three groups or levels. The levels of this variable are *exceeds*, *meets*, and *does not meet* the proficiency standards set forth by the State of Georgia. The demographic variables were categorical independent variables. The levels of these variables were:

- 1) gender – male and female
- 2) ethnicity – White, Black and Hispanic, Asian and Asian Indian.
- 3) socioeconomic status – receives free and reduced lunch and does not receive free and reduced lunch
- 4) disability category – receives special education services and does not receive special education services.
- 5) English language proficiency level – native English speaker and English language learner.

The seventh grade CRCT scores were the dependent variables that were analyzed retrospectively in terms of how they were associated with the biology EOCT score categories.

## **Procedure and Data Analysis**

The data used for this study was obtained from the data specialists representing the North Georgia counties of County A, County B, and County C. After the data were obtained, they were sorted and analyzed through two-way ANOVA. The Statistical Package for the Social Sciences (SPSS) was employed as the instrument of data analysis. Causal comparative research was designed “to investigate whether one or more pre-existing conditions have possibly caused subsequent differences in the groups of subjects” (McMillan and Shumacher, 2006, p. 241). For the purposes of this study, the independent variables were gender, ethnicity, disability level, socioeconomic status, and the CRCT scores. Causal comparative research was used to determine what effect the independent variables have on student performance on biology EOCTs.

Two-way ANOVA is used when two or more independent variables are analyzed together. This method of data analysis was used to determine relationships between the seventh grade CRCT scores of students in the demographic groups of gender, ethnicity, socioeconomic status, and disability level and their performance on the biology EOCT. Once the data were collected, the biology ECOT scores were separated into *exceeds*, *meets*, and *does not meet*. Then, the mean score of each of these groups were computed.

In terms of the analysis of the effects of gender, ethnicity, socioeconomic status, and disability level on biology EOCT scores, the chi square method of data analysis was used to determine this relationship. This method of data analysis is “a statistical procedure that is used with nominal data to test relationships between the frequency of observations in categories of independent variables” (McMillan and Shumacher, 2006, p. 470).

## CHAPTER 4

### ANALYSIS OF DATA

#### **Introduction**

The primary objective of this research study was to determine which factors in seventh grade academics were associated with overall success in tenth grade biology. In an effort to understand this problem, the researcher analyzed tenth grade student performance on criterion referenced competency tests (CRCTs) in reading, language arts, mathematics, and science taken in the seventh grade.

Due to the fact that information presented on the seventh grade science CRCTs dealt with some of the same concepts that were presented on the tenth grade biology EOCT, analysis of seventh grade reading, language arts, math, and science CRCT scores of students who went on to take the tenth grade biology EOCT, allowed researchers to pinpoint factors that could possibly contribute to different performance levels on the tenth grade biology EOCT.

A total of 1175 students took the biology EOCT in the North Georgia counties of A, B, and C. Out of those students, 320 (27.2%) did not meet the standards on the biology EOCTs, 604 (51.4%) students met the standards, and 251 (21.3%) students exceeded the standards. Out of the 1175 students tested, 169 females (52.8%) did not meet the standards and 151 males (48.2%) did not meet the standards. 302 females (50%) met the standards and 302 males (50%) met the standards. In terms of exceeding the standards on the biology

EOCT, 97 females (38.6%) exceeded the standards, while 154 males (66.4%) exceeded the standards. Table 1 provides *n* values and percentages for males and females at various biology EOCT performance levels.

Table 1  
Breakdown of the Sample by Gender and EOCT Level

	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Does Not Meet	151	48.2	169	51.8	320	100
Meets	302	50.0	302	50.0	604	100
Exceeds	154	61.4	97	38.6	251	100
Total	607	51.6	568	48.4	1175	100

### Research Questions

Responses to the following research questions were analyzed in an attempt to explain the connection, if any, between criterion referenced competency (CRCT) tests in science, math, reading, and language arts taken in seventh grade and performance on the tenth grade biology EOCT.

1) Were there significant differences in performance levels in seventh grade CRCT scores in science, math, reading, and language arts associated with performance categories in tenth grade biology EOCTs and the following demographic variables?

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

2) Was there a relationship among the categorical variables on the tenth grade biology

EOCT and the following demographic variables?

- a) gender
- b) ethnicity
- c) socioeconomic status
- d) disability category
- e) English language proficiency level

### **Procedure and Data Analysis**

Two-way ANOVA was used because the dependent variable (CRCTs) was continuous and there were two sets of grouping variables. These were the Biology EOCT performance levels and the various demographic variables. This method of data analysis was used to determine relationships between the seventh grade CRCT scores of students in the demographic groups of gender, ethnicity, socioeconomic status, English language proficiency level and disability level and their performance on the biology EOCT. Once the data were collected, the biology EOCT scores were separated into the groups of *exceeds* (E), *meets* (M), and *does not meet* (DNM). Then, the mean score of each of these groups was compared for the four CRCTs.

In terms of the analysis of the effects of gender, ethnicity, socioeconomic status, English language proficiency level and disability level on biology EOCT scores, the chi square method of data analysis was used to determine this relationship. According to McMillan and Shumacher (2006), this method is used with nominal data in the determination of relationships among frequency of observations in independent variable categories.

## **Testing the Null Hypotheses and Results**

The previously mentioned research questions comprised the framework for solving the problem set forth by this research study. The following null hypotheses were expansions of the research questions which gave the researcher specific statements that could be tested. The fact that these statements were null hypotheses provided the researcher with the opportunity to use statistics to “determine the probability that the null hypothesis is untrue” (McMillan and Shumacher, 2006, p. 291). The null hypotheses were grouped by CRCT and tested in the order of science, math, reading, and language arts. Within these subject areas, the demographic variables were analyzed in the order of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level using two-way ANOVA.

### **Null Hypothesis 1a: There was no difference in seventh grade science scores based on gender and tenth grade biology EOCT performance levels.**

A 3 X 2 ANOVA was conducted to evaluate the effects of biology EOCT performance level (BPL) conditions and gender on science 7<sup>th</sup> grade CRCT scores. Table 2 shows that there was a significant interaction between the effects of gender and BPL on Science. Since the interaction of BPL and gender was significant,  $F(2, 1169) = .02, p < .01$ , main effects were ignored and simple effects considered. Table 3 shows the number of subjects, the means, and the standard deviations of science scores for each cell. Games-Howell post hoc tests revealed that of students with BPL scores of DNM, there was no difference between males and females. The null hypothesis was not rejected. This means that there was no gender difference at any of the biology EOCT performance levels. There was a significant difference in the math CRCT scores based on gender,  $F(1, 1169) = 5.86, p = 0.02$ .



Table 2

Two-Way Analysis of Variance for Science CRCT Scores as a Function of Gender and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
Gender	1	20144.63	5.86	.02	.01
BPL	2	375406.86	109.22	<.01	.16
Gender X BPL	2	13891.48	4.04	.02	.02
Error	1169	3437.23			

Table 3 provides means and standard deviations for the various subgroups. Generally, females performed better than males on the science CRCT.

Table 3

Means, Standard Deviations and *n* for Science CRCT Scores as a Function of Gender and BPL

BPL	<i>n</i>	Female		<i>n</i>	Males		<i>N</i>	Total	
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
DNM	169	794.26	43.02	151	770.91	99.87	320	783.24	76.04
M	302	822.54	20.91	302	814.05	68.36	604	818.31	50.68
E	97	854.10	57.91	154	859.01	43.32	251	857.11	52.17
Total	568	819.52	41.81	607	814.74	79.66	1175	817.05	64.23

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there was no difference in seventh grade science scores based on gender and tenth grade biology EOCT performance levels. The *t* tests were conducted for gender and each of the three biology performance levels. The tests were significant at the DNM level,  $t(318) = 2.771$ ,  $p = 0.01$ , and the M level,  $t(602) = 2.06$ ,  $p = 0.04$ , but not at the E level,  $t(249) = -0.72$ ,  $p = 0.47$ . The null hypothesis was rejected in terms of the DNM and M categories, but not in the E category. (Table 4) Females performed better than males in the *does not meet* and *meets* categories, but males and females performed equally in the *exceeds* category.

Table 4

Independent-Samples *t* Test of Differences of Means  
of Science CRCT Scores by Gender and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	2.77	318	0.01
M	2.06	602	0.04
E	-0.72	249	0.47

There was a significant difference in seventh grade science CRCT scores of students who belonged to three performance categories based on the tenth grade biology EOCT scores. The students who scored the highest on the biology EOCT (exceeds) had the highest mean on the seventh grade science CRCT (857.11); students who scored in the middle on the biology EOCT also scored in the middle on the seventh grade science CRCT (818.31), and students who scored at the bottom on the tenth grade biology EOCT also scored at the bottom on the seventh grade science CRCT (783.24). The students were separated significantly on their science performance levels as early as the seventh grade.

Follow up tests were conducted to evaluate the significant differences among the science CRCT score means. Post hoc comparisons were conducted using the Tukey HSD test. There was a significant difference in the means between the students who did not meet the standards on the science CRCT and those who met the standards. There was a significant difference in the means between students who did not meet the standards and those who exceeded the standards. There was also a significant difference in the means between students who met the standards and those who exceeded the standards. The means of the science CRCT scores, as well as the significant differences among the science CRCT score means are reported in Table 5

Table 5  
Significant Differences Among Science CRCT Score Means

BPL	<i>m</i>	DNM	M
DNM	783.24		
M	818.31	*	
E	857.11	*	*

\*The difference in means of science CRCT scores of the three BPL groups is significant at the  $p < 0.05$  level.

**Null Hypothesis 1b: There was no difference in seventh grade science scores based on ethnicity and tenth grade biology EOCT performance levels.**

A 3X3 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and ethnicity on student performance on the seventh grade science CRCT. The ANOVA indicated (Table 6) no significant interaction between biology EOCT performance levels and ethnicity,  $F(4,1166) = 0.12, p = 1.00$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2,1166) = 13.76, p < 0.01$ . There was no significant difference in the science CRCT scores based on ethnicity,  $F(2,1166) = 0.12, p = 0.89$ .

Table 6  
Two-Way Analysis of Variance for Science CRCT Scores as a Function of Ethnicity and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
Ethnicity	2	409.73	0.12	0.89	<0.01
BPL	2	48062.67	13.76	<0.01	-0.02
Ethnicity X BPL	4	42.65	0.01	1.00	<0.01
Error	1166	3493.08			

Table 7 provides the means and standard deviations for the various subgroups.

Table 7

Means, Standard Deviations and *n* for Science CRCT Scores as a Function of Ethnicity and BPL

BPL	<i>n</i>	White		Black/Hispanic			Asian/Asian Indian			<i>n</i>	Total	
		<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
DNM	276	782.96	81.69	32	783.91	15.73	12	788.00	11.01	320	783.24	76.04
M	544	818.31	52.99	48	817.15	19.59	12	823.17	22.88	604	818.31	50.68
E	241	857.04	53.19	3	851.00	7.00	7	862.14	14.36	251	857.11	52.17
Total	1061	817.91	66.97	83	805.55	25.53	31	818.35	33.21	1175	817.05	64.23

**Null Hypothesis 1c: There was no difference in seventh grade science scores based on socioeconomic status and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and socioeconomic status on student performance on the seventh grade science CRCT. The ANOVA indicated (Table 8) no significant interaction between biology EOCT performance levels and socioeconomic status,  $F(2,1169) = 0.99, p = .37$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2,1169) = 101.20, p < 0.01$ . There was no significant difference in the science CRCT scores based on socioeconomic status,  $F(1,1169) = 2.08, p = 0.15$ .

Table 8

Two-Way Analysis of Variance for Science CRCT Scores as a Function of Socioeconomic Status (SES) and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta</i> <sup>2</sup>
SES	1	7232.35	2.08	0.15	<0.01
BPL	2	351766.40	101.20	<0.01	0.15
SES X BPL	2	3439.97	0.99	.37	<0.01
Error	1169	3475.90			

Table 9 provides the means and standard deviations for the various subgroups.

Table 9

Means, Standard Deviations and n for Science CRCT Scores as a function of Socioeconomic Status and BPL

	Does Not Receive Free and Reduced Lunch			Receives Free and Reduced Lunch			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
BPL									
DNM	172	787.30	68.03	148	778.52	84.39	320	783.24	76.04
M	333	817.82	58.31	271	818.91	39.44	604	818.31	50.68
E	167	860.02	47.81	84	851.32	59.79	251	857.11	52.17
Total	672	820.50	64.05	503	812.44	64.25	1175	817.05	64.23

**Null Hypothesis 1d: There was no difference in seventh grade science scores based on disability category and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and disability category (DC) on student performance on the seventh grade science CRCT. The ANOVA indicated (Table 10) no significant interaction between biology EOCT performance levels and disability category,  $F(2, 1169) = 1.56, p = .21$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2,1169) = 40.76, p < 0.01$ . There was a significant difference in the science CRCT scores based on disability category,  $F(1,1169) = 1.46, p = 0.02$ .

Table 10

Two-Way Analysis of Variance for Science CRCT Scores as a Function of Disability Category (DC) and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
DC	1	5050.67	1.46	0.02	<0.01
BPL	2	140698.78	40.76	<0.01	0.07
DC X BPL	2	5383.13	1.56	.21	<0.01
Error	1169	3451.81			

Table 11 provides the means and standard deviations for the various subgroups. According to the means presented in table 11, students receiving special education services performed generally worse than those students not receiving special education services.

Table 11  
Means, Standard Deviations and n for Science CRCT Scores as a function of Disability Category and BPL

BPL	Does Not Receive Special Education Services			Receives Special Education Services			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	251	788.69	66.02	69	763.41	84.39	320	783.24	76.04
M	560	819.01	52.11	44	809.45	39.44	604	818.31	50.68
E	242	856.88	52.86	9	863.44	59.79	251	857.11	52.17
Total	1053	820.48	60.54	122	787.39	64.25	1175	817.05	64.23

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there was no difference in seventh grade science scores based on disability category and tenth grade biology EOCT performance levels. The *t* tests were conducted for disability category and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 2.47, p = 0.01$ , but not at the M level,  $t(602) = 1.20, p = 0.23$ , and the E level,  $t(249) = 0.71, p = 0.71$ . The null hypothesis was rejected in terms of the DNM category, but not in the M category or E category. (Table 12) The performance difference between students receiving special education services and those not receiving special education services was associated with lower performing special education students in the *does not meet* performance category.

Table 12

Independent-Samples *t* Test of Differences of Means  
of Science CRCT Scores by Disability Category and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	2.47	318	0.01
M	1.20	602	0.23
E	-0.37	249	0.71

**Null Hypothesis 1e: There was no significant difference in seventh grade science scores based on English language proficiency level and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and English language proficiency level on student performance on the seventh grade science CRCT. The ANOVA indicated (Table 13) no significant interaction between biology EOCT performance levels and English language proficiency level,  $F(1, 1170) = .26, p = .61$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2,1170) = 87.45, p < 0.01$ . There was a no significant difference in the science CRCT scores based on English language proficiency level,  $F(1,1170) = 0.97, p = 0.33$ .

Table 13

Two-Way Analysis of Variance for Science CRCT Scores as a Function of English Language Proficiency Level (ELPL) and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
ELPL	1	3364.58	.97	0.33	<0.01
BPL	2	304234.58	87.45	<0.01	0.13
ELPL/BPL	1	909.92	.26	.61	<0.01
Error	1169	3478.96			

Table 14 provides the means and standard deviations for the various subgroups. According to table 14, there appeared to be a significant gap in science CRCT score means between native English speakers and English language learners. However, based on the small *n* value for English language learners, the results were inconclusive.

Table 14

Means, Standard Deviations and n for Science CRCT Scores as a function of English Language Proficiency Level and BPL

	Native English Speaker			English Language Learner			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
BPL									
DNM	315	783.48	76.61	5	786.20	8.17	320	783.48	76.04
M	603	818.39	50.69	1	770.00	-	604	818.31	50.68
E	251	857.11	52.17	-	-	-	251	857.11	52.17
Total	1169	817.30	64.30	6	768.50	7.34	1175	817.05	64.23

### Summary of Null Hypotheses 1a. – 1e for Science.

There were no significant differences for seventh grade science scores based on interactions between biology EOCT performance levels and ethnicity, socioeconomic status, English language proficiency level, and disability category. However, there was a significant difference for seventh grade science scores based on interaction between biology EOCT performance levels and gender. Table 15 represents a summary of ANOVA results obtained



through the analysis of interactions of science CRCT scores, previously mentioned demographic variables, and biology EOCT performance levels.

Table 15

Composite Two Way ANOVA Results for Science

	<i>F</i>	<i>df</i>	<i>p</i>
Gender/BPL	4.04	2,1169	0.02
Ethnicity/BPL	0.01	4,1166	1.00
SES/BPL	0.99	2,1169	0.37
DC/BPL	1.56	2,1169	0.21
ELPL/BPL	0.26	1,1170	0.61

**Null Hypothesis 2a: There was no difference in seventh grade math scores based on gender and tenth grade biology EOCT performance levels.**

A 3X 2 ANOVA was conducted to evaluate the effects of BPL conditions and gender on math 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 16) no significant interaction between BPL and gender,  $F(2, 1169) = 1.30, p=.27$ , but significant main effects for BPL  $F(2, 1169)= 36.43, p <.01$  and Gender  $F(2, 1169) = 7.35, p=.01$ . The gender main effect indicated that females performed significantly better than did males on Math CRCT scores. There was a significant difference in the math CRCT scores based on gender,  $F(1, 1169) = 7.35, p = 0.01$ .

Table 16

Two-Way Analysis of Variance for Math CRCT Scores as a Function of Gender and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta</i> <sup>2</sup>
Gender	1	76531.04	7.35	0.01	0.01
BPL	2	379360.98	36.43	<0.01	0.06
Gender/BPL	2	13498.92	1.30	.27	<0.01
Error	1169	10412.96			

Table 17 provides the means and standard deviations of the various subgroups.

Generally, females performed better than males on the math CRCT.

Table 17

Means, Standard Deviations and  $n$  for Math CRCT Scores as a Function of Gender and BPL

BPL	Female			Males			Total		
	$n$	$M$	$SD$	$n$	$M$	$SD$	$n$	$M$	$SD$
DNM	169	788.07	83.61	151	756.40	143.58	320	773.13	116.73
M	302	807.38	84.73	302	790.40	123.28	604	798.89	106.03
E	97	848.38	56.32	154	844.56	75.22	251	846.04	68.44
Total	568	808.64	82.56	607	795.68	122.83	1175	801.94	105.46

A series of independent-samples  $t$  tests were conducted to evaluate the null hypothesis that there is no difference in seventh grade math CRCT scores based on gender and tenth grade biology EOCT performance levels. The  $t$  tests were conducted for gender and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 2.44$ ,  $p = 0.02$ , and the M level,  $t(602) = 1.97$ ,  $p = 0.05$ , but not at the E level,  $t(249) = 0.43$ ,  $p = 0.67$ . The null hypothesis was rejected in terms of the DNM category and the M category but not the E category. (Table 18) Females performed better than males in the *does not meet* and *meets* categories, but performed equally in the *exceeds* category.

Table 18

Independent-Samples  $t$  Test of Differences of Means  
of Math CRCT Scores by Gender and BPL

BPL	$t$	$df$	$p$
DNM	2.44	318	0.02
M	1.97	602	0.05
E	0.43	249	0.67

There was a significant difference in seventh grade math CRCT scores of students who belonged to three performance categories based on the tenth grade biology EOCT scores. The students who scored the highest on the biology EOCT (exceeds) had the highest mean on the seventh grade math CRCT (846.04); students who scored in the middle on the biology EOCT also scored in the middle on the seventh grade math CRCT (798.89), and students who scored at the bottom on the tenth grade biology EOCT also scored at the bottom on the seventh grade math CRCT (773.13). The students were separated significantly on their math performance levels as early as the seventh grade.

Follow up tests were conducted to evaluate the significant differences among the math CRCT score means. Post hoc comparisons were conducted using the Tukey HSD test. There was a significant difference in the means between the students who did not meet the standards on the science CRCT and those who met the standards. There was a significant difference in the means between students who did not meet the standards and those who exceeded the standards. There was also a significant difference in the means between students who met the standards and those who exceeded the standards. The means of the science CRCT scores, as well as the significant differences among the science CRCT score means are reported in Table 19.

Table 19

## Significant Differences Among Math CRCT Score Means

BPL	<i>m</i>	DNM	M
DNM	773.13		
M	798.89	*	
E	846.04	*	*

\*The difference in means of math CRCT scores of the three BPL groups is significant at the  $p < 0.05$  level.

**Null Hypothesis 2b: There was no difference in seventh grade math scores based on ethnicity and tenth grade biology EOCT performance levels.**

A 3X3 ANOVA was conducted to evaluate the effects of BPL conditions and ethnicity on math 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 20) no significant interaction between BPL and ethnicity,  $F(4, 1166) = 2.08, p = .081$ . No significant main effects were indicated for BPL,  $F(2, 1166) = 2.80, p = .06$ . The ethnicity main effect indicated that Black and Hispanic students performed significantly worse on math CRCT scores than did White and Asian students. There was a significant difference in the math CRCT scores based on ethnicity,  $F(2, 1166) = 4.43, p = 0.01$ .

Table 20

## Two-Way Analysis of Variance for Math CRCT Scores as a Function of Ethnicity and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
Ethnicity	2	76531.04	7.35	0.01	0.01
BPL	2	379360.98	36.43	<0.01	0.06
Ethnicity/BPL	4	13498.92	1.30	.27	<0.01
Error	1166	10412.96			

Table 21 provides the means and standard deviations for the various subgroups. The ethnicity main effect indicated that Black and Hispanic students performed significantly worse on math CRCT scores than did White and Asian/Asian Indian students.

Table 21  
Means, Standard Deviations and *n* for Math CRCT Scores as a Function of Ethnicity and BPL

BPL	White			Black/Hispanic			Asian/Asian Indian			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	276	774.43	115.91	32	754.34	143.02	12	793.33	1.54	320	773.13	116.73
M	544	797.50	109.27	48	806.17	76.32	12	823.58	20.35	604	798.89	106.03
E	241	847.51	63.23	3	686.60	253.46	7	863.71	26.69	251	846.04	68.44
Total	1061	802.86	105.76	83	781.87	116.67	31	824.42	33.42	1175	801.94	105.46

There was a significant difference in seventh grade math CRCT scores of students who belonged to three ethnic groups of White, Black/Hispanic, and Asian/Asian Indian. Asian/Asian Indian students had the highest mean on the seventh grade math CRCT (824.42); White students scored in the middle on the seventh grade math CRCT (802.86), and Black/Hispanic students scored at the bottom on the seventh grade science CRCT (781.87). The students seemed to have been separated significantly on their science performance levels based on ethnicity as early as the seventh grade.

Follow up tests were conducted to evaluate the significant differences among the science CRCT score means based on ethnicity. Post hoc comparisons were conducted using the Tukey HSD test. This is a test that does not assume equal variances among the three means. There was no difference in the means between White and Black/Hispanic students. There was no difference in the means between White and Asian/Asian Indian students. There was also no difference in the means between Black/Hispanic and Asian/Asian Indian

students. The difference failed to show up because of a comparatively small  $n$  for the Asian/Asian Indian group. The means of the science CRCT scores, as well as the significant differences among the science CRCT score means are reported in Table 22.

Table 22  
Significant Ethnicity Differences Among Math CRCT Score Means

Ethnicity	$m$	White	Black/Hispanic
White	802.86		
Black/Hispanic	781.87	Ns	
Asian/Asian Indian	824.42	Ns	ns

**Null Hypothesis 2c: There was no difference in seventh grade math scores based on socioeconomic status and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and socioeconomic status on student performance on the seventh grade math CRCT. The ANOVA indicated (Table 23) no significant interaction between biology EOCT performance levels and socioeconomic status,  $F(1, 1169) = 0.15, p = 0.86$ ; however, there is a significant difference in 7<sup>th</sup> grade math CRCT scores based on the three biology EOCT performance levels,  $F(2, 1169) = 31.32, p < 0.01$ . There was no difference in math CRCT scores based on socioeconomic status. Students who received free and reduced lunch performed no worse on the math CRCT than students who were better off. There was no significant difference in the math CRCT scores based on socioeconomic status,  $F(1, 1169) = 2.27, p = 0.13$ .

Table 23

Two-Way Analysis of Variance for Math CRCT Scores as a Function of SES and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
SES	1	23818.04	2.27	0.13	<0.01
BPL	2	328763.47	31.32	<0.01	0.05
SES/BPL	2	1604.97	-0.15	0.86	<0.01
Error	1169	10496.31			

Table 24 provides the means and standard deviations for the various subgroups.

Table 24

Means, Standard Deviations and *n* for Math CRCT Scores as a function of SES and BPL

BPL	Does Not Receive Free and Reduced Lunch			Receives Free and Reduced Lunch			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	172	775.80	117.43	148	770.02	116.23	320	773.13	116.73
M	333	802.69	104.61	271	794.21	107.76	604	798.89	106.03
E	167	851.22	47.81	84	835.74	76.99	251	846.04	68.44
Total	672	807.87	103.27	503	794.03	107.90	1175	801.94	105.46

**Null Hypothesis 2d: There was no difference in seventh grade math scores based on disability category and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and disability category on student performance on the seventh grade math CRCT. The ANOVA indicated (Table 25) no significant interaction between biology EOCT performance levels and disability category,  $F(2, 1169) = 0.63, p = .53$ . ; however, there is a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2,1169) = 10.48, p <0.01$ . There was no significant difference in the math CRCT scores based on disability category,  $F(1,1169) = 1.14, p = 0.29$ .

Table 25

Two-Way Analysis of Variance for Math CRCT Scores as a Function of DC and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
DC	1	11931.38	1.14	0.29	<0.01
BPL	2	109849.47	10.48	<0.01	0.02
DC/BPL	2	6592.37	0.63	0.53	<0.01
Error	1169	10479.48			

Table 26 provides the means and standard deviations for the various subgroups.

Students who received special education services performed no worse on the math CRCT than students who did not receive special education services.

Table 26

Means, Standard Deviations and *n* for Math CRCT Scores as a Function of DC and BPL

BPL	Does Not Receive Special Education Services			Receives Special Education Services			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	251	779.31	111.11	69	750.64	133.73	320	773.13	116.73
M	560	793.77	108.05	44	793.77	76.47	604	798.89	106.03
E	242	846.37	69.38	9	837.11	35.58	251	846.04	52.17
Total	1053	805.35	103.97	122	772.57	113.84	1175	801.94	105.40

**Null Hypothesis 2e: There was no difference in seventh grade math scores based on**

**English language proficiency level and tenth grade biology EOCT performance levels.**

A 3X2 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and English language proficiency level on student performance on the seventh grade math CRCT. The ANOVA indicated (Table 27) no significant interaction between biology EOCT performance levels and English language proficiency level,  $F(1, 1170) = 3.53, p = .06$ ; however, there was a significant difference in 7<sup>th</sup> grade



math CRCT scores based on the three biology EOCT performance levels,  $F(2,1170) = 34.29$ ,  $p < 0.01$ . There was no significant difference in the math CRCT scores based on English language proficiency level,  $F(1,1170) = 2.76$ ,  $p = 0.10$ .

Table 27

Two-Way Analysis of Variance for Math CRCT Scores as a Function of ELPL and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
ELPL	1	28555.01	2.76	0.10	<0.01
BPL	2	354750.60	34.29	<0.01	0.06
ELPL/BPL	1	36514.98	3.53	.06	<0.01
Error	1170	10345.85			

Table 28 provides the means and standard deviations for the various subgroups. There appeared to be a significant gap in math CRCT score means between native English speakers and English language learners. However, based on the small *n* value for English language learners, the results were inconclusive.

Table 28

Means, Standard Deviations and *n* for Math CRCT Scores as a Function of ELPL and BPL

BPL	Native English Speaker			English Language Learner			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	315	776.22	111.44	5	578.60	252.65	320	773.13	116.73
M	603	798.87	106.12	1	811.00	-	604	798.89	106.03
E	251	846.04	52.17	-	-	-	251	846.04	68.44
Total	1169	802.89	103.66	6	617.33	245.09	1175	801.94	105.46

### Summary of Null Hypotheses 2a. – 2e for Math.

There were no significant differences for seventh grade math scores based on interactions between biology EOCT performance levels and gender, ethnicity, socioeconomic status, English language proficiency level, and disability category.

Table 29 represents a summary of ANOVA results obtained through the analysis of interactions of math CRCT scores, previously mentioned demographic variables, and biology EOCT performance levels.

Table 29  
Composite Two Way ANOVA Results for Math

	<i>F</i>	<i>df</i>	<i>p</i>
gender/BPL	1.30	2,1169	0.27
ethnicity/BPL	2.08	4,1166	0.81
socioeconomic status/BPL	0.15	2,1169	0.86
disability category/BPL	0.63	2,1169	0.53
English language proficiency level/BPL	3.53	1,1170	0.06

### Null Hypothesis 3a: There was no difference in seventh grade reading scores based on gender and tenth grade biology EOCT performance levels.

A 3 X 2 ANOVA was conducted to evaluate the effects of BPL conditions and gender on 7<sup>th</sup> grade reading CRCT scores. The ANOVA indicated (Table 30) no significant interaction between BPL and gender,  $F(2, 1169) = 1.29, p = .28$ , but significant main effects for BPL  $F(2, 1169) = 353.95, p < .01$  and gender  $F(1, 1169) = 22.26, p < .01$ . The Gender main effect indicated that females did significantly better than did males on reading CRCT scores. There was a significant difference in the reading CRCT scores based on gender,  $F(1, 1169) = 22.26, p < 0.01$ .

Table 30

Two-Way Analysis of Variance for Reading CRCT Scores as a Function of Gender and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta</i> <sup>2</sup>
Gender	1	6757.55	22.26	<0.01	0.02
BPL	2	107465.40	353.95	<0.01	0.38
Gender/BPL	2	391.73	1.29	.28	<0.01
Error	1169	303.62			

Table 31 provides the means and standard deviations for the various subgroups.

Generally, females performed better than males on the reading CRCT.

Table 31

Means, Standard Deviations and *n* for Reading CRCT Scores as a Function of Gender and BPL

BPL	<i>n</i>	Female		<i>n</i>	Male		<i>n</i>	Total	
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
DNM	169	811.16	15.60	151	803.93	14.56	320	807.75	15.52
M	302	803.93	16.59	302	824.23	18.55	604	825.92	17.66
E	97	849.69	22.97	154	844.70	17.19	251	846.63	19.73
Total	568	826.48	21.69	607	824.37	22.52	1175	825.39	22.14

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there was no difference in seventh grade reading CRCT scores based on gender and tenth grade biology EOCT performance levels. The *t* tests were conducted for gender and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 4.27, p < 0.01$ , and the M level,  $t(602) = 2.35, p = 0.02$ , but not at the E level,  $t(249) = 1.96, p = 0.05$ . The null hypothesis was rejected in terms of the DNM category and the M category but not the E category. (Table 32) Females performed better than males in the *does not meet* and *meets* categories, and performed equally in the *exceeds* category.

Table 32

Independent –Samples *t* Test of Differences of Means  
of Reading CRCT Scores by Gender and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	4.27	318	<0.01
M	2.35	602	0.02
E	1.96	249	0.05

There was a significant difference in seventh grade reading CRCT scores of students who belonged to three performance categories based on the tenth grade biology EOCT scores. The students who scored the highest on the biology EOCT (exceeds) had the highest mean on the seventh grade reading CRCT (846.63); students who scored in the middle on the biology EOCT also scored in the middle on the seventh grade reading CRCT (825.92), and students who scored at the bottom on the tenth grade biology EOCT also scored at the bottom on the seventh grade reading CRCT (807.75). The students were separated significantly on their science performance levels as early as the seventh grade.

Follow up tests were conducted to evaluate the significant differences among the reading CRCT score means. Post hoc comparisons were conducted using the Tukey HSD test. This is a test that does not assume equal variances among the three means. There was a significant difference in the reading CRCT means between the students who did not meet the standards on the biology EOCT and those who met the standards. There was a significant difference in the means between students who did not meet the standards and those who exceeded the standards on the biology EOCT. There was also a significant difference in the means between students who met the standards and those who exceeded the standards. The means of the reading CRCT scores, as well as the significant differences among the science CRCT score means are reported in Table 33

Table 33

## Significant Differences Among Reading CRCT Score Means

BPL	<i>M</i>	DNM	<i>M</i>
DNM	807.75		
M	825.92	*	
E	846.63	*	*

\* The difference in means of Reading CRCT Scores of the three BPL groups is significant at the  $p < 0.05$  level.

**Null Hypothesis 3b: There was no difference in seventh grade reading scores based on ethnicity and tenth grade biology EOCT performance levels.**

A 3X3 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and ethnicity on student performance on the seventh grade reading CRCT. The ANOVA indicated (Table 34) no significant interaction between biology EOCT performance levels and ethnicity,  $F(4, 1166) = 0.94, p = .44$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2, 1166) = 57.22, p < 0.01$ . There was no ethnic difference on the seventh grade reading CRCT scores. There was no difference in the reading CRCT scores based on ethnicity,  $F(2, 1166) = 0.48, p = 0.62$ .

Table 34

## Two-Way Analysis of Variance for Reading CRCT Scores as a Function of Ethnicity and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta</i> <sup>2</sup>
Ethnicity	2	148.05	0.48	0.62	<0.01
BPL	2	17685.71	57.22	<0.01	0.09
Ethnicity/BPL	4	290.26	-0.94	0.44	<0.01
Error	1166	309.09			

Table 35 provides the means and standard deviations for the various subgroups.

Table 35

Means, Standard Deviations and *n* for Reading CRCT Scores as a Function of Ethnicity and BPL

BPL	<i>n</i>	White		Black/Hispanic			Asian/Asian Indian			Total		
		<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	276	808.32	15.84	32	805.22	14.35	12	801.33	8.02	320	807.75	15.52
M	544	826.05	17.81	48	822.96	14.87	12	831.75	20.53	604	825.92	17.63
E	241	846.50	20.00	3	843.33	20.84	7	852.43	5.03	251	846.63	19.73
Total	1061	826.08	22.25	83	816.86	17.76	31	824.65	24.51	1175	825.39	22.14

**Null Hypothesis 3c: There was no difference in seventh grade reading scores based on socioeconomic status and tenth grade biology EOCT performance levels.**

A 3X 2 ANOVA was conducted to evaluate the effects of BPL conditions and socioeconomic status on reading 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 36) no significant interaction between BPL and socioeconomic status,  $F(2, 1169) = .98, p = .38$ , but significant main effects for BPL  $F(2, 1169) = 310.82, p < .01$  and socioeconomic status,  $F(1, 1169) = 18.43, p < .01$ . The Socioeconomic status main effect indicated that students who did not receive free and reduced lunch did significantly better than students who receive free and reduced lunch on reading CRCT scores. The BPL main effect indicated those with higher BPL scores also performed better on reading CRCT scores at all levels of BPL. There was a significant difference in the reading CRCT scores based on socioeconomic status,  $F(1, 1169) = 18.43, p < .01$ .

Table 36

Two-Way Analysis of Variance for Reading CRCT Scores as a Function of SES and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
SES	1	5617.15	18.43	<0.01	0.02
BPL	2	94711.48	310.82	<0.01	0.35
SES/BPL	2	297.22	0.98	0.38	<0.01
Error	1169	304.72			

Table 37 provides the means and standard deviations of the various subgroups. Generally, students who received free and reduced lunch performed worse than students who did not receive free and reduced lunch on the reading CRCT

Table 37

Means, Standard Deviations and *n* for Reading CRCT Scores as a function of SES and BPL

BPL	Does Not Receive Free and Reduced Lunch			Receives Free and Reduced Lunch			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	172	809.26	14.71	148	805.99	16.29	320	807.75	15.52
M	333	827.67	18.28	271	823.76	16.66	604	825.92	17.66
E	167	849.06	20.09	84	841.80	76.99	251	846.63	19.73
Total	672	828.27	22.82	503	821.54	20.06	1175	825.39	22.14

A series of independent-samples t tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade reading CRCT scores based on socioeconomic status (SES) and tenth grade biology EOCT performance levels. The t tests were conducted for SES and each of the three biology performance levels. The test was not significant at the DNM level,  $t(318) = 1.89, p = 0.06$ . The test was significant at the M level,  $t(602) = 2.72, p < 0.01$ , and at the E level,  $t(249) = 2.79, p < 0.01$ . The null hypothesis was rejected in terms of the M category and the E category, but not the DNM category. (Table 38) Students receiving free and reduced lunch performed worse than students not receiving free and

reduced lunch in the *meets* and *exceeds* categories. The two groups performed equally in the *does not meet* category.

Table 38

Independent –Samples *t* Test of Differences  
of Means of Reading CRCT Scores by SES and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	1.89	318	0.06
M	2.72	602	<0.01
E	2.79	249	<0.01

**Null Hypothesis 3d: There was no difference in seventh grade reading scores based on disability category and tenth grade biology EOCT performance levels.**

A 3X 2 ANOVA was conducted to evaluate the effects of BPL conditions and disability category on reading 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 39) no significant interaction between BPL and disability category,  $F(2, 1169) = .20, p = .82$ , but significant main effects for BPL  $F(2, 1169) = 94.00, p < .01$  and disability category  $F(1, 1169) = 24.53, p < .01$ . The disability category main effect indicated that students who did not receive special education services did significantly better than students who received special education services on reading CRCT scores. The BPL main effect indicated those with higher BPL scores also performed better on reading CRCT scores at all levels of BPL. There was a significant difference in the reading CRCT scores based on disability category,  $F(1, 1169) = 24.53, p < 0.01$ .



Table 39

Two-Way Analysis of Variance for Reading CRCT Scores as a Function of DC and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
DC	1	7314.13	24.53	<0.01	0.02
BPL	2	28016.82	94.00	<0.01	0.14
DC/BPL	2	58.43	0.20	0.82	<0.01
Error	1169	298.10			

Table 40 provides the means and standard deviations of the various subgroups. Generally, students not receiving special education services performed better than students receiving special education services.

Table 40

Means, Standard Deviations and n for Reading CRCT Scores as a function of DC and BPL

BPL	Does Not Receive Special Education Services			Receives Special Education Services			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	251	810.43	14.84	69	797.99	14.04	320	807.75	15.52
M	560	826.66	17.41	44	816.45	18.36	604	825.92	17.66
E	242	847.04	19.74	9	837.67	17.05	251	846.63	19.73
Total	1053	827.47	21.45	122	807.43	19.74	1175	825.39	22.14

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade reading CRCT scores based on disability category and tenth grade biology EOCT performance levels. The *t* tests were conducted for disability category and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 6.24, p < 0.01$  and the M level,  $t(602) = 3.73, p < 0.01$ . The test was not significant at the E level,  $t(249) = 1.70, p = 0.09$ . The null hypothesis was rejected in terms of the DNM category and the M category, but not the E category. (Table 41) Students receiving special education services performed worse than students who did not receive

special education services in the *does not meet* and *meets* categories. The groups performed equally in the *exceeds* category.

Table 41

Independent –Samples *t* Test of Differences  
of Means of Reading CRCT Scores by DC and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	6.24	318	<0.01
M	3.73	602	<0.01
E	1.70	249	0.09

**Null Hypothesis 3e: There was no difference in seventh grade reading scores based on English language proficiency level and tenth grade biology EOCT performance levels.**

A 3 X 2 ANOVA was conducted to evaluate the effects of BPL conditions and English language proficiency level on reading 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 42) no significant interaction between BPL and English language proficiency level,  $F(1, 1170) = 2.24, p = 0.14$ , but significant main effects for BPL  $F(2, 1170) = 275.71, p < .01$  and English language proficiency level,  $F(1, 1170) = 11.53, p < .01$ . The English language proficiency level main effect indicated that native English speakers performed significantly better than did English language learners on reading CRCT scores. The BPL main effect indicated those with higher BPL scores also performed better on reading CRCT scores at all levels of BPL. There was a significant difference in the reading CRCT scores based on English language proficiency level,  $F(1, 1169) = 11.53, p < .01$ .

Table 42

Two-Way Analysis of Variance for Reading CRCT Scores as a Function of ELPL and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
ELPL	1	3531.04	11.53	<0.01	0.01
BPL	2	84470.81	275.71	<0.01	0.32
ELPL/BPL	1	686.59	2.24	.14	<0.01
Error	1169	303.36			

Table 43 provides the means and standard deviations for the various subgroups.

Generally, Native English speakers performed better than English language learners on the reading CRCT.

Table 43

Means, Standard Deviations and n for Reading CRCT Scores as a Function of ELPL and BPL

	Native English Speaker			English Language Learner			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
BPL									
DNM	315	808.03	15.30	5	789.80	20.52	320	807.78	15.52
M	603	825.99	17.57	1	779.00	-	604	825.92	17.66
E	251	846.63	19.73	-	-	-	251	846.63	19.73
Total	1169	825.58	21.10	6	814.74	79.66	1175	825.39	22.13

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade reading CRCT scores based on English language proficiency level (ELPL) and tenth grade biology EOCT performance levels. The *t* tests were conducted for ELPL and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 2.63, p = 0.01$  and the M level,  $t(602) = 2.67, p = 0.01$ . Out of the 1175 students tested, there were only 6 students who were English language learners. Of those 6 students, none of them exceeded the standards. Therefore, the *t* test could

not be conducted at the E level. The null hypothesis was rejected in terms of the DNM category and the M category, but not the E category. (Table 44) Native English speakers did better than English language learners (ELL) in the *does not meet* and *meets* categories. Results in the *exceeds* category are inconclusive due to the small *n* value and the fact that no ELL students were in the *exceeds* category.

Table 44

Independent –Samples *t* Test of Differences  
of Means of Reading CRCT Scores by ELPL and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	2.63	318	0.01
M	2.67	602	0.01
E	-	-	-

**Summary of Null Hypotheses 3a. – 3e for Reading.**

There were no significant differences for seventh grade reading scores based on interactions between Biology EOCT performance levels and gender, ethnicity, socioeconomic status, English language proficiency level, and disability category.

Table 45 represents a summary of ANOVA results obtained through the analysis of interactions of reading CRCT scores, previously mentioned demographic variables, and biology EOCT performance levels.

Table 45

Composite Two Way ANOVA Results for Reading

	<i>F</i>	<i>df</i>	<i>p</i>
gender/BPL	1.29	2,1169	0.28
ethnicity/BPL	0.94	4,1166	0.44
socioeconomic status/BPL	0.98	2,1169	0.38
disability category/BPL	0.20	2,1169	0.82
English language proficiency level/BPL	2.24	1,1169	0.14

**Null Hypothesis 4a: There was no difference in seventh grade language arts scores based on gender and tenth grade biology EOCT performance levels.**

A 3 X 2 ANOVA was conducted to evaluate the effects of biology EOCT performance level (BPL) conditions and gender on 7<sup>th</sup> grade language arts CRCT scores. Table 46 shows that there was a significant interaction between the effects of gender and BPL on language arts. Since the interaction of BPL and gender was significant,  $F(2, 1169) = 4.23, p = 0.02$ , main effects were ignored and simple effects considered. Table 47 shows the number of subjects, the means, and standard deviations of science scores for each cell. Games-Howell post hoc tests revealed that among students with BPL scores of DNM, females did better than males at a significant level,  $p < .01, d = .64$ , a large effect and once again females outperformed males at the M level,  $p = .01, d = .29$  a moderate effect. There was no significant difference between Females and Males at the E level. Thus although M and F did not differ significantly at main effects on ELA, there was a substantial difference at the DNM and M levels. There was a significant difference in the language arts CRCT scores based on gender,  $F(1,1169) = 34.71, p < 0.01$ .

Table 46

Two-Way Analysis of Variance for Language Arts CRCT Scores as a Function of Gender and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
Gender	1	11900.87	34.71	<0.01	.03
BPL	2	102723.09	299.69	<0.01	.34
Gender X BPL	2	1451.32	4.23	0.02	.01
Error	1169	342.88			

Table 4.2 provides the means and standard deviations for the various subgroups.

Generally females performed better than males on the Language Arts CRCT.

Table 47

Means, Standard Deviations and *n* for Language Arts CRCT Scores as a Function of Gender and BPL

BPL	<i>n</i>	Female		<i>n</i>	Male		<i>n</i>	Total	
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
DNM	169	818.02	19.03	151	806.21	17.92	320	812.47	19.40
M	302	832.70	17.45	302	827.47	18.74	604	830.08	18.28
E	97	852.76	20.43	154	849.06	18.51	251	850.49	19.53
Total	568	831.76	21.80	607	827.67	23.89	1175	829.65	22.99

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade language arts CRCT scores based on gender and tenth grade biology EOCT performance levels. The *t* tests were conducted for gender and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 5.67, p < 0.01$  and the M level,  $t(602) = 3.55, p < 0.01$ , but not at the E level,  $t(249) = 1.46, p = 0.14$ . The null hypothesis was rejected in terms of the DNM category and the M category, but not the E category. (Table 48) Females performed better than males in the *does not meet* and the *meets* categories, but males and females performed equally in the *exceeds* category.

Table 48

Independent –Samples *t* Test of Differences  
of Means of Language Arts CRCT Scores by Gender and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	5.67	318	<0.01
M	3.55	602	<0.01
E	1.46	249	0.14

There was a significant difference in seventh grade language arts CRCT scores of students who belonged to three performance categories based on the tenth grade biology EOCT scores. The students who scored the highest on the biology EOCT (exceeds) had the highest mean on the seventh grade language arts CRCT (850.49); students who scored in the middle on the biology EOCT also scored in the middle on the seventh grade language arts CRCT (830.08), and students who scored at the bottom on the tenth grade biology EOCT also scored at the bottom on the seventh grade language arts CRCT (812.47). The students were separated significantly on their science performance levels as early as the seventh grade.

Follow up tests were conducted to evaluate the significant differences among the language arts CRCT score means. Post hoc comparisons were conducted using the Tukey HSD test. There was a significant difference in the means between the students who did not meet the standards on the reading CRCT and those who met the standards. There was a significant difference in the means between students who did not meet the standards and those who exceeded the standards. There was also a significant difference in the means between students who met the standards and those who exceeded the standards. The means of the reading CRCT scores, as well as the significant differences among the science CRCT score means are reported in Table 49.

Table 49

## Significant Differences Among Language Arts CRCT Score Means

BPL	<i>M</i>	DNM	<i>M</i>
DNM	812.47		
M	830.08	*	
E	850.49	*	*

\* The difference in means of Language Arts CRCT Scores of the three BPL groups is significant at the  $p < 0.05$  level.

**Null Hypothesis 4b: There was no difference in seventh grade language arts scores based on ethnicity and tenth grade biology EOCT performance levels.**

A 3X3 ANOVA was conducted to evaluate the effects of three performance levels on the biology end of course test and ethnicity on student performance on the seventh grade language arts CRCT. The ANOVA indicated (Table 50) no significant interaction between biology EOCT performance levels and ethnicity,  $F(4, 1166) = 0.66, p = .62$ ; however, there was a significant difference in 7<sup>th</sup> grade science CRCT scores based on the three biology EOCT performance levels,  $F(2, 1166) = 42.68, p < 0.01$ . There was no difference in the reading CRCT scores based on ethnicity,  $F(2, 1166) = 0.70, p = 0.499$ .

Table 50

## Two-Way Analysis of Variance for Language Arts CRCT Scores as a Function of Ethnicity and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
Ethnicity	2	254.43	0.70	0.50	<0.01
BPL	2	15050.04	42.68	<0.01	0.07
Ethnicity/BPL	4	230.93	0.66	0.62	<0.01
Error	1166	352.66			



Table 51 provides the means and standard deviations for the various subgroups.

Table 51

Means, Standard Deviations and *n* for Language Arts CRCT Scores as a Function of Ethnicity and BPL

BPL	White			Black/Hispanic			Asian/Asian Indian			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
DNM	276	813.53	19.02	32	803.59	22.46	12	811.92	13.79	320	812.47	19.40
M	544	830.69	18.41	48	823.37	14.97	12	829.50	14.97	604	830.08	18.28
E	241	850.58	19.55	3	857.67	36.12	7	844.57	9.66	251	850.49	19.53
Total	1061	830.74	22.82	83	816.99	22.48	31	826.10	20.09	1175	829.65	22.99

**Null Hypothesis 4c: There was no difference in seventh grade language arts scores based on socioeconomic status and tenth grade biology EOCT performance levels.**

A 3 X 2 ANOVA was conducted to evaluate the effects of BPL conditions and socioeconomic status on language arts 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 52) no significant interaction between BPL and socioeconomic status,  $F(2, 1169) = .18$ ,  $p = .83$ , but significant main effects for BPL  $F(2, 1169) = 261.02$ ,  $p < .01$  and socioeconomic status  $F(1, 1169) = 11.61$ ,  $p < .01$ . The socioeconomic status main effect indicated that students who did not receive free and reduced lunch did significantly better on language arts CRCT scores than students who received free and reduced lunch. The BPL main effect indicated those with higher BPL scores also performed better on language arts CRCT scores at all levels of BPL. There was a significant difference in the language arts CRCT scores based on socioeconomic status,  $F(1, 1169) = 11.61$ ,  $p = < 0.01$ .

Table 52

Two-Way Analysis of Variance for Language Arts CRCT Scores as a Function of SES and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta</i> <sup>2</sup>
SES	1	4092.62	11.61	<0.01	0.01
BPL	2	91991.80	261.02	<0.01	0.31
SES/BPL	2	63.83	0.18	0.83	<0.01
Error	1169	352.43			

Table 53 provides the means and standard deviations for the various subgroups.

Students who did not receive free and reduced lunch performed better than those receiving free and reduced lunch on the language arts CRCT.

Table 53

Means, Standard Deviations and *n* for Language Arts CRCT Scores as a Function of SES and BPL

BPL	Does Not Receive Free and Reduced Lunch			Receives Free and Reduced Lunch			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	172	813.91	18.96	148	810.80	19.84	320	812.47	19.40
M	333	831.96	17.58	271	827.77	18.88	604	830.08	18.28
E	167	852.18	20.08	84	847.14	18.03	251	850.49	19.53
Total	672	832.27	23.01	503	826.02	22.48	1175	829.65	22.99

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade language arts CRCT scores based on socioeconomic status (SES) and tenth grade biology EOCT performance levels. The *t* tests were conducted for SES and each of the three biology performance levels. The test was significant at the M level,  $t(602) = 2.82$ ,  $p = 0.01$ , but not at the DNM level,  $t(318) = 1.43$ ,  $p = 0.15$  or the E level,  $t(249) = 0.05$ ,  $p = 0.05$ . The null hypothesis was rejected in terms of the M category, but not the DNM category or the E category. (Table 54) Students who did not receive free and reduced lunch did better than students who received free and reduced lunch in the *meets* category, but students in the two subgroups performed equally in the *does not meet* and *exceeds* categories.

Table 54

Independent –Samples *t* Test of Differences  
of Means of Language Arts CRCT Scores by SES and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	1.43	318	0.15
M	2.82	602	0.01
E	1.94	249	0.01

**Null Hypothesis 4d: There was no difference in seventh grade language arts scores**

**based on disability category and tenth grade biology EOCT performance levels.**

A 3X 2 ANOVA was conducted to evaluate the effects of BPL conditions and disability category on language arts 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 55) no significant interaction between BPL and disability category,  $F(2, 1169) = 3.00, p = .05$ , but significant main effects for BPL  $F(2, 1169) = 83.49, p < .01$  and disability category  $F(1, 1169) = 37.75, p < .01$ . The disability category main effect indicated that students who did not receive special education services did significantly better on Language Arts CRCT scores than students who received special education services. The BPL main effect indicated those with higher BPL scores also performed better on Language Arts CRCT scores at all levels of BPL. There was a significant difference in the language arts CRCT scores based on disability category,  $F(1, 1169) = 37.75, p < 0.01$ .

Table 55

Two-Way Analysis of Variance for Language Arts CRCT Scores as a Function of DC and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
DC	1	12324.48	37.75	<0.01	0.03
BPL	2	27260.25	83.49	<0.01	0.13
DC/BPL	2	964.97	2.96	0.05	0.01
Error	1169	326.51			

Table 56 provides the means and standard deviations for the various subgroups.

Generally, students who did not receive special education services performed better on the language arts CRCT than those who received special education services.

Table 56

Means, Standard Deviations and *n* for Language Arts CRCT Scores as a function of DC and BPL

BPL	Does Not Receive Special Education Services			Receives Special Education Services			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
DNM	251	816.16	18.17	69	799.06	17.86	320	812.47	19.40
M	560	831.66	17.37	44	810.07	17.90	604	830.08	18.28
E	242	850.69	19.40	9	845.22	23.43	251	850.49	19.53
Total	1053	832.34	21.57	122	807.43	22.99	1175	829.65	22.99

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there is no difference in seventh grade language arts CRCT scores based on disability category (DC) and tenth grade biology EOCT performance levels. The *t* tests were conducted for DC and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 6.95$ ,  $p < 0.01$  and the M level,  $t(602) = 2.65$ ,  $p = 0.01$ , but not the E level,  $t(249) = 0.82$ ,  $p = 0.41$ . The null hypothesis was rejected in terms of the DNM category and the M category, but not the E category. (Table 57) Students not receiving special education services performed better than students receiving special education services

in the does not meet and meets categories, but the two groups performed equally in the exceeds category.

Table 57

Independent –Samples *t* Test of Differences  
of Means of Language Arts CRCT Scores by DC and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	6.95	318	<0.01
M	2.65	602	0.01
E	0.82	249	0.41

**Null Hypothesis 4e: There was no difference in seventh grade language arts scores based on English language proficiency level and tenth grade biology EOCT performance levels.**

A 3 X 2 ANOVA was conducted to evaluate the effects of BPL conditions and English language proficiency level on math 7<sup>th</sup> grade CRCT scores. The ANOVA indicated (Table 58) no significant interaction between BPL and English language proficiency level,  $F(1, 1170) = .89, p=.35$ , but significant main effects for BPL  $F(2, 1170)= 230.22, p <.01$  and English language proficiency level,  $F(1,1170) = 14.00, p <.01$ . The English language proficiency level main effect indicated that native English speakers did significantly better than did English language learners on language arts CRCT scores. The BPL main effect indicated those with higher BPL scores also performed better on Math CRCT scores at the does not meet and meets levels of BPL. There was a significant difference in the language arts CRCT scores based on English language proficiency level,  $F (1,1170) = 14.00, p < 0.01$ .

Table 58

Two-Way Analysis of Variance for Language Arts CRCT Scores as a Function of ELPL and BPL

Variables and Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>eta2</i>
ELPL	1	4906.50	14.00	<0.01	0.01
BPL	2	80759.46	230.22	<0.01	0.28
ELPL/BPL	1	313.62	.89	.35	<0.01
Error	1170	350.79			

Table 59 provides the means and standard deviations for the various subgroups.

Generally native English speakers did better than English language learners on the language arts CRCT.

Table 59

Means, Standard Deviations and *n* for Language Arts CRCT Scores as a Function of ELPL and BPL

	Native English Speaker			English Language Learner			Total		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
BPL									
DNM	315	812.92	18.86	5	784.20	32.84	320	812.47	19.40
M	603	830.16	18.79	1	782.00	-	604	830.08	18.28
E	251	850.49	19.53	-	-	-	251	850.49	19.53
Total	1169	829.88	22.73	6	783.83	29.38	1175	829.65	23.00

A series of independent-samples *t* tests was conducted to evaluate the null hypothesis that there was no difference in seventh grade language arts CRCT scores based on English language proficiency level (ELPL) and tenth grade biology EOCT performance levels. The *t* tests were conducted for ELPL and each of the three biology performance levels. The test was significant at the DNM level,  $t(318) = 3.34$ ,  $p < 0.01$  and the M level,  $t(602) = 2.65$ ,  $p = 0.01$ . Out of the 1175 students tested, there were only 6 students who were English language learners. Out of those 6 students, none of them exceeded the standards. Therefore, the *t* test could not be conducted at the E level. The null hypothesis was rejected in terms of the DNM

category and the M category, but not the E category. (Table 60) Native English speakers did better than English language learners (ELL) in the *does not meet* and *meets* category. Results in the *exceeds* category were inconclusive due to the small *n* value and the fact that no ELL students were in the exceeds category.

Table 60

Independent –Samples *t* Test of Differences  
of Means of Language Arts CRCT Scores by ELPL and BPL

BPL	<i>t</i>	<i>df</i>	<i>p</i>
DNM	3.34	318	<0.01
M	2.65	602	0.01
E	-	-	-

**Summary of Null Hypotheses 4a. – 4e for Language Arts.**

There were no significant differences for seventh grade language arts scores based on interactions between biology EOCT performance levels and ethnicity, socioeconomic status, English language proficiency level, and disability category. However, there was a significant difference for seventh grade language arts scores based on interaction between Biology EOCT performance levels and gender. Table 61 represents a summary of ANOVA results obtained through the analysis of interactions of language arts CRCT scores, previously mentioned demographic variables, and biology EOCT performance levels.

Table 61

Composite Two Way ANOVA Results for Language Arts

	<i>F</i>	<i>df</i>	<i>p</i>
gender/BPL	4.23	2,1169	0.02
ethnicity/BPL	0.66	4,1166	0.62
socioeconomic status/BPL	0.18	2,1169	0.83
disability category/BPL	2.96	2,1169	0.05
English language proficiency level/BPL	0.89	1,1170	0.35

**Null Hypothesis 5a: There was no relationship between the performance categories on the biology EOCT and gender.**

A two-way contingency analysis on 11<sup>th</sup> graders taking the biology ECOT test was conducted to determine whether gender was independent of the performance categories on the biology ECOT. Gender and BPL level were found to be to be significantly related, Pearson  $\chi^2(2, N=1175)=12.68, p <.01$ . The standardized residual of -2.2 indicated that fewer females than expected exceeded the standards on the biology EOCT. Also, more males than expected exceeded the standard with a standardized residual of 2.1. The information included in Table 62 represents frequencies and percentages of how males and females performed on the biology EOCT.

Table 62

Chi Square Data Relating Gender and Biology EOCT Performance Level

BPL	Gender				Total	
	Female		Male		<i>f</i>	<i>%</i>
	<i>f</i>	<i>%</i>	<i>f</i>	<i>%</i>	<i>f</i>	<i>%</i>
DNM	169	52.8	151	47.2	320	100
M	302	50.0	302	50.0	604	100
E	97	38.6	154	66.4	251	100



**Null Hypothesis 5b: There was no relationship between the performance categories on the biology EOCT and ethnicity.**

A two-way contingency analysis of 11<sup>th</sup> graders taking the biology ECOT test was conducted to determine whether ethnicity was independent of the performance categories on the biology ECOT. Ethnicity and BPL level were found to be to be significantly related, Pearson  $\chi^2(4, N=1175)=20.80, p <.01$ . Standardized residual of -3.5 indicated that fewer Black and Hispanic students than expected exceeded the standards on the biology EOCT. Also, more Black and Hispanic students than expected did not meet the standard with a standardized residual of 2.0. The information included in table 63 represents frequencies and percentages related to the performance of White students, Black/Hispanic students, and Asian/Asian Indian students performed on the biology EOCT.

Table 63

Chi Square Data Relating Ethnicity and Biology EOCT Performance Level

	Ethnicity						Total	
	White		Black and Hispanic		Asian and Asian Indian			
BPL	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
DNM	276	86.3	32	10.0	12	3.8	320	100
M	544	90.1	48	7.9	12	2.0	604	100
E	241	96.0	3	1.2	7	2.8	251	100

**Null Hypothesis 5c: There was no relationship between the performance categories on the biology EOCT and socioeconomic status.**

A two-way contingency analysis on 11<sup>th</sup> graders taking the biology EOCT test was conducted to determine whether socioeconomic status was independent of the performance categories on the biology ECOT. Socioeconomic status and BPL level were found to be

significantly related, Pearson  $\chi^2(2, N=1175) = 11.54, p < .01$ . Standardized residual of -2.3 indicated that fewer students than expected who received free and reduced lunch exceeded the standards on the biology EOCT. Also, more students than expected who did not receive free and reduced lunch exceeded the standards on the biology EOCT with a standardized residual of 2.0. The information included in table 64 represents frequencies and percentages related to the performance of students who received free and reduced lunch and those who did not receive free and reduced lunch on the biology EOCT.

Table 64

Chi Square Data Relating Socioeconomic Status and Biology EOCT Performance Level

BPL	Socioeconomic Status				Total	
	Free and Reduced Lunch Participants		No			
	Yes		No		<i>f</i>	%
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
DNM	172	53.8	148	46.3	320	100
M	333	55.1	271	44.9	604	100
E	67	66.5	154	33.5	251	100

**Null Hypothesis 5d: There was no relationship between the performance categories on the biology EOCT and disability category.**

A two-way contingency analysis on 11<sup>th</sup> graders taking the Biology ECOT test was conducted to determine whether disability category was independent of the performance categories on the biology ECOT. Disability category and BPL level were found to be significantly related, Pearson  $\chi^2(2, N=1175) = 61.68, p < .01$ . A standardized residual of -2.1 indicated that fewer students than expected who did not receive special education services did not meet the standards on the biology EOCT. More students than expected who received special education services did not meet the standards with a standardized residual of 6.2.

Fewer students than expected who received special education services met the standards with a standardized residual of -2.4. In addition, fewer students than expected who received special education services exceeded the standards with a standardized residual of -3.3. The information included in Tables 65 provides frequencies and percentages of how students who received special education services and those who did not receive special education services performed on the biology EOCT.

Table 65

Chi Square Data Relating Disability Category and Biology EOCT Performance Level

BPL	Disability Category Receives Special Education Services				Total	
	No		Yes			
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
DNM	251	78.4	69	21.6	320	100
M	560	92.7	44	7.3	604	100
E	242	96.4	9	3.6	251	100

**Null Hypothesis 5e: There was no relationship between the performance categories on the biology EOCT and English language proficiency level.**

A two-way contingency analysis on 11<sup>th</sup> graders taking the biology ECOT test was conducted to determine whether English language proficiency level was independent of the performance categories on the biology ECOT. There was no significant relationship between the performance categories on the biology EOCT and English language proficiency level because out of the 1175 students who were tested, only 6 students were categorized as English language learners. Of these 6 students, 5 did not meet the biology EOCT standards. Therefore, no further analysis was conducted.

Table 66 represents a summary of chi square results obtained through the analysis of interactions of biology EOCT performance levels and previously mentioned demographic variables.

Table 66

Composite Chi Square Results for Biology EOCT Performance Level (BPL)

	Pearson Chi-Square	<i>df</i>	<i>p</i>
gender	12.68	2	<0.01
ethnicity	20.80	4	<0.01
socioeconomic status	11.54	2	<0.01
disability category	61.68	2	<0.01
English language proficiency level	9.67	2	0.01

## **CHAPTER 5**

### **FINDINGS, IMPLICATIONS, AND RECOMMENDATIONS**

#### **Introduction**

The federal No Child Left Behind Act has placed pressure on teachers and students in the United States to perform at a certain level. Science has been an area of particular interest when considering student achievement. According to the Georgia Department of Education, the first end of course tests (EOCTs) were administered in 2004. The fact that there have always been students who have not passed the biology test raised the question of what factors in seventh grade academics were associated with overall success in tenth grade biology?

The purpose of this study was to analyze student performance on criterion referenced competency tests (CRCTs) in reading, language arts, mathematics, and science taken by students in seventh grade. Due to the fact that information presented on the seventh grade science CRCTs dealt with some of the same concepts that were presented on the tenth grade biology EOCT, analysis of seventh grade reading, language arts, math, and science CRCT scores of students who went on to take the tenth grade biology EOCT allowed researchers to pinpoint factors that could possibly contribute to different performance levels on the tenth grade biology EOCT.

## **Review of Literature**

As a result of increased accountability in the United States, states have implemented policies and procedures to increase student achievement. Because accountability for educators was an important part of No Child Left Behind (NCLB), assessment has emerged as a major focus in schools in the United States. When evaluating the additional impact of the emphasis on accountability, it has become important to remember that differences exist in students and that these differences should always be considered. These disparities could have contributed to differences in test scores on standardized tests. Four categories that have been previously investigated to determine their effects on academic performance are gender, ethnicity, socioeconomic status, and disability category.

Evidence of a gender achievement gap was found by various researchers. There was also evidence that supported the idea that boys and girls were equal in terms of academic potential. The important thing to remember when analyzing the effect of gender on student achievement was that there was much more research that should be done and that previous research could be used as a stepping stone to new findings that would serve to improve student achievement. Park and Reis (2001) found that fewer girls and women pursued careers in math and science in the previous ten years. They indicated that this was caused by a decrease in self-esteem among young girls and increasingly negative attitudes toward both mathematics and science. A study conducted by Miles and Rehorn (1999) affirmed the notion of a gender gap and attributed the problem to test bias against girls, male genetic superiority, more score variability among boys, the timed nature of the test, girls being less mathematically inclined, lower parental expectations for girls, and different teacher expectations for girls. A recent article written by Bailey and Whitmire (2010) reinforced the

notion of a gender gap that existed in the area of academic achievement. The authors wrote that boys have always lagged behind girls in terms of literacy.

Ethnicity has also been examined in terms of whether or not an achievement gap existed among students of different ethnic backgrounds. In a 1997 article, William F. Tate discussed this achievement gap as it related to mathematics achievement. He found an achievement gap between Caucasian and minority students in mathematics achievement, and this gap only narrowed for African American students on items that reflected the mastery of low-level and basic skills. Jeremy D. Visone (2009) offered another perspective about ethnicity and student achievement as they related to standardized testing in science. Visone described a study done on reading and its relation to science achievement. This study was done in 90/90/90 schools, schools which had greater than ninety percent of students eligible for free and reduced lunch, ninety percent identified as ethnic minorities, and ninety percent meeting high academic standards on test achievement. According to Visone, “these schools made deliberate decisions to trade content area time for reading comprehension and nonfiction writing instruction” (p.50). The results of the study showed an increase in student achievement on all standardized test scores in all student groups. This, in turn, led to the conclusion that achievement was not based on ethnicity but was, rather, a result of effort.

Research about how to improve academic achievement of students whose native language was not English identified the primary issue as the reading ability of these students. Regardless of the fact that these students were limited English proficient (LEP), they were still expected to do well in their academic courses and pass standardized tests which were typically administered in English rather than in the students’ first languages. According to Kim and Sturtevant (2010), many ELL students preferred read aloud experiences but had

difficulty with science and social studies textbooks. The authors attributed this to a lack of student motivation. Hargrove (2005) described a study done by a teacher in a bilingual classroom. The focus of this study was how to improve learning and self discipline of gifted, underachieving Hispanic boys. Results of this study indicated that student motivation and individualized teacher attention involving supportive learning environments were essential for student success. Curtin (2005) expanded on the idea of the improvement of academic achievement among ELL students when she described the results of her research. She noted that ELL students benefited greatly from instruction that involved ELL teachers who employed an interactive teaching style which provided cooperative learning opportunities for students.

The effects of socioeconomic factors on student achievement in high school were analyzed by Taylor Curtis and Robert K. Toutkoushian (2005). The authors asserted that the most influential and consistent factors related to student performance were socioeconomic status and the percentage of students in the school who came from low-income families. In addition, they noted that “student performance on standardized tests was affected by the income level and ethnic diversity of the community” (p. 2). Poverty was a limiting factor as far as student achievement was concerned. According to Bracey (2004), children living in poverty were at risk from the moment that they were born. He further asserted that poverty could be a reason for poor student performance in school and on standardized high stakes tests. In addition, he described traits that affluent schools possessed that the majority of poverty stricken schools did not have. Although there had been a great deal of research done about the negative effects of poverty on student achievement, other studies had shown that poverty had little effect on student achievement. Angle and Moseley (2009) found that



student scores on End-of –Instruction Biology I tests were directly related to teacher expectations for students, regardless of SES. Their results showed that teachers who had high achievement expectations assumed the responsibility for their students’ learning. This, in turn, resulted in teachers exhibiting behaviors that served to increase student learning.

The Individuals with Disabilities Education Act served to “define clearly the responsibilities of school districts regarding children with disabilities and to provide a measure of financial support to assist states in meeting their obligations” (Essex, 2005, p. 107). Cawthon (2009) described the most recent revision to this act by saying that it required schools to identify the strengths and weaknesses of each student who had a disability, and to produce an individualized education program (IEP) to ensure that students with disabilities would receive services and opportunities tailored to his or her needs. Juola-Rushton and Rushton (2008) described several ways that educators could reduce student stress associated with taking standardized tests. The authors asserted that teachers needed to be sensitive to the needs and stress levels of individual students. They also suggested that if teachers built a strong classroom community that made students feel safe and valued, students would develop trust in their teachers and thus activate their natural responses to want to learn. According to the No Child Left Behind Act, all students were expected to pass standardized tests. This included students with disabilities. In order to accommodate these students, teachers worked to develop more modifications in already existing inclusive classrooms. The primary goal of an inclusive classroom was to immerse students with disabilities in typical classrooms while making modifications based on the individual learning needs of students. According to Shank et al. (2003), these modifications were designed to reduce curriculum roadblocks. This would, in turn, level the playing field for students and foster student success.

Education is necessary for an individual's advancement. There are many different types of students in a variety of educational situations. Due to the accountability requirements of No Child Left Behind, students will continue to be assessed to measure their academic progress. Furthermore, there will be ongoing efforts to try to improve student performance based on results of these assessments. The use of past and current research about academic performance of different types of students will open the door to future research and developments of new strategies that could improve overall student achievement.

### **Methodology**

This was an ex post facto study that used retrospective causal comparative research as the main research design. Retrospective causal comparative research examined the different performance levels on the biology EOCT in light of student performance on seventh grade CRCTs and the demographic groups of gender, ethnicity, socioeconomic status, and disability level. Using this method, the researcher analyzed the relationship between several independent variables and one dependent variable. Causal comparative research helped the researcher determine the existence of relationships between students who exceeded, met, or did not meet Georgia standards on the biology EOCT and seventh grade reading, language arts, math and science CRCT scores of students. The demographic categories of gender, ethnicity, disability level, and socioeconomic status were factored in to determine what effect, if any, these had on the seventh grade CRCT performance.

## **Research Questions**

- 1) Were there significant differences in performance levels in seventh grade CRCT scores in science, math, reading, and language arts associated with performance categories in tenth grade biology EOCTs and the following demographic variables.
  - a) gender
  - b) ethnicity
  - c) socioeconomic status
  - d) disability category
  - e) English language proficiency level
- 2) Was there a relationship among the categorical variables on the tenth grade biology EOCT and the following demographic variables
  - a) gender
  - b) ethnicity
  - c) socioeconomic status
  - d) disability category
  - e) English language proficiency level

## **Population and Sample**

The sample used in this study was a representative sample reflecting gender, ethnicity, disability level, and socioeconomic status. The group consisted of all of the students from the middle schools in North Georgia County A, County B, and County C who took the math, reading, language arts, and life science CRCTs in the 2006-2007 school year, and subsequently took the biology EOCT in the 10<sup>th</sup> grade in the 2009-2010 school year. In

2006-2007, County A tested 850 students, County B tested 579 students, and County C tested 696 students. The CRCT information for the study was obtained from a census sample of seventh grade life science students who fell into the previously mentioned groups and who attended middle schools in the North Georgia counties of County A, County B, and County C. These middle schools were A1 Middle School, A2 Middle School, and A3 Middle School in County A, B1 Middle School and B2 Middle School in County B, and C1 Middle School, C2 Middle School, and C3 Middle School in County C.

The EOCT score information was taken from the high school records of the same students who took the life science and other CRCTs in the seventh grade at the previously mentioned feeder middle schools. These high schools were A1 High School, A2 High School, and A3 High School in County A, B1 High School and B2 High School in County B, and C1 High School, and C2 High School in County C.

### **Variables in the Study**

For the purposes of this study, the biology EOCT score was the independent variable that was categorized into three groups or levels. The levels of this variable were exceeds, meets, and does not meet the proficiency standards set forth by the State of Georgia. The demographic variables were categorical independent variables. The levels of these variables were as follows:

- 1) gender – male and female
- 2) ethnicity – White, Black and Hispanic, Asian and Asian Indian.
- 3) socioeconomic status – received free and reduced lunch and did not receive free and reduced lunch

- 4) disability category – received special education services and did not receive special education services.
- 5) English language proficiency level – native English speaker and English language learner.

The seventh grade CRCT scores were dependent variables that were analyzed retrospectively in terms of how they were associated with the biology EOCT score categories.

### **Procedure and Data Analysis**

The data used for this study were obtained from the data specialists in the North Georgia counties of County A, County B, and County C. It was obtained in the form of excel spreadsheets which are included in Appendix B. After the data was obtained, it was sorted and analyzed through two-way ANOVA. The Statistical Package for the Social Sciences (SPSS) was employed as the means of data analysis. For the purposes of this study, the independent variables were gender, ethnicity, disability level, socioeconomic status, and CRCT scores. Causal comparative research was used to determine what effect the independent variables had on student performance on biology EOCTs.

ANOVA was used to identify relationships between the seventh grade CRCT scores of students in the demographic groups of gender, ethnicity, socioeconomic status, and disability level and their performance on the biology EOCT. Once the data were collected, the biology EOCT scores were separated into the groups of exceeds, meets, and does not meet. Then, the mean score for each of these groups was taken and compared on the four dependent variables. In terms of the analysis of the effects of gender, ethnicity,

socioeconomic status, and disability level on biology EOCT scores, the chi square method of data analysis was used to determine this relationship.

## **Findings and Discussion**

The null hypotheses were grouped by CRCT and tested in the order of science, math, reading, and language arts. Within these subject areas, the demographic variables were analyzed in the order of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level using two-way ANOVA. The interactions between biology performance levels and demographic variables as well as main effects and simple effects were analyzed to determine the presence or absence of significant relationships.

### **Science CRCT**

Science CRCT scores were analyzed to evaluate the effects of biology EOCT performance level (BPL) conditions and the demographic variables of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level on science 7<sup>th</sup> grade CRCT scores.

In terms of student performance on the science CRCT and the biology EOCT, if students did not meet the standards on the seventh grade science CRCT, they also did not meet the standards on the biology EOCT in the tenth grade. This was also true for those who met the standards and exceeded the standards on both tests.

Females performed better than males on the science CRCT in the *does not meets* and *meets* categories, but males and females performed equally in the *exceeds* category. The results of this study are consistent with research done by Bailey and Whitmire (2010) who asserted that males have consistently lagged behind girls in the areas of reading, math, and

science. These authors suggested that the best way to close this gap was to continually stress the importance of high academic achievement for all students and continue to hold both female and male students to the same academic standards.

There was no difference in performance among the various ethnic groups on the science CRCT. These findings are consistent with research done by Visone (2009). He conducted a study that focused on the ethnicity achievement gap where students were deliberately grouped according to ethnicity and given specific reading instruction. Results of this study revealed an increase in standardized tests across subject areas. This suggested that student achievement was a result of effort rather than ethnicity.

There was no difference in performance on the science CRCT between students who receive free and reduced lunch and those who did not receive free and reduced lunch. This was consistent with research conducted by Cantrell, et al. (2006) who asserted that when students at any socioeconomic level were exposed to engaging classroom activities that required the use of tools and materials, there was no achievement gap noted. This suggested that when teachers engaged students and had high expectations, students would rise to the achievement challenge.

Students receiving special education services performed worse on the science CRCT than students who did not receive special education services. The performance difference between students receiving special education services and those not receiving special education services was caused by lower performing special education students in the *does not meet* performance category. This finding is supported by a study conducted by McLaughlin, et al. (2002) who described the efficacy of inclusive classrooms as fostering higher achievement for students who received special education services in language arts, math, and

science. This implied that students receiving special education services would benefit from being in classrooms with those students who did not receive special education services.

This research study revealed a gap in science CRCT scores between native English speakers and English language learners. However, due to the small  $n$  value for English language learners, the results were inconclusive. Although there was a small number of English language learners, the findings were consistent with research done by Kim and Sturtevant (2010) who asserted that ELL students had difficulty reading and this reading deficit was the main contributor to poor performance on standardized tests.

### **Math CRCT**

Math CRCT scores were analyzed to evaluate the effects of biology EOCT performance level (BPL) conditions and the demographic variables of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level on Math 7<sup>th</sup> Grade CRCT scores.

In terms of student performance on the math CRCT and the biology EOCT, if students did not meet the standards on the seventh grade math CRCT, they also did not meet the standards on the biology EOCT in the tenth grade. This was also true for those who met the standards and exceeded the standards on both tests.

Females performed better than males on the math CRCT in the *does not meet* and *meets* categories. However, males and females performed equally in the *exceeds* category. These findings were consistent with the existence of an achievement gap between girls and boys in mathematics described by Bailey and Whitmire (2010).



Black and Hispanic students performed worse than White and Asian/Asian Indian students on the Math CRCT. This finding was consistent with research conducted by William F. Tate in 1997 which found an achievement gap between Caucasian and minority students in mathematics achievement. Gallant and Moore (2008) also addressed the notion of an achievement gap between Black and Hispanic students and other ethnic groups by asserting that Black and Hispanic students performed consistently lower on standardized assessments.

Findings from this research study revealed no difference in math CRCT scores based on socioeconomic status. Students who received free and reduced lunch did no worse on the math CRCT than students who were better off. These findings were consistent with research done by Cantrell, et al. (2006) who asserted that when students at any socioeconomic level were exposed to engaging classroom activities that required the use of tools and materials, there was no achievement gap noted. This suggested that when teachers engaged students and had high expectations, students would rise to the achievement challenge.

According to this research study, students who received special education services performed no worse on the math CRCT than students who did not receive special education services. This finding was consistent with research conducted by Lee et al. (2010) who studied the impact of curriculum modification on the classroom behavior of students and teachers. They found that if students with disabilities were going to succeed in general education classrooms, there should be careful consideration of curriculum modifications, teacher and student behavior, and classroom ecological variables. Results of this study revealed that when curriculum modifications were in place, positive academic responses

were evident. Furthermore, classroom behavior problems were not as prevalent in classrooms where curriculum modifications were in place.

According to this research study, native English speakers performed better than English language learners on the math CRCT. Although there was a small number of English language learners participating in the study, the findings were consistent with research done by Kim and Sturtevant (2010) who asserted that ELL students had difficulty reading and this reading deficit was the main contributor to poor performance on standardized tests.

### **Reading CRCT**

Reading CRCT scores were analyzed to evaluate the effects of biology EOCT performance level (BPL) conditions and the demographic variables of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level on Reading 7<sup>th</sup> Grade CRCT scores. In terms of student performance on the reading CRCT and the biology EOCT, if students did not meet the standards on the seventh grade reading CRCT, they also did not meet the standards on the biology EOCT in the tenth grade. This was also true for those who met the standards and exceeded the standards on both tests.

Results of this study indicated that females performed significantly better than males on the Reading CRCT. Females performed better than males in the *does not meet* and *meets* categories. Females and males performed equally in the *exceeds* category. The results of this study are consistent with research done by Bailey and Whitmire (2010) who asserted that males have consistently lagged behind girls in reading, math, and science. These authors suggested that the best way to close this gap was to continually stress the importance of high

academic achievement for all students and continue to hold both female and male students to the same academic standards.

According to this study, there was no ethnic difference on the seventh grade reading CRCT. This was consistent with a study conducted by Visone in schools which had greater than ninety percent of students eligible for free and reduced lunch, ninety percent identified as ethnic minorities, and ninety percent meeting high academic standards on test achievement. Visone (2009) wrote that these schools focused on reading comprehension and writing instruction over content instruction. The results of the study showed an increase in student achievement on all standardized test scores in all student groups. This, in turn, led to the conclusion that achievement was not based on ethnicity but was, rather, a result of effort.

Results of this study revealed that students who received free and reduced lunch performed worse than students who did not receive free and reduced lunch on the Reading CRCT in the *meets* and *exceeds* categories. The two groups performed equally in the *does not meet* category. This is consistent with research by Bracey (2004) who made a strong case for the connection between poverty and poor student achievement. Farmer-Hinton and Holland (2009) also suggested that students attending schools in high poverty areas would not have access to proper resources that foster academic success.

Students who did not receive special education services performed better than students receiving special education services on the reading CRCT in the *does not meet* and *meets* categories. The groups performed equally in the *exceeds* category. These findings reinforced the need for the Individuals with Disabilities Act. The act defined the responsibilities of school districts regarding students with disabilities by stating that they must provide financial support to these students, identify their strengths and weaknesses and

develop an individualized education program to assist educators in developing proper classroom modifications to foster student success. These findings also reinforced the research done by McLaughlin et al. (2002) who described the efficacy of inclusive classrooms as fostering higher achievement for students who received special education services in language arts, math, and science.

This study revealed that native English speakers performed better than English language learners on the reading CRCT in the does not meet and meets category. Although there was a small number of English language learners participating in the study, the findings were consistent with research done by Kim and Sturtevant (2010) who asserted that ELL students had difficulty reading and this reading deficit was the main contributor to poor performance on standardized tests.

### **Language Arts CRCT**

Language arts CRCT scores were analyzed to evaluate the effects of biology EOCT performance level (BPL) conditions and the demographic variables of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level on language arts 7<sup>th</sup> grade CRCT scores. In terms of student performance on the language arts CRCT and the biology EOCT, if students did not meet the standards on the seventh grade language arts CRCT, they also did not meet the standards on the biology EOCT in the tenth grade. This was also true for those who met the standards and exceeded the standards on both tests.

Results of this research study indicated that females performed better than males on the language arts CRCT in the *does not meet* and the *meets* categories, but males and females

performed equally in the *exceeds* category. These findings were consistent with an article written by Bailey and Whitmire (2010) who reinforced the notion of a gender gap that existed in the area of academic achievement. The authors wrote that boys have always lagged behind girls in terms of literacy. Despite this difference, girls were making strides in the areas of math and science by outperforming boys on assessments in these areas.

According to this study, there was no difference in performance among the ethnic groups on the language arts CRCT. This was consistent with research done by Visone (2009) who conducted a study that focused on the ethnicity achievement gap where students were deliberately grouped according to ethnicity and given specific reading instruction. Results of this study revealed an increase in standardized tests across subject areas. This suggested that student achievement was a result of effort rather than ethnicity.

This study revealed that students who did not receive free and reduced lunch performed better than those receiving free and reduced lunch on the language arts CRCT. Students who did not receive free and reduced lunch performed better than students who received free and reduced lunch in the *meets* category, but students in the two subgroups performed equally in the *does not meet* and *exceeds* categories. These findings were consistent with work done by Bracey (2004) who made a strong case for the connection between poverty and poor student achievement. Furthermore, in accordance with this study, Cantrell et al. (2006) asserted that when students at any socioeconomic level were exposed to engaging classroom activities that required the use of tools and materials, there was no achievement gap noted. This suggested that when teachers engaged students and had high expectations, students would rise to the achievement challenge.

Findings from this study revealed that students who did not receive special education services performed better on the language arts CRCT than those who received special education services in the *does not meet* and *meets* categories, but the two groups performed equally in the *exceeds* category. These findings reinforce the need for the Individuals with Disabilities Act. The act defined the responsibilities of school districts regarding students with disabilities by stating that they must provide financial support to these students, identify their strengths and weaknesses and develop an individualized education program to assist educators in developing proper classroom modifications to foster student success. These findings also reinforced the research done by McLaughlin et al. (2002) who described the efficacy of inclusive classrooms as fostering higher achievement for students who received special education services in language arts, math, and science.

According to this study, native English speakers performed better than English language learners on the language arts CRCT in the *does not meet* and *meets* category. Although there was a small number of English language learners participating in the study, the findings were consistent with research done by Kim and Sturtevant (2010) who asserted that ELL students had difficulty reading and this reading deficit was the main contributor to poor performance on standardized tests. Geva and Limbos (2001) also stated that it was important for reading difficulties to be properly identified. Campbell et al., (2008) conducted a study that revealed that ELL students had difficulty with writing ability. Faller et al. (2010) also asserted that ELL students had issues with the mastery of vocabulary.

## **Implications**

The primary purpose of this research study was to assist educators in North Georgia in the development of intervention strategies to improve student achievement by pinpointing factors in seventh grade academics that could possibly contribute to different performance levels on the tenth grade biology EOCT. Students deserve the best opportunity for success. Following the collection and analysis of data, it became clear that there were definite areas in which interventions could be developed.

### **Science CRCT**

Results of this study indicated that females performed better on the science CRCT than males in the *does not meets* and *meets* categories. However, males and females performed equally in the *exceeds* category. These results imply that seventh grade science teachers or other researchers should focus on the students who fell into the *does not meet* and *meets* categories and try to determine what differences emerge. Perhaps females performed better than males because they had a particular interest in science, or maybe males did not perform as well as females because they had a more difficult time than females focusing in their science classes or on standardized tests. These are issues that could be addressed in future research studies.

According to the results of this study, there was no difference in performance among the ethnic groups on the science CRCT. In terms of science education, ethnicity should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

Based on the results of this study, there was no difference in performance on the science CRCT between students who receive free and reduced lunch and those who did not receive free and reduced lunch. These results imply that in terms of science education, socioeconomic status should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

This study indicated that students receiving special education services performed worse than those students not receiving special education services. The performance difference between students receiving special education services and those not receiving special education services was caused by lower performing special education students in the does not meet performance category. These results imply that seventh grade science teachers or other researchers should focus on special education students who fell into the does not meet category and revisit the types of special education services that these students receive. Perhaps the reason for their poor performance is that they are not receiving the proper special education services that adequately foster improved science achievement. Perhaps they are not being given appropriate testing modifications. These are issues that could be explored in future research studies.

According to this study, native English speakers performed better on the science CRCT than English language learners in the *does not meet* and *meets* categories. Although the results for this section of the study were inconclusive due to a small number of English language learner participants, the results imply that future researchers could focus on English language learners who fell into the *does not meet* and *meets* categories. Perhaps these students did not do well on the science CRCT because they had difficulty reading the



questions. Perhaps their lack of understanding of the science vocabulary was a factor. These are issues that could be addressed in future research studies.

### **Math CRCT**

Results of this study indicated that females performed better than males on the math CRCT. Females performed better than males in the *does not meet* and *meets* categories, but performed equally in the *exceeds* category. This implies that future researchers should focus on students who fell into the *does not meet* and *meets* categories in an effort to determine where differences lie. It is possible that females have a greater affinity for mathematics than males. Furthermore, it could be true that the males in question do not have the parental support at home to help them overcome their deficiencies in math. These are ideas that can be addressed in future research studies.

Based on results of this study, Black and Hispanic students performed significantly worse on math CRCT scores than did White and Asian students. Although the difference failed to show up because of a comparatively small  $n$  for the Asian/Asian Indian group, the results imply that future researchers could focus on factors in the lives of the Black/Hispanic students that might contribute to poor performance on the math CRCT. Perhaps they do not do well on standardized tests. Maybe they do not do as well in math classes. It could be that they do not have a support system at home or at school that will help them to overcome their mathematical deficiencies. These are things that can be explored in future research studies.

According to this study, there is no difference in math CRCT scores based on socioeconomic status and that students who received free and reduced lunch performed no worse on the math CRCT than students who were better off. These results imply that in terms

of math education, socioeconomic status should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

Results of this study indicated that students who received special education services performed no worse on the math CRCT than students who did not receive special education services. These results imply that in terms of math education, disability category should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

This study indicated that native English speakers performed better than English language learners on the math CRCT. Native English speakers performed better than English learners in the *does not meet* and *meets* categories. Although the results for this section of the study were inconclusive due to a small number of English language learner participants, implications of this study are that future researchers could focus on English language learners who fell into the *does not meet* and *meets* categories. Perhaps these students did not do well on the math CRCT because they had difficulty reading the questions. Perhaps their lack of understanding of the math vocabulary was a factor. These are issues that could be addressed in future research studies.

### **Reading CRCT**

Results of this study indicated that females performed better than males on the reading CRCT. Females performed better than males in the *does not meet* and *meets* categories, and performed equally in the *exceeds* category. These results imply that future researchers should focus on students who fell into the *does not meet* and *meets* categories. Perhaps male students did not read as well and therefore had lower self esteem in terms of

reading skills. This self esteem could have contributed to poor performance on the reading CRCT. Furthermore, females could have been favored by their teachers in reading classes due to their literacy skills. This favoritism could have contributed to a difference in reading CRCT scores. These are issues that could be addressed in future research studies.

Based on the results of this study, there was no difference on the seventh grade reading CRCT scores based on student ethnicity. These results imply that in terms of reading education, ethnicity should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

According to this study, students who received free and reduced lunch performed worse than students who did not receive free and reduced lunch on the reading CRCT. Students who received free and reduced lunch performed worse than students who did not receive free and reduced lunch in the *meets* and *exceeds* categories. The two groups performed equally in the *does not meet* category. These results imply that future researchers should focus on students who fell into the *meets* and *exceeds* categories in terms of deciding what types of interventions should be developed to improve student achievement. Perhaps students who received free and reduced lunch did not have parents at home to help them with their homework because they had to work long hours to support their family. Perhaps these same students did not have access to food and other resources at home that would help them focus on school work instead of basic survival. These are issues that might be addressed by future research studies.

This research study indicated that students not receiving special education services performed better than students receiving special education services on the Reading CRCT in the *does not meet* and *meets* categories. The groups performed equally in the *exceeds*

category. These results imply that future researchers should focus on students who fell into the *does not meet* and *meets* categories. Perhaps students receiving special education services did not have special education teachers who were qualified in delivering reading remediation for these students. Perhaps these special education students were not properly assessed to identify reading deficiencies in a timely manner to promote success in seventh grade reading. These are areas issues that could be addressed in future research studies.

Results of this research study indicated that native English speakers performed better than English language learners on the reading CRCT. Native English speakers performed better than English learners in the *does not meet* and *meets* categories. Although the results for this section of the study were inconclusive due to a small number of English language learner participants, the results imply that future researchers could focus on English language learners who fell into the *does not meet* and *meets* categories. Perhaps these students did not do well on the math CRCT because they had difficulty reading the questions. Perhaps their lack of understanding of the reading vocabulary was a factor. These are issues that could be addressed in future research studies.

### **Language Arts CRCT**

According this study, females performed better than males on the language arts CRCT. Females performed better in the *does not meet* and *meets* categories , but males and females performed equally in the *exceeds* category. Future researchers should focus on students who fell in the *does not meet* and *meets* categories. Perhaps female students were favored by their language arts teacher. This favoritism might have contributed to the lack of performance in males who saw this favoritism, and in turn, were not motivated to do their

work. This lack of motivation might have contributed to their poor performance on the language arts CRCT. These are issues that could be the focus of future research.

There was no difference on the seventh grade language arts CRCT scores based on student ethnicity. These results imply that in terms of language arts education, ethnicity should not be an area of interest in terms of deciding what type of interventions should be developed to improve student achievement.

Based on the results of this study, students who did not receive free and reduced lunch performed better than those receiving free and reduced lunch on the Language Arts CRCT. Students who did not receive free and reduced lunch performed better than students who received free and reduced lunch in the *meets* category, but students in the two subgroups performed equally in the *does not meet* and *exceeds* categories. These results imply that future researchers should focus on students who received free and reduced lunch who fell into the *meets* category. Perhaps these students did not have the resources such as school supplies that they need. Perhaps they were distracted by their poverty and could not concentrate on their studies. These are issues that could be addressed in future research studies.

Results of this study indicated that students who did not receive special education services performed better on the language arts CRCT than those who received special education services. Students not receiving special education services performed better than students receiving special education services in the *does not meet* and *meets* categories, but the two groups performed equally in the *exceeds* category. These results imply that future researcher should focus on students who fell into the *does not meet* and *meets* categories. Perhaps the reading and writing deficiencies of these special education students were not

diagnosed in a timely manner to accommodate language arts deficiencies. Perhaps accommodations that were made for these students were not adequate enough to foster academic improvement in the area of language arts.

This study indicated that native English speakers performed better than English language learners on the language arts CRCT. Native English speakers performed better than English language learners (ELL) in the *does not meet* and *meets* categories. Although the results for this section of the study were inconclusive due to a small number of English language learner participants, the results imply that future researchers could focus on English language learners who fell into the *does not meet* and *meets* categories. Perhaps these students did not do well on the language arts CRCT because they had difficulty reading the questions. Perhaps their lack of understanding of the language arts vocabulary was a factor. These are issues that could be addressed in future research studies.

### **Recommendations for North Georgia Schools**

The purpose of this research study was to investigate relationships between the seventh grade math, reading, language arts, and life science CRCT scores and the tenth grade biology EOCT performance levels of the same students in terms of gender, ethnicity, socioeconomic status, disability category, and English language proficiency level. In an attempt to help school leaders to develop possible intervention strategies for seventh grade life science students who will take the biology EOCT in the tenth grade, the following recommendations were suggested:

- Administrators at the middle and high school levels should work together to coordinate work sessions for seventh grade math, reading, language arts, and

science teachers and high school biology teachers. The purpose of these work sessions would be to allow these teachers to collaborate with one another to identify effective practices that would allow students to succeed on the Biology EOCT.

- Biology teachers could use the findings from this study in their science department meetings in an attempt to modify their lesson plans and teaching strategies in accordance with effective practices that would allow students to succeed on the biology EOCT.
- The ideas presented in this research study could be presented to seventh grade math, reading, language arts, and science teachers and high school biology teachers. Following the presentation, these teachers could use the findings from the study and collaborate with each other to develop intervention strategies that would allow students to succeed on the Biology EOCT.
- According to this study, reading comprehension is a vital part of success on the science, math, reading, and language arts CRCT. In order to improve Biology EOCT scores, school administrators and teachers of seventh grade math, science, reading and language arts, and biology teachers should focus on developing literacy initiatives that will insure that their students are reading at grade level.
- Staff development should be offered to seventh grade teachers in the core subject areas of science, math, reading and language arts, as well as high school biology teachers that stresses the importance of raising the academic bar for all students regardless of gender.

- Staff development should be provided to seventh grade teachers in the core subject areas of science, math, reading and language arts, as well as high school biology teachers that will help them develop strategies that will actively engage students in classroom activities. This active engagement will promote student learning by involving all students regardless of ethnicity in activities that will promote student learning.
- Grant writers in school systems with high minority, high poverty, low performing schools should be actively involved in writing grants to provide needed resources that these schools might not have (lab equipment, textbooks, etc.,) in order to provide students with the resources that they need to succeed in the seventh grade core subject areas of science, math, reading, and language arts, as well as high school biology classes.
- Special education teachers should receive continuing staff development in the areas of development of individualized education programs, developing effective instructional modifications for students who receive special education services .
- All teachers should receive ongoing training in conducting inclusion classes. These classrooms allow special education students to participate in regular education classrooms while being provided with modifications to accommodate their learning needs.
- All teachers of core subjects (math, reading, language arts, and science) should engage their students in activities that foster reading comprehension in order to reduce the reading deficit in all of their students.



- Special education teachers should be proactive in identifying reading and writing deficiencies in their students in order to help them develop strategies to improve reading and writing skills. This will help students increase their standardized test scores.
- Teachers of seventh grade math, reading, language arts, and science classes, as well as those who teach high school biology classes, should involve their students in project based learning activities that will allow students to work together on classroom projects while solving problems and learning important concepts. This will allow students to actively engage in classroom activities and work with others to increase content knowledge.

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APPENDIX A  
INSTITUTIONAL REVIEW BOARD APPROVAL

**MEMORANDUM**

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TO: Jennifer Henry Ward  
Dr. Hinsdale Bernard **IRB # 11-064**

FROM: Lindsay Pardue, Director of Research Integrity  
Dr. Bart Weathington, IRB Committee Chair

DATE: April 5, 2011

SUBJECT: IRB # 11 - 064: Factors in Seventh Grade Academics Associated with Performance Levels on Tenth Grade Biology End of Course test in Selected Middle and High Schools in Northwest Georgia

The Institutional Review Board has reviewed and approved your application and assigned you the IRB number listed above. You must include the following approval statement on research materials seen by participants and used in research reports:

***The Institutional Review Board of the University of Tennessee at Chattanooga (FWA00004149) has approved this research project # 11-064.***

Please remember that you must complete a Certification for Changes, Annual Review, or Project Termination/Completion Form when the project is completed or provide an annual report if the project takes over one year to complete. The IRB Committee will make every effort to remind you prior to your anniversary date; however, it is your responsibility to ensure that this additional step is satisfied.

Please remember to contact the IRB Committee immediately and submit a new project proposal for review if significant changes occur in your research design or in any instruments used in conducting the study. You should also contact the IRB Committee immediately if you encounter any adverse effects during your project that pose a risk to your subjects.

For any additional information, please consult our web page <http://www.utc.edu/irb> or email [instrb@utc.edu](mailto:instrb@utc.edu)

Best wishes for a successful research project.

APPENDIX B

GLOSSARY

90/90/90 schools - Schools with greater than 90% of students on free and reduced lunch, 90% of students identified as minorities, and 90% of students meeting high academic standards.

(Visone, 2009)

Adolescent Learning - Educational experiences and knowledge attainment that takes place during adolescence. (Fisher & Frey, 2008)

Adult Knowledge – Amount of information that adults bring to the learning environment as a result of life experiences. (Fisher & Frey, 2008)

African American English (AAE) - Modified version of the English language that is sometimes spoken by African Americans. (Craig, et al., 2009)

Attention Deficit Hyperactivity Disorder (ADHD) - Characterized by inappropriate levels of inattention and hyperactivity. (Antshel, et al., 2009)

Bilingual Classroom – Classroom in which two languages are spoken by students. (Hargrove, 2005)

Block Scheduling – Scheduling design in which students complete four yearlong courses in one semester. (Cobb, et al., 2005)

College Culture – Learning environment that offers current information, resources, and conversations about the various aspects of college, including preparation for, enrollment in, and graduating from college. (Farmer-Hinton & Holland, 2009)

Content Literacy – Approach to reading instruction in which the reading strategy is taught and then practiced with content material. (Fisher & Frey, 2008)

Content Proficiency – Degree to which students understand content material. (Fisher & Frey, 2008)

Critical Latino theory (LatCrit) – Framework used to understand how race and racism impact the education of Latinos. (Aviles de Bradley & Davila, 2010)

Critical Race Theory (CRT) – Theory used to understand racial inequity in society as it relates to school discipline, testing, tracking, and curriculum. (Aviles de Bradley & Davila, 2010)

Culturally Relevant Pedagogy- Teaching methodology that is appropriate for the student culture being served. (Adeleke, et al., 2009)

Curriculum-Based Measurement – Progress monitoring system that teachers use to enhance instructional decision making and student achievement. (Campbell, et al., 2008)

Curriculum-Embedded Assessment – Performance assessments that are incorporated into classroom instruction. (Gallant & Moore, 2008)

Curriculum Modification – Changes in general education curriculum which provide strategies that enhance the education of students with disabilities. (Lee, et al., 2010)

Curriculum Principle – Principle stating that students need a focused, coherent curriculum connecting math ideas and concepts. (Berry, et al., 2002)

Diocese – Group of Catholic churches under jurisdiction of a bishop. (Domingues & Fenzel, 2009)

Diversity Principle – Idea that the more diverse a school's population is, the less likely it is to make AYP. (Geneseo & Granger, 2008)

Direct Observation Form (DOF) - Standard form using observation of student behavior to assess students for learning disabilities. (Antshel, et al., 2009)

Emotional and Behavior Disorders (EBD) - A condition exhibiting behavior or emotional characteristics over a long period of time that negatively affects educational performance.

(Mason, et al., 2009)

Equity Principle – Principle stating that all students are capable of learning mathematics and should be provided with support and accommodations. (Berry, et al., 2002)

Georgia High School Graduation Test (GHSGT) – Standardized assessment required for high school graduation in the state of Georgia. (Bruce, et al., 2009)

Gifted – Characteristic of a student having above average academic ability. (Barnard-Brak, et al., 2010)

Hearing Impaired (HI) – Condition of not being able to hear. (Chiu, et al., 2009)

Home Schooling – Type of education in which students are taught by parents in their home environment. (Ray, 2000)

Inclusion – Process of involving students with disabilities in educational experiences with students who do not have disabilities. (Campbell & Rosas, 2010)

Inclusive Classrooms – Educational condition in which students with disabilities are taught in the same classroom as students without disabilities. (Campbell & Rosas, 2010)

Individualized Education Program – Educational document that recommends program or school placements, and modifications that will insure a fair and appropriate education for students with disabilities. (Cawthon, 2009)

Linguistically Diverse – Consisting of individuals who speak different languages. (Faller, et al., 2010)

Learning Principle – Principle stating that student learning is directly related to past experiences. (Berry, et. al, 2002)

Metacognition – Awareness of how an individual supports his or her learning. (Fisher & Frey, 2008)

Nativity Schools –Catholic schools that are run by Catholic religious communities and provide small class size, advisory groups, close monitoring of student progress, and strong parental involvement. (Domingues & Fenzel, 2009)

Natural Supports – Student supports that are based on the notion that reliance on people who are normally in their learning environment increases the likelihood for success. (Shank, et al.)

National Council of Teachers of Mathematics (NCTM) – Organization of mathematics educators that ensures the highest quality of math education for students through vision, leadership, professional development and research. (Berry, et al., 2009)

Principles and Standards for School Mathematics (PSSM) - A document written by the National Council of Teachers of Mathematics to spell out a vision for pre college mathematics education in the United States. (Berry, et al., 2009)

Pullout Program – Instructional condition in which students with disabilities are taught in the same classroom away from students who do not have disabilities. (McLaughlin, et al., 2002)

Reflective Teachers – Teachers in inclusive classrooms who seek help and expand their repertoire of teaching practices. (Shank et al., 2003)

Scholastic Aptitude Test (SAT) - Test that measures the ability of high school students to succeed in college.

Single Sex Schooling – Educational technique that involves placing students of one gender in a classroom or entire school. (Arms & Herr, 2004)

Single Sex Academy (SSA) - Middle school academy that was opened in 1999 that was made up of all single sex classes. (Arms & Herr, 2004)

Sustained Focus – Commitment by teachers and other educational professionals to work diligently to fully realize strategies. (Fisher & Frey, 2008)

Teaching Principle – Principle stating that teaching of mathematics depends on the teacher's understanding of math concepts. (Berry, et al., 2002)

Technology Principle – Principle stating that technology plays a major role in facilitating math learning. (Berry, et al., 2002)

Traditional Catholic Schools - Catholic schools that are run by diocese and are housed in larger pre-K through grade 8 schools. (Domingues & Fenzel, 2009)

Teacher Development Committees – Groups of education professionals that work together to develop effective professional development activities for teachers. (Fisher & Frey, 2008)

Tier 1 Intervention – Reading intervention that focuses on appropriate vocabulary selection, pronunciation, understandable definitions, and examples. Comprehension in terms of asking questions, main idea, summarizing, and text structure recognition are also a focus of this intervention. (Wexler, et al., 2010)

Tier 2 Intervention – Reading intervention that focuses on word study and fluency, and vocabulary and comprehension. (Wexler, et al., 2010)

Virtual Reality Classroom – Classroom in which a 3D environment is simulated through computer generated imagery which gives the student a sense being in the actual environment and being able to take control of and interact with the environment. (Ausburn, et al., 2009)

Virtual Learning Environments – Learning environment which simulates a 3D environment through computer generated imagery which gives the student a sense being in the actual environment and being able to take control of and interact with the environment. (Ausburn, et al., 2009)



WAIS-R Test – Wechsler Adult Intelligence Scale – Revised; widely used and respected adult intelligence test. (Hishinuma, 1998)

## VITA

Jennifer Henry Ward graduated from the University of Tennessee at Chattanooga with a Bachelor of Science degree in biology in 1996. Following this, she was employed as a phlebotomist at Memorial Hospital in Chattanooga, Tennessee where she worked while pursuing her Master's in Education from UTC. Prior to completing her master's degree, she began working as a biology teacher at Notre Dame High School in Chattanooga, Tennessee, in August 1998. Upon completion of her M.Ed in 2000, she went to work as a biology teacher at Lakeview Fort Oglethorpe High School in Catoosa County, Georgia. Along with her teaching duties, she coached track and worked before and after school tutoring students who were having a hard time passing the Science Georgia High School Graduation Test. In 2005, she was accepted into Cohort I of the University of Tennessee at Chattanooga's doctoral program in Learning and Leadership. In November of 2006, she had her first child and made the decision to stop teaching. She earned her Education Specialist Degree and Administrative license in 2008 prior to having her second child in 2009. She continued work on her doctorate while raising her family and tutoring at Baylor School in Chattanooga. She graduated with her doctorate in August, 2011.