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An Examination of Blended Learning and the Traditional Classroom Using Achievement Scores

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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Although varying models of blended learning are being adopted in schools, research on the effect of blended learning on students in different subjects and grade levels has not been examined. This naturalistic, quasi-experimental study examined the effect of the rotation model of blended learning at the middle school level on students' language arts performance to determine how the rotation model of blended learning compares to the traditional model of learning. The study's theoretical framework consisted of Mayer's cognitive theory of multimedia learning and Bloom's theory of mastery learning. The population consisted of 979 non-Title 1, Georgia public middle school students within the same middle school in a metropolitan school district during the 2013-2014 school year. The sample size was 237 sixth graders, 255 seventh graders, and 272 eighth graders. The specific data collected were Criteria Referenced Competency Test (CRCT) scores for all sample students. Data analysis consisted of both stepwise multiple regression and two-way ANOVA. The study found no significant difference in academic achievement of special education or regular education students. However, gifted students who participated in the blended model of instruction performed at a lower level than those who participated in the traditional model of instruction. Educational stakeholders may use this study, and others like it, to make decisions on the adoption of educational models at the middle school level that are beneficial, as well as to avoid models for subgroups that might be harmful.

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Dedication

My husband is the greatest man I have ever known. We have walked the PhD journey together, and I could not have done it without him. We have juggled the tasks of parenting, careers, homemaking, and life together to get to this point. I love you more than you can know!

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I praise God for the strength and endurance that this journey has taken. Thank you to my family. I could not have achieved this accomplishment if it had not been for you. My husband has been my support and endurance though this journey. My three children have watched my husband and I work through the PhD journey. My mom has helped us find the time it takes to accomplish the required work. I love you all!

Thank you to Dr. Foshay and Dr. Bauder! You have worked diligently to get me through this dissertation process. I have learned so much through your guidance. I could not have accomplished this without you.

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Chapter 1: Introduction to the Study

Introduction

Blended learning is not a new concept. Educators have been blending the use of computer technologies within education since the 1980s, when personal computers made their debut in the educational arena. However, in recent years, much research and debate have focused on the details of blended learning (Dziuban, Picciano, Graham, & Moskal, 2016; Halverson, Graham, Spring, & Drysdale, 2012). There are varying definitions of blended learning and several models of blended learning. The research that has been conducted on the effectiveness of blended learning, by its various definitions, has yet to shift into K-12 education (Bakia, Shear, Toyama, & Lasseter, 2012; Halverson et al., 2012; International Association for K-12 Online Learning, 2013). This study was conducted in an attempt to sharpen the focus of this confused area of learning by examining the rotation model of blended learning and its effect on middle school language arts achievement. Issues tied to blended learning are discussed in detail through the paper.

The introduction to the research in this chapter includes the background, problem statement, purpose, research question, hypotheses, theoretical framework, nature, definitions, assumptions, scope, limitations, and significance of the study. The background section focuses on key literature about blended learning and the gap in the literature in order to demonstrate why the research is beneficial. The problem statement details the need for research in the area of blended learning effectiveness in K-12 education. The research intent details are in the purpose section. The theoretical

framework outlines cognitive theories that explain why the rotation model of blended learning should impact student learning. The methodology and design of the study are summarized in the nature of the study section. In the scope section, I discuss the boundaries and generalizability of the research. Finally, in the significance section, I address the implications of the study for positive social change.

Background

Blended learning is a disruptive innovation that is sweeping education at all levels (Kennedy, 2013; Means, Toyama, Murphy, Bakia, & Jones, 2010; Staker, 2011). In a meta-analysis of existing literature (Means et al., 2010), the United States Department of Education declared that online and blended learning were areas in which the use of technology in K-12 education was growing rapidly. According to Watson, Murin, Vashaw, Gemin, and Rapp (2013), no fewer than 24 states have some type of blended school program. A large portion of these schools are charter schools; however, there has been an increase in the prevalence of blended learning programs within public school systems (Watson et al., 2013).

Although there are many blended learning educational environments in the United States, there is a lack of research regarding blended learning's educational effectiveness (Bakia et al., 2012; Dziuban et al., 2016; Halverson et al., 2012; Kennedy, 2013, Means, Bakia, & Murphy, 2014). In 2008, the United States Department of Education conducted a meta-analysis of research regarding online, blended, and face-to-face education and found that there was little research that met the criteria of random assignment or quasi-experimental design that also measured student learning (Means et al., 2010). Halverson,

Graham, Spring, and Drysdale (2012) conducted a study of blended learning publication trends from 2001-2012. They found that the majority of research available in the literature pertained not to the effectiveness of blended learning, but to definitions, models, and the potential of blended learning. They concluded that there were many gaps within the literature regarding K-12 blended learning. Also in 2012, Bakia, Shear, Toyama, and Lasseter prepared a report for the United States Department of Education in which they reported a lack of research to support the effectiveness of blended learning in K-12 education, specifically experimental or quasi-experimental research and learning outcomes. Bakia et al. recognized this limitation, as they used higher education studies to draw conclusions about the overall effectiveness of the blended model of instruction. Means, Bakia, and Murphy (2014) concluded that although K-12 online and blended learning education were growing rapidly, "research-based guidance regarding effective online learning practices and their implementation in different contexts is strongly needed" (*p*. 6).

In 2013, the International Association for K-12 Online Learning (Kennedy, 2013) devoted an entire publication to the need for further research regarding blended learning in K-12 education. Ten areas of research need were identified: (1) which blended learning environments are most appropriate for different groups of students, (2) what models of blended learning are most effective, (3) how to best support educational professionals with blended learning, (4) how to best manage blended learning models, (5) what the best teaching strategies are for blended models, (6) instructional design for blended learning models, (7) how to provide access for all students to blended and online education, (8)

appropriate type and frequency of assessments, (9) changing roles and needs for educators, and (10) effect of government policy on blended learning education. An area of particular interest is the effectiveness of different forms of blended learning. Picciano (as cited by Dziuban et al., 2016) reported that online and blended learning are rapidly becoming common; however, data on blended learning in both American higher education and K-12 education are limited because of a lack of a common definition.

The gaps in research, in the presence of a rise in the adoption of blended learning in K-12 education, demonstrate the need for more research on the topic of blended learning. The adoption of blended learning should be guided by evidence of its effectiveness. The guidance of research enables stakeholders in education to better predict the effects of blended learning. At this point, there is no clear indication of which types of blended learning are most effective for different populations of students. The goal of this study was to contribute evidence on whether or not the rotation model of blended learning benefits middle school students in the area of language arts.

Problem Statement

Blended learning is being implemented across the United States, but there is not much research regarding the effectiveness of blended learning within the K-12 sector. Halverson et al. (2012) conducted an exploration of publications on blended learning and found that little had been written about the effectiveness of blended learning. Bakia et al. (2012) conducted a study for the United States Department of Education regarding the research that had been done on blended learning in K-12 education. Bakia et al. found that there had been very little research conducted in the area of K-12

education in general, and that K-12 research involving blended learning was particularly lacking. Dziuban et al. (2016) wrote that given the current enquiry regarding blended learning, there is a need for research on the effectiveness of blended learning. The current literature and research indicate that there is a large gap in what is known about the effectiveness of blended learning in K-12 education. There needs to be exploration concerning the different types of blended learning, with diverse populations and with different subject matter, to determine the most effective types of blended learning for different population groups.

There have been reports that the rotation model of blended learning is an effective instructional model; however, the reports have not been in peer-reviewed sources. In Colorado, an elementary school initiated a rotation model of blended learning, and reports showed significant academic growth (Perkins, 2014). Rocketship, a group of public charter schools (Rocketship, 2015), has implemented the rotation model of blended learning in elementary schools in California, Wisconsin, and Tennessee. Rocketship reports indicate that the rotation model is providing students with academic growth (Rocketship, 2015); however, these studies could be biased, as the research has been self-conducted and details of the studies have not been revealed.

Purpose of the Study

This study explored the effectiveness of the rotation model of blended learning in middle school education in order to fill a gap in research. This quantitative study compared the academic achievement of sixth, seventh, and eighth grade students who received education within a traditional model with the achievement of those who received

education within a rotation model by means of the Edgenuity software program for the 2013-2014 school year. The study determined whether students who participated in the rotation model of blended learning had higher academic achievement in language arts than those who participated in the traditional model of education. The independent variable for the study was model of instruction. The study's dependent variable was academic achievement measured by the Criterion-Referenced Competency Test (CRCT) score for each grade level. There were four moderator variables: pretest (last year's CRCT score), teacher effectiveness, learning environment, and student educational label. This study contributes to the developing body of literature in that it may inform policy makers and practitioners as to which models work best for students.

Nature of the Study

This study was a naturalistic quasi-experiment using historical data on Georgia State standardized testing scores (CRCT; dependent variable) to determine whether the rotation model of blended learning produces higher achievement scores than the traditional model (model of instruction, independent variable) in language arts. The study used CRCT scores from 2013 to examine the equivalence of the blended and traditional models of education. CRCT scores from 2014 were then analyzed to compare the blended and traditional model of education in the area of language arts. Data from the years 2013 and 2014 were investigated because a new state standardized test was implemented in 2015 that cannot be compared to the CRCT. Pretest score, teacher effectiveness, learning environment, student educational label, posttest blended learning, and posttest traditional

learning were the mediators in the study. These mediators are discussed further in Chapters 2 and 3.

This study was quasi-experimental due to the use of a comparison group but lack of random sampling or assignment. There was not random assignment due to the parent choice involved in the determination of whether students would participate in the blended model or the solely traditional model. This was a limitation of the study. The study population was non-Title 1 public Georgia middle school students within a metropolitan school district. The comparison group consisted of middle school language arts students who did not participate in the rotation model. The treatment group was composed of those students who did participate in the rotation model. The census sample consisted of students from each of the grade levels: sixth, seventh, and eighth.

Each grade level was divided into two groups, which corresponded to the traditional model and rotation model of blended learning. The scores could not be compared across grade levels. Therefore, there were three comparisons made by grade level. The sixth-grade traditional student CRCT scale scores were compared to the sixth-grade rotation model of blended learning CRCT scale scores. The seventh-grade traditional student CRCT scale scores were compared to the seventh-grade rotation model of blended learning CRCT scale scores. The eighth-grade traditional student CRCT scale scores were compared to the eighth-grade rotation model of blended learning CRCT scale scores.

Group equivalence was tested by comparison of the means and distributions of each group's CRCT scores before treatment. (For example, the preassessment for the

seventh-grade was students' CRCT scores from their sixth-grade school year.) The comparison were made in order to establish that the groups were statistically equal, and if not, a nonequivalent pre/post quasi-experimental design was used. The postassessment compared scores for the traditional model and blended model of education groups following treatment.

The population of the study was non-Title 1, public Georgia middle school students within a metropolitan school district. Watson, Murin, Vashaw, Germin, and Rapp (2013) identified Georgia as having no blended model of instruction in K-12 schools, but that has been changing due to State Bill 289, which encourages increased online and blended learning opportunities for Georgia students (United States Senate Press, 2012). The sample population came from one middle school in Georgia, and the length of treatment was one academic school year. The school total population was 961 during the 2013-2014 school year. There were 554 students in the traditional educational group: 137 sixth graders, 218 seventh graders, and 199 eighth graders. There were 407 students in the rotation model of blended learning group: 154 sixth graders, 118 seventh graders, and 407 eighth graders.

Research Question(s) and Hypotheses

- What is the difference in academic achievement as revealed by CRCT scaled scores in language arts of sixth, seventh, and eighth grade students participating in a rotation model of blended learning as compared to those participating in a traditional model of instruction?

- Was there a difference in teacher effectiveness between teachers who taught using the blended model of education and the teachers who taught using the traditional model of education?

Hypotheses

1. $H1_0$: There was no significant difference in academic achievement between students taught in the traditional model and students taught in the blended model in sixth grade when holding constant the student educational label.

   $H1_a$: There was a significant difference in academic achievement between students taught in the traditional model and students taught in the blended model in sixth grade when holding constant the student educational label.

2. $H2_0$: There was no significant difference between traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

   $H2_a$: There was a significant difference between traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

3. $H3_0$: There was no significant difference between traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

   $H3_a$: There was a significant difference between traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

4. $H4_0$: There was no significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the sixth grade.

   $H4_a$: There was a significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the sixth grade.

5. $H5_0$: There was no significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the seventh grade.

   $H5_a$: There was a significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the seventh grade.

6. $H6_0$: There was no significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the eighth grade.

   $H6_a$: There was a significant difference in teacher effectiveness between teachers who taught using the traditional model of education and those who taught using the blended model of education in the eighth grade.

Theoretical Framework for the Study

The theories that provided a framework for the research were the cognitive theory of multimedia learning and the theory of mastery learning (Bloom, Chicago Univ., & Regional Educational Laboratory for the Carolinas and Virginia, 1968; Mayer, 2009).

Chapter 2 provides a detailed description of each of these theories. This section provides information on the major conclusions of each theory and how these conclusions relate to the research.

The cognitive theory of multimedia learning (Mayer, 2009) explains why students participating in the rotation model of blended learning should learn the content more effectively than those participating in the traditional model of instruction (Mayer, 2009). There are three main principles that Mayer (2009) recognized: (a) dual channels, (b) limited capacity, and (c) active processing. The term *dual channels* indicates that learners process information through both images and verbal stimuli. Multimedia instruction enables learners to receive information through both channels to advance learning. The implementation of blended learning with Edgenuity addresses the concept of limited capacity, meaning that each learner is unique in the capacity of information that he or she can process at a given time. Multimedia instruction, when properly designed, enables each learner to control the amount of information he or she process at a time to ensure that the information is learned. Lastly, learners must engage in active processing to learn (Mayer, 2009). This means that each learner must focus on the content, organize the content, and integrate the content for it to be remembered. Multimedia instruction can provide increased motivation and engagement, which will increase focus (Devlin, Feldhaus, & Bentrem, 2013; Lin & Jou, 2013; Perez-Lopez & Contero, 2013). Learners are also able to organize and integrate the content because lessons using multimedia instruction are provided in sections that assist learners in the process (Mayer, 2009). However, the multimedia used must follow certain guidelines so as to not inhibit

the learning process. A detailed discussion of multimedia guidelines is presented in Chapter 2.

The theory of mastery learning further demonstrates the potential of the rotation model of blended learning (Bloom et al., 1968; Guskey, 2010). The foundation for the rotation model of blended learning is its ability to allow for self-paced learning. The computerized learning management system within Edgenuity is arranged as a stand-alone online curriculum with frequent assessment. It provides learners with constant access to their progress in reaching their target learning levels, based on their assessments and the content that must be learned to reach these levels. Therefore, students should learn at an advanced individual level based on mastery learning because they are able to choose what content to focus on until the target learning level is reached (Bloom et al., 1968; Guskey, 2010). Then the students move to another content area or another level of learning in the same content area, thus accelerating the speed of learning.

The main ideas of mastery learning have held true through the years. Guskey (2010) is a current advocate of mastery learning. He recognizes the following as foundational elements of mastery learning: preassessments, differentiated group-based instruction, regular formative assessments to monitor progress, corrective instruction based on assessments, parallel formative assessments, and enrichment activities (Guskey, 2010). In addition, McGaghie, Issenberg, Barsuk, and Wayne (2014) recognized that

> mastery learning has at least seven complementary features: (i) baseline or diagnostic assessment; (ii) clear learning objectives, sequenced as units in increasing difficulty; (iii) engagement in powerful and sustained educational

> activities (e.g. deliberate skills practice, data interpretation, reading) focused on reaching the objectives; (iv) a fixed minimum passing standard (e.g. test score, checklist percentage) for each educational unit; (v) formative assessment with specific feedback to gauge unit completion at the minimum passing standard for mastery; (vi) advancement to the next educational unit given measured achievement at or above the mastery standard (summative assessment), and (vii) continued practice or study on an educational unit until the mastery standard is reached. (*p*. 376)

No two models of blended learning are exactly the same. The school of study used several of the components of blended learning defined above. Each of the definitions reflects recognition of the need for preassessments to ensure that all students are learning at an appropriate level, and the school of study did provide preassessments in order to provide students, parents, teachers, and other stakeholders their beginning level of mastery. Guskey (2010) further recognized that students must be provided with differentiated group instruction. Students were grouped according to their most current assessments to best meet their needs in differentiated instruction during face-to-face instruction. Frequent formative assessment is required in both definitions, and students in the blended model of instruction were assessed in multiple ways through the Edgenuity computer program as well as during face-to-face instruction to continually check for learning and give feedback. Corrective practice is also a portion of each of the definitions. Corrective practice was provided to students by allowing them to review the

Edgenuity lessons, and they were given alternate practice assignments while in the face-to-face portion of the instructional program.

The definitions differed on the other components. Guskey (2010) also identified parallel formative assessments and enrichment activities as parts of his definition. The school of study provided parallel formative assessments to provide students with many opportunities to show mastery of the subject matter. Students who were ahead in all subject matter were able to engage in enrichment activities during their face-to-face instruction time. McGaghie, Issenberg, Barsuk, and Wayne (2014) identified clear learning objectives, educational activities that assisted students in reaching the objectives, a fixed minimum passing standard for each unit, and advancement to the next lesson/unit requiring students to show mastery of the content by passing a summative assessment with mastery level or higher. The school of study used the Georgia State Performance Standards as learning objectives (Georgia Department of Education, 2015c). Some of the educational activities that assist students in reaching objectives are skills practice, the use of data dashboards that show students which standards have been mastered and which have not, and real-world applications. The fixed minimum passing standard was 70%. There was not a fixed minimum passing standard for each unit. The individual teacher was allowed to choose the minimum passing standard.

Beyond the instruction itself, there were variables that needed to be analyzed to determine if the instructional method was the only reason for the difference in academic achievement. The moderator variables of teacher effectiveness and learning environment needed to be analyzed to determine whether they were equal or could have caused

instructional differences in the research. The variable of educational label could have affected the students' ability to do well in a self-paced educational environment. Each of these variables could have affected the success or failure of the rotation model of blended learning.

The theory of multimedia learning and the theory of mastery learning provide support for an explanation of why the rotation model of blended learning should increase learning effectiveness and speed. The theory of multimedia learning supports the cognitive foundation for why learners should more effectively learn the content. The theory of mastery learning supports the principle that self-paced learning increases individual learning speed. The speed of learning is important because students are able to learn more subject matter during the school year if they are able to master it at a quicker pace.

The blended model of instruction implemented by the school of study is supported by the theories of multimedia learning and mastery learning. The school of study met most of the qualifications listed by both Guskey (2010) and McGaghie, Issenberg, Barsuk, and Wayne (2014) for blended model instruction. However, the moderator variables of teacher effectiveness, learning environment, and educational label should be analyzed to determine if any of these variables has an effect on academic achievement.

Definitions

Traditional model of instruction: Teacher directed, face to face, and synchronous (Bonk & Graham, 2013, *p*. 5).

Blended learning: "A formal education program in which a student learns: (1) at least in part through online learning, with some element of student control over time, place, path, and/or pace; (2) at least in part in a supervised brick-and-mortar location away from home; (3) and [in which] the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience" (Clayton Christensen Institute, 2012, para. 1).

Rotation model of blended learning: "A course or subject in which students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include activities such as small-group or full-class instruction, group projects, individual tutoring, and pencil-and-paper assignments. The students learn mostly on the brick-and-mortar campus, except for any homework assignments" (Clayton Christensen Institute, 2012, para. 2).

Online tutorial mastery learning system: An instructional online program that was used to facilitate the online portion of the rotation model of blended learning. The program provides assessments, lessons, and assignments to teach and assess student progress with the subject matter. The program was used to in all of the core content areas (mathematics, language arts, reading, science, and social studies; Edgenuity, *n*.d.).

Teacher effectiveness: An assessment of how effective a teacher is based upon observation of and/or teacher-provided data on teacher professional knowledge, instructional planning, instructional strategies, differentiated instruction, assessment strategies, assessment uses, learning environment, academically challenging environment, professionalism, and communication (Georgia Department of Education,

Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2015). The performance standards and rubrics are provided in Appendix B.

Learning environment: Learning environment is one of the 10 components evaluated in the Georgia Teacher Keys Evaluation. The Georgia Department of Education defines a positive learning environment as one in which "the teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all" (Georgia Department of Education, Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2014, *p*. 40).

Educational label: Students are labeled with one of three categories depending on their need for assistance with learning: special education, regular education, and gifted education. Students who receive special education services have struggled to learn subject material. Teachers and parents work together to develop individualized education plans for these students that may allow them to be placed in smaller groups or to have extended time, repeated directions, and/or other accommodations depending on need. Regular education students do not receive any accommodations. Gifted education students have passed a norm-referenced test to determine that they qualify for the gifted education curriculum created by the local board of education (Georgia Department of Education, 2015d).

Assumptions

Three assumptions were made for the study. First, there was an assumption regarding scheduling. There are blocks of time that students are intended to spend conducting specific activities during their school day; however, there are also

uncontrollable circumstances that may alter these times, such as mandated drills, safety procedures, and interruptions in class. For this reason, it was assumed that students in both groups were provided the intended times of learning, although there was no way of ensuring that this was the case.

Second, there was an assumption that instructional time was implemented as intended. There are many variables that cannot be controlled in a naturalistic setting, such as teacher implementation of the daily routine and individual student behavior and on-task time. The implementation of instructional time can affect academic achievement; however, it was assumed to be equal in both groups.

Third, the alignment of the measure of the CRCT test to the curriculum was assumed to be the same in both models of instruction. Both models of instruction were built around the Georgia Performance Standards, and the CRCT tests were constructed to evaluate the learning of these standards. Therefore, both models of instruction should have aligned to the CRCT test.

Scope and Delimitations

There are many variables of blended learning that need to be researched to give stakeholders in education a clearer vision of what blended learning means and how to implement it most effectively in various environments. The study was limited to one middle school, so the populations for the control and experimental groups were similar. The year of study was significant because a new state-mandated annual assessment began at the end of the 2014-2015 school year that was not comparable to the CRCT assessments.

The scope and delimitations section provides the limits of the study. The study had four delimitations. First, the participants in the research were non-Title 1 public Georgia middle school students within a metropolitan school district. The participants of the study limit generalization to other age, socioeconomic-status, and residence-population-level groups. Second, the rotation model was the only type of blended learning that was researched for the study; thus, the research was limited to this model of blended learning. Third, the research was limited to the content area of language arts. The study only examined whether the rotation model of blended learning is effective in the content area of language arts, thus limiting generalizability to any other content areas. Fourth, the comparison was based on Georgia standardized testing scores. There were other assessments that could have been used to compare student academic achievement, but the Georgia Department of Education provided the most valid and reliable assessment; therefore, this was the assessment that I chose.

Limitations

Five limitations are important for interpretation of this study. First, parental support is important in the success of students (Sad, 2012). However, it was beyond the scope of this research to compare the levels of parental support received by each group of students. This was a limitation because it could have affected internal validity, but it could not be controlled during the research.

Second, random selection is the most rigorous sampling procedure because it allows for each subcategory to have an equal likelihood of being part of the sample population. However, random selection was not a possibility for the research because

parents elected the student learning model. Therefore, the research was limited in rigor based on the use of a systematic sample procedure.

Third, the curriculums were not equated in both groups. This posed a limitation in that the students who received the rotation model of blended learning received curriculum materials through Edgenuity that were different from those that the students in the traditional model of instruction received. The students who were taught through the traditional model of instruction received their lessons using the same curriculum materials (county-issued books) as did the same grade the year before. The hope is that all materials were equally aligned with the state curriculum and the state annual testing, but this cannot be proven. All students were to learn the same material based on the Georgia English language arts State Standards. In addition, each classroom was unique, and the curriculum was shared differently in different classrooms. Little was known about the face-to-face daily instruction.

I was able to check the fourth and fifth limitations to strengthen the study. The fourth limitation was teacher effectiveness equality in both groups, and the fifth was the equality of learning environment in both groups. Teacher effectiveness is important because students who are in classes with effective teachers are higher achievers (Steinberg & Sartain, 2015). According to Willms and Ma (2004), a positive educational environment improves academic achievement. Academic achievement can be impacted by both of these assumptions; therefore, each of these confounding variables must be checked to ensure equality of the groups. Both of these confounding variables were

checked using the Georgia Teacher Keys evaluation documents for all teachers who taught language arts at the school.

The Georgia Teacher Keys evaluation system assesses teachers in five main categories, which are each broken into two subcategories. The five categories are (a) planning, (b) instructional delivery, (c) assessment of and for learning, (d) learning environment, and (e) professionalism and communication. Teachers are evaluated multiple times each school year based on a four-level rubric for each of the 10 subcategories (Appendix B). Two aspects of learning environment are assessed: (1) "The teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all," and (2) "the teacher creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners" (Georgia Department of Education, Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2014, *p*. 7). Each category is evaluated based on how consistently the teacher demonstrates the category. The teacher receives a 1 if the category is not observed, 2 if the category is observed inconstantly, 3 if the category is observed consistently, and 4 if the category is observed continually (Georgia Department of Education, Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2014).

At the end of the school year, teachers are presented with an overall rating based on the assessments that have occurred during the school year (Georgia Department of Education, Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2015). The category of learning environment and the overall score for this

category were compared for each of the language arts teachers to assess learning environments. The teachers' overall scores were compared to assess teacher effectiveness.

Significance

There is a need for a greater body of research on the effectiveness of all models of blended learning (Dziuban et al., 2016; Means, Bakia, & Murphy, 2014). As school districts plan to implement blended learning, they need literature that helps them to better understand what models of learning are effective for different academic subjects and student populations. A study in which the results pertained to the whole of the United States public school system, or even a state-level public school system, would be impractical, if not impossible, due to the nature of human sciences. Therefore, there is a need for a broad range of research targeting specific grade levels, geographic locations, and other demographic variables for a more complete and informative body of literature.

Specifically, this study contributes some perspective on the rotation model of blended learning's effectiveness in increasing student achievement as measured by the CRCT. The *rotation model of blended learning* is a broad term and will be specifically defined as applicable to the study environment in Chapter 2. The CRCT is the Georgia state standardized testing that is completed annually. Demographic variables of the researched population may help developers of professional learning, as well as district leaders, to know whether the research conclusions are likely to be applicable to their student population. It is not enough to adopt a model of blended learning, or any other model of learning, due to popularity, potential, or trend. Knowledge of the effect of

blended learning on student achievement may support positive social change by helping school district leaders make informed decisions regarding how to increase students' capacity for achievement.

Summary

The study continued the research regarding the effectiveness of blended learning. Using the framework of the theory of multimedia learning and the theory of mastery learning, I sought to understand whether the incorporation of self-paced learning through the rotation model of blended learning increased middle school language arts achievement as evident in standardized testing scores. The following chapter provides a review of the literature regarding the theory of multimedia learning, the theory of mastery learning, and blended learning.

Chapter 2: Literature Review

Introduction

As technology advances, those who work within the educational environment seek to adopt improved ways of educating. To date, the effectiveness of blended learning has not been appropriately addressed in research, although it is being implemented at a growing rate (Bakia et al., 2012; Dziuban et al., 2016; Halverson et al., 2012; Kennedy, 2013; Means et al., 2010; Means et al., 2014; Staker, 2011; Watson et al., 2013).

Both Means et al. (2010, 2014) and Bakia et al. (2012) conducted meta-analysis for the United States Board of Education and concluded that the area of blended learning effectiveness was a much-needed area of research. Halverson et al. (2012) analyzed blended learning publication trends and found that publications on blended learning effectiveness were sparse. Watson, Murin, Vashaw, Germin, and Rapp (2013) conducted a study of programs and policies that were being implemented nationwide and found that blended and online learning opportunities were on the rise in the K-12 setting. This research necessitates an understanding of effectiveness regarding blended learning and student achievement. This study adds to this discussion by concentrating on the rotation model of blended learning as pertaining to the content area of middle school language arts. The measurement of academic achievement was based on student CRCT scores.

The following literature review provides the reader with information on how research has contributed to the understanding of blended learning education through the years. In the first section of the literature review, I describe the search strategies used for the study. The second section contains a discussion of online and blended learning.

Blended learning in Georgia is reviewed in the third section. Lastly, the theoretical framework for the study is discussed in the fourth section of the literature review.

Search Strategies

The literature search began broadly with a search on blended learning through Walden University Library's education and multidisciplinary databases, including ERIC, Education Research Complete, SAGE, ProQuest, and Academic Search Complete. The results of these searches were narrowed by applying the following search criteria: full text and peer-reviewed article. The ERIC database search resulted in 776 sources. The Education Research Complete search resulted in 964 sources. The SAGE search resulted in 422 sources. The ProQuest resulted search in 674 sources. The Academic Search Complete search resulted in 583 sources. The majority of articles were duplicated in each of the databases. The key terms used to limit the searches were *blended learning, hybrid learning, rotation, K-12, education,* and *effectiveness*.

Research was also conducted using Google and Google Scholar searches. These searches resulted in many government documents that pertained to blended learning, as well as information about the CRCT, the intended dependent variable. There was no documentation to be found on the validity and reliability of the CRCT; therefore, email was used to contact the Georgia Department of Education. The email did result in finding the intended information on validity and reliability of the test.

Online and Blended Learning

Defining Online and Blended Learning

Online learning is a form of education that is confined to content that can be delivered through the Internet (Watson & Kalmon, 2005). The courses can be asynchronous or synchronous. Courses are constructed to include both assignments and discussions that take place through the chosen software (Watson & Kalmon, 2005). A defined by Watson et al. (2013), "fully online schools are the main education process for their students, who do not need to go to a physical school to access any aspect of their education (although they may do so)" (*p*. 16). These programs do not require students to meet with instructors; however, they may schedule times and places when face-to-face meetings are available. In the United States, 28 states have fully online K-12 programs (Watson et al., 2013).

The term *blended learning* is multifaceted. In general, the term describes an educational setting that blends face-to-face instruction with online-based instruction (Akkoyunlu & Soylu, 2008; Bonk & Graham, 2013; Caulfield, 2011; Dzakiria, Mustafa, & Bakar, 2006; Watson, 2008). Dziuban, Picciano, Graham, and Moskal (2016) defined blended learning as a "fluid" process that integrates media-facilitated technology with face-to-face classroom activities, in which a portion of the face-to-face learning is replaced by online activities. Clayton Christensen Institute (2012) provided readers with a more detailed definition of blended learning:

> a formal education program in which a student learns: (1) at least in part through online learning, with some element of student control over time, place, path,

> and/or pace; (2) at least in part in a supervised brick-and-mortar location away from home; (3) and the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience. (para. 1)

In addition, Means, Bakia, and Murphy (2014) recognized blended learning as allotting at least 30% of content being delivered online and at least 21% of the content delivered face to face. Within these definitions is a plethora of combinations for the way in which traditional education is blended with online education.

There are variations of the categories of blended learning. Staker (2011) divided blended learning into six categories: face-to-face driver, rotation, flex, online lab, self-blend, online driver. The models are presented in order by reliance on online learning. *Face-to-face driver* is the least reliant on the online portion of learning, and *online driver* is the most reliant on online learning. Clayton Christensen Institute (2012) recognized four categories: rotation, flex, a la carte, and enriched virtual models. These are ordered according to their dependence on the online portion of learning, with the rotation model being the least dependent and the enriched virtual model being the most dependent on online learning.

This study focused on the rotation model of blended learning. Staker (2011) recognized this model as the most centralized model because it identifies both the traditional and online portions of learning equally. The rotation model of blended learning entails

> a course or subject in which students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include activities such as small-group or full-class instruction, group projects, individual tutoring, and pencil-and-paper assignments. The students learn mostly on the brick-and-mortar campus, except for any homework assignments. (Clayton Christensen Institute, 2012, para. 2)

Clayton Christensen Institute (2012) subdivided this category further. The four divisions of the rotation model are station, lab, flipped, and individual rotation. The lab rotation model is the division that was researched. In the lab rotation model of blended learning, students participate in a traditional classroom setting and rotate to a computer lab to participate in online learning.

This study went beyond the Clayton Christensen Institute (2012) definition of the rotation model of blended learning. In the model used in this study, students who participated in the rotation model of blended learning were provided self-paced instruction through the online portion of their instruction. This afforded them the opportunity to remediate or accelerate their learning. These students were then grouped during their class instruction according to the data collected from the online instruction. This grouping allowed students to receive differentiated instruction within the traditional component based on their self-paced progress during the online component. Teachers were able to provide students with lessons that pertained to the students' areas of need. The rotation model of blended learning program being studied went beyond the Clayton

Christensen Institute definition of the lab rotation model by including a multimedia-based, self-paced online portion and differentiated instruction in the traditional education.

Research on Blended Learning

Teacher perceptions. Evidence on blended learning is often limited to reports of teacher perceptions. For example, Werth, Werth, and Kellerer (2013) conducted a study involving teachers in rural Idaho. The teachers participated in a perception survey using a branch design dependent on the use of the blended model of instruction. One of the findings was that 53% of the teachers believed that blended learning was effective in increasing student achievement. This type of research regarding teacher perceptions is not a scholarly gauge of the effectiveness of blended learning. There needs to be more analysis of student achievement data in order for appropriate decisions to be made regarding implementation. Further, it would be beneficial to identify which methods of teaching and learning are most beneficial for each student subgroup.

Student perceptions. A search was conducted using the ERIC database to locate information on blended learning student perceptions, with the result of 109 peer-reviewed articles. Of the 109 results, only one source referred to K-12 student perceptions of blended education; the remaining referred to higher education. Chandra and Fisher (2009) found that high school science and physics students were both satisfied and enjoyed the blended learning experience that they were provided. The study had 214 participants. Chandra and Fisher used a Likert scale survey to determine student perceptions of the implemented blended learning; however, there was no discussion of which tests were used to analyze the data. The only discussion of the type of blended learning that was

implemented indicated that 30%-79% of the instruction was facilitated online; therefore, the researchers defined the learning type as blended. The literature is lacking in discussion of methods used for blended learning and implementation of blended learning; thus, it provides weak evidence on student perceptions of blended learning.

The majority of the literature regarding student perceptions of blended learning education pertains to adult learners. Literature that focuses on adult student perceptions is not generalizable to K-8 student perceptions. The population studied in adult student perception literature includes only those people who have graduated from high school and continued to higher education. According to the National Center for Education Statistics, in 2013, the high school dropout rate was 7%, and only 66% of students enrolled in college directly after high school graduation. This means that 41% of the students in Grades K-8 do not go from high school graduation to college. The perception of education is very different for K-12 education and higher education groups; therefore, the generalizability of perceptions about education between adult students in higher education programs and K-12th grade students is weak.

Descriptions. *Blended learning* is a loaded term. There are various terms, descriptions, and models that all fall under the umbrella of blended learning. These variations make blended learning difficult to understand, thus impacting measurements of the degree to which blended learning is being implemented and how it is being studied (Alammary, Sheard, & Carbone, 2014; Dziuban et al., 2016; Picciano et al., 2014; Poon, 2013). Means et al. (2010) declared that their study of blended learning included any combination of online and face-to-face instruction. Uzun and Senturk (2010) simply

referd to blended learning as a combination of virtual learning and face-to-face learning. Ashby, Sadera, and McNary (2011) gave more detail about the specifics of the model of blended learning used in their study, but it was not clear how it was implemented. The model of blended learning that was implemented in their study provided students with all content online and replaced one class per week of face-to-face to face instruction with optional lab class. Kazu and Demirkol (2014) provided readers with several interpretations of blended learning but then did not define which form of blended learning was used in the study.

Blended learning is also synonymous with *hybrid learning* and *mixed learning*. Within the literature, hybrid learning is defined as combining online and traditional face-to-face instruction (Crawford, Barker, & Seyam, 2014; Hall & Villareal, 2015; Martinucci, Stein, Wittmann, & Morote, 2015; What Works Clearinghouse, 2015). Xin, Kempland, and Blankson (2015) added to their definition of hybrid learning that the online portion of instruction is 30%-74% of the total instruction time. Allen and Seaman (2013) concluded that in blended/hybrid learning, 30%-79% of instructional time is online instruction. Kazu and Demirkol (2014) revealed that *mixed learning* is another term that may be used interchangeably with *blended learning*.

Multiple models of blended learning diversify the conversation further. *Flipped blended learning* consists of students engaging in the lecture portion of the course outside of the classroom via online sources and then engaging in discussions and hands-on work in the classroom (Egbert, Herman, & Lee, 2015; Mazur, Brown, & Jacobsen, 2015). Chen and Summers (2015) furthered the discussion by declaring that there are differences in

the terms *flipped classroom* and *flipped learning*. In one study, three flipped learning designs were compared, indicating the diverseness of the vague descriptions of each model of blended learning (Mazur, Brown, & Jacobsen, 2015).

Many of the studies reviewed did not present a clear picture of what the blended model of learning that was being implemented contained. Some of the studies that did present a breakdown of the implementation of blended learning indicated a plethora of implementation procedures. Kazu and Demirkol (2014) described their implementation of blended learning as students spent 12 hours of an 18-hour course face to face and the other 6 hours using an online management system as well as a blog. Giannousi, Vernadakis, Derri, Antoniou, and Kioumourtzoglou (2014) reported that their design consisted of seven face-to-face lectures and six online lectures. The online portion of the course also included discussion boards and quizzes. Smith and Suzuki's (2015) study required students grouped in the traditional and blended models of instruction to both meet in the classroom. Traditional students received the face-to-face delivery of content, and the lesson was videotaped for students in the blended model of instruction to access the following day.

Descriptions within the literature present a varied and complex view of blended learning. The accepted definitions of blended learning are vague, and there are several types of blended learning. Therefore, it is imperative that the specifics of the type of blended learning being investigated are explained so that readers may understand this study. The model of blended learning used in this study was the rotation model of blended learning. Students were provided self-paced instruction through the online

portion of their instruction. The self-paced instruction allowed them the opportunity to remediate or accelerate their learning. Students were then grouped during their class instruction according to the data collected from the online instruction. The grouping allowed students to receive differentiated instruction within the traditional component based on their self-paced progress during the online component. The rotation model of blended learning program being studied went beyond the Clayton Christensen Institute definition of the lab rotation model to include a multimedia-based, self-paced online portion as well as differentiated instruction in the traditional education component.

Trends in blended learning. Halverson, Graham, Spring, and Drysdale (2012) conducted a meta-analysis of literature regarding blended learning. They discussed literature that has been the most widely cited regarding blended learning. Their list of literature begins with work from 2001. These early pieces of literature focused on definitions, frameworks, strategies, and guidelines regarding blended learning; however, through the year 2009, the literature was still being developed around definitions, frameworks, strategies, and guidelines regarding blended learning. Below is a review of several of the pieces of literature that were listed by Halverson et al. (2012).

The earliest research article identified by Halverson et al. (2012) was "A Comparison of Student Outcomes and Satisfaction Between Traditional and Web Based Course Offerings" (Rivera, McAlister, & Rice, 2002). In this study, the authors compared traditional, online, and blended models of instruction at the university level by means of three exams and a student satisfaction survey. The traditional group conducted all elements of the course in the classroom, face-to-face. The online group met once a week

to test and review. Rivera et al. (2002) did not state how often the blended group met. It was recorded that this group completed lectures, assignments, and tests face to face and that course materials, discussions, and exams were provided online. They found no significant difference in achievement; however, the authors did not discuss the effect size or significance value of the *t* test that was used to analyze the results. The study did not clearly clarify the design of the groups or the analysis of data; thus, it provides little knowledge on blended learning achievement.

*"*A study comparing traditional and hybrid internet-based instruction in introductory statistics" (Utts, Sommer, Acredolo, Maher, & Matthews, 2003) and "Using blended learning to improve student success rates in learning to program" (Boyle, Bradley, Chalk, Jones, & Pickard, 2003) were identified for 2003 by Halverson et al. (2012). Utts, Sommer, Acredolo, Maher, and Matthews (2003) used an ANOVA to compare the test scores of university-level students who participated in a traditional model of instruction to those who participated in a blended model of instruction. They found that there was no significant difference in achievement levels between the two groups; however, the Cohen's *d* for the final exam is 0.08 and the pre- to posttest significance value was < .001. Both of these numbers indicate that there was a significant difference in the two groups. The study did not clearly present the results, as the researchers' claims did not match the numbers that they presented. This literature did not provide relevant information. Boyle, Bradley, Chalk, Jones, and Pickard (2003) reported blended learning as being a new educational concept. They compared traditional and blended models of instruction at the university level. The blended model of instruction

students met once a week for a lecture, and all other assignments and materials were provided through an online management system. Students also turned in assignments and took assessments via the online management system. The authors concluded that the students found that the blended model of instruction increased the engagement, motivation, and pass levels of university students; however, they did not provide the effect size or the significance value to support their conclusions.

Halverson et al. (2012) identified twenty-eight studies from 2004 through 2011. All of the identified studies were at the university level. The majority of the studies focused on practices, strategies, perceptions, and experiences of blended learning students and teachers. Only one of the studies identified was a study regarding student learning/achievement. This study was "Blending problem-based learning with web technology positively impacts student learning outcomes in acid–base physiology**"** **(**Taradi, Taradi, Radic, and Pokrajac, 2005). The study population was second year medical students. The model of blended learning included meeting face-to-face three times during the course and participating in both synchronous and asynchronous assignments with a group during the course, and the blended learning students participated in online assessments. The blended learning students' final exam scores were compared to face-to-face students' final exam scores. They found that there was an effect size of 0.721 and a significance value of 0.0009. Both the effect size and the significance value indicates that the students who participated in the blended model of instruction out performed those who participated in the face-to-face instruction model. This study provided evidence that the blended model of instruction was a beneficial alternative to

face-to-face instruction.

A search for blended learning was conducted through the database Academic Research complete to investigate the trends of blended learning from 2010 through the present. Once the search was limited to scholarly literature in the English language from 2010 to the present there were 351 results. Each result was assessed for research in regards to blended learning, and there were 117 found. Of that one-hundred and seventeen, four studies involved K-12th grade education. The four studies pertaining to K-12 grade education will be analyzed as well as other studies that enhance the discussion regarding blended learning.

Effectiveness. There is the potential that blended learning courses improve the effectiveness of the educational environment (Picciano, Dziuban, Graham, 2014). Studies have provided evidence that blended learning increases student engagement and participation, thus promotes learning effectiveness (Asif, Vertejee, & Lalani, 2015; Clark, 2015; Light & Pierson, 2014). Although there is an abundance of literature that declares the potential for blended learning effectiveness, research on effectiveness is lacking (Dziuban et al., 2016; Halverson et al., 2012).

Means, Toyama, Murphy, Baka, and Jones (2010) found a total of 176 research studies that compared a combination of online, blended, and face-to-face instruction and met the qualifications of random assignment or quasi-experiment, and measurement of learning effectiveness. The results of the research indicate that blended learning is more effective than face-to-face instruction, with an effect size of 0.35, $p < .001$. Next, online instruction was compared to face-to-face instruction with an effect size of 0.20 indicating

that online instruction was more effective than face-to-face instruction. The generalization of the research is limited because only nine of the research studies found pertained to K-12 education. The study provides a strong evidence for blended learning across educational levels; however modest to weak evidence regarding K-12 blended learning because of the lack of research regarding K-12 education.

Uzun and Senturk (2010) compared 179 college students' pre- and posttests and concluded that blended learning had significantly higher achievement results than face-to-face instruction alone, with a significance value of 0.00 and a Cohen's effect size value of 1.0. This study provides strong evidence regarding college level blended learning; however, provides weak evidence regarding K-12 blended learning. Thus, it does not provide high generalizability to the intended research.

At the community college level Ashby, Sadera, and McNary (2011) conducted a study in which 167 participants self-selected into either an online, blended, or face-to-face Intermediate Algebra course. The participants were compared using unit tests, final exams, and course averages through an ANOVA. This study had two students from face-to-face, fourteen from blended, and fifteen from online education for a total of 33 students who dropped out. The research found that after removing the students that did not complete the course, the students who participated in online learning performed highest, next were blended learning students, and face-to-face students performed lowest. The students who dropped out of the class skewed the data results. Considering these factors, the study provides weak evidence for blended learning.

In 2012, Wei-Fan (2012) studied the effects of online and blended learning on third grade students. There were 93 students placed in one of three groups: online only, online plus interaction with peers, and online with peer and teacher interaction. A MANOVA was performed to determine differences in post-test scores of the three groups. The findings were that there was not a significant difference between the two blended learning environments but there was a significant difference between the online only group and both of the blended learning groups (p=.00). This study indicates that face-to-face interaction whether peer or teacher is important to the learning process.

Hong, Tsai, Ho, Hwang, and Wu (2013) conducted a study of the effects of blended learning through interactive digital games with a sample size of 255 kindergarten students. The kindergarten students were put into two learning model groups: digital learning and blended learning. The digital learning students did not receive any face-to-face instruction but the blended learning students received both the digital and the face-to-face instruction. Both groups received the same amount of instruction. The students that received the blended model of instruction outperformed the digital learning students in a t-test comparison (p=0.001). The study provides evidence that blended learning through interactive digital games is an effective means of enhancing kindergarten education.

Also in 2013, Jia, Chen, Ding, Bai, Yang, Li, and Qi performed a study in China regarding English learning students. The grading system is different than from the United States and appears to be middle school aged learners. The study group included 4 schools but does not indicate the number of students. The control group participated in a

traditional model of instruction while the experimental group participated in a blended model of instruction. The blended model of instruction implemented an internet based learning management system to teach English. A pre and postassessment were given to all students to measure academic achievement. The researchers reported that the blended model of instruction students achieved significantly higher than the traditional model of instruction students.

Bottge, Ma, Gassaway, Toland, Butler, and Cho (2014) studied the effects of blended learning on middle school students with disabilities. There were 335 students who participated in the study these students were randomly placed in either the traditional model of instruction or the blended model of instruction groups. The study explored the use of blended learning to teach mathematics. The blended learning students participated in online modules with videos and interactive tools as well as face-to-face instruction. The students in the blended model of instruction group showed more academic improvement based on a pre-test, post-test comparison.

A study of 54 high school biology students was conducted using pre-test, post-test, and final exam grades. The statistical test used was the ANOVA. The study concluded that students achieved higher scores in the blended model environment than the face-to-face environment (Kazu & Demirkol, 2014). The study showed that there was a significance value of less than 0.05 (p=0.00) and Cohen's effect size value (d=.57). Given these considerations, this study offers strong evidence of effectiveness of blended learning at the high school level. In addition, this is the only research that was found that had a study population of K-12 grade United States population.

Pane, Steiner, Baird, and Hamilton (November 2015) reported on the effects of personalized learning on student achievement, implementation, and teacher and student surveys regarding personalized learning through a three-year quasi-experimental design which analyzed both quantitative and qualitative data. The personalized learning definition given meets the criteria for blended learning in that it combines face-to-face instruction with instruction through technology platforms and digital content in order to self-pace the learning process. The study population is 1st through 12th grade students and teachers from 83 district and charter schools. The curriculums analyzed were mathematics and language arts. The results of the study were students who participated in the personalized/blended model of education had higher academic achievement than the traditional comparison group. However, the study found that the schools were having difficulty implementing self-paced curriculum because of the concentration of grade level content. This study provides evidence that blended learning is an effective model of learning for K-12th grade students in the areas of mathematics and language arts.

Clark (2015) conducted a mixed-methods study regarding the flipped learning model of blended learning. The study measured student engagement and academic performance. Of the four-hundred and fifty 9th through 12th grade students, forty-two were selected for the study because of their participation in one teachers Algebra class. Engagement was measured by surveys and interviews. Academic performance was measured by a teacher created unit test that was taken at the end of seven weeks. Twenty-seven students participated in the survey and twelve students participated in interviews. A *t*-test was used to analyze the student test scores. The study found that student

engagement was enhanced by the flipped model of instruction; however, no significant difference was found between students who participated in the flipped model of instruction and those who participated in a traditional model of instruction. The study was limited in regards to the time period of implementation and the implementation being confined to one teacher. These limitations were listed in the limitations section of the literature. The study provides limited evidence regarding the flipped model of instruction because of its lack of generalizability and short time frame.

Chih-Yuan Sun and Yu-Ting (2016) studied blended learning in higher education physics using the flipped classroom model of blended learning. The design was a mixed methods design using achievement tests and interviews. One-hundred and eighty-one college freshman participated in the quasi-experimental study. An ANCOVA test was used to analyze the achievement data. The effect size was 0.06 and the significance value was 0.87. The effect size is < 0.1 indicating that there was a weak correlation. The significance value was > .05 indicating that the results are nonsignificant. Considering these values, this study provides weak evidence for blended learning, although they report that there was a medium significance.

Other research studies found that there is no significant difference between achievement levels of students participating in online, blended, or face-to-face instruction. Larson and Sung (2009) conducted a study of 168 undergraduate Principles of Management Information Systems students. ANOVA was used to compare the exam grades of students in each of the online, blended, and face-to-face instruction models. No statistically significant difference was found. As in the majority of other studies, the

participants of this study were participating in higher education classes and there was not a specific definition of blended learning provided to the reader. The research fails to provide significant evidence for specific types of blended learning and the generalizability is lacking.

Generalizability. Blended learning research has primarily been focused at the higher education level where blended learning has been adopted more quickly to accommodate the need for flexibility in time and place of instruction (McGe & Reis, 2012). However, the lack of standardized definitions for blended learning has caused many issues with calculating how many students are participating in blended learning at any level (Dziuban, Picciano, Graham, & Moskal, 2016). The generalizability all of the reviewed studies is questionable because the majority of the data collected is from post-secondary education. There is very little data that investigates the effectiveness of blended learning at the K-12 level (Bakia, Shear, Toyama, & Lasseter, 2012; Department of Education, 2012; International Association for K-12 online learning, 2013). The studies that were found that specifically relate to K-12 blended learning all indicate that blended learning has the potential to be effective in increasing academic achievement (Bottge et al., 2014; Hong et al., 2013; Jia et al., 2013; Kazu & Demirkol, 2014; Pane et al., 2015; Wei-Fan, 2012).

Research methods. The research method that was most used in exploring the effectiveness of the blended model of education is quantitative. One of the methods used was a meta-analysis in which literature involving blended learning effectiveness was explored (Means et al., 2010). The other 4 studies that were reviewed were quasi-

experimental comparison studies. Two of these studies did not utilize a pretest to determine similarity of student knowledge before treatment (Ashby, Sadera, & McNary, 2011; Larson & Sung, 2009). The others used a pre and posttest to determine where the students started and the amount of learning that took place during the treatment. This study utilized the effectiveness of blended learning using a quasi-experimental research method with the use of pre and posttests.

The research test most used in the research methods reviewed was the ANOVA. The ANOVA test compares the means of numerical data but does not allow for determining how the groups differ, only the significance of difference (Field, 2013). In order to contrast differences in the groups, multiple *t*-tests could be used in addition to the ANOVA, but this increases the type I error rate (Field, 2013). The gap in research reviewed implies that there is a need to know what specific types of blended learning are most effective with specific populations. I used both the multiple regression and the ANOVA in order to compare the types of instruction, teacher effectiveness, learning environment, and student label.

In sum, the research regarding blended learning is limited, divided, and vague. The majority of the research pertains to higher education, which limits the generalizability to K-12 education. The results of the blended learning research have not had consistent results regarding effectiveness. And the research does not present a clear definition of what type of blended learning was being researched. The research does not present a clear picture of the effectiveness of blended learning, especially at the K-12 level.

Georgia Blended Learning

The state of Georgia recently enacted legislation that is intended to increase blended learning opportunities for K-12 students. State Bill 289, the digital learning bill, now prohibits Georgia's school districts from limiting online learning opportunities for students and encourages the participation in K-12 online learning (United States. Senate Press, 2012). The State of Georgia has encouraged participation both by means of funding and a personalized learning infrastructure (Georgia Department of Education, 2015a; State of Georgia, 2015). In 2012, Governor Deal signed an executive order to begin the Digital Learning Task Force (State of Georgia, 2012). The Digital Learning Task Force published a report in 2013 which outlined how the State should provide digital learning opportunities, including both online and blended forms of K-12 education, and the educational infrastructure (Digital Learning Task Force, 2013). The Georgia Department of Education supported an increase in digital learning by providing competitive grants to school systems that equaled $37 million in 2014.

Georgia has met this demand by beginning several free public K-12 online schools (Littlefield, 2015). At this point there is no record of a K-12 fully blended model of education in Georgia (Watson, Murin, Vashaw, Germin, & Rapp, 2013). However, one of Georgia's initiatives is personalized learning (Georgia Department of Education, 2015a). School districts are applying this concept in various ways. There are K-12 schools that are piloting blended learning programs to increase online learning access to students.

The Evergreen Education Group has published Keeping Pace with K-12 Digital Learning for 12 years. The publication reports on research, trends, and practices regarding digital learning (Gemin, Pape, Vashsaw, & Watson, 2015). The 2015 report declares that the majority of school districts are implementing some type of digital learning opportunity for their students. Georgia is one of States highlighted in the 2015 report. Gemin, Pape, Vashaw, and Watson (2015) review two county initiatives for digital learning as well as the Georgia Cyber Academy. The Gwinnett online campus provides a blended model of instruction for their 4th through 9th grade students. The second highest enrollment in the Gwinnett online campus is language arts (Gemin, Pape, Vashaw, & Watson, 2015). In addition, Georgia is included in the 5 largest State virtual schools (Gemin. Pape, Vashaw, & Watson, 2015).

Theoretical Framework

There are two theories that provide a theoretical framework for the research. The cognitive theory of multimedia learning (Mayer, 2009, 2014) is the framework the online portion of the rotation model of blended learning. Mastery learning (Bloom, 1968) was the framework for the self-paced learning component of the rotation model of blended learning. Each of these theories will be discussed in detail in the following pages.

Cognitive Theory of Multimedia Learning

The theory that was used to frame the research is a branch of cognitive learning theory. Cognitive learning theory provides a lens of how mental processes elicit learning (Yilmaz, 2011). Mayer (2009, 2014) expanded on cognitive learning with the cognitive theory of multimedia learning. “A cognitive theory of multimedia learning assumes that

the human information-processing system includes dual channels for visual/pictorial and auditory/verbal processing, each channel has limited capacity for processing, and active learning entails carrying out appropriate cognitive processing during learning" (Mayer, 2009, *p*. 57).

Dual processing is the concept that the brain processes information from both images and verbal stimuli; therefore, if both stimuli are used in conjunction then the information is more likely to move into long term memory. Figure 2 below presents a visual of how pictures, spoken words, and printed words are processed. Visual stimuli can be images or printed words which are processed through the eyes first. Auditory stimuli is received from someone else narrating or reading text. Learning is accelerated when the learner is presented with both relevant visual and auditory stimuli that complement one another (Mayer, 2009, *p*. 208).

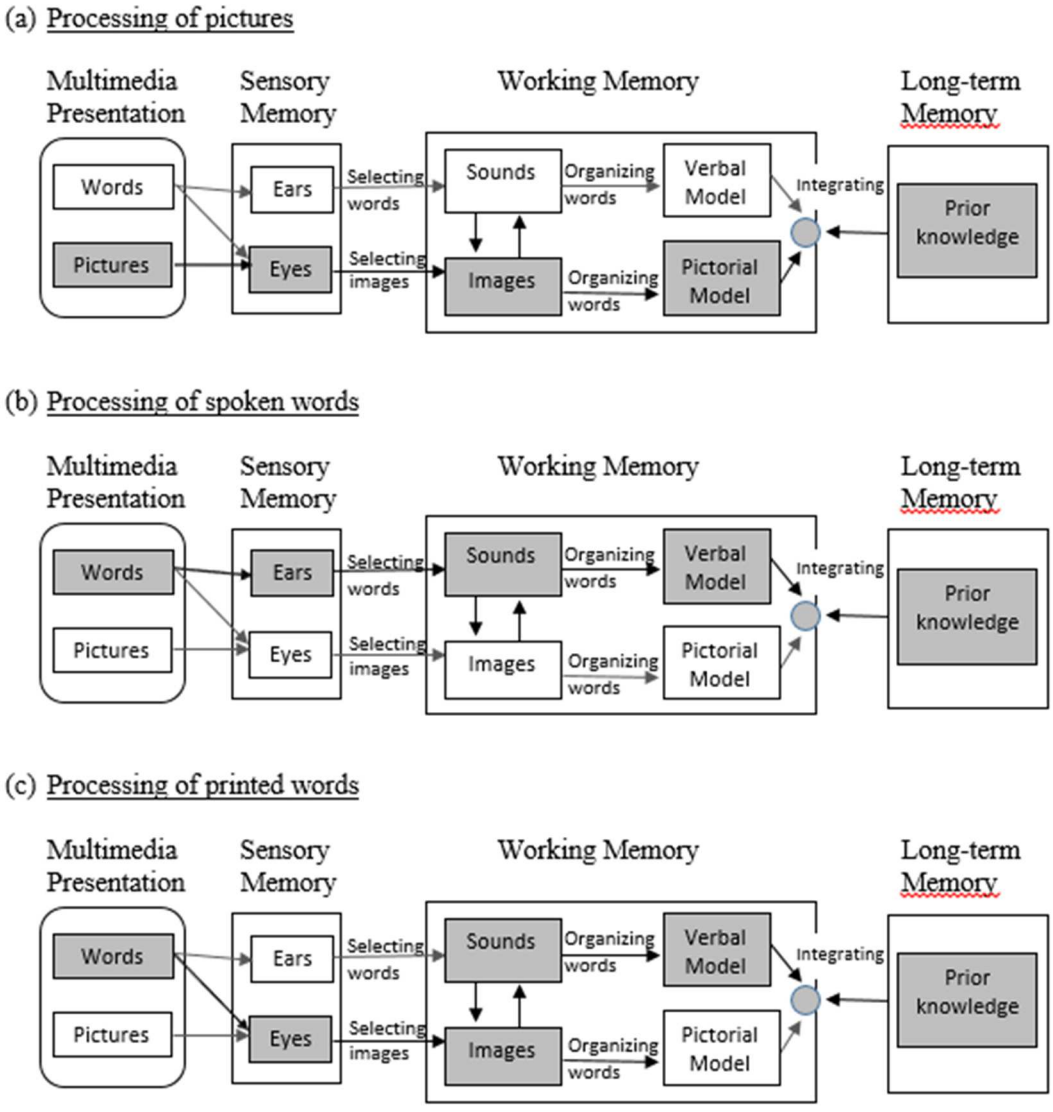

Figure 1. Recreation of Mayer's process of multimedia learning. From *Multimedia Learning* (2nd ed., *p*. 77), by R. E. Mayer, Cambridge, MA: Cambridge University Press. Copyright [2009].

Limited capacity recognizes that the brain is only able to process a limited amount of information at a time (dependent on the individual) (Mayer, 2014). The average individual can process about five to seven pieces of information at a time (Mayer, 2009, *p*. 67). More information can be remembered if it is taken in by different channels, thus to not overload either of the channels, and the information overlaps (Mayer, 2009, *p*. 66).

Active processing describes the process of how an individual selects, organizes, and integrates information (Mayer, 2009, *p*. 71). The individual is an active participant in the learning process. The learner must be attentive to be able to select the relevant information. The learner then organizes the selected information for understanding. Next, the learner connects the visual and auditory information and associates the information to build onto their knowledge scaffold.

The principles of segmenting, pre-training, and modality are key to the multimedia learning process (Mayer, 2009). Segmenting breaks lessons/units into small chunks of instruction that the learner is able to pace. Pre-training is the concept that learners must be taught the foundational information needed to understand the lesson before the lesson is presented. Both of these principles protect the learner from cognitive overload (Mayer, 2009). The modality principle states that learners are able to retain more information "from pictures and spoken words than from pictures and printed words" (Mayer, 2009, *p*. 200). This principle supports the concept of dual coding in that if both auditory and visual stimuli are provided in conjunction the learner is better able to learn the material (Mayer, 2009).

Hagiwara (2015) conducted research using the multimedia theory of learning with 32 English speakers who were taking a Japanese language university level course. The students participated in a translation assessment which was analyzed using a two-way repeated measures ANOVA. Hagiwara (2015) reported that the data supported Mayer's multimedia theory of learning (Mayer, 2009). The study is limited to university English students learning Japanese. In addition, there were only 32 students who participated in this study. The study provides a weak contribution to the effectiveness of Mayer's multimedia theory of learning (Mayer, 2009).

Shu-Chiao Tsai (2012) performed a study with 129 Chinese speakers who were learning to speak specific English words for their occupations. The adult learners were split into three groups: face-to-face, blended, and online. The learning software was partially developed based on Mayer's theory of multimedia learning (Mayer, 2009). The learners were given pretest and a posttest to analyze learning. The results of the study showed there was no significant difference in any of the three groups of learners, thus this study also provides a weak contribution to the effectiveness of Mayer's multimedia theory of learning (2009).

Also in 2012, Ibrahim studied the impact of multimedia learning. Two-hundred and twenty-six undergraduate students who were broken into two groups based on the video they viewed. One video was an original educational video on insects that included no text. The other video was modified into segments with text to focus on important portions of the video as well as video that was interesting but not educational removed, as to follow Mayer's theory of multimedia learning (Mayer, 2009). The students

participated in a pretest and a posttest to analyze learning, and a MANCOVA statistical test was used to analyze the data. The results were that students that viewed the video that had been modified to meet the theory of multimedia learning significantly outperformed the other group. This research provides a strong contribution to support Mayer's theory of multimedia learning (Mayer, 2009).

Kennedy, Thomas, Meyer, Alves, and Lloyd (2014) conducted an analysis of 141 high school world history student learning. They compared student learning through a pretest and posttest which were analyzed through one-way ANOVAs. The students participated in one of two instructional models. One group of students received the lesson via multimedia podcasts which were shared with the whole class through a LCD projector and speakers. The other group of students received text based lessons through a LCD projector. The results were that both regular education and special education students that received the lesson via the multimedia podcasts significantly outperformed the students that received text based lessons. This study provides a strong contribution to support Mayer's theory of multimedia learning (Mayer, 2009)

Although there is mixed literature on Mayer's theory, Schüler, Scheiter, and van Genuchten, (2011) analyzed many of the contributing literature to Mayer's theory of multimedia learning. They concluded that "it seems safe to argue that using the current multimedia learning theories is appropriate for educational research as long as they explain the phenomena of interest" (*p*. 408). Thus, the phenomena of interest are well documented in the research provided and is supported by Mayer's theory of multimedia learning (2009).

The cognitive theory of multimedia learning supports the concept of blended learning. The rotation model of blended learning that was implemented by the school of interest includes the Edgenuity online program. This product allows for dual processing of information; limited capacity; and active processing as students learn information by being active participants in the learning process. The student is able to participate in dual processing through the use of videos, text and read-aloud, images and audio. The student is able to control the information that he/she is receiving by repeating lessons or proceeding to the next lesson at a personalized pace, when mastery has been demonstrated. The tools that are available through the Edgenuity program, such as notes and highlighters, assist the student with distinguishing which information is important. In addition, the student is an active participant in organizing and integrating information as they learn and thus are able to gain each piece of the content so that there are no gaps in knowledge.

Mastery Learning

Bloom (1968, 1971) presented the theory of mastery learning. The theory was the lens for this study as it supports the use of self-paced learning. The theory of mastery learning is that the majority of students can reach a high level of learning achievement given the appropriate time and environment. Bloom also states that all students have individual educational needs and when these needs are met students are able to reach a high level of achievement. Bloom recommends that students take assessments often and receive feedback and corrective assignments based on these assessments. Then once the corrective assignments have been completed the student takes another assessment on the

same content to determine mastery of the content (Bloom, 1976; 1977). Students should not move forward until they have reached a mastery level of the information. The theory predicts that student gaps in achievement will be filled as students learn the prerequisite knowledge needed to learn higher level content.

Bloom (1968) recognized five variables for mastery learning. First, students have individual aptitudes for learning and their aptitudes vary across content. Here aptitude has to do with how much time a student needs to learn the material. Second, the quality of instruction affects mastery learning. The quality of learning is based on the way in which the content is delivered to the student, the amount of information the student is presented with at a time, and the sequencing of the content. Third, the content must be presented to the students in a way which they can understand. The instruction must be clearly communicated to the student through the language used and the steps of the task. Fourth, each student differs in their perseverance for the expected task. Last, because of these variables, students vary in the time it takes to master different content.

There have been research studies to support the use of mastery learning in education. Guskey (2007) found that Bloom's mastery learning has been implemented successfully. He reviewed several research studies and concluded that the educational programs that are founded on Bloom's mastery learning are able to fill gaps in student learning. As the gaps are filled, overall student achievement is gained. In 2011, a research study found that mastery learning promoted student motivation and achievement because they felt personally responsible for their learning (Changeiywo, Wambugu, & Wachanga, 2011).

Bloom's mastery (Bloom, 1968) learning supports the concept of self-paced learning. Each student has unique learning aptitudes and therefore need to be able to remediate or accelerate at their own pace. This is unlikely to happen in an educational environment where all students are taught synchronously. However, in a rotation model of blended learning environment students are able to move through content at their own pace. According to Bloom's mastery learning, these students should be able to fill in any gaps in learning they may have and continue to master each content area. When gaps in learning are filled, students have the needed knowledge to continue learning more advanced lessons. In addition, an educational program based on Bloom's mastery learning should increase student motivation and achievement which should increase their perseverance for the expected task (Bloom, 1968; Changeiywo, Wambugu, & Wachanga, 2011).

In 1979, it was recognized that mastery learning was a sound theory but education was not able to implement its principles at that time (Horton, 1979). Horton revealed that mastery learning required specific goals to obtain; a way to quickly and effectively assess students and provide feedback; and change in the rigid time structure of the school schedule. Since that time, specific goals for each subject area for each grade level have been issued by each State. The use of automated learning programs such as Edgenuity provides quick and effective assessment and feedback. Lastly, the rotation model of blended learning allows for flexibility in the school schedule.

Through the years mastery learning has been criticized and questioned. Slavin was one of the greatest critics of mastery learning. Slavin (1987) explored the

effectiveness of mastery learning and lists three forms of mastery learning: personalized system of instruction, continuous progress, and group-based mastery learning. Slavin's concept of schooling differed from what is an option today. His objections to mastery learning included instructional time needed to conduct mastery learning, and misaligned objectives as measured by experimenter created assessments (1987). However, one of the prerequisites of studies that were chosen for the meta-analysis was "group-based mastery learning" (Slavin, 1987, *p*. 16). In 1989, Slavin also wrote a critique based on mastery learning effectiveness which limited the research to group-based mastery learning and indicated that there was no statistical significance found in the research (Slavin, 1989). In addition, Slavin participated in an interview in which he made the following statement: "The concept of mastery learning is almost axiomatically true, but the issue is what it means in actual practice. I am talking here only about group-based mastery learning" (Kulik, Kulik, Bangert-Drowns, & Slavin, 1990, *p*. 24). He said, "either corrective instruction must be given outside of regular class time, or students who achieve mastery early on will have to waste considerable amounts of time waiting for their classmates to catch up" in order for mastery learning to be obtainable (Slavin, 1987, *p*. 6).

There are several reasons that Slavin's concerns with mastery learning are not a concern in the school environment that is being researched. First, the study's school environment is not based exclusively on group-based instruction. It is based on self-paced instruction. This element in itself makes Slavin's critique of mastery learning irrelevant. Second, instructional time is not different in the control and experimental groups used for the intended research. Third, all students are being measured based on a state

standardized assessment that all students in Georgia participate in. Mastery Learning is an option that can be effectively provided using blended learning.

In 2014, Pearson, Floryn, and the CAN Corporation made a comparison of three Kentucky high schools that were implementing mastery learning. The research reported that students were more engaged and their achievement was enhanced as a result of the implementation of mastery learning. However, there were challenges in implementing mastery learning in the schools. One of the most noted challenges was overcoming the traditional school culture. Issues such as students of the same age being on different levels of education according to their mastery level and the traditional averaging of grades made demonstration of mastery of a subject difficult.

Blended Learning Implementation at Study School

The rotation model of blended learning as implemented by the school of study allows for students to have a personalized learning experience by means of both online and face-to-face instruction, as defined by Clayton Christensen Institute (2012). During the online portion of the blended learning, students are able to participate in lessons at a self-paced learning process through online lessons facilitated by Edgenuity in order to master the subject matter, supported by the theory of mastery learning (Bloom, 1968; Guskey, 2010; & McGaghie, Issenberg, Barsuk, & Wayne, 2014). The online lessons, which consist of videos, readings, and assessments, enable the students to remediate or accelerate their learning process on an individual pace, as supported by the theory of multimedia learning (Mayer, 2009, 2014).

The face-to-face aspect of the rotation model of blended learning as implemented by the school of study allows teachers to differentiate learning based on student academic need as revealed by assessment. The assessment data that is recorded during lab time is evaluated and students are grouped by area of need weekly. Students that are not grasping learning standards were grouped together in order to tailor the lessons to specifically meet the needs of the students. The portion of face-to-face learning in the blended model of instruction has been poorly defined in the literature.

The computer management system that was used in the school of study is the Edgenuity software program. The instructional materials supplied by Edgenuity were aligned with the Georgia State curriculum standards and common core. The instructional materials contain videos, assignments, and assessments. The videos present a teacher in the top right hand corner of the screen and images of the content being taught on the rest of the screen. The teacher then walks the students through the content by interacting with the images. Students are able to pause, rewind, and once a lesson is watched in its entirety students may fast forward the videos to take notes or repeat information. Each lesson ends in an assignment. The definitions of mastery learning provided by Guskey (2010) and McGaghie et al. (2014), and the theory of multimedia learning (Mayer, 2009, 2014) support the use of a computer management system.

The assignments provided by Edgenuity consist of readings with embedded questions, problems that students are expected to solve, or e-writing. The assignments that result in one right answer, such as multiple choice or math calculation, are graded by the software program and result in immediate feedback. Assignments that can have

multiple right answers, such as written responses, must be graded by the teacher. Each unit ends in a multiple-choice question assessment which must show mastery of the content for the student to continue. The formative and summative assessments reviewed align with the definitions for mastery learning provided by Guskey (2010) and McGaghie et al. (2014).

The unit assessments provided by Edgenuity also give students immediate feedback on their progress shown by the student progress dashboard. The feedback includes a percentage score and a breakdown of what questions they marked correct and incorrect. The dashboard shows students their progress in each subject area which is aligned with the State curriculum standards, so that students are able to determine what areas they need to allocate more effort. Feedback is an essential component in mastery learning (McGaghie et al., 2014).

Figure 2 below presents the time allotment for both the traditional students and the rotation model of blended learning students at the school of study, the operational constructs are also discussed in Chapter 3. The school day is 8 hours. Each group had two hours of nonacademic activities, four hours of core academic learning (Mathematics, English/language arts, Science, and Social Studies), and two hours of connection classes (Physical education, health, Family and consumer science, band, chorus, art, Spanish). The arrangement of these allotted times did fluctuate across grade levels. However, the allotment of time for the core academic learning differs in each of the two models. The traditional model provides an hour for each of the subject areas. Whereas, the rotation

model of blended learning provides a two-hour block of self-paced online learning and two hours for traditional face-to-face instruction.

The pace of instruction is different for each of the two groups. The traditional education classes must move at the teacher's discretion where most students are prepared to move ahead, some have not mastered the subject and others have been ready to move ahead for some time. The rotation model of blended learning students were able to move to the next subject when they have personally mastered the subject. The teachers were then able to group students based on their strengths and weaknesses, as recognized by online assessments, to group students during their face-to-face instruction, all of which are key components of mastery learning (Bloom, 1968; Guskey, 2010; & McGaghie, Issenberg, Barsuk, & Wayne, 2014).

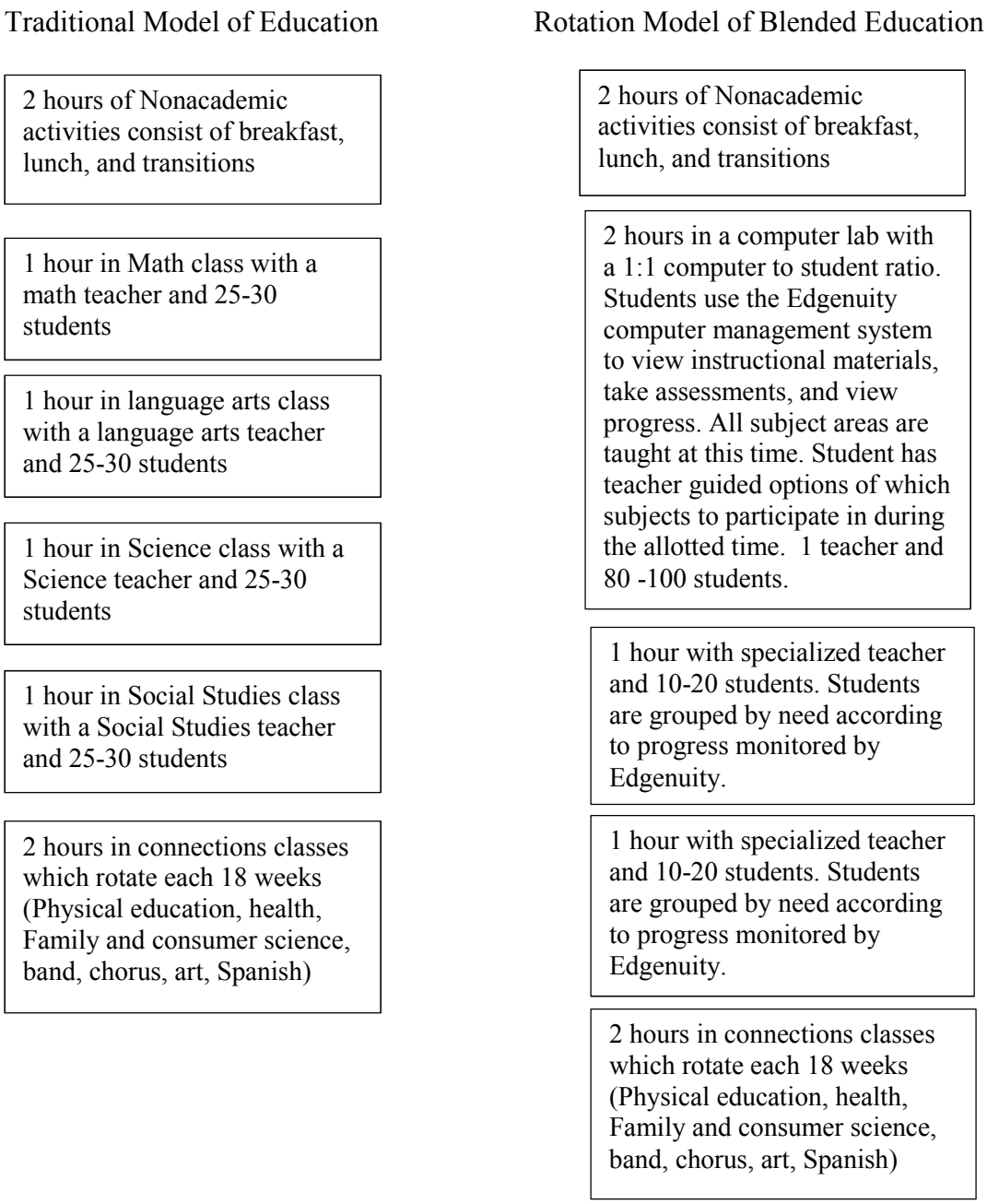

Figure 2. Time allotment for traditional students and rotation model of blended learning students at the school of study.

Summary

This literature review revealed the following three main points: 1) the majority of literature on blended learning has been based on defining blended learning, 2) there has been mixed evidence on the effectiveness of blended learning, 3) and there is little published research on K-12 blended learning and effectiveness. The lack of consensus on defining blended learning has made research less significant, because it lacks generalizability (Alammary, Sheard, & Carbone, 2014; Dziuban et al., 2016; Picciano et al, 2014; Poon, 2013). Nine pieces of literature were found that assist in defining blended learning and blended learning subcategories (Akkoyunlu & Soylu, 2008; Bonk & Graham, 2013; Caulfield, 2011; Clayton Christensen Institute, 2012; Dzakiria, Mustafa, & Bakar, 2006; Staker, 2011; Watson, 2008; Watson & Kalmon, 2005; Watson et al., 2013). Nine research articles found evidence that blended learning enhanced academic achievement (Ashby, Sadera, & McNary, 2011; Bottge, Ma, Gassaway, Toland, Butler, & Cho, 2014; Hong, Tsai, Ho, Hwang, & Wu, 2013; Kazu & Demirkol, 2014; Means et al., 2010; Pane, Steiner, Baird, and Hamilton, November 2015; Uzun & Senturk, 2010; Wei-Fan, 2012; Werth, Werth, & Kellerer, 2013). One research study found that there was no significant difference in blended learning and traditional learning academic achievement (Larson & Sung, 2009). Only one of these research studies that pertained to the K-12 population (Ash, 2012). The generalizability of the available research is lacking and there is a high need for research regarding K-12 education, blended learning, and effectiveness (Bakia et al., 2012; Dziuban et al., 2016; Halverson et al., 2012; Kennedy, 2013; Means et al., 2010; Means et al., 2014; Staker, 2011; Watson et al., 2013).

The theories of cognitive theory of multimedia learning (Mayer, 2009) and mastery learning (Bloom, 1968) present evidence of why the rotation model of blended learning using the Edgenuity program should be an effective blended model of education. The cognitive theory of multimedia learning (Mayer, 2009) reveals that the Edgenuity program should enhance learning through the processes of dual processing, limited capacity, and active processing. Self-paced learning through the rotation model of blended learning is consistent with mastery learning (Bloom, 1968) principles as students are provided quality education with the time and assistance needed to master the entire curriculum.

Chapter 3 will discuss the methods used to study the effectiveness of the rotation model of blended learning in Middle School language arts based on academic achievement. This study seeks to fill the gaps revealed in the literature pertaining to effectiveness, K-12 education, and a specific form of blended learning.

Chapter 3: Research Method

Introduction

The purpose of the research study was to determine if the rotation model of blended learning using Edgenuity results in higher academic achievement in middle school language arts than the traditional model of education. This chapter provides information regarding the methodology of the study. The specifics of the middle school study population are documented, as well as how the students were grouped. In this section, I present how the data were gathered and how the data-gathering instrument was used. The threats to validity and ethical procedures are also discussed within this chapter.

Research Design and Rationale

The research method that aligned with the research question was quantitative. In this research, I sought to determine whether the traditional or the rotation model of blended learning best facilitates the learning of language arts at the middle school level. A quantitative method was the most appropriate, as it allowed for the comparison of an independent variable and dependent variables. The model of instruction was the independent variable of the study, and the CRCT scores were the dependent variables of the study. The following four moderator variables were analyzed to determine their effects on student achievement: pretest score, teacher effectiveness, learning environment, and student educational label.

The research design was a naturalistic quasi-experimental design. The school of study began implementing the rotation model of blended learning in 2013, and the CRCT scores were the natural outcome of the academic achievement of the students. Students

could not be randomly assigned to a learning model of instruction, as their parents voluntarily selected which model of instruction their children would participate in during the 2013-2014 school year. The state of Georgia implemented a new state standardized test in 2015 that was not comparable to the CRCT scores; therefore, the data used for the study were retrieved from the years 2013 and 2014.

Methodology

The methodology section contains information regarding the study population, sampling procedures, and procedures for recruitment, participation, and data collection. The study population was retrieved from one Georgia middle school. The data were historical data; therefore, permissions from the school and county were obtained, but individual recruitment and permissions were not necessary.

Population

The population consisted of non-Title 1 Georgia public middle school students within the same school in a metropolitan school district. The school population was 979 students during the 2013-2014 school year. The demographics of the population were 67.05% White, non-Hispanic; 22.67% Black, non-Hispanic; 4.57% Hispanic; 4.48% Multiracial; .95% Asian or Pacific Islander; and .29% American Indian or Alaskan Native. The students were divided into two educational groups by parent choice. The traditional educational group consisted of 554 students, including 137 sixth graders, 218 seventh graders, and 199 eighth graders. The rotation model of blended learning group consisted of 407 students, and this group included 154 sixth graders, 118 seventh graders, and 135 eighth graders.

The Georgia government selected 12 counties to be Race to the Top counties. Each of these counties was required to submit plans indicating how they were to implement personalized programs and science, technology, engineering, and math (STEM) programs in their schools. The county in which the school of study was located was one of the elected counties. The school of study was one of the schools that began adopting a personalized learning program through the rotation model of blended learning to meet Race to the Top plans (Georgia Department of Education, 2015b).

Sampling and Sampling Procedures

The research explored whether there were differences in student academic achievement by means of the CRCT test (dependent variable) as a result of the model of instruction students received (independent variable). The research was a between-subjects design because the groups were distinguished by the model of instruction the students received. There was one dependent variable and one independent variable with two groups (the traditional model of instruction and the rotation model of instruction). The covariate (added independent variable) of the previous year's CRCT score was evaluated to compensate for group nonequivalence. The two groups also had the following covariates: pretest score, teacher effectiveness, learning environment, and student educational label. The CRCT scaled scores were continuous variables, and the model of instruction was a nominal variable. The test used for the majority of the research reviewed was the ANOVA; however, the ANOVA could not accurately account for all of the confounding variables that were being evaluated in the research. The appropriate test for comparison of the two models of instruction with the confounding

variables was multiple regression. All of the covariates were analyzed through the multiple regression using a stepwise procedure.

The G*Power software was used to determine the needed sample size. The test chosen was linear multiple regression: fixed model, *r*-squared deviation from zero. The effect size was set at .15, the alpha level was set at .05, and the confidence interval was set at .95. The number of predictors for the research was six (pretest score, teacher effectiveness, learning environment, student educational label, posttest blended learning, and posttest traditional learning), which calculated a census sample of a minimum of 146 (Faul, Erdfelder, Lang, & Buchner, 2007). The analysis can be viewed in Appendix C. There were six census samples with at least 73 students per group, because each grade level was broken into separate groups and model of instruction groups due to the inability to compare across grade levels. This accounted for at least 146 students per grade level group. The predictors of pretest score, teacher effectiveness, learning environment, and educational label are discussed in detail in the operational constructions portion of this chapter. The predictors were also mentioned in the Nature of Study, Definitions, and Limitations sections in Chapter 1 and were discussed in the methodology section of Chapter 2.

The teacher effectiveness and learning environment predictors were discussed in the definitions section of Chapter 1, and the rubrics for the evaluations are provided in Appendix B. The teachers' scores on the Teacher Keys evaluations were compared by grouping according to model of instruction. The comparison investigated whether teacher

effectiveness and learning environment were similar in both the traditional and the blended-learning models of instruction.

The data needed for the study were historical data. The data were archived at the school that piloted the rotation model of blended learning program. The sampling strategy that was implemented was a sample size for a linear multiple regression: fixed model, *r*-squared deviation from zero.

Procedures for Recruitment, Participation, and Data Collection

There was no recruitment process because the data used were historical. An administrator at the school of study provided me with the data. I received an email (Appendix D) that stated that I had permission to collect the data. Before data could be collected, IRB permission was granted, and then school/county permissions were granted.

The Criterion Referenced Competency Test (CRCT) has been analyzed for both validity and reliability according to the Georgia Department of Education (2014b). Reliability is checked by the Cronbach's alpha reliability coefficient and standard error of measurement tests. The Cronbach's alpha scores recorded for the language arts portion of the testing were .91 for sixth grade, .91 for seventh grade, and .88 for eighth grade. The standard error of measurement test results recorded were 2.81 for sixth grade, 2.65 for seventh grade, and 2.68 for eighth grade (Georgia Department of Education, 2014b). Validity was ensured as curricular specialists, Georgia educators, and professional assessment specialists reviewed the field test responses to check that the questions measured the intended curriculum and standards (Georgia Department of Education, 2014b).

Operationalization of Constructs

Part of each grade level in the school of study participated in the traditional model of instruction, which was teacher-directed, face to face, and synchronous (Bonk & Graham, 2013, *p*. 5). The other part of the school of study participated in the blended model of learning, which consisted of

> a formal education program in which a student learns: (1) at least in part through online learning, with some element of student control over time, place, path, and/or pace; (2) at least in part in a supervised brick-and-mortar location away from home; (3) and the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience. (Clayton Christensen Institute, 2012, para. 1)

The specific type of blended learning in which these students and teachers participated was the rotation model of blended learning:

> a course or subject in which students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include activities such as small-group or full-class instruction, group projects, individual tutoring, and pencil-and-paper assignments. The students learn mostly on the brick-and-mortar campus, except for any homework assignments. (Clayton Christensen Institute, 2012, para. 2).

The rotation model of blended learning was implemented through the online tutorial mastery learning system Edgenuity, an instructional online program that was used to facilitate the online portion of the rotation model of blended learning. The program

provides assessments, lessons, and assignments to teach and assess student progress with the subject matter. The program was used in all of the core content areas (mathematics, language arts, reading, science, and social studies).

CRCT scores were categorized into three groups of scaled scores throughout each grade level. The *exceeds expectations* category corresponded to a score of 850 or above. The *meets expectations* category indicated a score of 800 to 849. The *does not meet expectations* category signified a score below 800. Because the curriculum standards are different each school year, the scores are not to be compared from school year to school year. The CRCT scores were compared by educational model of instruction during the 2013-2014 school year. Group equivalence was evaluated by comparing the 2012-2013 CRCT scores.

The moderator variables in the study were pretest score, teacher effectiveness, learning environment, and student educational label. The pretest scores were the CRCT scores from the previous year. The scores were grouped by model of instruction in the year of study to establish equality of groups. Teacher effectiveness and learning environment were compared using the Georgia Teacher Keys Evaluation. The teachers were grouped according to the model of instruction in which they taught. The groups were then compared based on their evaluation scores. The evaluation was assessed by the school principals and was based upon observation or data pertaining to teacher professional knowledge, instructional planning, instructional strategies, differentiated instruction, assessment strategies, assessment uses, learning environment, academically challenging environment, professionalism, and communication. Each of the components

was assessed individually multiple times during the school year. At the end of the school year, each teacher received a summative evaluation based on all of the formative evaluations throughout the school year. The performance standards and rubrics are provided in Appendix B. Learning environment is one of the 10 components evaluated in the Georgia Teacher Keys Evaluation. The Georgia Department of Education defines a *positive learning environment* as one in which "the teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all" (Georgia Department of Education, Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2014, *p*. 40). These moderator variables were analyzed to ensure that both groups of students received the same quality of education and that quality of education was not the result of any difference in academic achievement.

Students are given educational labels in one of three categories depending on their need for assistance with learning: special education, regular education, and gifted education. Students who receive special education services have struggled to learn subject material. Teachers and parents work together to develop an individualized education plan for these students that may allow students to be placed in smaller groups, have extended time, receive repeated directions, and/or have other accommodations dependent on student need. Regular education students do not receive any accommodations. Gifted education students have passed a norm-referenced test to determine that they qualify for the gifted education curriculum created by the local board of education (Georgia Department of Education, 2015d). In addition to being part of the

whole group, these students were grouped according to their label in order to analyze the differences in their scores to determine if any group benefited more or less from the type of educational model they received during the 2013-2014 school year.

The following describes the constructs of the two models of instruction at the school of study. The time allotted for academic classes, connection classes, and nonacademic activities was the same for both groups of students; however, the scheduling of the blocks of times differed for each of the grade levels. Below is a bullet list of the blocks of times for each group. The times are also shown in Figure 2 in Chapter 2.

Traditional Model of Instruction

- Four hours in core academic classes (language arts, math, social studies, and science) in the traditional learning environment.
- Two hours in connections (physical education, health, family and consumer science, band, chorus, music appreciation, Spanish, art).
- Two hours of nonacademic activities (transitions, breakfast, lunch).

The Rotation Model

- Two hours in a computer lab learning core academic content areas (language arts, math, social studies, and science) through the artificial intelligence computer learning program Edgenuity.
- Two hours of traditional instruction.
- Two hours in connections (physical education, health, family and consumer science, band, chorus, music appreciation, Spanish, art).

- Two hours of nonacademic activities (transitions, breakfast, lunch).

The main difference in these two classroom learning environments was the pacing of learning resulting in mastery learning. The traditional students were taught synchronously, meaning that all students were held at the same pace of learning, which was determined by the teacher (Bonk & Graham, 2013). The rotation model students received self-paced learning (Clayton Christensen Institute, 2012). During the time that the blended learning students spent in the computer lab, they were able to move through the content at their own pace, repeating content or advancing at a self-determined pace. At the end of each unit, students participated in an assessment that required mastery to move forward. The study was conducted during two semesters.

The data (assessments) collected from the Edgenuity program provided teachers with information on how to group the students best based on their knowledge of the content during the traditional classroom time period; thus, each traditional classroom's focus was uniquely based on student need. Teachers viewed the data weekly or multiple times per week to determine which students were not achieving their target goals and where these students were struggling. During the traditional classroom time, students were grouped according to their areas of need. These students were able to get additional face-to-face instruction regarding their areas of need without holding other students back. Students who were on target or exceeding expectations were able to work on projects to enhance mastery of the content.

Data Analysis Plan

Coding

There are several variables that were coded in SPSS to analyze the differences in the groups. The CRCT scores from the previous year were the pretest data and were used to ensure equality of the groups. The pretest scale score was a moderator variable.

The posttest was the CRCT scale score from the year of study. This data is interval data and was recorded as the scale score. The posttest scores were compared to analyze differences in student academic achievement.

Transformations and Added Dummy Variables

The following table presents the nominal variables for the study and how they were coded into dummy variables. A dummy variable is a numerical value used to represent a category or level.

Table 1

Coding Nominal Variables

Nominal variables	Coded 1	Coded 2	Coded 3	Coded 4
Model of instruction	Traditional model	Rotation model of blended learning		
Student educational label	Special education	Regular education	Gifted education	
Georgia Teacher Keys Evaluation	Ineffective	Needs development	Proficient	Exemplary
Learning environment	Ineffective	Needs development	Proficient	Exemplary

Exploratory Analysis (e.g., Graphing the Data, etc.)

Stepwise multiple regression was used to analyze the data through the SPSS software program. The data were graphed as a box plot, histogram, and scatterplot to analyze the statistical assumptions and coding errors. These graphs were also be used to test the hypothesis through visualization. The correlation coefficients were analyzed to determine the relationships between confounding variables. The multiple regression provided an ANOVA that provides the *F*-value and the significance value (Field, 2013). Missing data were managed by omitting the record for that student.

Testing of Statistical Assumptions

All statistical tests have assumptions that were tested to ensure the conclusions of the study are accurate. The statistical assumptions were identified by the statistical test being implemented in the study. A multiple regression statistical analysis required the following assumptions: additivity and linearity, independent errors, homoscedasticity, and normally distributed errors, and homogeneity of regression slopes (Field, 2013). The assumptions of additivity and linearity and independent errors were tested using the Durbin-Watson test (Field, 2013). The assumption of homoscedasticity were tested using a box plot. A histogram was used to test both the homoscedasticity and normal distribution of errors (Field, 2013). A scatterplot was used to analyze the homogeneity of the regression slopes (Field, 2013).

Research Question(s) and Hypotheses

- What is the difference in academic achievement as revealed by CRCT scaled scores in language arts of sixth, seventh, and eighth grade students

participating in a rotation model of blended learning by means of the Edgenuity software program as compared to those participating in a traditional model of instruction?

Hypotheses

1. $H1_0$: There was no significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

   $H1_a$: There was a significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

2. $H2_0$: There was no significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

   $H2_a$: There was a significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

3. $H3_0$: There was no significant difference between the traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

   $H3_a$: There was a significant difference between the traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

4. $H4_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

   $H4_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

5. $H5_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

   $H5_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

6. $H6_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

   $H6_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

Testing of the Hypotheses

The hypotheses were tested by analyzing the *F* ratio from the multiple regression, which provided data on the significance of difference between the academic achievement

of the traditional model of instruction students and the rotation model of blended learning students.

Additional Exploratory Analyses and Supplemental Comparisons

The moderator variables of pretest, teacher effectiveness, and learning environment were analyzed to determine if they were predictors for the dependent variable. This was analyzed using the correlations table. A correlation of 0 means there was no correlation between the variables to a correlation of 1 for a strong correlation between variables.

If the previous year's CRCT tests do not show that student achievement was equal the year before, then student benchmark exams will be used to analyze academic achievement. However, these tests are not tested for reliability and validity. The benchmark exams are county created exams. The exams are given at the beginning of the school year, the middle of the school year, and close to the end of the school year to determine if students are on target compared to the curriculum maps. Both groups of students did take the same benchmark exam at the same time.

Threats to Validity

The threats to internal validity were minimized by equating the control and treatment groups, and equating the language arts teachers. There were ten teachers who taught using the traditional model of instruction and nine teachers who taught using the rotation model of blended learning. The control and treatment groups were equated by analyzing the CRCT scores of the previous year and ensuring that the scores of both groups are statistically similar. If they are not similar, the pretest scores of both groups

will be added to the stepwise regression equation as a moderator variable. The language arts teachers were equated by analyzing their Teacher Keys Evaluations for the 2013-2014 school year and determining if each teacher received similar scores.

As with any research there were additional threats to validity. Internal threats include selection, maturation, and mortality. Random selection was not an option; therefore, selection of participants into each group was a threat. Maturation could be a threat because the data analyzed is from the first year of adopting the rotation model of blended learning Mortality was a threat because there was a small group of students that withdrew from school, enrolled in school, or transitioned from one group to the other.

The dependent variable data were the Georgia State Standardized testing scores (CRCT); therefore, the Georgia Department of Education ensured validity and reliability of the tests and test scores. A draft of the CRCT was written at the State level by curricular specialists, Georgia educators, and professional assessment specialists. The test was then field tested and each question is reviewed for reliability and validity. Reliability was checked by the Cronbach's alpha reliability coefficient and the standard error of measurement tests. The Cronbach's alpha scores recorded for the language arts portion of the testing was sixth grade .91, seventh grade .91, and eighth grade .88. The standard error of measurement test results recorded were sixth grade 2.81, seventh grade 2.65, and eighth grade 2.68 (Georgia Department of Education, 2014b). Validity was ensured as the curricular specialists, Georgia educators, and professional assessment specialists review the field test responses to check that the questions measure the intended curriculum and standards.

Ethical Procedures

Data Collection

The data were school historical data. Permissions to collect the data were obtained from both the County (Appendix D) and Walden University (07-08-16-0357257). The data were obtained through a school administrator by student number in order to maintain student confidentiality. The county allowed six weeks to collect the data.

There were no procedures for exiting or follow-ups for participants. All data was historical. There was no need in contacting the participants.

Privacy and Security

I used SPSS to code the data by treatment group and analyze the data for mean differences on the dependent variable. The data was an aggregated set. All data will be kept secure using a password protected file. No student names or teacher names were recorded in the records, as all data will be coded to provide privacy. The data was not viewed by persons other than the school of study personnel that assists in retrieving the data and the researcher; therefore, confidentiality agreements should not be needed. The data will be kept for five years to ensure that the study can be defended if needed. After this time, the data will be deleted from my possession.

Sharing Plan

Upon completion of the dissertation as verified by the last IRB approval, I will submit a copy of my dissertation to the stakeholders of the school.

Risks

There should not be any psychological, relationship, legal, economic/professional, or physical risks or conflicts. Analyzing and reporting on CRCT data did not pose any psychological risks. I did obtain a letter of cooperation from the school of interest before conducting the research which eliminated the risks from legal, and economic/professional risks. There were be no physical risks as no contact was made to participants.

Role of the Researcher

During the time of treatment, I was a Health teacher at the school of interest. I did teach a large percentage of the students health, but no other subject area. I also interacted with the other teachers at the school. I did not, however, have any supervisory position over any of the language arts teachers, nor do I have any supervisory position at this time. Internal validity was ensured by my not teaching the subject area of language arts to the students and my not administering the assessment to any of the students.

Experimental Design

The experimental design encompasses an appropriate amount of students for the effect size to be set at .15, the alpha level set at .05, and the confidence interval set at .95. Therefore, the study provided meaningful new knowledge. The design used archived data, which allowed for multiple years of data to be collected quickly.

Summary

The methods, analysis of data, and ethical procedures discussed enabled the study to provide evidence regarding the effectiveness of the rotation model of blended learning in middle school language arts. The study was a naturalistic quasi-experimental design.

Stepwise multiple regression was used to compare the control and experimental groups as well as the covariates. Chapter 4 will expound on Chapter 3 by presenting the analysis of the data.

Chapter 4: Data Collection and Assumptions

Introduction

The study was designed to explore the effectiveness of the rotation model of blended learning in middle school education in order to fill a gap in existing research. This quantitative research study compared academic achievement of sixth, seventh, and eighth grade students who had received a traditional model of education with the academic achievement of those who had received the rotation model of blended education by means of the Edgenuity software program for the 2013-2014 school year. The study determined whether students who participated in the rotation model of blended learning had higher academic achievement in language arts than those who participated in the traditional model of education. The theoretical framework indicated that blended learning should be an effective model of education, and the literature recognized the need for additional research to evaluate blended learning. The theories supporting blended learning are the cognitive theory of multimedia learning (Mayer, 2009, 2014) and mastery learning (Bloom, 1968). The literature indicated that blended learning is a widely implemented model of education, although little research has been done to evaluate its effectiveness (Bakia et al., 2012; Dziuban et al., 2016; Halverson et al., 2012; Kennedy, 2013; Means et al., 2010; Means et al., 2014; Staker, 2011; Watson et al., 2013).

There were some discrepancies in the plan related to how the data would be analyzed for the study. The plan was to use a stepwise multiple regression to analyze multiple covariates. However, the covariates teacher effectiveness and learning

environment were removed from the analysis because the data indicated that these covariates were the same for all teachers. The independent variables were then model of instruction and student educational label. A *t* test was used to determine equality of groups. A stepwise regression was used to determine which variables were most significant. An ANOVA was used to evaluate significance levels of each variable and the subgroups of each student educational label. The specifics of these procedures are detailed in this chapter.

The research questions and hypotheses were as follows:

- What is the difference in academic achievement as revealed by CRCT scaled scores in language arts of sixth, seventh, and eighth grade students participating in a rotation model of blended learning as compared to those participating in a traditional model of instruction?
- Was there a difference in teacher effectiveness between the teachers who taught within the blended model of education and the teachers who taught within the traditional model of education?

Hypotheses

1. $H1_0$: There was no significant difference between traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

   $H1_a$: There was a significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

2. $H2_0$: There was no significant difference between traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

   $H2_a$: There was a significant difference between traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

3. $H3_0$: There was no significant difference between traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

   $H3_a$: There was a significant difference between traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

4. $H4_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

   $H4_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

5. $H5_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

$H5_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

6. $H6_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

   $H6_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

Population

The population consists of non-Title one, Georgia public middle school students within the same middle school in a metropolitan school district. The school population was 979 students during the 2013-2014 school year. The 979 students were grouped as 291 sixth grade students, 336 seventh grade students, and 334 eighth grade students. The demographics (figure 3) of the population were 67.05% white, non-Hispanic; 22.67% black, non-Hispanic; 4.57% Hispanic; 4.48% multi-racial; .95% Asian or Pacific Islander; and .29% American Indian or Alaskan Native. A whole group sample was used in order to ensure that the sample group was proportional to the population.

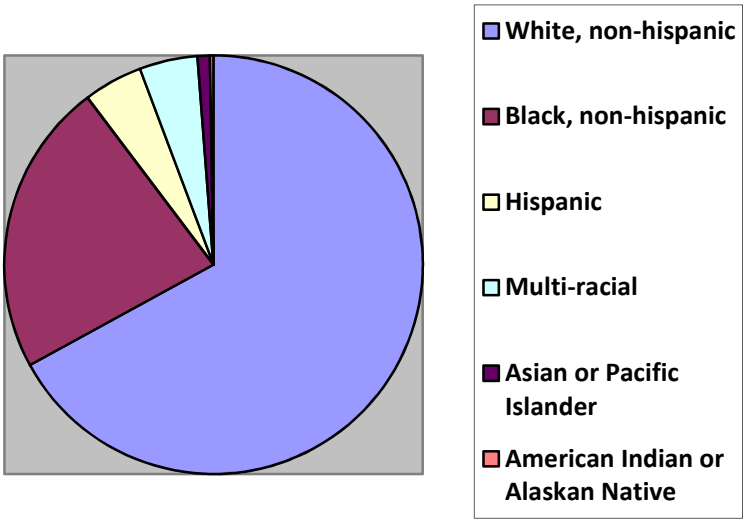

Figure 3. Demographics of school population.

Chapter 4 will include three parts. First, approval to collect data, how the variables were coded, analysis of the instruments, and assumptions checks. Second, results of the analysis of the data. Third, a summary of the findings will be included.

Section 1: Collection and Preparation of the Data

Approval to Collect Data

The study required two levels of approval to collect data. The approval to collect data from Walden University was issued on July eighth of 2016. The IRB approval number for this study is 07-08-16-0357257. The approval from the county in which the study was being administered was issued on August 2nd of 2016; however, the letter was not received until August fifth (Appendix E). The data was requested on Monday, August eighth and access to the CRCT data was granted on the same day. The CRCT data were given as whole school data; therefore, the students and test scores had to grouped by educational model according to the scheduling records of the 2013-2014 school year.

Preparation of the Data

Instruments and Their Reliability and Validity

The dependent variable data is Georgia State Standardized testing scores (CRCT); therefore, the Georgia Department of Education ensures validity and reliability of the tests and test scores. A draft of the CRCT is written at the State level by curricular specialists, Georgia educators, and professional assessment specialists. The test is then field tested and each question is reviewed for reliability and validity. Reliability is checked by the Cronbach's alpha reliability coefficient and the standard error of measurement tests. The Cronbach's alpha scores recorded for the language arts portion of the testing was sixth grade .91, seventh grade .91, and eighth grade .88. The standard error of measurement test results recorded were sixth grade 2.81, seventh grade 2.65, and eighth grade 2.68 (Georgia Department of Education, 2014b). Validity is ensured as the curricular specialists, Georgia educators, and professional assessment specialists review the field test responses to check that the questions measure the intended curriculum and standards.

The Teacher Keys Evaluations are performed by the school administrators. The administrators receive training from the Georgia Department of Education on how to evaluate the teachers within their schools. Then, the teachers are evaluated a minimum of four times a school year based on a four level rubric for each of the ten subcategories (Georgia Department of Education Office of School Improvement Teacher and Leader Keys Effectiveness Division. (2013, *p*. 21). The ten subcategories are detailed in Appendix B. Each teacher receives an evaluation each school year.

Grouping

The students were divided into two educational groups by parent choice. The traditional educational group consisted of 554 students, including 137 sixth graders, 218 seventh graders, and 199 eighth graders. The rotation model of blended learning group consisted of 407 students, and this group included 154 sixth graders, 118 seventh graders, and 135 eighth graders.

The teachers consisted of nine blended instruction and 13 traditional instruction language arts teachers. In sixth grade there were three blended instruction and four traditional instruction teachers. In seventh grade there were three blended instruction and four traditional instruction teachers. In eighth grade there were three blended instruction and five traditional instruction teachers. There were some teachers who chose to move to the blended model of education; however, the majority of teachers were assigned to the position that they taught. The following Figure illustrates how the models of instruction differed for the two groups of teachers and students:

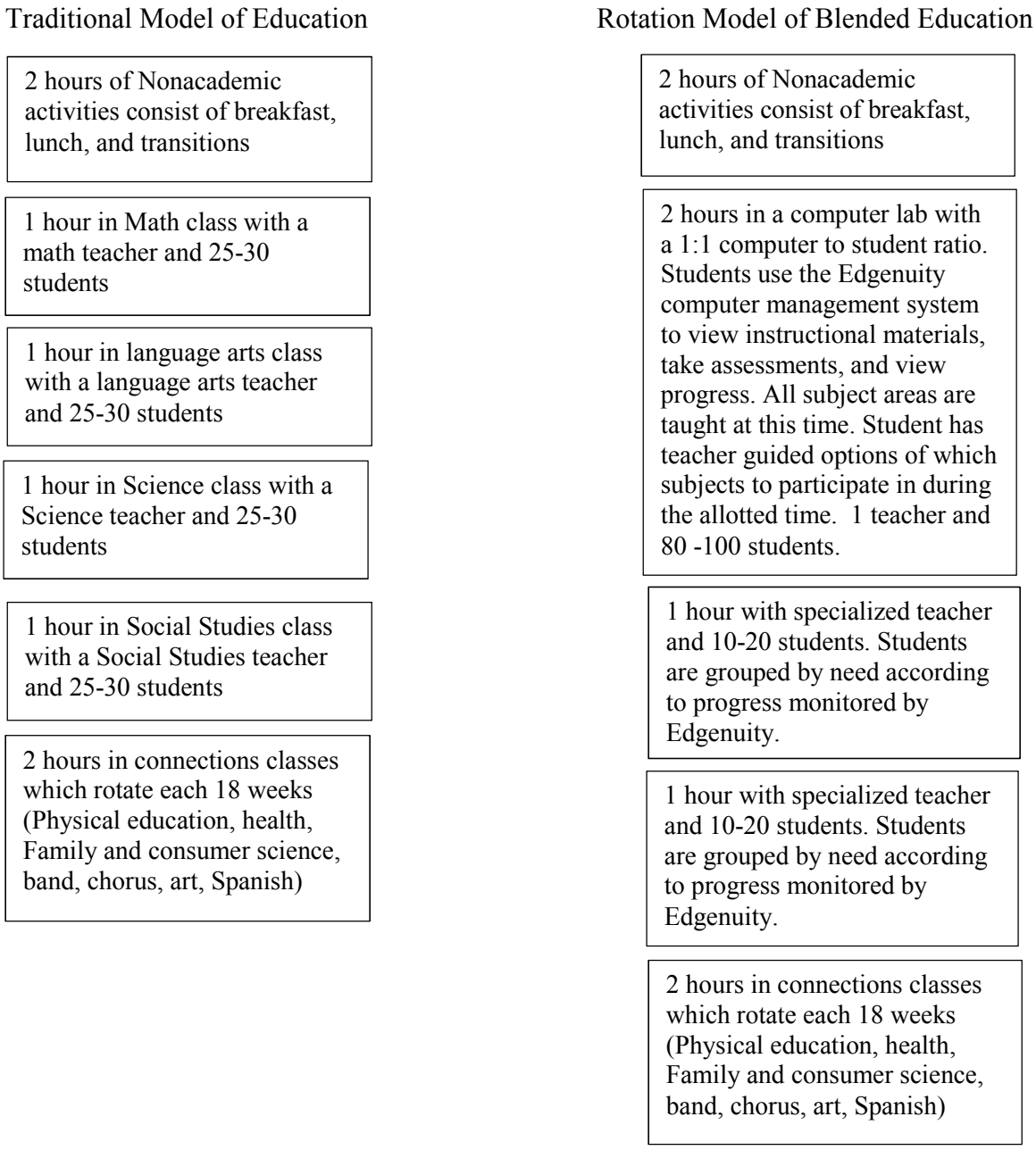

Figure 2. Time allotment for traditional students and rotation model of blended learning students at the school of study. Figure also used in Chapter 2.

The data collection was from a whole group sample. The sixth-grade sample consisted of 129 traditional model students and 149 blended model of instruction students. There were 17 of the traditional model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis. There were 24 of the blended model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis.

The seventh-grade sample consisted of 203 traditional model of education students and 83 blended model of education students. There were 25 of the traditional model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis. There were six of the blended model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis.

The eighth-grade sample consisted of 182 traditional model of education students and 101 blended model of education students. There were four of the traditional model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis. There were seven of the blended model of instruction students that were missing one of the CRCT scores; therefore, these students were not included in the analysis.

The previous G*Power calculation was run for a multiple regression analysis. The G* Power software was used again to calculate the needed sample size for a two-way ANOVA because the number of independent variables have been changed due to the Teacher Keys Evaluations being the same for all of the language arts teachers. There will

be further discussion of the Teacher Keys data in the Significance and Assumptions section below. The G*Power software calculated 400 for the needed total sample size. This calculation was derived from an effect size of .25, *a* err prob. of 0.05, and a power of .95 (Faul, Erdfelder, Lang, & Buchner, 2007). There are six groups thus each group would need approximately 67 students. Each of the sample groups consisted of a sufficient number of students.

Data Scaling and Coding

Several variables were coded in SPSS to analyze the differences in the groups. The 2013-14 CRCT scores were used to assess the academic achievement of each group of students. The CRCT scores from the previous year are the pretest data and were used to ensure equality of the groups. The Teacher Key data were coded to analyze differences in teacher effectiveness and learning environment. The educational label of the students were coded to compare academic achievement of each group.

There were both scale and nominal data coded in the analysis. The CRCT scores were coded as scale data. The model of instruction, Teacher Keys Evaluation data, and educational label were coded as nominal data.

Transformations and Added Dummy Variables

The following table presents the nominal variables for the study and how they were coded into dummy variables. A dummy variable is a numerical value used to represent a category or level.

Table 1

Coding Nominal Variables

Nominal variables	Coded 1	Coded 2	Coded 3	Coded 4
Model of instruction	Traditional model	Rotation model of blended learning		
Student educational label	Special education	Regular education	Gifted education	
Georgia Teacher Keys Evaluation	Ineffective	Needs development	Proficient	Exemplary
Learning environment	Ineffective	Needs development	Proficient	Exemplary

Note. The variables were coded in SPSS according to Table 1. This table was also used in Chapter 3 to illustrate the coding of variables.

The table above was also used in Chapter 3 to detail the coding of the variables. The model of instruction was chosen by the students' parents. The two models of instruction are the traditional model and the blended model. The traditional model of instruction is teacher-directed, face-to-face, and synchronous (Bonk & Graham, 2013, *p*. 5). The blended model is "a formal education program in which a student learns: (1) at least in part through online learning, with some element of student control over time, place, path, and/or pace; (2) at least in part in a supervised brick-and-mortar location away from home; (3) and the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience" (Clayton Christensen Institute, 2012, para. 1). The specific type of blended learning that was implemented was the rotation model of blended learning which is "a course or subject in which students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include

activities such as small-group or full-class instruction, group projects, individual tutoring, and pencil-and-paper assignments. The students learn mostly on the brick-and-mortar campus, except for any homework assignments" (Clayton Christensen Institute, 2012, para. 2).

Student educational label was decided through testing done at the school level which is requested by the parents of the student. The student educational label is one of three categories and is dependent on their need of assistance learning: special education, regular education, and gifted education. Students that receive special education services have struggled to learn subject material. Teachers and parents work together to develop an individualized education plan for these students that may allow students to be placed in smaller groups, have extended time, repeated direction, and/or other accommodations dependent on student need. Regular education students do not receive any accommodations. Gifted education students have passed a norm-referenced test to determine they qualify for the gifted education curriculum created by the local board of education (Georgia Department of Education, 2015d).

Georgia Teacher Keys Evaluation is administered by the school administrators, and the learning environment is part of the Georgia Teacher Keys Evaluation. Teacher effectiveness is an assessment of how effective a teacher is based upon the observation and/or teacher provided data of teacher professional knowledge, instructional planning, instructional strategies, differentiated instruction, assessment strategies, assessment uses, learning environment, academically challenging environment, professionalism, and communication (Georgia Department of Education: Office of School Improvement

Teacher and Leader Keys Effectiveness Division, 2015). The performance standards and rubrics are provided in Appendix B. The learning environment is one of the ten components evaluated in the Georgia Teacher Keys Evaluation. The Georgia Department of Education defines a positive learning environment as "the teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all" (Georgia Department of Education Office of School Improvement Teacher and Leader Keys Effectiveness Division, 2014, *p*. 40).

There were missing data and outliers found in the data. If a student was missing either year of CRCT data, the student was removed from the analysis to ensure symmetry for each school year. This method was deemed acceptable by the National Institute of Mental Health (Chen, 2005). The students that were removed from the analysis did not have CRCT scores from one of the two years because they repeated a school year or they moved out of state, thus they did not take the assessment. There are multiple days set aside to ensure that all students enrolled at the time of the assessment do participate in the assessment. The outliers were left in the analysis to determine if they affected the normal distribution of the data. If there were also problems with the normal distribution of data, the outliers were removed in order to meet the assumption of no outliers for the independent *t*-test and the two-way ANOVA which is an acceptable way to deal with outliers according to Laerd Statistics (2015).

Significance and Assumptions

To ensure equivalence of treatment and comparison groups, first the 2012-13 CRCT scores were compared using an independent *t*-test. The 2012-13 test scores may

only be used to equate the groups, because each year's CRCT test evaluates a different set of content and is not comparable year to year. Next, if the groups were found to be equivalent, a two-way ANOVA was used to determine differences in academic achievement between the two models of instruction was based on the 2013-14 CRCT scores. The majority of the reviewed studies used an ANOVA to explore the data. If the pretest (CRCT 2012-13) found that the groups were not equivalent, then a multiple regression would be used to explore the data. The multiple regression allows for the pretest to be a moderator variable and explore all correlations of data.

There are six assumptions for an independent *t*-test. These assumptions are as follows: 1) the dependent variable a single continuous dependent variable, 2) the independent variable is a two group categorical variable, 3) there is independence of observation, 4) there are no significant outliers, 5) that there is normal distribution of data, and 6) there is homogeneity of variances (Laerd Statistics, 2015). The assumptions for a two-way ANOVA are 1) there is a continuous dependent variable, 2) there are two independent variables that are both categorical with two or more groups, 3) there is independence of observations, 4) there are no significant outliers, 5) there is normal distribution of the data, and 6) there is homogeneity of variances (Laerd Statistics, 2015).

The first three assumptions for the *t*-test and the two-way ANOVA are the same and have been met. The following section will analyze each of these assumptions. The assumption of a single continuous dependent variable is met because the dependent variable is CRCT scores which is a continuous variable. The assumption of the independent variable being a two group categorical for the independent *t*-test and two

independent variables that are both categorical for the two-way ANOVA are both met. The independent variable for the independent *t*-test is the model of instruction which is categorical, and the independent variables for the two-way ANOVA are the model of instruction and the educational label which are both categorical variables. The third assumption is independence of observation. This assumption was met as students were not permitted to move from one group to another throughout the school year.

Teacher Keys Evaluation data had to be eliminated from analysis due to lack of variance. When the data were gathered it showed that all the teachers received the same evaluation scores. Thus, there is no need to analyze this as the data indicates that each of the teachers provided the same degree of learning environment and were equally effective. When there is no variance, a variable cannot significantly affect the dependent variable. The research question and hypotheses that were abandoned are:

- Was there a difference in teacher effectiveness between the teachers who taught the blended model of education and the teachers who taught the traditional model of education?

$H4_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

$H4_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the sixth grade.

$H5_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

$H5_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the seventh grade.

$H6_0$: There was no significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

$H6_a$: There was a significant difference between teacher effectiveness of the teachers who taught in the traditional and blended model of education in the eighth grade.

Section 2: Analysis of the Data

The following section will be a presentation of the tests used to analyze the data and the assumptions of the tests. The section will be divided according to grade level.

Sixth Grade (H1)

The following section tests the hypothesis of:

$H1_0$: There was no significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

$H1_a$: There was a significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

Independent *t* test. The fourth assumption of an independent *t*-test is that there are no significant outliers (Laerd Statistics, 2015). The assumption was analyzed using a boxplot. Figure 4 below indicates that there were significant outliers. There were four outliers on the high side of the traditional group and one outlier on the low side of the blended group. The analysis was continued to determine the importance of the outliers.

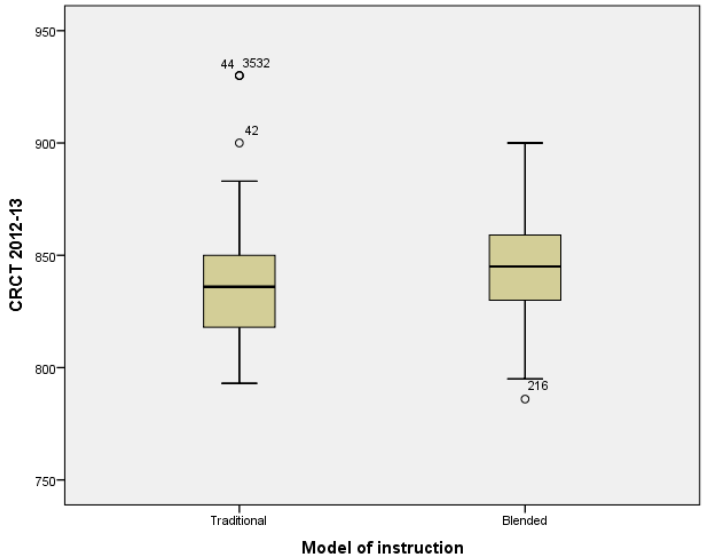

Figure 4. Boxplot of the 2012-2013 CRCT sixth grade sample. Figure indicated that there were outliers.

The fifth assumption states that there is normal distribution of data. The assumption of normal distribution was explored using the Shapiro-Wilk test. The test is interpreted by viewing the significance value to determine if it is less than or greater than .05. If the significance value is less than .05, than there was not normal distribution of the data (Laerd Statistics, 2015). The Shapiro-Wilk test indicated that there was an issue with

the distribution of data as the significance of the traditional model of instruction group was not greater than .05 (Table 2).

Table 2

Sixth Grade Tests of Normality Table

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT	Traditional	.125	106	.000	.914	106	.000
2012-13	Blended	.051	125	.200*	.991	125	.556

Note. Adapted from the SPSS output for the *t* test sixth grade data.
*This is a lower bound of the true significance.
[a]Lilliefors significance correction.

At this point there was a revision of the data. According to Laerd Statistics (2015), the outliers can be removed to satisfy the assumptions. The outliers of traditional/ regular education 930, 930, 930 and 900 and blended/regular education 804 were removed from the analysis and the analysis was run again with the following results. The sixth grade comparison reveals normal distribution as the Shapiro-Wilk test is greater than .05 (Table 3).

Table 3

sixth Grade Tests of Normality Table With Outliers Removed

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT 2012-13	Traditional model	.071	102	.200*	.978	102	.086
	Blended model	.056	124	.200*	.989	124	.407

Note. Adapted from the SPSS output for the *t* test sixth-grade data.

*This is a lower bound of the true significance.

[a]Lilliefors significance correction.

The sixth assumption of homogeneity of variances was explored using Levene's test of equality of variances. There was homogeneity of variances between the traditional and blended student test scores as viewed in table 4 (.733>.05).

Table 4

Sixth Grade Levene's Test for Equality of Variances Independent Samples t Test

		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
CRCT 2012-13	Equal variances assumed	.117	.733	-4.117	224	.000	-11.596	2.817	-17.148	-6.045
	Equal variances not assumed			-4.138	219.413	.000	-11.596	2.803	-17.120	-6.073

Note. Adapted from the SPSS output for the *t* test sixth grade data.

There was a statistically significant difference between the traditional and the blended groups on the 2012-13 CRCT scores of the fifth to sixth grade group of students $t(244) = -4.117$, $p = .000$. Because there was a statistically significant difference between the traditional and blended groups according to the 2012-13 CRCT scores, the groups cannot be compared as equals for the 2013-14 CRCT scores. The plan for comparing the

groups if they were found to be significantly different was to compare the benchmark exams for the two groups. The benchmark exams can be accessed two years in the past. At the time I was able to collect the data, the benchmark exams for the 2013-14 school year were not accessible. The sixth-grade groups were analyzed by multiple regression to explore the variable of pretest as a moderator variable.

Stepwise Multiple Regression

The first two statistical assumptions of multiple regression are there is a continuous dependent variable and two or more continuous or categorical data. The study's dependent variable is a standardized testing score which is a continuous variable. The study's independent variables are the model of instruction, student educational label, and pretest. The model of instruction is categorical data. The educational label is nominal data are categorical data. The pretest is a continuous variable.

The third assumption is the assumption of independence of observations which was assessed using the Durbin-Watson test. The Durbin-Watson test illustrated in table 5 indicates that there is an independence of observations as the score of 1.824 is close to 2 (Laerd Statistics, 2015).

Table 5

Sixth Grade Multiple Regression Model Summary

Model	*R*	*R* square	Adjusted *R* square	Durbin-Watson
1	.539[a]	.291	.288	
2	.554[b]	.307	.301	1.824

Note. Adapted from the SPSS output for the stepwise regression sixth grade data. [a]Predictors: (Constant), CRCT 2012-2013. [b]Predictors: (Constant), CRCT 2012-2013, Educational Label. [c]Dependent variable: CRCT 2013-2014.

The fourth and fifth assumptions can be assessed using a scatterplot. The fourth assumption declares that there is a linear relationship between the dependent variable (2013-14 CRCT scores) and each of the independent variables. The fifth assumption states that there is homoscedasticity of the residuals (Laerd Statistics, 2015).

The scatterplot shown in figure 5 indicates that there is a linear relationship between the dependent and independent variables thus the assumption of linearity was substantiated by the scatterplot chart. The assumption of homoscedasticity is held as the scatterplot is random in its relationship to linearity.

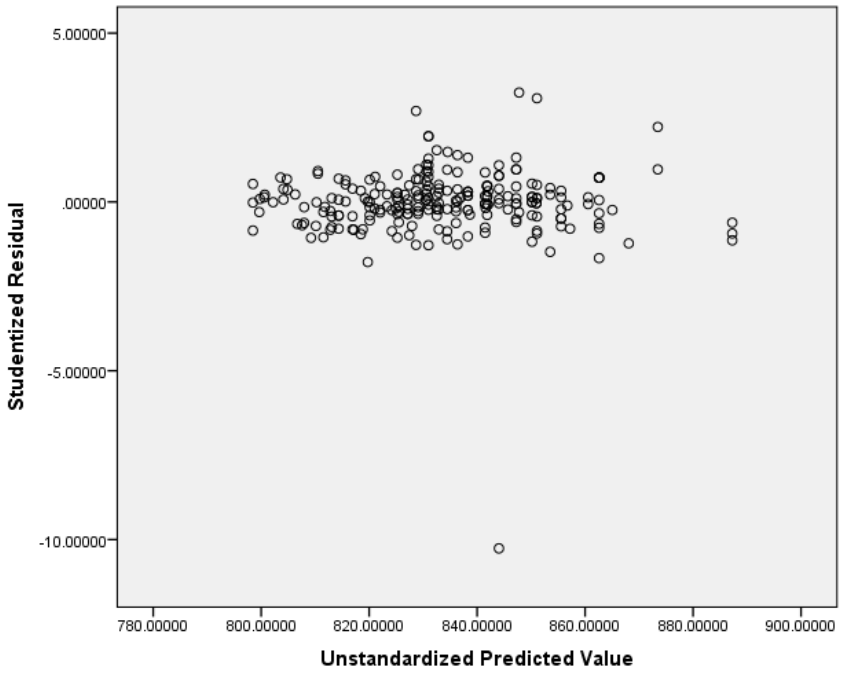

Figure 5. Sixth grade scatterplot. Figure shows homoscedasticity and linearity.

The sixth assumption states that there was not multicollinearity between the independent variables. This assumption was assessed through the collinearity statistics. The table below presents the correlation coefficients. The Tolerance values are greater than 0.1; except for CRCT 2012-13. Therefore, the assumption of multicollinearity has been met for all variables except CRCT 2012-13 (Laerd Statistics, 2015).

Table 6

Sixth Grade Collinearity Statistics Table

Model		Beta In	*T*	Sig.	Partial correlation	Collinearity statistics Tolerance	VIF
1	Model of instruction	.101[b]	1.805	.072	.119	.975	1.026
	Educational label	.130[b]	2.319	.021	.152	.967	1.034
2	Model of instruction	.087[c]	1.545	.124	.102	.960	1.042
3	CRCT 2012-13	.539[a]	9.688	.000	.539	1.000	1.000
4	CRCT 2012-13	.516[a]	9.198	.000	.520	.967	1.034
	Educational label	.130[a]	2.319	.021	.152	.967	1.034

Note. Adapted from the SPSS output for the stepwise regression sixth grade data.
[a]Predictors: (Constant), CRCT 2012-2013. [b]Predictors: (Constant), CRCT 2012-2013, Educational Label. [c]Dependent variable: CRCT 2013-2014.
Note. Adapted from the SPSS output for the stepwise regression sixth grade data.

The seventh assumption declares that there are no significant outliers. The outliers were detected using a casewise diagnostic test (Table 7). Three outliers were found. There is no error in these scores. A check for influential points was done to determine if any of the LEV_1 data points were greater than 0.2 (Laerd Statistics, 2015). None of the data points proved to be of risk with the highest being 0.05843. Next, Cook's Distance values were explored to determine if any of them were above one resulting in influential points. The highest was 0.18643 indicating that there are no influential points. There were no variables removed, because there are no outliers that produce influential points.

Table 7

Sixth Grade Casewise Diagnostics Table

Case number	Std. residual	CRCT 2013-2014	Predicted value	Residual
134	-10.098	580	841.76	-261.763
144	3.232	930	846.21	83.791
149	3.126	930	848.96	81.035

Note. Adapted from the SPSS output for the stepwise regression sixth grade data.
[a]Dependent variable: CRCT 2013-2014.

Assumption eight recognizes that there is a normal distribution of residuals. A P-P plot was used to assess this assumption (Figure 6). The P-P plot indicates that there is a normal distribution of residuals (Laerd Statistics, 2015).

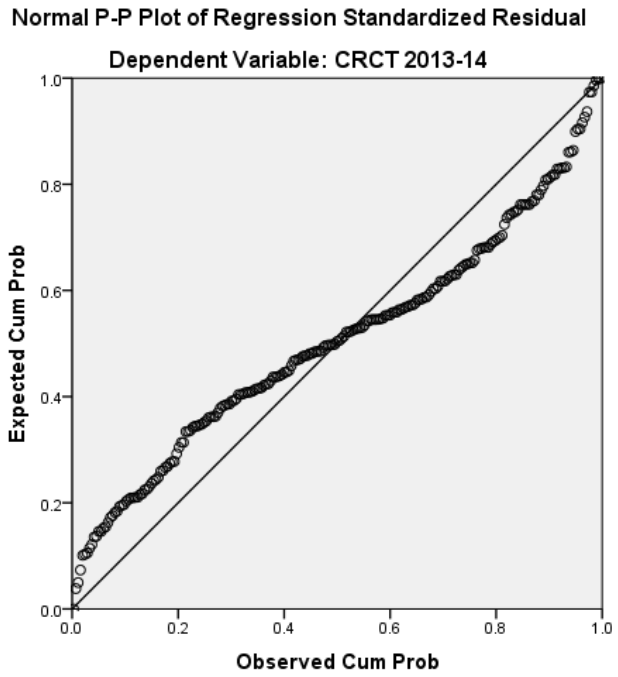

Figure 6. Sixth grade normal P-P plot regression.

In stepwise regression variables are kept in the analysis as they have a statistically significant relationship. If there is not a statistically significant relationship found, then the variable is removed from the analysis. Table 8 illustrates that pretest scores (CRCT 2012-13) and educational label did have a statistically significant relationship with the 2013-14 CRCT scores, and the model of instruction did not have a statistical significance. The correlations table (Table 9) indicates that the most substantial correlation is between the CRCT 2012-13 and CRCT 2013-14 variables model 1 (.539) This is also the variable that failed the assumption of multicollinearity (table 6). Model 2 analyzed the combination of the CRCT 2012-13 and educational label was next substantial. The educational label accounted for .128 of the correlation. The conclusion is that there is not a significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label ($H1_0$), as evidenced by Table 8.

Table 8

Sixth Grade Stepwise Regression Variables Entered/Removed[a]

Model	Variables entered	Variables removed	Method
1	CRCT 2012-2013	.	Stepwise (Criteria: Probability-of-*F*-to-enter <= .050, Probability-of-*F*-to-remove >= .100).
2	Educational label	.	Stepwise (Criteria: Probability-of-*F*-to-enter <= .050, Probability-of-*F*-to-remove >= .100).

Note. Adapted from the SPSS output for the stepwise regression sixth grade data.
[a]Dependent variable: CRCT 2013-2014.

Table 9

Sixth Grade Regression Correlations Table

Model		*R*	*R* square	Beta	Correlations[a] Zero-order	Partial	Part
1	(Constant)	.539	.291	.539	.539	.539	.539
	CRCT 2012-13						
2	(Constant)	.554	.307	.516	.539	.520	.507
	CRCT 2012-13						
	Educational label			.130	.223	.152	.128

Note. Adapted from the SPSS output for the stepwise regression sixth grade data.
[a]Dependent variable: CRCT 2013-2014.

Seventh Grade (H2)

The following section tests the hypothesis of:

$H2_0$: There was be no significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

$H2_a$: There was a significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

Independent *t* Test

The fourth assumption is that there are no significant outliers (Laerd Statistics, 2015). The assumption was analyzed using a boxplot. Figure 7 below indicates that there were significant outliers. The outliers were four high in the traditional group and one high in the blended group. The analysis was continued to determine the significance of the outliers.

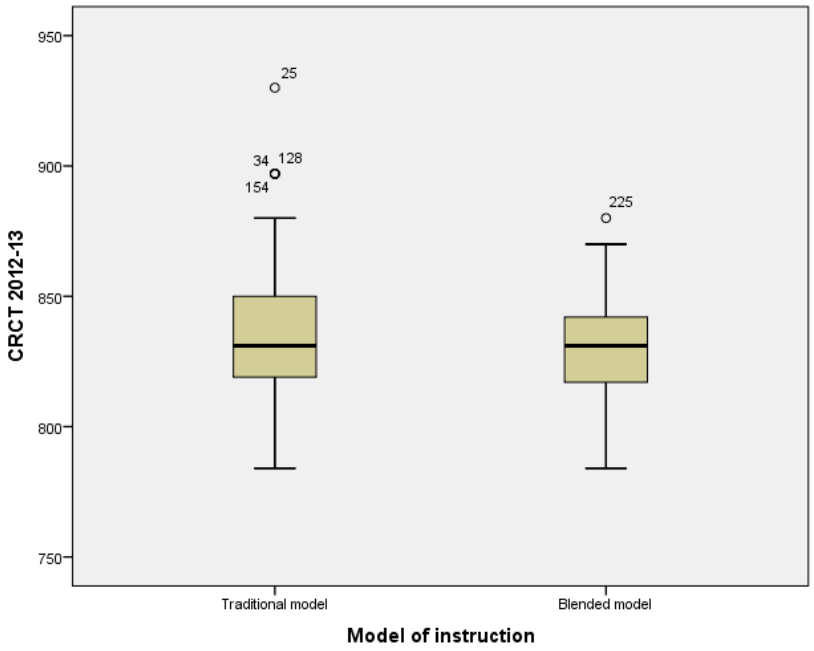

Figure 7. Boxplot of the seventh grade 2012-2013 CRCT data. There were significant outliers found in both groups.

The fifth assumption states that there is normal distribution of data. The assumption of normal distribution was explored using the Shapiro-Wilk test (Laerd Statistics, 2015). The Shapiro-Wilk test indicated that there was an issue with the distribution of data as the significance of the traditional model of instruction group was not greater than .05 (Table 10).

Table 10

Seventh Grade Tests of Normality Table

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT	Traditional	.076	178	.013	.973	178	.002
2012-2013	Blended	.062	77	.200*	.994	77	.971

Note. Adapted from the SPSS output for the *t* test seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

At this point there was a revision of the data. According to Laerd Statistics (2015), the outliers can be removed to satisfy the assumptions. The outliers of traditional/gifted education 930; two traditional/regular education scores of 897; traditional/ gifted education 897; and blended/ regular education 890 were removed from the analysis and the analysis was run again with the following results. The assumption of normality was met as the significance of the Shapiro-Wilk is greater than .05 in Table 11 (Laerd Statistics, 2015).

Table 11

Seventh Grade Tests of Normality Table With Outliers That Were Not Included in Final Analysis

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
CRCT	Traditional	.056	174	.200*	.990	174	.282
2012-13	Blended	.069	76	.200*	.990	76	.826

Note. Adapted from the SPSS output for the *t* test seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

The sixth assumption of homogeneity of variances was explored using the Levene's test of equality of variances. There was homogeneity of variances between the traditional and blended student test scores (*.p* > .05) in Table 12 (Laerd Statistics, 2015).

Table 12

Seventh Grade Levene's Test for Equality of Variances Independent Samples t Test

		F	Sig.	*T*	*df*	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
CRCT 2012-2013	Equal variances assumed	1.030	.311	1.119	232	.264	3.121	2.789	-2.373	8.614
	Equal variances not assumed			1.175	164.822	.242	3.121	2.655	-2.123	8.365

Note. Adapted from the SPSS output for the *t* test seventh grade data.

There was not a statistically significant difference between the traditional and the blended groups on the 2012-13 CRCT scores of the sixth to seventh grade group of students $t(232) = 1.119$, $p = .311$. Because the groups were shown to be significantly similar the analysis was continued with a two-way ANOVA to determine if there were differences in academic achievement between the two groups.

Stepwise Multiple Regression

The variable of CRCT 2012-13 was the only variable that was analyzed in the stepwise regression (table 13). For this reason, the stepwise regression did not provide useful information in the analysis of the seventh grade data. A two-way ANOVA was used to further analyze the data.

Table 13

Seventh Grade Stepwise Regression Variables Entered/Removed[a]

Model	Variables entered	Variables removed	Method
1	CRCT 2012-2013	.	Stepwise (Criteria: Probability-of-*F*-to-enter <= .050, Probability-of-*F*-to-remove >= .100).

Note. Adapted from the SPSS output for the stepwise regression seventh grade data.
[a]Dependent variable: CRCT 2013-2014.

Two-Way ANOVA

Assumptions one through three of the ANOVA have been met as they are concerning the variables of the study. The fourth assumption is there are no significant outliers (Laerd Statistics, 2015). The boxplots below were used to assess this assumption.

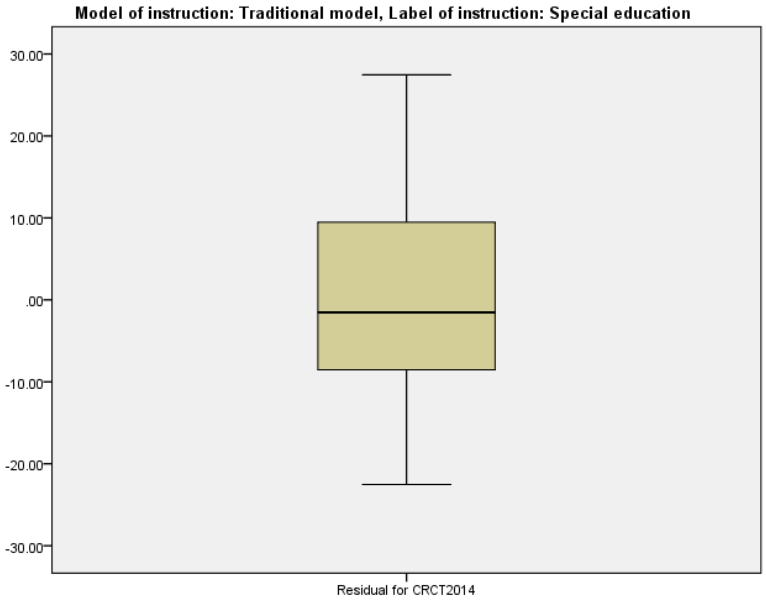

Figure 8. Seventh grade traditional/special education two-way ANOVA. Figure shows that there were no outliers.

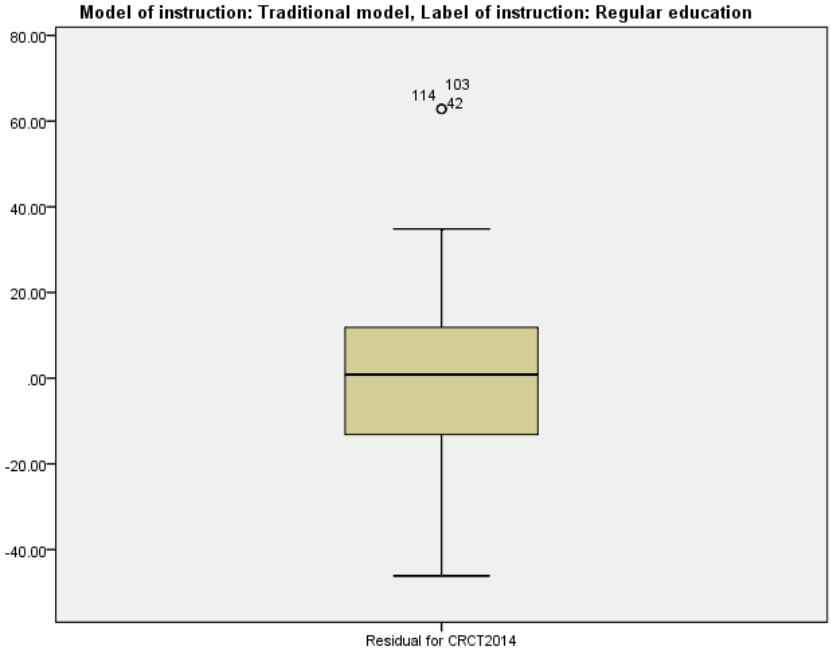

Figure 9. Seventh grade traditional/regular education two-way ANOVA. Figure shows three outliers.

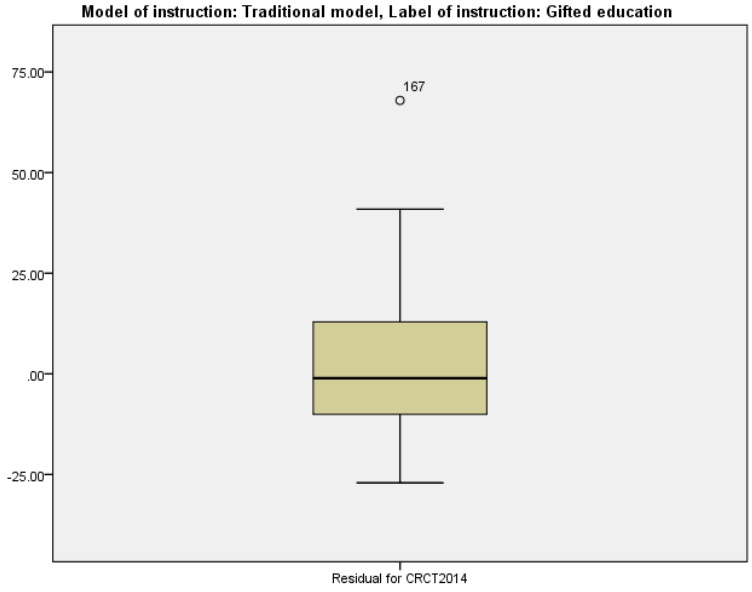

Figure 10. Seventh grade traditional/gifted education two-way ANOVA. Figure shows one outlier.

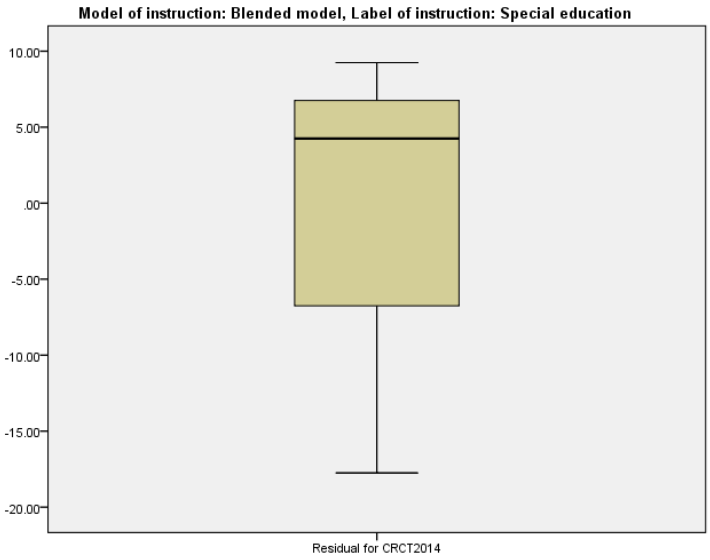

Figure 11. Seventh grade blended/special education two-way ANOVA. Figure shows that there were no outliers.

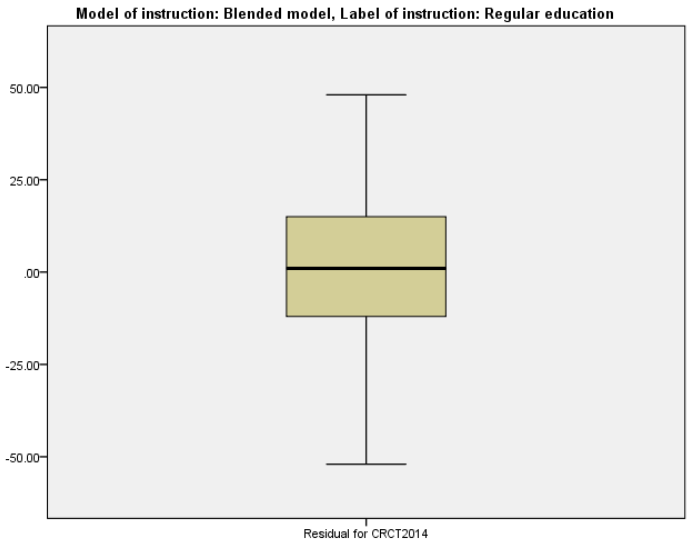

Figure 12. Seventh grade blended/regular education two-way ANOVA. Figure shows that there were no outliers.

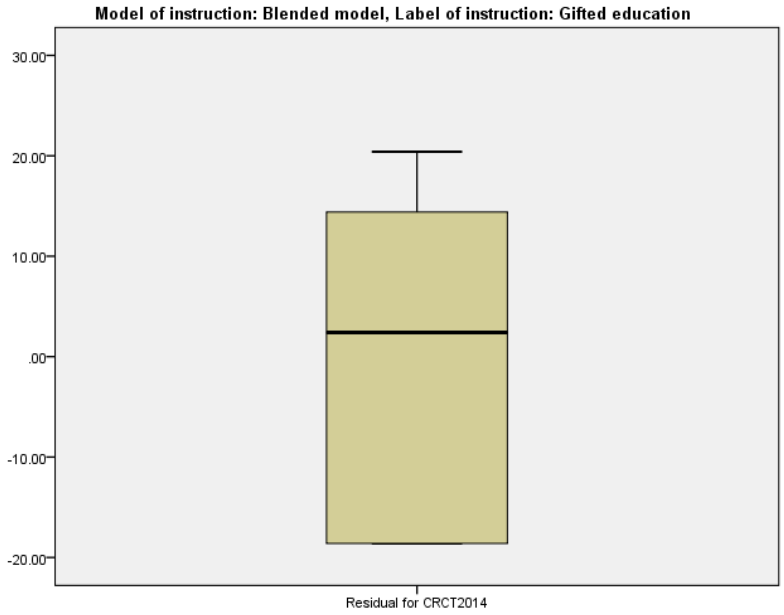

Figure 13. Seventh grade blended/gifted education two-way ANOVA. Figure shows that there were no outliers.

Review of the boxplots (figures 8-13) for outliers resulted in the identification of three outliers in the traditional/regular education group and one outlier in the traditional/gifted education group. The Two-Way ANOVA was run with the outliers and then again without the outliers to determine their overall importance.

The fifth assumption is that there is normal distribution (Laerd Statistics, 2015). This assumption was analyzed using the Shapiro-Wilk test shown in Table 14 below. The test indicates that there are distribution issues in the traditional/gifted education group ($.003<.05$). At this point the outliers identified below were modified to a less extreme value and the Two-Way ANOVA was reanalyzed (Laerd Statistics, 2015).

Table 14

Seventh Grade Two-Way ANOVA Tests for Normality Table

Model of instruction	Educational label	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
Traditional	Special education	.123	15	.200*	.982	15	.980
	Regular education	.068	137	.200*	.973	137	.008
	Gifted education	.213	26	.004	.852	26	.002
Blended	Special education	.388	4	.	.788	4	.083
	Regular education	.093	68	.200*	.983	68	.464
	Gifted education	.247	5	.200*	.869	5	.263

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

The data were not normally distributed for traditional/gifted education ($p < .05$). The three outliers in the Traditional/regular group were all 903. This score was aligned with the next highest score of 885. The two outliers in the Traditional/gifted group was 930. The 903 scores were changed to 885, and the 930 score was changed to 903 as these scores were the next highest in the group. Assumptions four and five were then reanalyzed. The fourth assumption is there are no significant outliers (Laerd Statistics, 2015). The outliers were assessed according to boxplots found below.

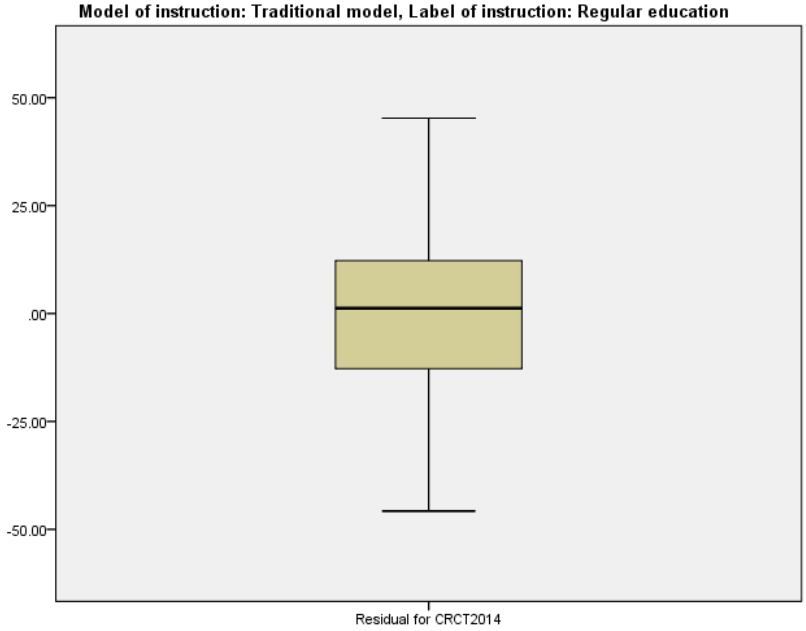

Figure 14. Modified seventh grade traditional/regular education two-way ANOVA.

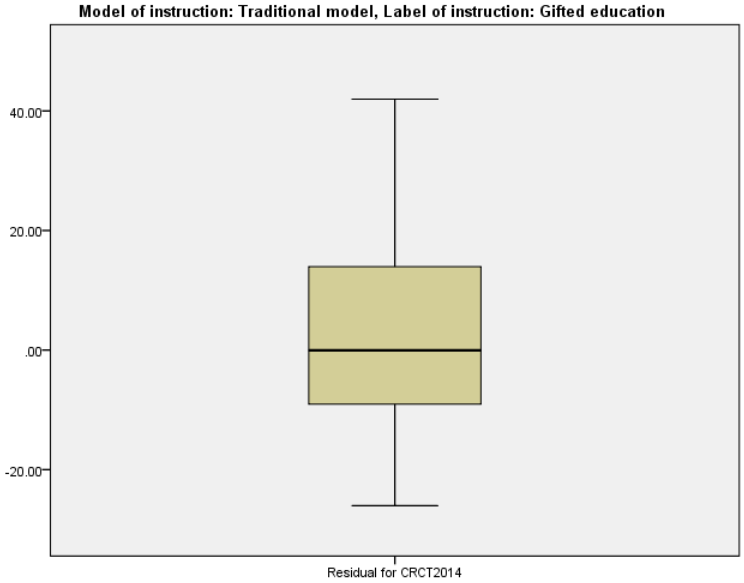

Figure 15. Modified seventh grade traditional/gifted education two-way ANOVA.

The modified boxplots (figures 14 and 15) indicate that there are no outliers in the groups. The next assumption is the assumption of normal distribution (Laerd Statistics, 2015). This assumption was analyzed using the Shapiro-Wilk test shown in Table 15 below. The test indicates that all groups except the traditional/gifted education group exhibit normal distribution as Shapiro-Wilk significance is above .05.

Table 15

Modified Seventh Grade Tests of Normality Table

Model of instruction	Educational label	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
Traditional	Special education	.123	15	.200*	.982	15	.980
	Regular education	.083	137	.022	.986	137	.163
	Gifted education	.193	26	.114	.915	26	.034
Blended	Special education	.388	4	.	.788	4	.083
	Regular education	.093	68	.200*	.983	68	.464
	Gifted education	.247	5	.200*	.869	5	.263

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

The sixth assumption is that there is homogeneity of variances (Laerd Statistics, 2015). The assumption of homogeneity of variances was analyzed using the Levene's Test of Equality. The test (table 16) indicates that there is homogeneity of variances ($p >$ .05). Each of the assumptions for the two-way ANOVA have been met, except for the assumption of normal distribution, for the seventh grade groups.

Table 16

Seventh Grade ANOVA Levene's Test of Equality of Error Variances

Dependent variable: CRCT 2013-14			
F	df1	df2	Sig.
1.426	5	249	.215

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
[a]Design: Intercept + Independent + Label + Independent * Label

The evidence in the tests between-subjects effects (Table 17) indicates that there was a statistically significant interaction between model of instruction and educational label according to 2013-14 CRCT scores, $F(2, 249) = 4.754$, $p = .009$, partial $\eta 2 = .037$. In addition, it indicates that there is not a significant difference between model of instruction without educational label significance level of .058 ($p > .05$). The accepted hypothesis is $H2_a$: There was a significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label.

Table 17

Seventh Grade Tests of Between-Subjects Effects

Dependent variable: CRCT 2013-14

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial eta squared
Corrected model	22011.193[a]	5	4402.239	11.808	.000	.192
Intercept	43433764.211	1	43433764.211	116498.149	.000	.998
Model	1355.869	1	1355.869	3.637	.058	.014
Label	5176.659	2	2588.329	6.942	.001	.053
Model * Label	3544.749	2	1772.374	4.754	.009	.037
Error	92834.156	249	372.828			
Total	179772467.000	255				
Corrected total	114845.349	254				

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.

[a]*R* squared = .192 (adjusted *R* squared = .175).

Exploratory Analysis

One-way ANOVA tests were used to explore to what extent the model of instruction affected each group by student label. The student labels of special education, regular education, and gifted education were compared as group subsets. The assumptions of a one-way ANOVA are 1) the dependent variable a single continuous dependent variable, 2) the independent variable contains two or more categorical groups, 3) there is independence of observation, 4) there are no significant outliers,5) that there is normal distribution of data, and 6) there is homogeneity of variances (Laerd Statistics, 2015).

The first three assumptions have been met. First, the depended variable (CRCT scores) is a single continuous variable. Second, the independent variable (model of

instruction) contains two categorical groups. Third, there was independence of observation. Each of the other assumptions was analyzed for each educational label group.

Special education. The assumptions of no significant outliers, normal distribution of data, and homogeneity of variances have been met. Figure 16 illustrates that there were no significant outliers. Table 18 illustrates a significance values of greater than .05 indicating normal distribution of data. Table 19 reveals a significance value of greater than .05 indicating homogeneity of variances.

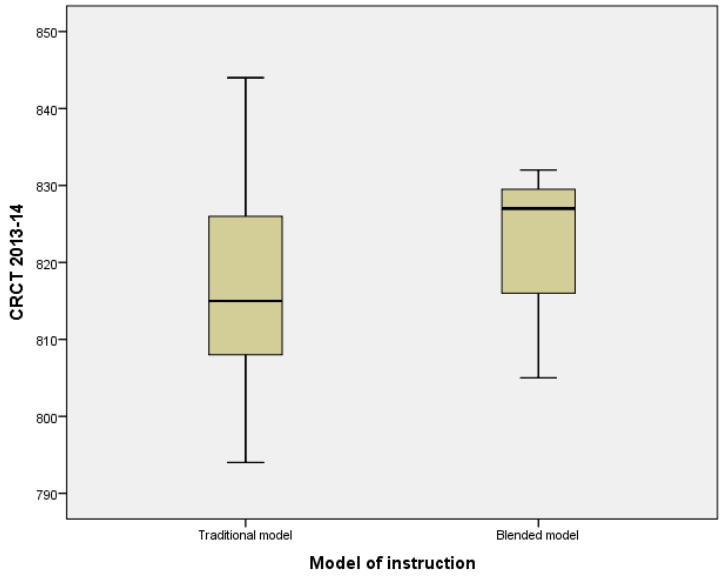

Figure 16. Seventh grade special education boxplot. Figure shows no outliers.

Table 18

Seventh Grade Tests of Normality

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT 2013-14	Traditional model	.123	15	.200*	.982	15	.980
	Blended model	.388	4	.	.788	4	.083

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

Table 19

Seventh Grade Test of Homogeneity of Variances

CRCT 2013-2014

Levene statistic	df1	df2	Sig.
.088	1	17	.770

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.

As all assumptions have been met the analysis is continued by exploring the ANOVA table (table 20). The significance of the ANOVA table indicates that there was no statistical difference between students who received the traditional model of instruction and the students that received the blended model instruction $F(1,17)=.718$, $p = .408$.

Table 20

Seventh Grade Special Education One-Way ANOVA (H2)

CRCT 2013-2014

	Sum of squares	*df*	Mean square	*F*	Sig.
Between groups	122.043	1	122.043	.718	.408
Within groups	2888.483	17	169.911		
Total	3010.526	18			

Note. Adapted from the SPSS output for the two-way ANOVA for the seventh grade data.

Regular education. The assumptions of no significant outliers, normal distribution of data, and homogeneity of variances have been met. Figure 17 illustrates that there were no significant outliers. Table 21 illustrates significance values of greater than .05 in the Shapiro-Wilk's test indicating normal distribution of data. Table 22 reveals a significance value of greater than .05 indicating homogeneity of variances.

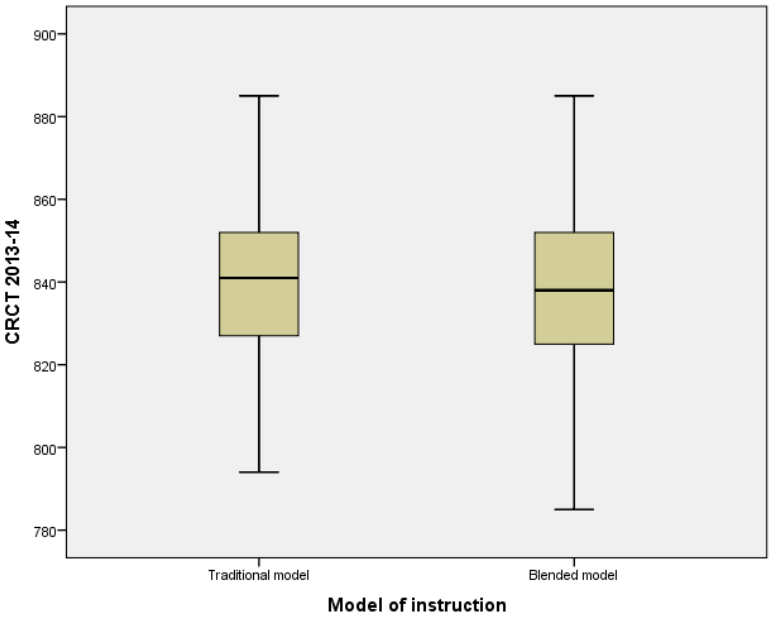

Figure 17. Seventh grade regular education boxplot. Figure shows no outliers.

Table 21

Seventh Grade Tests of Normality

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT 2013-14	Traditional model	.083	137	.022	.986	137	.163
	Blended model	.093	68	.200*	.983	68	.464

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

Table 22

Seventh Grade Test of Homogeneity of Variances

CRCT 2013-2014			
Levene statistic	df1	df2	Sig.
.702	1	203	.403

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.

As all assumptions have been met the analysis is continued by exploring the ANOVA table (table 23). The significance of the ANOVA table indicates that there was no statistical difference between students who received the traditional model of instruction and the students that received the blended model instruction $F(1,203)=.859$, $p = .355$.

Table 23

Seventh Grade Regular Education One-Way ANOVA (H2)

CRCT 2013-2014

	Sum of squares	*df*	Mean square	*F*	Sig.
Between groups	344.099	1	344.099	.859	.355
Within groups	81311.511	203	400.549		
Total	81655.610	204			

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.

Gifted education. The assumptions of no significant outliers, normal distribution of data, and homogeneity of variances have been met. Figure 184 illustrates that there were no significant outliers. Table 24 illustrates that there is a violation of normal distribution as the significance value of traditional model is less than .05 in the Shapiro-Wilk's test indicating normal distribution of data. Table 25 reveals a significance value of greater than .05 indicating homogeneity of variances.

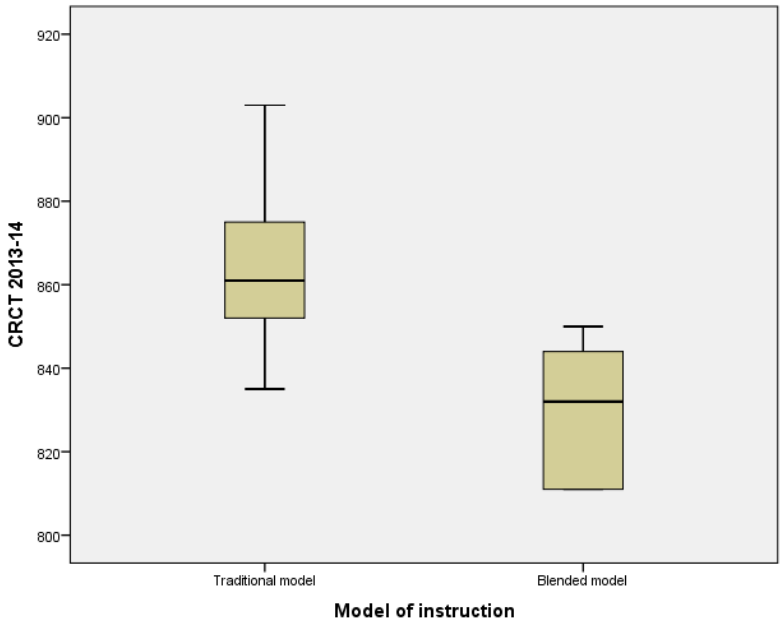

Figure 18. Seventh grade gifted education boxplot. Figure shows no outliers.

Table 24

Seventh Grade Gifted Education Tests of Normality

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT 2013-14	Traditional model	.193	26	.014	.915	26	.034
	Blended model	.247	5	.200*	.869	5	.263

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.
*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 25

Seventh Grade Gifted Education Test of Homogeneity of Variances

CRCT 2013-2014			
Levene statistic	df1	df2	Sig.
.227	1	29	.637

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh-grade data.

The assumption of normal distribution was not met; however, all other assumptions were met. The analysis is continued by exploring the ANOVA table (table 26). The significance of the ANOVA table indicates that there was a statistical difference between students who received the traditional model of instruction and the students that received the blended model instruction in the gifted model of instruction $F(1,29)=13.921$, $p < .05$.

Table 26

Seventh Grade Gifted Education One-Way ANOVA (H2)

CRCT 2013-2014

	Sum of squares	*df*	Mean square	*F*	Sig.
Between groups	4144.806	1	4144.806	13.921	.001
Within groups	8634.162	29	297.730		
Total	12778.968	30			

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.

The exploratory analysis was performed to determine the effects of the model of instruction on each separate educational label. No significant difference was found in special education or regular education; however, there was a significant difference found in gifted education in seventh grade ($p = .001$).

The Two-way ANOVA estimated marginal means table was explored to determine which model of instruction better facilitated learning for the seventh grade gifted students (Table 27). The table shows that the gifted students who participated in the traditional model of instruction outperformed those who participated in the blended model of instruction.

Table 27

Seventh Grade Estimated Marginal Means

Dependent variable: CRCT 2013-2014

				95% confidence interval	
Model of instruction	Label of instruction	Mean	Std. Error	Lower bound	Upper bound
Traditional model	Special education	816.533	4.985	806.714	826.352
	Regular education	839.766	1.650	836.517	843.015
	Gifted education	861.038	3.787	853.580	868.497
Blended model	Special education	822.750	9.654	803.735	841.765
	Regular education	837.015	2.342	832.403	841.626
	Gifted education	829.600	8.635	812.593	846.607

Note. Adapted from the SPSS output for the one-way ANOVA for the seventh grade data.

Eighth Grade (H3)

The following section will test the following hypotheses:

$H3_0$: There was no significant difference between the traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

$H3_a$: There was a significant difference between the traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

Independent *t* Test

The fourth assumption is that there are no significant outliers (Laerd Statistics, 2015). The assumption was analyzed using a boxplot. Figure 19 below indicates that there were significant outliers. In the traditional group there was one high outlier, and in the blended group there were two high and two low outliers. The analysis was continued to determine the significance of the outliers.

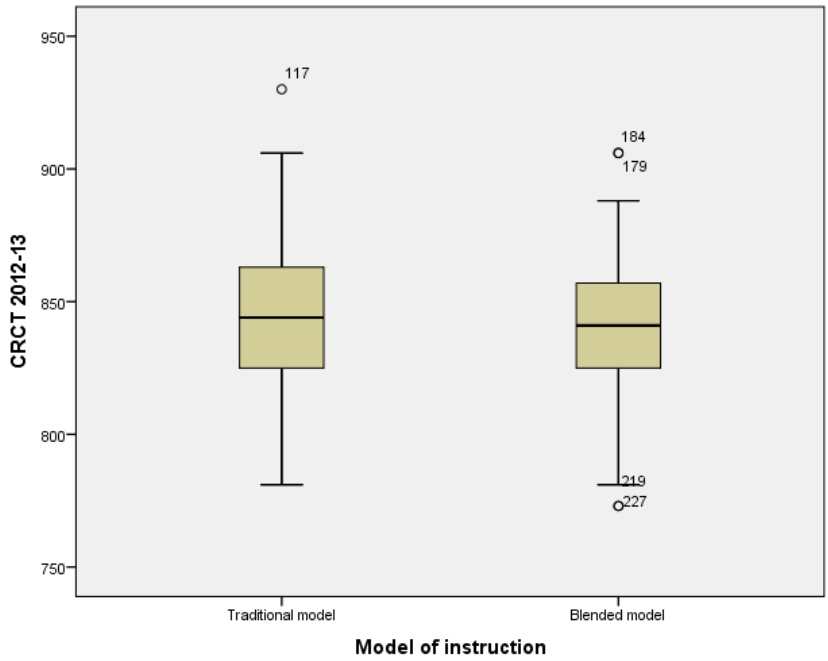

Figure 19. Boxplot of the eighth grade 2012-2013 CRCT data. There were significant outliers found in both groups.

The fifth assumption states that there is normal distribution of data. The assumption of normal distribution was explored using the Shapiro-Wilk test (Laerd Statistics, 2015). The Shapiro-Wilk test indicated that there was not an issue with the distribution of data as the significance of both groups was greater than .05 (Table 28). The outliers were kept in the analysis because there is normal distribution of the data.

Table 28

Eighth Grade Tests of Normality Table

	Model of instruction	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
CRCT 2012-13	Traditional	.067	162	.070	.986	162	.102
	Blended	.077	94	.200*	.977	94	.100

Note. Adapted from the SPSS output for the *t* test eighth grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

The sixth assumption of homogeneity of variances will be explored using the Levene's test of equality of variances. There was homogeneity of variances between the traditional and blended student test scores (.661 > .05) in Table 29 (Laerd Statistics, 2015).

Table 29

Eighth Grade Levene's Test for Equality of Variances Independent Samples t Test

		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
CRCT 2012-2013	Equal variances assumed	.193	.661	.873	254	.383	3.038	3.479	-3.815	9.890
	Equal variances not assumed			.878	197.989	.381	3.459	3.459	-3.783	9.859

Note. Adapted from the SPSS output for the *t* test eighth grade data.

There was not a statistically significant difference between the traditional and the blended groups on the 2012-13 CRCT scores of the seventh to eighth grade group of students $t(254) = .873$, $p = .383$. Because the groups were shown to be significantly similar the analysis continued with a two-way ANOVA to determine if there were differences in academic growth between the two groups.

Stepwise Multiple Regression

The variables of CRCT 2012-13 and educational label were the variables analyzed in the stepwise regression (table 30). The stepwise regression did not provide the needed information in the analysis of the eighth grade data. A two-way ANOVA was used to further analyze the data.

Table 30

Eighth Grade Stepwise Regression Variables Entered/Removed[a]

Model	Variables entered	Variables removed	Method
1	CRCT 2012-13	.	Stepwise (Criteria: Probability-of-*F*-to-enter <= .050, Probability-of-*F*-to-remove >= .100).
2	Educational label	.	Stepwise (Criteria: Probability-of-*F*-to-enter <= .050, Probability-of-*F*-to-remove >= .100).

Note. Adapted from the eighth grade stepwise multiple regression output.
[a]Dependent variable: CRCT 2013-2014.

Two-Way ANOVA

Assumptions one through three of the ANOVA have been met as they are concerning the variables of the study. The fourth assumption is there are no significant outliers (Laerd Statistics, 2015). The boxplots below were used to assess this assumption.

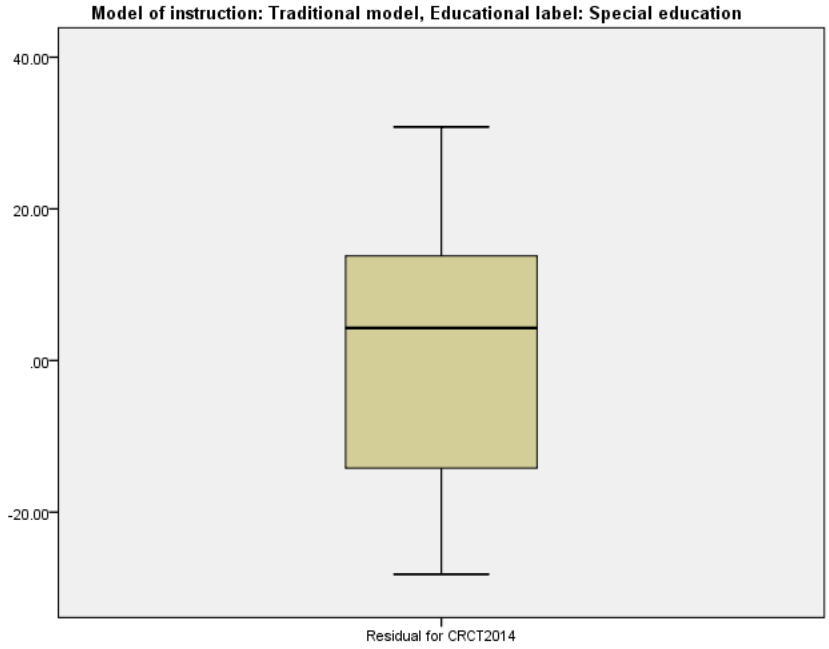

Figure 20. Eighth grade traditional/special education two-way ANOVA. Figure shows no outliers.

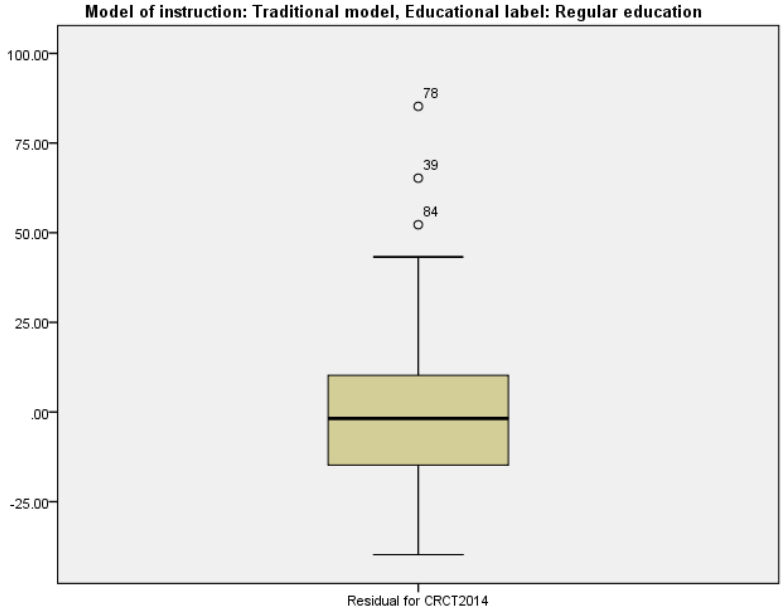

Figure 21. Eighth grade traditional/regular education two-way ANOVA. Figure shows three outliers.

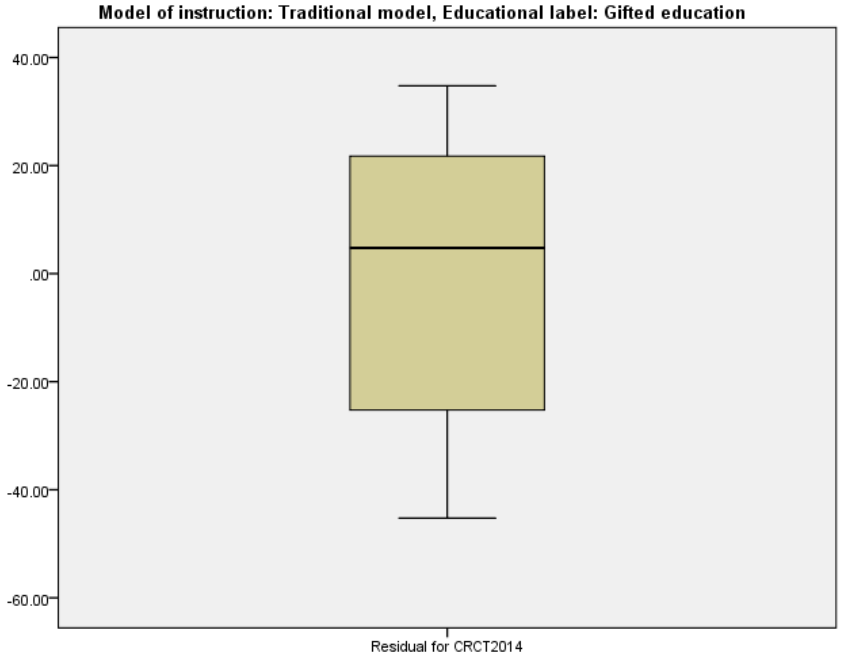

Figure 22. Eighth grade traditional/gifted education two-way ANOVA. Figure shows no outliers.

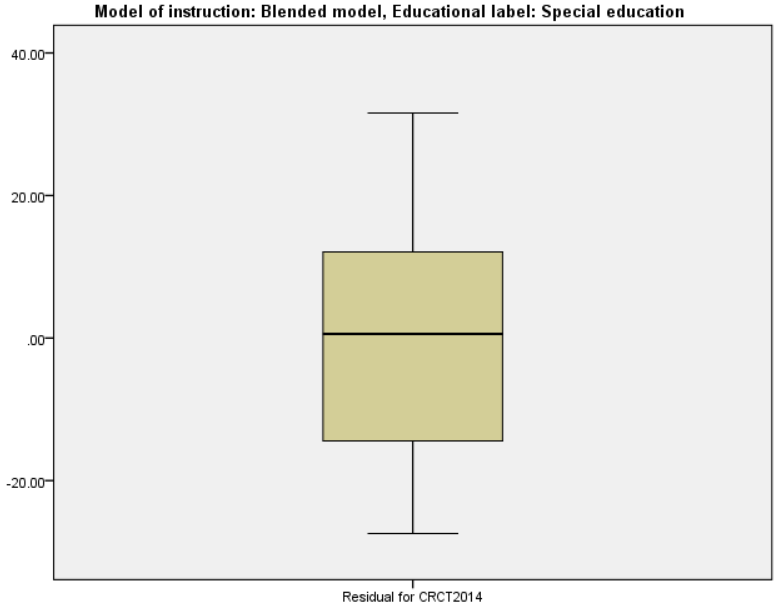

Figure 23. Eighth grade blended/special education two-way ANOVA. Figure shows no outliers.

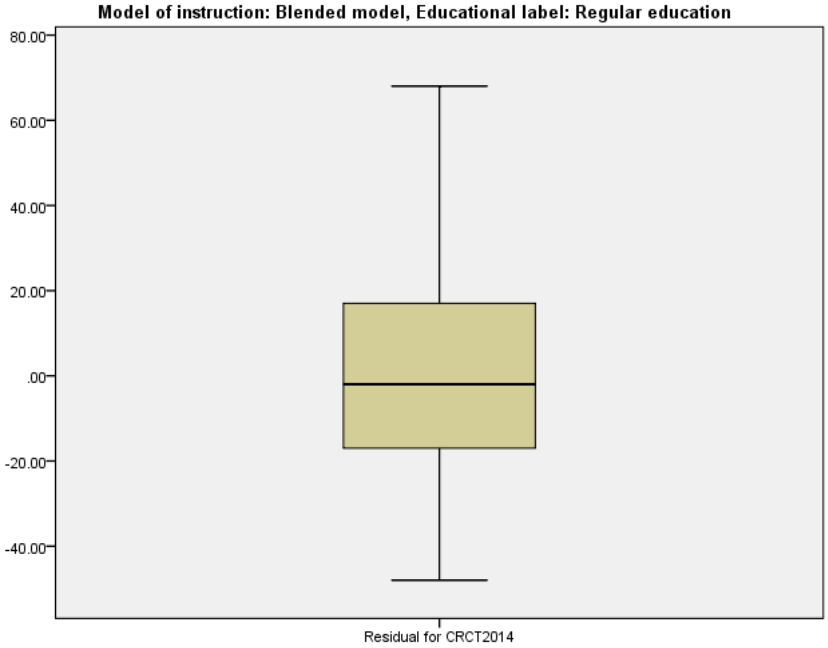

Figure 24. Eighth grade blended/regular education two-way ANOVA. Figure shows no outliers.

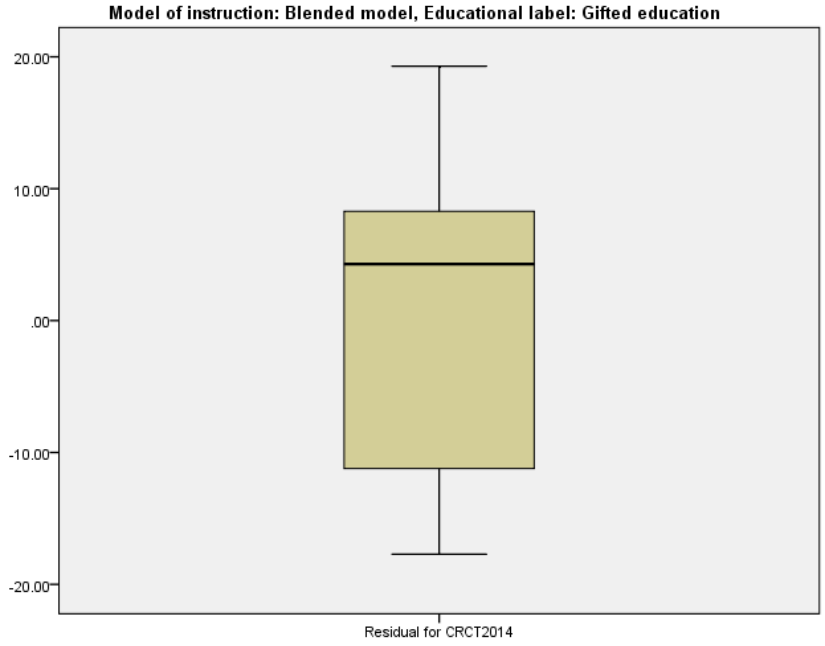

Figure 25. Eighth grade blended/gifted education two-way ANOVA. Figure shows no outliers.

Review of the boxplots (figures 20-25) for outliers resulted in the identification of three outliers in the traditional/regular education group. The Two-Way ANOVA were conducted with the outliers and then again without the outliers to determine their overall significance.

The fifth assumption is that there is normal distribution (Laerd Statistics, 2015). This assumption was analyzed using the Shapiro-Wilk test shown in Table 31 below. The test indicates that there are distribution issues in the traditional/regular education group (.001<.05) and blended/regular education (.037<.05). At this point the outliers identified below were not included in the final analysis and the Two-Way ANOVA were conducted again (Laerd Statistics, 2015).

Table 31

Eighth Grade Two-Way ANOVA Tests for Normality Table

Model of instruction	Educational label	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
Traditional	Special education	.134	20	.200*	.945	20	.298
	Regular education	.119	130	.000	.960	130	.001
	Gifted education	.154	12	.200*	.924	12	.318
Blended	Special education	.162	7	.200*	.957	7	.796
	Regular education	.107	80	.025	.967	80	.037
	Gifted education	.195	7	.200*	.933	7	.574

Note. Adapted from the SPSS output for the two-way ANOVA for the eighth grade data.

The three outliers in the Traditional/regular group were 925, 905, and 892. These scores were removed from final analysis in order meet the assumption of outliers and to correct the normality of distribution (Laerd Statistics, 2015). The two-way ANOVA was

rerun to assess assumptions four and five. The fourth assumption is there are no significant outliers (Laerd Statistics, 2015). The outliers were assessed according to figure 26 found below.

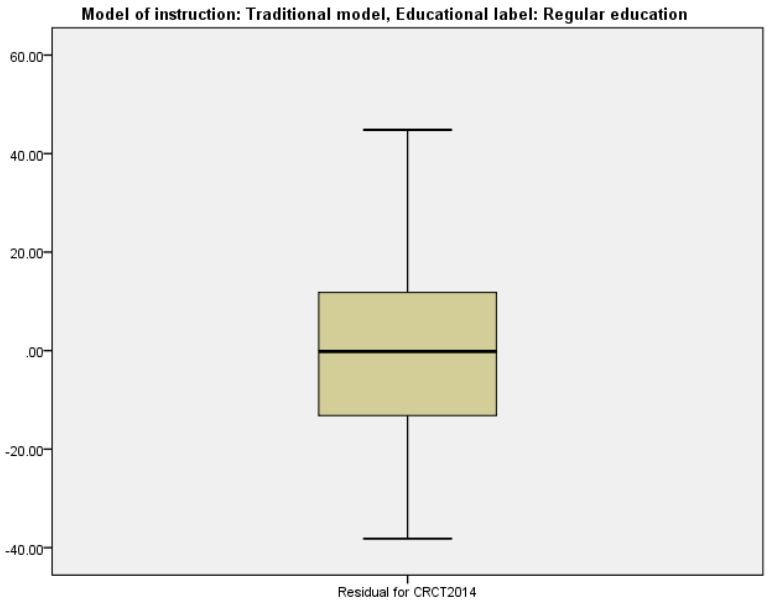

Figure 26. Eighth grade modified traditional/regular education two-way ANOVA. Figure shows no outliers.

The modified boxplot indicates that there are no outliers in the group. The next assumption is the assumption of normal distribution (Laerd Statistics, 2015). This assumption was analyzed using the Shapiro-Wilk test shown in Table 32 below. The test indicates that all groups except blended/regular education (.037<.05) exhibit normal distribution. Laerd Statistics (2015) reveals that violation of this assumption is tolerable and the results of the test are still valid.

Table 32

Modified Eighth Grade Tests of Normality Table

Model of instruction	Educational label	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	Sig.	Statistic	*df*	Sig.
Traditional	Special education	.134	20	.200*	.945	20	.298
	Regular education	.091	127	.011	.979	127	.048
	Gifted education	.154	12	.200*	.924	12	.318
Blended	Special education	.162	7	.200*	.957	7	.796
	Regular education	.107	80	.025	.967	80	.037
	Gifted education	.195	7	.200*	.933	7	.574

Note. Adapted from the SPSS output for the two-way ANOVA for the eighth grade data.
* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

The sixth assumption is that there is homogeneity of variances (Laerd Statistics, 2015). The assumption of homogeneity of variances was analyzed using the Levene's Test of Equality. The test illustrated on table 33 indicates that there is homogeneity of variances (.053 > .05). Each of the assumptions for the two-way ANOVA have been met, except for the assumption of normal distribution, for the eighth grade groups.

Table 33

Eighth Grade Levene's Test of Equality of Error Variances

Dependent variable: CRCT 2013-2014

F	df1	df2	Sig.
2.220	5	247	.053

Note. Adapted from the SPSS output for the two-way ANOVA for the eighth grade data. Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
[a]Design: Intercept + Model + Label + Model * Label.

The tests of between-subjects effects (table 34) indicates that the model of instruction did not significantly impact academic achievement in eighth grade language arts $F(2, 247) = 1.693$, $p = .186$, partial $\eta 2 = .014$. In addition, the tests of between-subjects effects indicates that there is only significance for Student Label (Label) with a significance level of .000 ($p < .05$). The study conclusion there is a failure to reject the null hypothesis. No exploratory analysis is needed for this group because no significant differences were found in either model of instruction (Model) or model of instruction and educational label (Model*Label).

Table 34

Eighth Grade Tests of Between-Subjects Effects

Dependent variable: CRCT 2013-2014

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial eta squared
Corrected model	28860.573[a]	5	5772.115	12.721	.000	.205
Intercept	57412131.496	1	57412131.496	126530.185	.000	.998
Model	1152.159	1	1152.159	2.539	.112	.010
Label	20550.307	2	10275.154	22.645	.000	.155
Model * Label	1536.617	2	768.309	1.693	.186	.014
Error	112074.415	247	453.743			
Total	177411677.000	253				
Corrected total	140934.988	252				

Note. Adapted from the SPSS output for the two-way ANOVA for the eighth grade data.
[a]*R* squared = .205 (adjusted *R* squared = .189).

Summary

Sixth Grade

A multiple regression was used to analyze the data because a *t*-test indicated that the students were not equivalent the previous year $t(244) = -4.117$, $p = .000$. A multiple

regression analysis was used to explore all variables. The multiple regression indicated that the variables of pretest (2012-13 CRCT), educational label, and model of instruction did predict the 2013-14 CRCT scores $F(3, 227) = 34.674$, $p < .000$. Therefore, $H1_a$ was accepted: there was a significant difference between the traditional and blended model student academic achievement in sixth grade when holding constant the student educational label.

Seventh Grade

A *t*-test showed that the blended model and traditional model of instruction students were statistically similar the previous year $t(232) = 1.119$, $p = .311$. A Two-way ANOVA was used to compare the model of instruction and educational labels according to their 2013-14 CRCT scores. The interaction effect between model of instruction and label of instruction on 2013-14 CRCT scores was statistically significant, $F(2, 249) = 4.754$, $p = .009$, partial $\eta 2 = .037$. Therefore, $H2_a$ was accepted: There was a significant difference between the traditional and blended model student academic achievement in seventh grade when holding constant the student educational label. However, through exploratory analysis (table 20, 24, and 27) it was shown that the model of instruction did not significantly impact the special education or the regular education groups. The gifted education/ traditional group performed significantly better on the 2013-14 CRCT than did the gifted education/ blended model group (table 28).

Eighth Grade

A *t*-test evidenced that the blended model and traditional model of instruction students were statistically similar the previous year $t(254) = .873$, $p = .383$. A Two-way

ANOVA was used to compare the model of instruction and educational labels according to their 2013-14 CRCT scores. The interaction effect between model of instruction and label of instruction on 2013-14 CRCT scores was not statistically significant, $F(2, 247) = 1.693$, $p = .186$, partial $\eta 2 = .014$. Therefore, $H3_0$ was accepted: There was not a significant difference between the traditional and blended model student academic achievement in eighth grade when holding constant the student educational label.

Teacher Effectiveness Hypotheses

Hypotheses four through six are in regards to teacher effectiveness in each of the grade levels. These hypotheses were abandoned because the data indicates that all of the teachers were evaluated as having the same level of teacher effectiveness by the school administrators for the 2013-14 school year.

Chapter 5: Findings, Recommendations, and Implications

Introduction

The purpose of this study was to explore the effectiveness of the rotation model of blended learning in middle school language arts education. The study explored the differences between traditional model of education and blended model of education 2013-2014 CRCT scores. The dependent variable was the 2013-2014 CRCT scores. The independent variables were model of instruction, educational label, and 2012-2013 CRCT scores. Each grade level (sixth, seventh, eighth) was analyzed separately because the CRCT test is not comparable year to year due to the inclusion of different content each year. The study design was quantitative naturalistic quasi-experimental. The sampling was whole study population sample.

Interpretation of the Findings

Blended learning is a diverse term, and the majority of research done in this area has been lacking in specificity and vigor (Alammary et al., 2014; Bonk & Graham, 2013; Clayton Christensen Institute, 2012; Dziuban et al., 2016; Means et al., 2014; Picciano et al., 2014; Poon, 2013; Staker, 2011). Although there has been little relevant research on its effectiveness, blended learning is being adopted at all levels of education (Bakia et al., 2012; Dziuban et al., 2016; Halverson et al., 2012; Kennedy, 2013; Means, Bakia, & Murphy, 2014; Watson et al., 2013). Literature also indicates that there is a need for research regarding blended learning at the K-12 level of education (Bakia et al., 2012; Halverson et al., 2012; International Association for K-12 Online Learning, 2013; Means

et al., 2014). The findings of this study continue the conversation on the effectiveness of the rotation model of blended learning in K-12 education.

Existing studies have indicated mixed results. No significant differences in academic achievement were reported by Rivera et al. (2002), Utts et al. (2003), Larson and Sung (2009), Wei-Fan (2012), Clark (2015), and Chih-Yuan Sun and Yu-Ting (2016). However, increases in academic achievement were reported by Boyle et al. (2003), Taradi et al. (2005), Means et al. (2010), Uzun and Senturk (2010), Hong et al. (2013), Jia et al. (2013), Bottge et al. (2014), Kazu and Demirkol (2014), Light and Pierson (2014), Asif et al. (2015), and Pane et al. (2015). The findings of this study aligned with studies that did not find that blended learning had a significant effect on academic achievement. The alignment will be discussed in more detail below.

Interpretation: Instrumentation

The CRCT was a reliable and valid instrument for assessing knowledge of learning standards. According to the Georgia Department of Education (2014b), the language arts portion of the CRCT has Cronbach's alpha scores of .91 for the sixth grade and seventh grade, and .88 for the eighth grade, with a standard error of measurement of 2.18 for the sixth grade, 2.65 for the seventh grade, and 2.68 for the eighth grade. A critical issue with the assessment is that each year, the assessment measures only the content that is standardized for that school year. Therefore, the assessment scores cannot be compared from year to year.

Interpretation: Research Question 1

- What is the difference in academic achievement as revealed by CRCT scaled scores in language arts of sixth, seventh, and eighth grade students participating in a rotation model of blended learning as compared to those participating in a traditional model of instruction?

Table 35 presents the overall results of the grade-by-grade analysis. Each grade level will be discussed in detail in relation to the research question.

Table 35

Results of the Grade-Level Analysis

Sixth	Multiple regression was used, because the groups were not statistically similar the previous year. This allowed for the pretest to be a moderator variable.	The variable of model of instruction was not found to be statistically significant in relation to 2013-2014 CRCT scores (.124 > .05).
Seventh	Two-way ANOVA was used, because the groups were statistically similar the previous year.	$F(2, 249) = 4.754$, $p = .009$, partial $\eta 2 = .037$. There was a statistical significance between the CRCT scores of blended and traditional model students.
Eighth	Two-way ANOVA was used, because the groups were statistically similar the previous year.	$F(2, 247) = 1.693$, $p = .186$, partial $\eta 2 = .014$. There was not a statistical significance between CRCT scores of blended and traditional model students.

For both sixth and eighth grades, there was no statistical significance found between the model of instruction and the 2013-2014 CRCT scores. There was a statistical significance found between the model of instruction and 2013-2014 CRCT scores in the seventh grade. Exploratory analysis using a one-way ANOVA of the seventh grade data revealed the educational label groupings of special education and regular education had no significance. The exploratory analysis using a one-way ANOVA revealed that the educational label of gifted education did show statistical significance. Figure 27

illustrates the trends for each of these groups. The special education group scores indicated a slight difference in CRCT scores from the traditional to the blended model of instruction. The regular-traditional students performed slightly better than the blended-traditional students. The gifted-traditional students performed significantly higher than the blended model of education students.

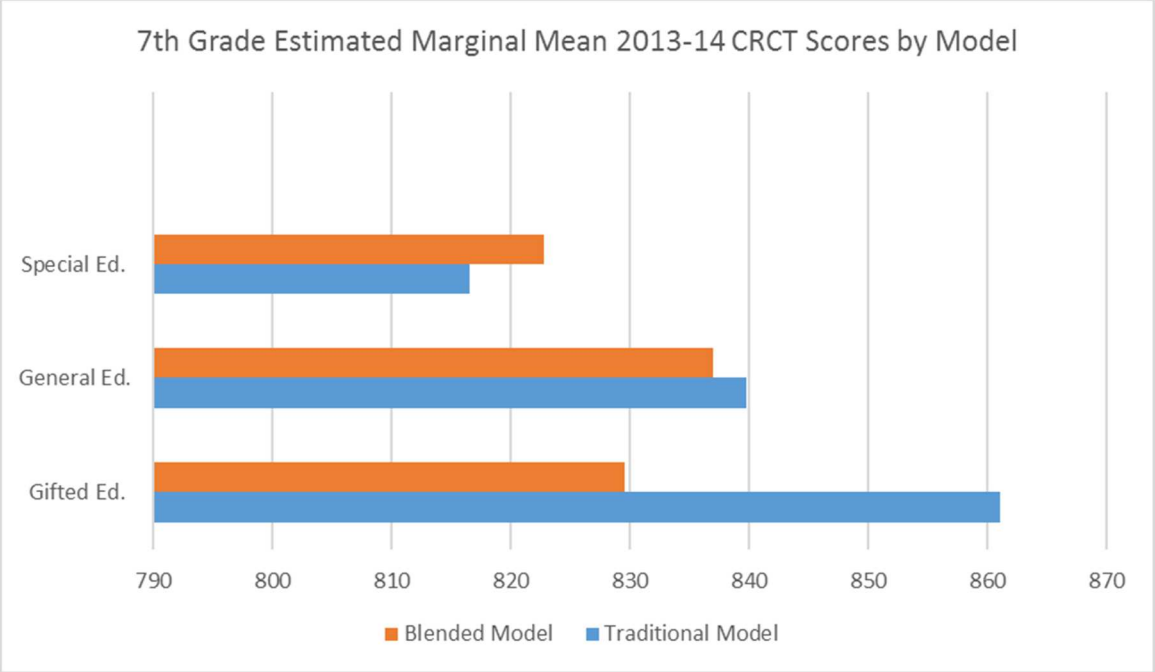

Figure 27. Seventh grade estimated marginal mean 2013-2014 CRCT scores by model. Figure shows that scores were slightly different for both special and regular education, and gifted education scores differed substantially from traditional to blended education in seventh grade.

As a two-way ANOVA was performed to explore the eighth grade data, the estimated marginal means chart was also analyzed to determine the trends of the educational label groupings. Figure 28 indicates that both the special education and the regular education groups performed similarly on the 2013-2014 CRCT. However, the

gifted education/ traditional students performed at a higher level than the gifted education/blended model of education students on the 2013-2014 CRCT.

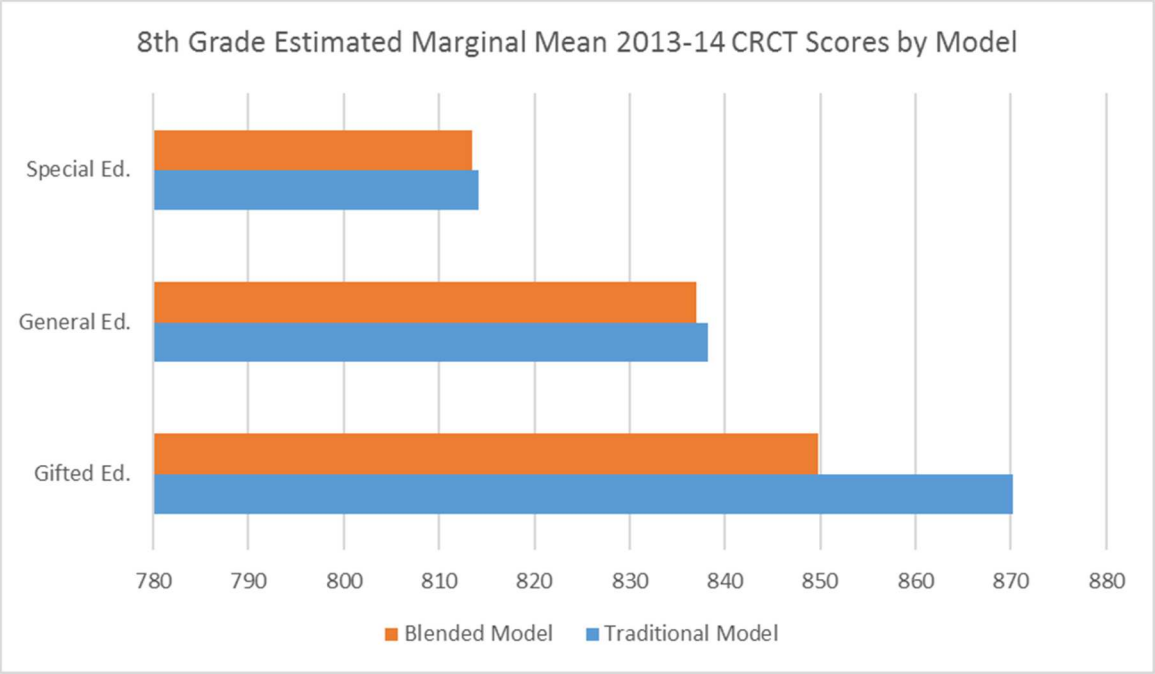

Figure 28. Eighth grade estimated marginal mean 2013-2014 CRCT scores by model. Figure shows that special education scores and regular education scores were similar in both the traditional and blended education groups. The gifted education scores differed significantly from traditional to blended education in eighth grade.

Several factors could have contributed to these findings. The differences in the gifted education grouping 2013-2014 CRCT scores could be related to the change to self-paced learning. Students in the traditional group were paced by the teacher. Students in the blended group were self-paced and had not experienced this control in their past educational experiences, because this was the first year of implementation. The blended model of education students may not have been self-driven and thus fell behind the traditional model of instruction students. The online tutorial mastery learning system may not have provided the best learning platform for the students. When the blended model of

education students were grouped for remediation or acceleration, there might not have been sufficient acceleration lessons for the gifted students. These are only possibilities, and further research would be necessary to confirm any such conjectures. More details on further research are discussed in the recommendations section.

Interpretation: Research Question 2

- Was there a difference in teacher effectiveness between the teachers who taught the blended model of education and the teachers who taught the traditional model of education?

Research Question 2 was abandoned after the collection of the data. The data indicated that all of the 22 language arts teachers received the same scores on the Teacher Keys Evaluations.

Interpretation of the Theory

Two theories were used to provide a framework for the study. Mayer's (2009, 2014) cognitive theory of multimedia learning provided an explanation for why the use of multimedia learning should enhance academic achievement. Bloom's (1968, 1971) theory of mastery learning provided an explanation of why self-paced mastery learning should enhance academic achievement. The study did not support the cognitive theory of multimedia learning (Mayer, 2009, 2014) or mastery learning (Bloom, 1968, 1971); however, the theories are not negated by the study because of the limitations listed in this chapter. A detailed analysis of instructional quality is outside the scope of the presented study.

Scope and Limitations of the Study

The CRCT scores for the sixth grade from the previous year contained differences. Initially, if the CRCT scores were found to contain differences, benchmark exams were going to be used. However, the data from benchmark exams were not accessible and therefore could not be analyzed. There were several student groups coming from different elementary schools that are grouped together for middle school. Within each of these groups, the students had been grouped with several different teachers. The differences in CRCT scores could have been impacted by a variety of variables not controlled for during this study.

The study was limited to the student population within a non-Title 1 Georgia public middle school within a metropolitan school district. The blended model of instruction was limited to the rotation model of blended learning as described in Chapter 2, and the only content area analyzed was language arts. Another limitation was the potential difference in parental support between groups. Parents were given the option of enrolling their children into the blended learning program, and it is possible that parents selecting this option were more involved while students with parents who did not respond were defaulted into the traditional model of instruction. The inability to adequately assess teacher effectiveness and learning environment also prevented the consideration of those covariates.

The 2013-2014 school year was the first year of implementation for the blended model of instruction at the school of study. The model of instruction was unfamiliar to stakeholders and students as it was implemented for the first time. The teachers were

provided professional learning, but the practice was a learning experience. The students also had to learn how to use the online tutorial mastery learning system and how to pace themselves successfully. Each of these limitations could have altered the results of the study.

Recommendations

Recommendations for future studies include greater control over extraneous variables for better analysis and understanding. This study did indicate that the blended model of instruction as implemented by this school is having a negative impact on achievement scores of advanced students and a limited benefit to the regular education group. Therefore, it is advisable to conduct a study pertaining to the gifted subgroup for greater understanding. Recommendations for future studies also include a longitudinal study of how academic achievement changes over time with the implementation of blended learning as students and teachers adapt, as well as a replication of the study after the second year to determine if there were differences in the subsequent years of implementation.

Implications

The potential adverse effect on the achievement scores of advanced-level students as indicated by this study is of concern. For positive social change, more research needs to be performed to achieve greater understanding of how blended learning may affect this subgroup as well as all other subgroups. With greater understanding of how different forms of instruction affect various subpopulations, the school system may be better able to provide the support needed for all students based on their needs.

At the societal level, it needs to be ensured that the instructional efforts of the public school system are adequately meeting needs of students to develop them into functional and contributing members of their community. This is necessary, in part, to encourage business and commerce growth in the areas served by each district. At the family level, the instructional efforts of the school system need to contribute to the capacity of each family member to provide for and support their family. This involves the skills necessary at the individual level to obtain jobs as well as to adapt and thrive in the environment.

Stakeholders in education may use this study, and others like it, to influence the adoption of models of education at the middle school level that are beneficial, as well as to avoid models for subgroups that might be harmful. Higher performing students may not benefit from the rotation model of blended instruction. Greater awareness of the effect of various models of instruction may enable decision makers to serve their students and communities in a manner that promotes positive social change.

Conclusion

The rotation model of blended learning did not significantly impact overall academic achievement of the sixth or eighth grade groups during the first year of implementation at the school of study. There was a significant negative effect found for the seventh grade blended-gifted students.

The studies pertaining to blended models of instruction illustrate a mixture of results on the effectiveness of the blended model of instruction. However, the prevalence of various models of blended instruction is increasing. The results of studies contained in

the research literature, lack of research performed within the K-12 public school environment, and findings of my study suggest that there is not adequate understanding of the benefits and unintended consequences of various forms of blended instruction. In addition, the rotation model of blended instruction may have a negative effect on achievement scores of higher performing students. However, due to the mission and purpose of the public-school system, which are to develop people, giving them the capacity to adapt, thrive, and function in greater society, there is a need for more immediate research that controls for extraneous variables within the K-12 public school system to the greatest extent possible.

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Appendix A: Definitions

- Criterion Reference Competency Tests (CRCT): The Georgia State annual assessment created by the Georgia Department of Education. The test format is multiple choice and students in the 1st through eighth grades are evaluated using the test scores each year. The CRCT is used in each of the core content areas (mathematics, language arts, reading, science, and social studies)

Appendix B: Performance Statndards and Rubrics

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

Georgia Department of Education
TKES Performance Standards and Rubrics

Exemplary *In addition to meeting the requirements for Proficient…*	Proficient *Proficient is the expected level of performance.*	Needs Development	Ineffective
Performance Standard 1: Professional Knowledge *The teacher demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences.*			
The teacher continually demonstrates extensive content and pedagogical knowledge, enriches the curriculum, and guides others in enriching the curriculum. *(Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences.	The teacher inconsistently demonstrates understanding of curriculum, subject content, pedagogical knowledge, and student needs, **or** lacks fluidity in using the knowledge in practice.	The teacher inadequately demonstrates understanding of curriculum, subject content, pedagogical knowledge and student needs, **or** does not use the knowledge in practice.
Performance Standard 2: Instructional Planning *The teacher plans using state and local school district curricula and standards, effective strategies, resources, and data to address the differentiated needs of all students.*			
The teacher continually seeks and uses multiple data and real world resources to plan differentiated instruction to meet the individual student needs and interests in order to promote student accountability and engagement. *(Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently plans using state and local school district curricula and standards, effective strategies, resources, and data to address the differentiated needs of all students.	The teacher inconsistently uses state and local school district curricula and standards, **or** inconsistently uses effective strategies, resources, **or** data in planning to meet the needs of all students.	The teacher does not plan, or plans without adequately using state and local school district curricula and standards, **or** without using effective strategies, resources, **or** data to meet the needs of all students.
Performance Standard 3: Instructional Strategies *The teacher promotes student learning by using research-based instructional strategies relevant to the content to engage students in active learning and to facilitate the students' acquisition of key knowledge and skills.*			
The teacher continually facilitates students' engagement in metacognitive learning, higher-order thinking skills, and application of learning in current and relevant ways. *(Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently promotes student learning by using research-based instructional strategies relevant to the content to engage students in active learning, and to facilitate the students' acquisition of key skills.	The teacher inconsistently uses research-based instructional strategies. The strategies used are sometimes not appropriate for the content area **or** for engaging students in active learning **or** for the acquisition of key skills.	The teacher does not use research-based instructional strategies, nor are the instructional strategies relevant to the content area. The strategies do not engage students in active learning **or** acquisition of key skills.
Performance Standard 4: Differentiated Instruction *The teacher challenges and supports each student's learning by providing appropriate content and developing skills which address individual learning differences.*			
The teacher continually facilitates each student's opportunities to learn by engaging him/her in critical and creative thinking and challenging activities tailored to address individual learning needs and interests. *(Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently challenges and supports each student's learning by providing appropriate content and developing skills which address individual learning differences.	The teacher inconsistently challenges students by providing appropriate content **or** by developing skills which address individual learning differences.	The teacher does not challenge students by providing appropriate content **or** by developing skills which address individual learning differences.
Performance Standard 5: Assessment Strategies *The teacher systematically chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are valid and appropriate for the content and student population.*			
The teacher continually demonstrates expertise and leads others to determine and develop a variety of strategies and instruments that are valid and appropriate for the content and student population and guides students to monitor and reflect on their own academic progress. *(Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher systematically and consistently chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are valid and appropriate for the content and student population.	The teacher inconsistently chooses a variety of diagnostic, formative, and summative assessment strategies **or** the instruments are sometimes not appropriate for the content or student population.	The teacher chooses an inadequate variety of diagnostic, formative, and summative assessment strategies **or** the instruments are not appropriate for the content or student population.

Georgia Department of Education
TKES Performance Standards and Rubrics

Performance Standard 6: Assessment Uses
The teacher systematically gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents.

Exemplary *In addition to meeting the requirements for Proficient…*	**Proficient** *Proficient is the expected level of performance.*	**Needs Development**	**Ineffective**
The teacher continually demonstrates expertise in using data to measure student progress and leads others in the effective use of data to inform instructional decisions. (*Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher systematically and consistently gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents.	The teacher inconsistently gathers, analyzes, or uses relevant data to measure student progress, inconsistently uses data to inform instructional content and delivery methods, **or** inconsistently provides timely or constructive feedback.	The teacher does not gather, analyze, or use relevant data to measure student progress, to inform instructional content and delivery methods, **or** to provide feedback in a constructive or timely manner.

Performance Standard 7: Positive Learning Environment
The teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all.

Exemplary *In addition to meeting the requirements for Proficient…*	**Proficient** *Proficient is the expected level of performance.*	**Needs Development**	**Ineffective**
The teacher continually engages students in a collaborative and self-directed learning environment where students are encouraged to take risks and ownership of their own learning behavior. (*Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all.	The teacher inconsistently provides a well-managed, safe, **and** orderly environment that is conducive to learning and encourages respect for all.	The teacher inadequately addresses student behavior, displays a negative attitude toward students, ignores safety standards, **or** does not otherwise provide an orderly environment that is conducive to learning or encourages respect for all.

Performance Standard 8: Academically Challenging Environment
The teacher creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners.

Exemplary *In addition to meeting the requirements for Proficient…*	**Proficient** *Proficient is the expected level of performance.*	**Needs Development**	**Ineffective**
The teacher continually creates an academic learning environment where students are encouraged to set challenging learning goals and tackle challenging materials. (*Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners.	The teacher inconsistently provides a student-centered, academic environment in which teaching and learning occur at high levels **or** where students are self-directed learners.	The teacher does not provide a student-centered, academic environment in which teaching and learning occur at high levels, **or** where students are self-directed learners.

Performance Standard 9: Professionalism
The teacher exhibits a commitment to professional ethics and the school's mission, participates in professional growth opportunities to support student learning, and contributes to the profession.

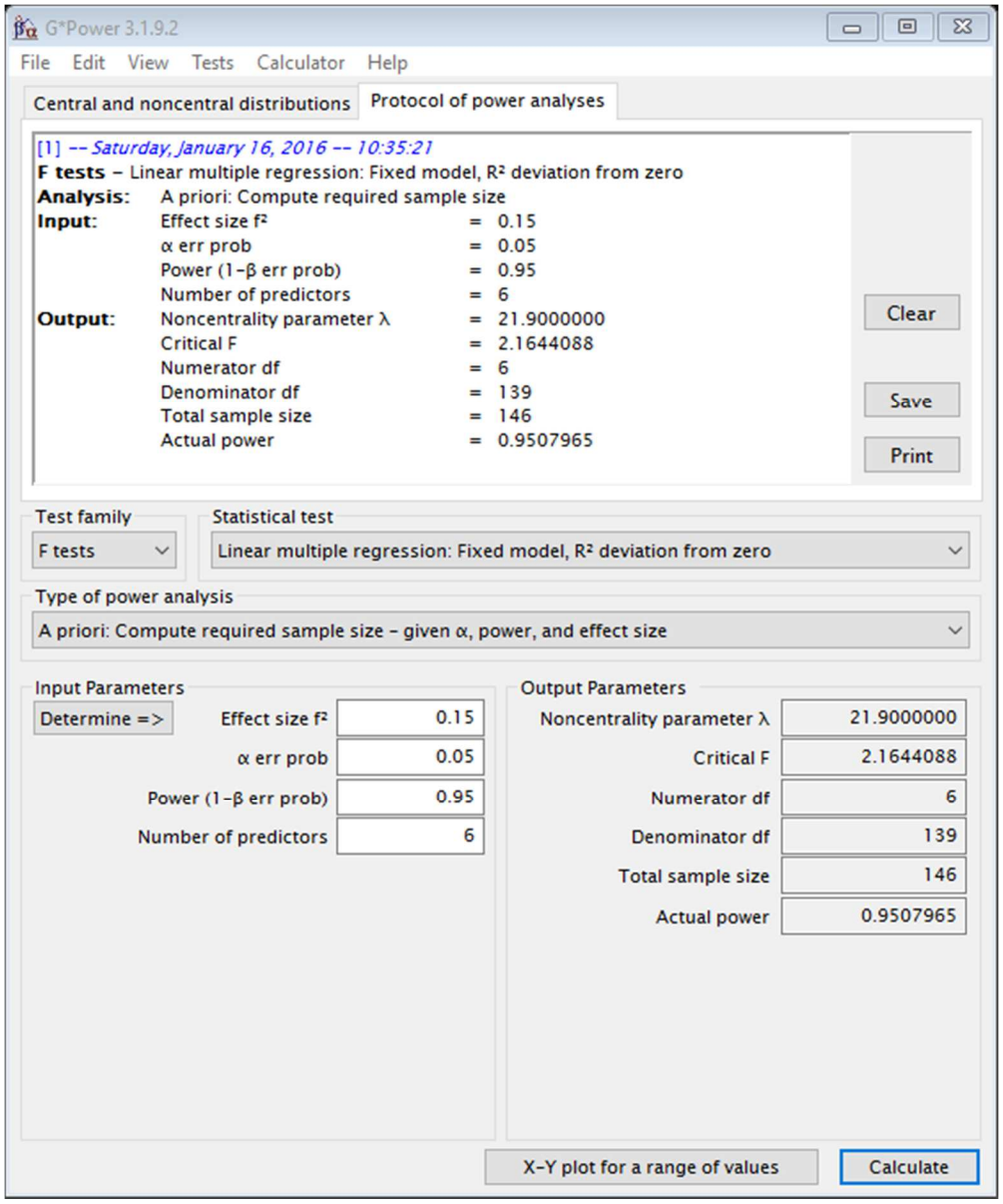
Exemplary *In addition to meeting the requirements for Proficient…*	**Proficient** *Proficient is the expected level of performance.*	**Needs Development**	**Ineffective**
The teacher continually engages in a high level of professional growth and application of skills and contributes to the development of others and the well-being of the school and community. (*Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher consistently exhibits a commitment to professional **ethics and the school's mission**, participates in professional growth opportunities to support student learning, and contributes to the profession.	The teacher inconsistently **supports the school's mission or** seldom participates in professional growth opportunities.	The teacher shows a disregard toward professional ethics **or** the **school's** mission **or** rarely takes advantage of professional growth opportunities.

Performance Standard 10: Communication
The teacher communicates effectively with students, parents or guardians, district and school personnel, and other stakeholders in ways that enhance student learning.

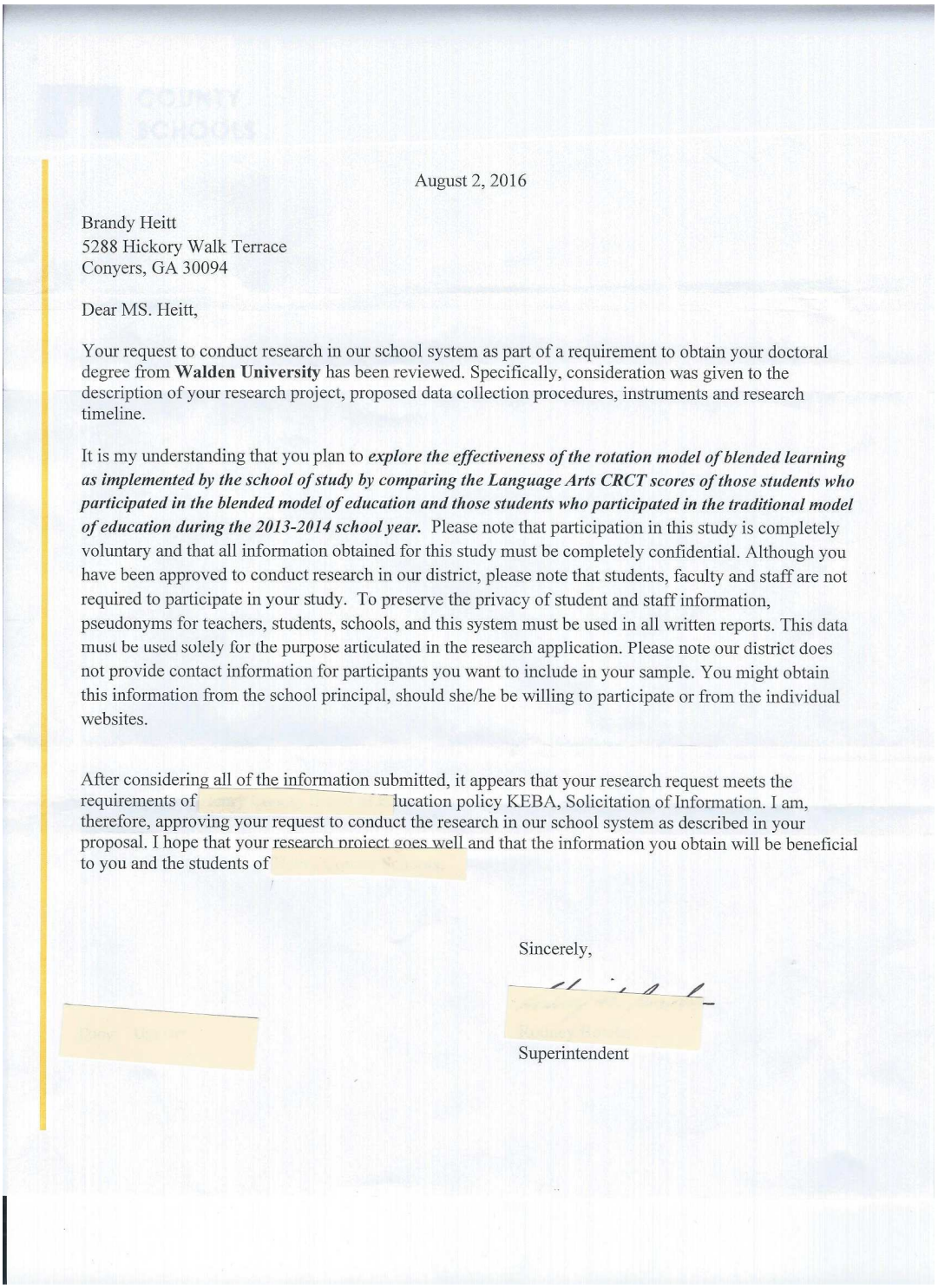
Exemplary *In addition to meeting the requirements for Proficient…*	**Proficient** *Proficient is the expected level of performance.*	**Needs Development**	**Ineffective**
The teacher continually uses communication techniques in a variety of situations to proactively inform, network, and collaborate with stakeholders to enhance student learning. (*Teachers rated as Exemplary continually seek ways to serve as role models or teacher leaders.)*	The teacher communicates effectively and consistently with students, parents or guardians, district and school personnel, and other stakeholders in ways that enhance student learning.	The teacher inconsistently communicates with students, parents or guardians, district and school personnel, or other stakeholders **or** communicates in ways that only partially enhance student learning.	The teacher inadequately communicates with students, parents or guardians, district and school personnel, or other stakeholders by poorly acknowledging concerns, responding to inquiries, or encouraging involvement.

The contents of this form were developed under a grant from the U. S. Department of Education. However, those contents do not necessarily represent the policy of the U. S. Department of Education, and you should not assume endorsement by the Federal Government.

Appendix C: G*Power Sample Size Calculation



Appendix D: County-Level Approval Letter



August 2, 2016

Brandy Heitt
5288 Hickory Walk Terrace
Conyers, GA 30094

Dear MS. Heitt,

Your request to conduct research in our school system as part of a requirement to obtain your doctoral degree from **Walden University** has been reviewed. Specifically, consideration was given to the description of your research project, proposed data collection procedures, instruments and research timeline.

It is my understanding that you plan to ***explore the effectiveness of the rotation model of blended learning as implemented by the school of study by comparing the Language Arts CRCT scores of those students who participated in the blended model of education and those students who participated in the traditional model of education during the 2013-2014 school year.*** Please note that participation in this study is completely voluntary and that all information obtained for this study must be completely confidential. Although you have been approved to conduct research in our district, please note that students, faculty and staff are not required to participate in your study. To preserve the privacy of student and staff information, pseudonyms for teachers, students, schools, and this system must be used in all written reports. This data must be used solely for the purpose articulated in the research application. Please note our district does not provide contact information for participants you want to include in your sample. You might obtain this information from the school principal, should she/he be willing to participate or from the individual websites.

After considering all of the information submitted, it appears that your research request meets the requirements of [redacted]lucation policy KEBA, Solicitation of Information. I am, therefore, approving your request to conduct the research in our school system as described in your proposal. I hope that your research project goes well and that the information you obtain will be beneficial to you and the students of [redacted]

Sincerely,

[redacted]

Superintendent