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A Regression Analysis of South Carolina Algebra I End-Of-Course Exam Scores by Schedule Type

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A REGRESSION ANALYSIS OF SOUTH CAROLINA ALGEBRA I
END-OF-COURSE EXAM SCORES BY SCHEDULE TYPE

by

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DEDICATION

To my parents, Mary T. Goldberg and Norman D. Goldberg who have always taught me to believe in myself and never give up. Dad, you are always in my mind and heart; thank you for the courage and inspiration to finish this journey.

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I would like to acknowledge the contributions and support I have received throughout this journey. I am very fortunate to have so many wonderful people in my life supporting my efforts.

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ABSTRACT

The purpose of this study was to examine the relationship between scheduling and first-year-high-school students' exam scores on the South Carolina Algebra I End-of-Course (EOC) assessment. The study compared existing empirical data from two southeastern high schools from the same school district using 4 X 4 block schedules from 2011-2014 and modified block (A/B) schedules from the years 2014-2016. The study results included Algebra I EOC exam scores from the 3 years each school was on a 4 X 4 block schedule and for the 2 years each school employed a modified (A/B) block schedule. South Carolina Algebra I EOC exam scores for first-time ninth grade students from these high schools were collected and analyzed. Descriptive statistics were used to report sample sizes, means, as well as standard deviations for each of the independent variables. Descriptive statistics were also reported for data from 2011-2016 regarding gender, ethnicity, and SES. A regression analysis was conducted to compare and analyze the mean differences of SC Algebra I EOC exam scores of students on 4 X 4 block schedules and modified (A/B) block schedules. In addition, the regression analysis was utilized to assess the relationship between SC Algebra I EOC exam scores and 4 X 4 block and modified (A/B) block scheduling.

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LIST OF ABBREVIATIONS

ACGR ....Adjusted Cohort Graduation Rate

ANOVA ....Analysis of Variance

AP ....Accelerated Placement

CCSR ....Chicago Consortium on School Research

CIP .... Children in poverty

ELA..English Language Arts

SC EOCEP ....South Carolina End-Of-Course Exam Program

ESEA.. Elementary and Secondary Education Act

HSPT... High School Proficiency Test

NAEP ....National Assessment of Educational Progress

NCLB..No Child Left Behind

PSAT... Preliminary Scholastic Aptitude Test

SAT... Scholastic Aptitude Test

SCEAA ....South Carolina Education Accountability Act

SES... Socio Economic Status

CHAPTER 1

INTRODUCTION

Statement of the Problem

American schools and school leaders have the responsibility of educating all children and ensuring that no children are left behind. The fifty-year-old Elementary and Secondary Education Act (ESEA) of 1965 mandates that all students meet high standards. The level of school leader accountability for student success has increased with every reauthorization of ESEA for the past six decades. Dr. Joseph M Carroll, retired superintendent and scholar, started a reform movement to restructure secondary school schedules in 1989 to increase student achievement and meet the high level of accountability brought forth by the reauthorizations of ESEA. This movement was also sparked by the publication of *A Nation at Risk: The Imperative for Educational Reform* (1983). The publication exposed underperforming high schools and the lack of preparation high school students were receiving to be successful in the global world. The Bush Administration passed a reauthorization of ESEA, the No Child Left Behind Act in 2002. This legislation prompted most secondary schools to engage in efforts to improve student achievement in specific gateway courses. As stated in Bitter and Oday (2010), since then, school leaders have implemented innovative schedules to help increase student achievement in gateway courses. These gateway courses, as defined by Freeman (1995), were important to the success of all high school students. Courses, such as

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Algebra I became the focus for school leaders and administrators throughout the nation. According to Bitter and Oday (2010), students were expected not only to meet high standards but also to complete and excel in rigorous mathematic courses in order to graduate from high school. This study will examine the mathematic achievement, measured by exam scores, of first-year high school students on the South Carolina Algebra I End-of-Course (EOC) assessment in schools which use 4 X 4 block and modified block (A/B) schedules. This study will also examine the descriptive statistics of student Algebra I exam scores including gender, ethnicity, and socioeconomic status (SES).

A Personal Perspective

I have been interested in school leadership since I entered the classroom as a teacher in 1998. I have always been curious as to why school leaders make decisions and what data can help leaders make better-educated decisions about scheduling. Even though I received a B.S. in Politics and Education, with a minor in History, understanding the importance of student success in critical courses, such as Algebra I, has become a passion of mine.

Through my Master's and Ph.D. coursework, I have developed a belief that many factors influence student achievement. Educators do not have control over many of these factors such as gender, ethnicity, and SES. However, many local school administrators and board members do have control over factors such as scheduling, class sizes, and per pupil expenditure (PPE). Educators, policymakers, and board members Education Production Function (EPF) literature is extensive and includes a multitude of

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multidisciplinary empirical studies. Most of the literature examines the productivity relationship between schooling inputs and test score outcomes for school-aged children (Todd, P. & Wolpin, K, 2003).

The conceptual frame or lens of this study is guided by EPF paradigm. This type of lens incorporates a variety of inputs from students, parents, teachers, schools, and many other sources which are associated with student achievement and attempts to explain the relationship between the inputs and outputs. While EPF is not new to the economists' world, it has become more prevalent in education studies due to the heightened sense of accountability and drive to educate all children.

Conceptual Framework

Researchers and policymakers have been interested in the causal effects of educational inputs on student achievement for decades. The most cited study examining education production functions if the *Equality of Educational Opportunity Report* (EEOR) that followed over 600,000 K-12 students in more than 3,000 schools (Coleman, 1966). Congress in the Civil Rights Act of 1964 commissioned the Report, more commonly known as the Coleman Report. The goal of the study was to research the lack of availability of equal opportunities for minority children in the United States. According to Gamoran and Long (2006), the initial intent of the report was to document that schools attended by minority students were badly lacking in the resources needed to sustain academic excellence. The outcome was supposed to support the notion that all of America's children should be afforded equal educational opportunity. The report's evidence and conclusions did support some of the speculations, but also posed questions

about the family's influence on children's school performance. Gamoran et al. (2006) concluded that the EEOR "inspired decades of research on school effects, on the impact of socioeconomic status (SES) on achievement, and on racial and ethnic disparities in academic achievement."

EPF's are used to study the relationship between student and school inputs and a measure of school output. School inputs, referred to as predictors, include but are not limited to class size, teacher experience, teacher education, and teacher pedagogy. Student inputs include but are not limited to predictors such as attendance, discipline, and socioeconomic status (SES). The most common student output is student achievement; often measured by standardized test scores. The aforementioned inputs and outputs are only a few of the many included in EPF literature and studies. The studies have led to mixed findings due to the use of widely diverse models. Many of the models incorporate per pupil expenditure (PPE) as well as indicators such as teacher experience, teacher education, teacher-pupil ratio, administrative inputs, and facilities to predict achievement Hanushek, 1996); however, these inputs are outside the scope and the conceptual framework of this particular study. This study will examine the relationship between schedule type (input) and SC Algebra I EOC exam scores (output). Student demographics will also be used to examine the relationship between 4 X 4 block and modified block scheduling and SC algebra I EOC exam scores.

Historical Background

The California Research Project (CRP) indicates that student achievement in Algebra I is critical to the success of all high school students and one of the major

predictors of high school graduation. The CRP revealed that 70% of students who fail Algebra I in the ninth grade drop out of high school compared to 30% who pass the course in their ninth grade year and graduate on time (Silver, Saunders, & Zarate, 2008). This study will examine mathematic achievement of first-year high school students measured by exam scores on the South Carolina Algebra I End-of-Course (EOC) assessment in schools which use 4 X 4 block and modified (A/B) block schedules. This study will also report the descriptive statistics of student Algebra I exam scores including gender, ethnicity, and SES .

The South Carolina Algebra I EOC exam and similar high stakes assessments are part of the school reform movement, which focuses on collecting and analyzing student data to drive decision making in education. On April 9, 1965, Congress enacted the ESEA; this legislation is arguably the most expansive federal education bill passed in the 20th century. As cited in Jorgensen and Hoffman (2003), President Lyndon B. Johnson introduced the bill to Congress three months prior to its enactment as part of his "War on Poverty" which aimed to reduce achievement gaps between students by offering fair and equal opportunities to students in low-achieving schools. These low-achieving schools received federal funding for staff development, bi-lingual education, technology, and special innovative programs to improve the education of disadvantaged students.

In 1983 the National Commission on Excellence in Education published A Nation at Risk: The Imperative for Educational Reform, which prompted a more thorough look into the ineffectiveness of the American education system and provided concrete data to influence the reauthorization of ESEA. The report exposed the mediocrity of American schools, especially high schools, and encouraged reform throughout all public schools.

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Jorgensen and Hoffman (2003) asserted this report gained attention from the Reagan administration as its findings threatened the United States' position as a dominant force in the global economy. Several policies and mandates resulted due to the findings of this published report.

First, Goals 2000: Educate America Act was signed into law on March 31, 1994. The Clinton administration passed this law with the intent of establishing a framework in which to identify high performance standards, measure student progress, and provide a support system including staff development for teachers to help students meet the standards. Shepard, Hannaway, and Baker (2009) argued that this legislation supported education reform to increase student achievement and implement standards-based curricula; however, state that there was a lack of accountability developed to support the act. Goals 2000 sparked the movement to implement standards-based curricula and increased the need for test-based accountability.

According to Shepard et al. (2009), after the passage of Goals 2000, states were left to develop their own content and performance standards to ensure their students were learning at a rate that would match or surpass that of students in other states as well as ensure on-time graduation. The ESEA was again reauthorized in 2002 with the passage of the No Child Left Behind Act (NCLB). Shepard et al., point out that NCLB legislation focused on school accountability and increased the role of the federal government in guaranteeing the quality of public education for all children, especially those in poor school districts and of low socioeconomic backgrounds. Jorgensen and Hoffman (2003) assert, "NCLB brought clarity to the value, use, and importance of achievement testing of students in kindergarten through high school" (p. 6).

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Later, President George W. Bush linked school funding to the attainment of essential skills and knowledge using state grade-level standards and benchmarks and required all schools to monitor the progress of all students (Jorgensen & Hoffman, 2003). Despite the attempts of NCLB to create uniform academic standards, Shepard et al. (2009) state that there is still extreme variability in some states and school districts with respect to rigor and development of challenging content standards. With individual states setting the standards, many students do not achieve proficiency on nationally approved tests such as the National Assessment of Educational Progress (NAEP). In an effort to help all students meet proficiency on NAEP, Jorgensen & Hoffman (2003) state the Clinton administration sought recommendations from the National Council on Education Standards and Testing, the Goals Panel, and the experience of states with systemic reforms already in place to identify high performance standards, measure student progress, and develop a support system to help students meet the standards.

In December 2015, President Obama signed the Every Student Succeeds Act (ESSA). This measure once again reauthorized the 50-year old ESEA, which reaffirmed the government's commitment to equal opportunity for all children. President Obama asserted:

> The goals of No Child Left Behind were the right goals: Making a promise to educate every child with an excellent teacher -- that is the right thing to do, that is the right goal. Higher standards are right. Accountability is right… But what hasn't worked is denying teachers, schools, and states what they need to meet these goals. That is why we need to fix No Child Left Behind (ESSA, 2015, p. 2).

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In 1998 the South Carolina legislature passed the South Carolina Education Accountability Act (SCEAA) and was well on the way to developing a method to monitor the adequate yearly progress of schools and students. South Carolina was premature in developing a program that would later be required by NCLB. South Carolina's SCEAA led to the development of the South Carolina End-of-Course-Examination Program (SC EOCEP), which required the development of end-of-course (EOC) tests in benchmark courses such as Algebra I, English I, Biology, US History and the Constitution. According to the South Carolina Department of Education (2015), the EOCEP "encourages instruction in the specific academic standards for the courses, encourages student achievement, and the documents the students' mastery of the academic standards." South Carolina contracted with Data Recognition Corporation (DRC) to develop the tests. According to the SCEAA mandates, tests for these benchmark courses are required at the culmination of a course and count a mandated 20% of a student's overall grade. The SCEAA legislation passed in 1998 was critical in South Carolina because it affirmed that curriculum development, implementation, and accountability were instrumental in the process of monitoring and evaluating student achievement.

National legislation such as NCLB and ESSA were passed with the intent of protecting the right to education for all students and asserting state accountability for student success. State legislation such as SCEAA was passed to meet the federal guidelines set forth by NCLB and ESSA; however, Swanson (2004) reported that research funded by the Bill & Melinda Gates Foundation exposed nearly one third of students do not graduate from high school. According to Rumberger (2008), passing

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legislation was not enough to ensure the success of all students. In order to increase the graduation rate and ensure that no children were left behind, educators needed to study the factors that led to low student achievement as well as the factors which led a student to drop out of school. He argued that the decision to stay in or leave school is affected by "multiple contextual factors—family, school, neighborhood, and peers." These factors act in an aggregate way throughout the lifetime of a student. Thus, it is very difficult to pinpoint one cause for the nation's dropout crisis. In 2004 the Consortium on Chicago Schools Research (CCSR) presented that the most overlooked factor in the quest to identify causes for the dropout rate is students' performance in their courses. The Consortium purported that inadequate credit accumulation in a student's freshman year is highly predictive of that student failing to graduate four years later. Students can earn six to eight Carnegie Units their first year of high school. The Carnegie Unit is based on the amount of time a student has direct contact with an instructor (Silva, White, & Toch, 2015). Students who earn fewer than five Carnegie Units in the ninth grade are at risk for not completing four years of high school successfully (Rumberger, 2008).

Research conducted by the CCSR (2004) and the CRP has shown that course performance in the first year of high school is a strong predictor for on-time graduation. Neild and Balfanz (2006) report that research from the CRP and CCSR has shown that course performance in the eighth and ninth grades can be used to identify dropouts and is a stronger predictor for graduation. A report released in 2005 by the CSSR indicated that ninth grade students who had five full-course credits and no more than one F in a core class at the end of their first year in high school were nearly four times more likely to graduate from high school (Allensworth, 2013). Failure in Algebra I has become a

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growing concern of educators and policymakers since the understanding of its content is fundamental to success in future math and science courses (Neild & Balfanz, 2006; Vigdor, 2013).

Silver et al. (2008) highlighted that the superintendent of LA Unified School District (second largest unified school district in the nation), asserted that failure in Algebra I is the number one trigger of dropouts in high school. Governor Arnold Schwarzenegger and many other influential policymakers have dubbed math, specifically Algebra I, as the "gateway" to college and higher paying careers. To prove this notion, the California Research Dropout Project (CRDP) funded a study that tracked the education performance of over forty-eight thousand students entering 9th grade for the first time in the Los Angeles Unified School District. This 7-year longitudinal study examined a variety of factors to predict on-time graduation rates. Statistical analysis revealed that demographics explained only 4% of the student level variability in drop-out rates whereas student academic experiences and school characteristics explained more of the variability. Most notably, the study found that controlling for all other variables, students who passed Algebra 1 by the end of their freshman year increased the likelihood of graduating on-time by more than 75% (Silver et al., 2008).

The CDRP and programs such as the Algebra Project have proven Algebra I to be a critical course in predicting the success of high school students as well as on-time graduation rates (Neild & Balfanz, 2006; Vigdor, 2013). One of the major decisions district leaders and board members face is the type of scheduling to best deliver Algebra I and other critical courses. During the 1990's reorganizing the school day and restructuring academic time became priorities for school leaders. Schools began to use

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block scheduling to improve the learning culture of high schools and increase student achievement (Zepeda & Mayers, 2006). A number of researchers, educators and policymakers asserted that the academic success of high school students lay in the structure of the school schedule. Goodlad (1984) stated that the school "time is virtually the most important resource for educators" (p. 30).   Since the 1990's block, scheduling has been recognized as a challenge to the "time-honored intellectual bonds" of the traditional school day and the Carnegie unit plan, which has been followed for decades (Murphy, Beck, Crawford, Hodges, & McGaughy, 2001).   Block schedule classes meet every day for 66-90 minutes for approximately ninety days. The modified block (A/B schedule) classes meet every day for 40-50 minutes or 2 to 3 times a week for ninety minutes a day for approximately 180 days.

Dr. Joseph M. Carroll (1990) was a proponent of high school restructuring. In 1989 he published The Copernican Plan-Restructuring the American High School and made revolutionary and controversial claims throughout his publication. Carroll claimed that restructuring the school day could lead to dramatic changes for students, teachers, and high schools:

> Virtually every high school in the U.S. can reduce its average class size by 20%; increase the number of courses or sections it offers by 20%; reduce the total number of students with whom a teacher works each day by 60% to 80%; provide students with regularly scheduled seminars dealing with complex issues; establish a flexible, productive instructional environment that fosters effective mastery learning, as well as other practices recommended by research; get students to master 25% to 30% more

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information beyond what they learn in seminars within present levels of funding (358-359).

Carroll believed student achievement could be improved by restructuring the school day so that students attended longer classes, which met for only part of the school year. He also believed that this schedule change would create a classroom environment fostering improved relationships between students and teachers and provide much more manageable workloads for both teachers and students (Carroll, 1994). Dubbed "The Copernican Plan", this proposal for change in the century-old structure of American schools brought about challenge and backlash from the educational community.

In 1994 Harvard University conducted an evaluation of schools which had switched to a Copernican-style schedule and found that students had better relationships with their teachers, did more writing, discussed and evaluated more in-depth issues and concepts, felt more challenged, and gained a deeper understanding of the content. The study revealed that teachers were more excited about teaching, felt rejuvenated, and believed they were teaching more effectively than ever (Carroll, 1994).

Block scheduling has been used in Canada since the 1970's and has become very popular in the United States since legislators have demanded reform in public education. Kramer (1996) indicated that lecture alone for ninety minutes is ineffective, but more hands-on and student-based learning activities increase student performance and retention. Kramer surveyed teachers on the block schedule who indicated this schedule provided an opportunity to teach more in-depth concepts to their students.

Rettig and Canady (1996) reported that more than 50% of American high schools used a form of block scheduling. Block scheduling was credited with raising exam

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scores (Evans, Tokarczyk, Rice, & McCray, 2002), decreasing discipline issues, encouraging teachers to use a variety of pedagogical strategies (Canady & Rettig, 1995 & Evans et al, 2002) and improving academic achievement (Evans et al., 2002 & Zepeda & Mayers, 2006).

A critic of the Copernican Plan and block scheduling, Howard (1997) argued that the block schedule actually provided less class time and found that the claims of reduced dropouts and absenteeism may be the result of poor record keeping. Gruber & Onwuegbuzi (2001) questioned the usefulness of block scheduling and encouraged educators to return to the more traditional Carnegie Plan. Despite evidence documenting the benefits of block scheduling, these opposing views reveal that the issue is unsettled and additional research is needed to address the criticism.

Most high schools in South Carolina use one of three different schedules: (a) traditional (7-8 periods per day that meet for 45-55 minutes), (b) 4 X 4 block (4 classes per day that meet for 85-90 minutes), and (c) modified (A/B) block (7-8 classes that meet on alternating days for 85-90 minutes). There have been several studies conducted to analyze all three scheduling options and the relationship each scheduling type has with student achievement and high school graduation; however, very few look at the relationship between student achievement and EOC exam scores on 4 X 4 block schedule or modified (A/B) block schedule in South Carolina schools. Also, very few look at mathematic achievement as measured by the exam score achieved on the South Carolina Algebra I EOC in schools using 4 X 4 block schedule or modified (A/B) block schedule in relation to ethnicity, gender and SES.

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The South Carolina Department of Education (SCDE) defines traditional schedules as schedules that consist of 6 to 8 classes per day with classes typically meeting for 45-50 minutes per day every day. Next, they define block scheduling as one three different types: 4 X 4, modified block (A/B), and hybrid block. The 4 X 4 block schedule divides the school day into four ninety-minute classes for one semester or ninety days. Students are then enrolled in four different courses during the second semester. The total amount of seat time with this schedule totals 135 hours. The modified block schedule, also known as the alternating day schedule; students attend 90-120 minute classes completing six to eight classes in the school year. The students attend three to four classes on *A* day and then three to four classes on *B* day. The modified (A/B) block schedule combines the block and traditional schedule. Students take 90 semester courses with 45 minute, yearlong courses. Again, the students have 135 minutes of academic instruction with this schedule. Lastly, they define the hybrid block as a combination of the two aforementioned blocks.

Given the variation of schedule types adopted by high schools is South Carolina as well as the competing perspectives regarding block scheduling, research is needed to examine whether the type of scheduling is positively or negatively correlated with student achievement in Algebra I. The following sections present an overview of the study, its purpose, significance, and design. In addition, the following sections identify the research questions guiding this study, address the limitations, and define the key terms.

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Purpose of the Study

The purpose of this quantitative study is to examine the relationship between schedule type and South Carolina Algebra I EOC exam of first-year high school students taking Algebra I on 4 X 4 block schedule and modified (A/B) block schedules. The two schools utilized a 4 X 4 block schedule from 2011-2014 and switched to a modified (A/B) block schedule from 2014-2016. The study results included Algebra I EOC exam scores from the 3 years each school was on a 4 X 4 block schedule and for the 2 years each school employed a modified (A/B) block schedule. This study will also report and analyze mathematic achievement, measured by exam scores, on the Algebra I EOC exam of first-year high school students enrolled in Algebra I on 4 X 4 block schedules and modified (A/B) block schedules with consideration of ethnicity, gender and SES.

Research Question

The following questions guided this study on making scheduling decisions for Algebra I classes for students in their first year of high school:

1. Is there a significant relationship between South Carolina Algebra I EOC exam scores and schedule type, examining a 4 X 4 block and modified (A/B) block schedule?

Descriptive statistics were also reported to provide data from 2011-2016 regarding gender, ethnicity, and SES.

Significance of Study

   This study design will provide school administrators and board members with quantitative data about the effects of scheduling on the SC Algebra I End of Course exam. The data will be useful when deciding to implement a school schedule that maximizes student achievement for all students in Algebra I classes. The understanding of Algebra I content is fundamental to success in future math and science courses. Since Algebra I is considered a "gateway" course to high school graduation, school leaders can use this data to make decisions about scheduling that will increase on-time graduation.

Research Design

   The participants for this study were selected from two secondary high schools in a southeastern school district which has both rural and suburban schools. The school district had eight high schools; however, six high schools were eliminated from the study because they did not follow 4 X 4 block and modified (A/B) block schedules for the years studied. The two schools selected for this study followed a 4 X 4 block schedule from 2011-2014 and a modified (A/B) block schedule with 8 blocks (80-90 minutes per block) which met on an alternating day schedule from 2014-2016. The participants ranged in age from 14-16 and were all first-time ninth grade students. A total of 1,679 students and their Algebra I exam scores were examined for this study. Approximately 53% of the students were female and 47% were male. Fifty percent were Black; 42% White; 6% Hispanic; and 2 % Asian. Four ethnic categories were not studied because their populations were too small to gather usable data. Seventy-one percent of the students were children in poverty (CIP) and 29% were not. For this study, children in poverty

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were defined as students receiving free or reduced lunch. Exam scores from the South Carolina Algebra I EOC exams and student demographic data were gathered for 2011-2016.

Student grades and South Carolina Algebra I EOC exam scores were collected from the school district's database: Berkeley's Resource and Information Network (BRAIN). Once the data was collected and sorted, descriptive statistics were used to provide information about the sample size, means, and standard deviations. A regression analysis was used determine if there was a significant relationship between South Carolina Algebra I EOC exam scores and students enrolled in 4 X 4 block or modified (A/B) block schedules.   Descriptive statistics were reported to provide data from 2011-2016 regarding gender, ethnicity, and SES.

Limitations

This study will add to the existing body of research and information on innovative scheduling; however, this study is narrow and has limitations. The small sample size (two schools) and a lack of random selection inhibit generalizing about the findings in this research. Students in the two schools were able to take Algebra I during the eighth grade; however, these students were omitted from this study. Other potential weaknesses of the study may include small sampling or errors in the data collection (Creswell, 2012). The results are limited to the secondary schools in one school district using 4 X 4 block or modified (A/B) block schedules during the years 2011-2016.   The test data was collected for five school years. An evaluation of testing over a 10-20 year period would support broader application of the results. A major limitation of the study was the lack of

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consideration of teacher practices, pedagogy, skills, and classroom experiences. The data were limited to a first-year high school population. All students who had taken Algebra I more than once were eliminated from the data set. In addition, the use of one high stakes test, the South Carolina Algebra I EOC, was used to measure participant exam scores in Algebra I. Finally, this study used a pre-post design and no control group. Consequently, one of the major issues associated with that is selection bias, which suggests there may be something unique about the schools that decided to change their scheduling in comparison to the schools that did not change their scheduling.

Definition of terms

Achievement gap. The achievement gap is the difference in the performance between each subgroup within a participating school and the statewide average performance of the state's highest achieving subgroups in reading/language arts and mathematics as measured by the assessments required under the Elementary and Secondary Education Act (Department of Education, 2015).

Assessment. An assessment is used to determine what a student has learned in the curriculum. (Carter, 2007, p. 34)

Block schedule (4 X 4). A block schedule class is defined as any extended period class (66-90 minutes). (SCDE, 2015)

Carnegie unit. The Carnegie Unit is based on the amount of time a student is in direct contact with an instructor. In the American school system, a Carnegie unit is 120 hours of contact time with an instructor. (Silva, White, & Toch, 2015)

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Children in Poverty (CIP). Children living in poverty are those who experience deprivation of the material, spiritual and emotional resources needed to survive, develop and thrive, leaving them unable to enjoy their rights, achieve their full potential or participate as full and equal members of society (Vandermoortele, 2000). In this study, children who receive free and reduced lunch will be referred to as children in poverty.

Copernican Plan. The Copernican Plan is a variation of block scheduling that is believed to increase retention, decrease teacher workload, and provide an environment more conducive to learning, without adding to school budgets. (Carroll, 1994)

Curriculum. Curriculum refers to the content, standards, and/or objectives for which students are held accountable. (Posner, 2004, p. 5)

Graduation rate. Graduation rate is the four-year or extended-year adjusted cohort graduation rate. (Department of Education, 2015)

High stakes test. A high stakes test is used to make important decisions about students, educators, schools, or districts, most commonly for the purpose of accountability. (SCDE, 2015)

Modified (A/B) block schedule. A modified (A/B) block schedule class is defined as any extended period class that meets every other day or two to three times per week (eighty-five to ninety minutes). (SCDE, 2015)

PASS. Palmetto Assessment of State Standards, a norm-referenced exam given in grades 3-8 in South Carolina. (SCDE, 2015)

Pearson Correlation. In statistics, the Pearson product-moment correlation coefficient is a measure of the linear correlation between two variables X and Y, giving a

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value between +1 and −1 inclusive, where 1 is total positive correlation, 0 is no correlation, and −1 is negative correlation.

Proficiency. Proficiency is attained through advancement in knowledge or skill. (SCDE, 2015)

Socioeconomic Status. An individual's or group's position within a hierarchical structure. Socioeconomic status depends on a combination of variables, including occupation, education, income, wealth, and place of residence. Sociologists often use scocieconomic status as a means of predicting behavior. (The American Heritage New Dictionary of Cultural Literacy, 2005)

South Carolina EOC Exam. The SC EOC Exam is an academic assessment administered in benchmark courses; it counts 20% of a student's final grade in South Carolina. (SCDE, 2015)

Standards. Standards describe what the students should be able to do and describe the processes used to meet the learning goals. (Posner, 2004, p. 6)

Student performance data. Student performance data provides information about the academic progress of a single student, such as formative and summative assessment data, coursework, instructor observations and information about student engagement and time on task. (Department of Education, 2015)

Summary

The American education system has evolved significantly; however, the main goal of meeting the needs of every student has remained the same. Some of the most notable changes have occurred in school structure, curriculum, pedagogy, and

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assessment. Many studies have examined the reasons students do not finish high school in four years, but a student's course performance in the critical or benchmark courses during the first year of high school proves to be extremely important (Neild & Balfanz, 2006; Vigdor, 2013). Student performance in Algebra I, the gateway course to graduation, provides keen insight into a student's success in high school.

Educators have searched for varied methods to teach Algebra I curriculum and the curriculum of other critical courses in order to increase student achievement. Alternative scheduling formats have been used to provide students with a variety of instructional methods. Canady and Rettig (1995) reason that the challenges of providing quality time, creating a positive school climate, and providing varying learning time can be addressed with alternative scheduling. This study is designed to analyze mathematic achievement, measured by exam score, on the South Carolina Algebra I EOC assessment of first-year high school students enrolled in Algebra I on 4 X 4 block and modified (A/B) block schedules. In addition, this study will analyze mathematic achievement, measured by exam score, on the South Carolina Algebra I EOC assessment of first-year high school students enrolled in Algebra I in relation to ethnicity, gender and SES. A more precise understanding of the relationship between scheduling and student performance in Algebra I will provide critical insight to educators who seek to improve high school completion rates. In addition, administration can use this new understanding to develop schedules for courses that are more likely to lead to improved student achievement.

This study was organized in a traditional fashion. Chapter Two is an examination of existing literature with respect to graduation rate, mathematics, assessments, and scheduling. Chapter Three outlines and explains the design and

methodology of the research. This section includes the study design, rationale, participation explanations, data gathering methods, and data-analysis procedures. The positionality of the research, subjectivity, ethical considerations, and limitations of the study are also addressed in Chapter Three. Contained within Chapter Four are the data, the associated analysis of the data, and the study findings.   Chapter Five is an analysis and discussion of the findings, which include the implications of the study and thoughts about the generalizability of the research.

CHAPTER 2

LITERATURE REVIEW

A review of literature was conducted to gather current and relevant research for this study. First, literature on graduation rates, dropout rates, mathematics, standardized testing, and the relationship between scheduling and student assessment performance in secondary schools was gathered. Then, literature on block and modified (A/B) block scheduling was collected. Extensive literature exists on traditional and block scheduling; however, very limited literature on A/B block scheduling is available. There are significant gaps in the literature with regard to the relationship between standardized testing and 4 X 4 block and modified (A/B) block scheduling.

Literature Search Procedures

A key word search was conducted using the following descriptors: block scheduling, A/B scheduling, modified block scheduling, student achievement on block scheduling, alternative scheduling in high school, graduation rates and standardized testing, South Carolina Algebra I EOC scores and scheduling, innovative scheduling and exam scores, and mathematics and scheduling. Multiple searches were conducted online using ERIC and ProQuest databases. Approximately 105 peer-reviewed articles, documents, and studies were found. There were fifty-four articles, documents, and studies relevant to the present study. The following sections will provide an overview of

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the key literature and themes emerging from the selection of articles, documents, and studies. The first section will highlight the focus of this study, improving graduation rates. The subsequent sections will dissect mathematic's centrality to graduation and the relationship between scheduling and instruction, assessment, and student achievement in Algebra I.

Graduation Rate

Historically, as cited by Shortt and Fitzsimmons in 2007, researchers surmised that the school dropout risk was associated with possible mental inferiority. Scholars have continued to search for empirical evidence to explain the reasons students drop out of high school. NCLB (2002) renewed the quest to improve graduation rates and reduce dropout rates through a focus on school accountability and an increase in the federal government's role in guaranteeing the quality of public education for all children, especially those in poor school districts and of low socio-economic backgrounds (Shepard et al., 2009).

Identifying factors which lead students to graduate on time has remained a high priority for educators, policymakers, and researchers since the early 1900's (Allensworth & Easton, 2005). Tracking student graduation rates helps educators identify successful practices and design targeted interventions focusing on less successful groups. The National Center for Education Statistics (NCES), a division of the U.S. Department of Education, which focuses on collecting and analyzing data and statistics, released the first national reporting of high school completion based on Adjusted Cohort Graduation rate (ACGR) in 2014. This was the first time ACGR was used to track an actual number of

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students and not just an estimated number of students finishing high school within four years. There are two main methods used to calculate graduation rates: the Average Freshman Graduation Rate (AFGR) and the ACGR. Understanding the data used to measure graduation rates is critical as the ACGR is considered the most accurate measure available for reporting on-time graduation rates. The AFGR is not as accurate as the ACGR; however, it can be used to estimate graduation rates back to the 1960's when comparable aggregate data is used. In 2011 the ACGR became available to nearly all states and was instrumental in showing where progress was being made and where challenges still existed.   Forty-nine states and the District of Columbia reported ACGR data for the 2012-2013 school year as of March 2015. The reporting of ACGR and AFGR statistics by the U.S. Department of Education prompted numerous groups, such as America's Promise, Civic Enterprises, Diploma's Count, Achieving Graduation for All, and Alliance for Excellent Education, to publish reports sharing strategies for increasing student achievement in high schools (Balfanz, Bridgeland, Bruce & Horning , 2015) . In 2015 the U.S. Department of Education reported that average graduation rates across the nation were steadily increasing for all subpopulations; however, the report concealed a persistent gap between demographic groups such as students who are from low socioeconomic backgrounds, students from minority backgrounds, students with limited English proficiency, or students with disabilities (Department of Education, 2015). The ACGR provided information as to who was graduating from high school and the demographics of those who were not. Research indicates the greatest disparity in graduation rates exists for minority students, students with disabilities and students who

come from low socioeconomic backgrounds (Allensworth & Easton, 2005; Balfanz et al., 2015; Shepard et al., 2009).

Balfanz et al. (2015) examined subgroup performance in a comprehensive report titled "Building a Grad Nation." Their analysis revealed significant disparities among minority students, students with disabilities, and students from low socioeconomic families. They concluded that these subgroups of students drop out of high school because they face barriers to their academic success. The barriers included "discipline disparities that often pushed them off track, language barriers, and a lack of access to rigorous coursework that enabled them to be successful" (p. 11).

This report also identified the barriers that negatively influence students who are considered economically disadvantaged. According to Balfanz et al. (2015), it is especially important to address the graduation rate disparity for low income students because 51% of the nation's public school students were eligible for free and reduced lunch in 2013. Students who qualify for free and reduced-price lunches are considered to be low income if their household income is no greater than 130% of the federal poverty guidelines. A gap in opportunities for this subgroup exits since most of these students do not have access to early medical care, education, or physical and mental health services. These detriments influence children's ability to learn and negatively affect their success in high school.

There is no uniform approach for defining, identifying or measuring poverty. The debate over poverty has been concerned with the different potential causes of poverty and ways by which poverty is measured and compared nationally and internationally. The monetary approach is the most widely used approach to identifying and measuring

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poverty (Vandemoortele, 2000). For the purposes of this study, children who receive free and reduced lunch will be referred to as children in poverty (CIP).

Balfanz et al. (2015) indicated that ACGR improvement among states and large districts varied between 2011 and 2013. In 2013 the national high school ACGR reached a record high of 81.4 percent (p. 5). While the overall improvement in the national average graduation rate was celebrated, an in-depth look into the disaggregated data exposed that school districts with a majority of low-income and minority students made big improvements, while others lost ground. The school districts which improved graduation rates significantly had implemented a wide variety of innovative reforms. According to Balfanz et al., graduation rates can be improved by "good leadership, innovative reforms, as well as multi-sector efforts of the state, district, and school levels" (p. 6). Furthermore, the researchers concluded that, based on the U.S. Department of Education reported data, graduation rates can be increased for all students in every part of the country.

In 2007 research conducted by the Chicago Consortium on School Research in 2007 concluded that student performance in the first year of high school is a good predictor of whether or not a student will graduate on time. The CCSR research study revealed that inadequate credit accumulation in the first year of high school due to course failure was found to be highly predictive of failure to graduate four years later. Similar research in New York City has shown a connection between inadequate credit accumulation and eventual dropping out (Cahill, Hamilton, & Lynch, 2006). National data confirms that all students who leave school before graduating are far behind in

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course credits (National Center for Education Statistics, 2007). Balfanz et al. (2015) completed similar research in 2015.

According to the Consortium on Chicago School Research (2007), educators "cannot hope to substantially increase or improve graduation rates unless educators substantially improve students' course performance in their freshman year" (p. 4). Research indicates that students who receive good grades in the ninth grade are put on a trajectory towards high school and college success (Allensworth & Easton, 2007; Roderick, Nagaoka, Coca, & Moeller, 2008). Furthermore, in both of these studies Algebra I was identified as a particularly important "gateway" course.

In response to the NCLB Act, many schools began to focus on improving graduation rates and decreasing dropout rates (Allensworth & Easton, 2005). The school systems were able to use the ACGR to monitor and report the successes and failures in this quest. By relying on the disaggregated ACGR data, educators have improved insight into the courses which students failed more frequently than other courses. Algebra I was identified as an essential course for high school matriculation (Allensworth & Easton, 2007; Roderick, Nagaoka, Coca, & Moeller, 2008). The next section will present an in-depth review of mathematic's centrality to graduation.

Importance of Mathematics in Graduation

In 1983 A Nation at Risk encouraged the efforts for reform in the teaching of mathematics. Since the publication of A Nation at Risk, over 300 reports have advocated reform in mathematics education (Robin & Fraser, 1991). The quest for reform has been driven by research that indicates challenging high school coursework, particularly

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mathematics, leads to high school graduation and success in college (Allensworth & Easton, 2007; Roderick et al., 2008; Alexander & Pallas, 1984; National Mathematics Advisory Panel, 2008).

In Everybody Counts: A Report to the Nation on the Future of Mathematics Education, the National Research Council stated that "current mathematical achievement of United States students is nowhere near what is required to sustain our nation's leadership in a global technological society, and to participate fully in the world of the future, America must tap the power of mathematics" (1989, p. 1). This report sparked an increasing concern with mathematics education which would last for the next three decades.

Algebra I is often called a gateway course since the understanding of its content is fundamental to success in future math and science courses. The "techniques and ideas in Algebra I pave the way to logical thinking" (Liskey, 2011, p. 1), which is essential for graduation from high school, democratic citizenship, access to important careers, and everyday life. In recent years, pressure has mounted for students to complete this gateway course earlier and earlier in their school careers. The California Collaborative on District Reform (CCDR), as cited in Bitter et al. (2010), mandates that "most districts require Algebra I in the ninth grade, some do so in the eighth grade and some offer it as early as seventh grade; however, most districts reveal large discrepancies among student groups in both their enrollment in and their successful completion of Algebra I (p. 1).

Ensuring success for all students in Algebra I involves several key areas of attention and action for districts. The CCDR emphasized "the creation of a strong K-12 mathematic curriculum, appropriate placement of students in mathematic courses,

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enhancement of current instructional capacity in mathematics, and provision of additional supports for struggling students" (Bitter et al., 2010, p. 1). Along with these key areas of attention comes the question of how to assess student achievement and mastery of the Algebra I curriculum. Since the passing of the federal legislation NCLB, many states have followed the trend toward assessing student progress with EOC exams (French, 2003; Center on Education Policy, 2009).

Assessments

High stakes testing is one of the most controversial subjects in education today. A high stakes test is any test used to make important decisions about students, educators, schools, or districts, and is most commonly used for the purpose of accountability. To hold schools accountable improvement, schools and districts have to report test results for a variety of student groups. These subgroups include, but are not limited to minority students, students from low-income households, students with special needs, and students with limited proficiency in English. The test results are published and used to rate schools across the nation and in individual states. Failing to meet a state's requirement for improvement may result in sanctions and a reduction in funding (Blazer, 2012).

WestEd released a policy brief in 2000 that highlighted the benefits and drawbacks to high-stakes testing. Ananda and Rabinowitz (2000) indicated that high-stakes tests are the result of a widespread public demand for accountability of schools. The benefits listed by the authors include:

1. High-stakes tests can establish challenging performance expectations for students, teachers, and schools.

2. High-stakes tests can highlight achievement gaps.

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3. High stakes tests can boost student performance by encouraging students to be more serious in school.

The drawbacks to high-stakes testing include:

1. High-stakes tests can increase student retention and failure rates to unacceptably high levels.

2. High-stakes tests can narrow the focus of instruction and assessment.

3. High-stakes tests can lead to inappropriate inferences about student performance.

4. High-stakes tests can increase stress levels of teachers and students.

Anada et al. argued that policymakers "must not lose sight that the ultimate goal of a comprehensive accountability system is not to reward or punish, but to improve the delivery of curricula and to increase student learning" (p.3).

The increased focus on accountability has prompted the widespread use of high-stakes tests throughout states in America. Critics argue that the number of tests and frequency must be limited or states will "risk creating a system that seriously overburdens teachers and students, taxing precious instructional time and resources" Anada et al., 2002, p. 3). Assessments and evaluations of student performance are important to identify areas of needed improvement. The debate of high-stakes testing will continue as long as states continue to use these tests to hold schools accountable for student progress. Two high-stakes tests used in the state of South Carolina are End-Of-Course (EOC) assessments and the Palmetto Assessment of State Standards (PASS).

PASS. The PASS assessment is a criterion referenced test administered to students in grades 3-8 in South Carolina. The PASS test contains ELA, Math, Science, Social Studies, and Writing sections. The scoring categories are: Not Met 1, Not Met 2,

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Met, Exemplary 4, and Exemplary 5. The SC Mathematics PASS assessment was utilized in this study as an indicator of prior student achievement. Student test scores are strongly correlated with SES, so the researcher did not use PASS scores as a variable in this study. Creswell (2012) indicated that researchers must check and address multicolinearity before conducting a regression analysis or the model-fitting process will provide answers that are inconsistent and often not repeatable in subsequent studies.

      End-Of-Course Assessment. Blazer (2012) indicated that NCLB has moved the United States into an unprecedented era of high-stakes testing. End-of-Course (EOC) testing is one of several methods adopted to provide subgroup performance data.   End-of-course assessments have gained popularity in recent years and are similar to final examinations but are typically standardized statewide tests. In 2002 at least twenty-two states administered EOC exams, and the Education Commission of the States predicted that the number of states administering these tests would increase to twenty-six by the year 2012 (Zinth, 2012).

      The number of EOC exams administered in the twenty-two states ranges from one in New Jersey to sixteen in California (Blazer, 2012). Seven states require that scores on EOC exams be used to calculate a student's final test grade with the percentage of a student's EOC score ranging from 15% to 30% in varying states. The Center on Education Policy reported that eight states require students to pass one or more EOC assessments in order to graduate from high school. The Center on Education Policy expects this number will increase to fifteen states by 2020 (Zinth, 2012).

      Research on high stakes EOC exams is preliminary in nature; however, there are some promising findings as to the impact of authentic assessment practice on student

learning. While standardized tests have their limitations in providing an in-depth look at a student's progress, they do provide a form of tracking student progress. The National Center for Research on Evaluations, Standards, and Student Testing's research on the effects of a year-long focus on classroom performance assessment found small academic gains, including gains in "opportunities to develop their mathematical understandings that had not occurred previously without the assessments" (as cited in Shepard, 1995, p. 14). A study of the Chicago Annenberg Research Project found that when teachers used high quality assessments containing higher-order thinking skills, in-depth understanding, and elaborated communication connections to students' lives beyond school, students produced higher quality work and achieved greater-than-average gains on low-stakes standardized tests in reading, mathematics, and writing (Newman & Nagoaka, 2001).

Rothstein (2000), however, questioned the validity of assessing a student's knowledge at one point in time. As cited in Rothstein in 2000, Kamin (1974) and Sacks (1999) demonstrated how a student fares on a standardized test can be greatly influenced by a host of external factors including stress, lack of sleep, distractions during the test, emotional state and test anxiety. These factors affect mostly low-income students and minorities. Sacks (1999) examined elementary-aged students in testing situations and observed students to be anxious, angry, bored, pessimistic, and withdrawn from the testing process. He found older students to be disillusioned and hostile towards the high-stakes tests:

> Test-driven classrooms exacerbate boredom, fear, and lethargy, promoting
> all manner of mechanical behaviors on the part of the teachers, students,

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schools, and bleed school children of their natural love of learning (pp. 256-257).

Sacks also concluded that high-stakes tests decrease student motivation and lead to lower student retention and higher dropout rates.

Petrilli and Wright (2016) also cited that financial stress in low-income families can create "toxic conditions in the home and also make it difficult for parents to afford tutoring, educational games, summer camps, after-school activities, and other educational experiences that middle and upper-middle-class students experience" (p. 47). While money is not the only factor contributing to low exam scores for students in poverty, there are other social misfortunes associated with poverty. For example, children in poverty are more likely to come from single-parent families headed by poorly educated mothers. Poverty is also associated with higher rates of alcoholism, drug abuse, and neglect. All of these "risk factors" are associated with lower exam scores and a greater likelihood of dropping out of school (Jorgensen & Hoffman, 2003).

While proponents of high-stakes tests declare their approach has led to significant gains in student achievement and even narrowed the achievement gaps based on ethnicity and income, McNeil (2000) and Orfield and Wald (2000) have indicated the opposite. They presented evidence that low-income, Black, and Latino students are negatively affected by the consequences of high-stakes tests. Regardless of the debate, thousands of students in South Carolina must take and pass the South Carolina Algebra I EOC as well as other South Carolina EOC's to graduate from high school (SCDE, 2015).

Prior to NCLB (2002), the South Carolina legislature passed the South Carolina Education Accountability Act (1998) and was well on the way to developing a method to

monitor the adequate yearly progress of schools and students. South Carolina's Education Accountability Act (SCEAA) created the South Carolina End-of-Course-Examination Program (SC EOCEP), which required the development of end-of-course tests in benchmark courses such as Algebra I, English I, Biology, US History and the Constitution. These "gateway" courses are identified by the State Board of Education and the math, science, and English/language arts EOC exams are administered to all public school students by the third year of high school. These tests are summative and South Carolina contracted with Data Recognition Corporation (DRC) to develop the tests. According to the SCEAA mandates, tests for these benchmark courses are required at the culmination of a course and count a mandated 20% of a student's overall grade. The SCEAA legislation was critical in South Carolina because it affirmed that curriculum development, implementation, and accountability were instrumental in the process of monitoring and evaluating student achievement (SCEAA, 1998). EOC exams are not the only type of high stakes testing used in South Carolina. The Palmetto Assessment of Sate Standards is used to monitor students' mastery of state standards in grades 3-8.

Ensuring success in Algebra I for all students involves several key areas of attention and action for school districts. One of the key areas is related to the teaching of mathematics on different schedule types. In 1994 the National Education Commission on Time and Learning stated, "Schools will have a design flaw as long as their organization is based on the assumption that all students can learn on the same schedule" (p. 11). The importance of mathematics mastery for student graduation is indisputable (Allensworth & Easton, 2007; Roderick et al., 2008; Alexander & Pallas, 1984; National Mathematics

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Advisory Panel, 2008). The question remains, however- which schedule type maximizes student learning and mastery in mathematics?

Scheduling Models

Even though it has been more than three decades since the 1983 publication of A Nation at Risk, improving achievement levels of American students remains at the top of state and national policy-making agendas. Academic achievement is still linked to the state of the U.S. economy and competitiveness in world trade markets. Even scholars who disagree with the notion that American students are not competitive internationally admit that students from low socioeconomic backgrounds perform poorly (Orfield & Wald, 2000). Most secondary schools have engaged in efforts to improve. Many of these efforts are focused around the restructuring of the daily schedule to maximize student achievement.

Donahue (1993) proposed that the restructuring of American schools is about comprehensive and formal changes in school building culture and the way time is used throughout the school day. Fullan (2006) and Goodlad (1984) concluded that many organizational change issues can be tackled by a willingness to be innovative and visionary in approaches to school change. Many schools have been successful at increasing student achievement through the implementation of many new reforms. For example, in schools where teachers received high levels of training and staff development to use a variety of instructional methods, student scores appeared significantly better on national achievement measures (Darling-Hammond, 2000; Hoy & Woolfolk-Hoy, 2006). In addition, where student achievement and school improvement were included as part of

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the mission and vision of a school, student scores were better (Marzano, 2003; Marzano, Waters, & McNulty, 2005). Although Dufor and Eaker (1998) do not relate their discussion of school improvement and student success directly to block scheduling, they do suggest the most successful schools are more likely to try innovative and non-traditional arrangements of the day and time.

Currently there are many types of schedules being used in schools throughout the nation. Research divides the various schedules into four primary categories: traditional six, seven, or eight period schedules; block schedule; modified block schedule; or trimester schedule (Trenta & Newman, 2002). Although many models are used, the most consistently and widely used schedules with consistency include the traditional, 4 X 4 block, and modified block schedules.

Traditional schedule. The traditional schedule has been used in schools dating back to the Industrial Age. This schedule was the most prevalent schedule until the 1990's when block and modified block schedules became popular. Students attend six to eight classes each day, and teachers are expected to use a defined set of minutes to cover material and standards. As cited in Trenta & Newman (2002), this type of schedule allows students to learn one subject at a time daily. At the end of the school year, students are awarded credits or Carnegie units if they finish the year with a passing average.

Table 2.1

Student schedule on a seven-period traditional schedule

Period	Class
1	Algebra I
2	Spanish I
3	Physical Education
4	Geography/Lunch
5	Keyboarding
6	Physical Science
7	English I

Note. Seven-Period Traditional Schedule (55 minutes per day-180 days).

A traditional schedule meets six, seven, or eight times a day with each period/class lasting from forty-give to fifty minutes.. Teachers typically educate 120-150 students per school year on this model. Seat time under the traditional schedule is approximately 10,000 minutes of student-teacher instructional time. Students generally take four to five academic classes and two to three non-academic classes depending on the state requirements and local school district procedures (see Table 2.1).

4 X 4 Block schedule. Block scheduling creates fewer classes each day with classes meeting for longer periods of time. There are many different variations which schools use to implement the block schedule. Lloyd Trump (1959) first proposed block scheduling to high schools through his Flexible Modular Scheduling model. The Trump Plan called for scheduling arrangements based on academic needs of students. According to Queen (2000), Trump advocated for teachers and administrators to be flexible in

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instructional strategies and the school day schedule. Trump further advocated that the

school day be flexible, fluid, and dependent in order to improve student learning (Queen,

2000). The most popular version of block scheduling, promoted by Rettig and Canady

(1996), changes the standard yearlong courses into half-year-long courses of ninety

minutes. Students enroll in four classes in the fall and four classes in the spring semester

(see table 2.2).

Table 2.2:

Student schedule on a 4 X 4 block schedule

Block	Class 1st Semester	Class 2nd Semester
1st	Algebra I	English I
2nd	Spanish I	IBA
3rd	Physical Education	Physical Science
4th	Geography/Lunch	Drama I

Note. 4 X 4 Block Schedule (90 minutes per day-90 days).

The 4 X 4 block schedule meets four times per day with each block lasting

between seventy-five to ninety minutes per class for ninety days (one semester). Students

take four new classes at the end of the semester; teachers receive new students at the

semester and teach approximately 180 students per year. Students accumulate

approximately 8100 minutes of seat time under the 4 X 4 block schedule. Most schools

utilizing the 4 X 4 block schedule arrange for students to take two to three academic

classes per semester. Elective courses are added in to complete the students' schedules

(Zepeda & Mayers, 2006) (see Table 2.2). The National Education Association reported

pros and cons to this type of schedule. The pros included:

- Teachers see fewer students during the day, giving them more time for individualized instruction.

- There is more time to conduct extended activities such as seminars and projects.

- With the increased span of teaching time, longer cooperative learning activities can be completed in one class period.

- Students have more time for reflection and less information to process over the course of the school day.

- Teachers have extended time for planning.

- There are less class changes, resulting in less change for discipline issues.

- Students have fewer tests, quizzes and homework assignments since they have less classes.

The cons included:

- Teachers see students only two to three days a week which fosters a lack of continuity from day to day.

- Students have difficulty focusing for 90-minute classes.

- It is difficult to cover the necessary material for Advanced Placement courses in the time allotted.

- In a 4 X 4, all of the information normally taught in a semester course has to be covered in one quarter.

- If a student misses a day under a 4 X 4 schedule, that is actually missing two days (NEA, 2015).

Modified (A/B) block schedule. Finally, a modified block schedule or A/B block model has students meeting four times on alternating days with eight classes for the entire school year. A teacher caseload for modified (A/B) block scheduling is approximately 200 students for the entire school year. The modified (A/B) block schedule consists of approximately 8100 minutes of instructional time with students taking eight classes in a

block setting of seventy-five to ninety minutes per day. The students attend the classes

on an alternating schedule throughout the 180-day school year (Zepeda & Mayers, 2006)

(see Table 2.3).

Table 2.3:

  Student schedule on a modified (A/B) block schedule

Block	A Day	B Day
1st	Algebra I	English I
2nd	Spanish I	IBA
3rd	Physical Education	Physical Science
4th	Geography/Lunch	Drama I

Note. A/B schedule (90 minutes per day-180 days).

A modified (A/B) block schedule combines components of a traditional and 4 X 4

block schedule. The modified (A/B) block schedule is sometimes used as a transition

schedule for schools moving from a traditional schedule to block schedule. The modified

block allows teachers to see fewer students during the day, allowing more time for

individualized instruction and time for cooperative learning activities (Zepeda & Mayers,

2006). It also affords students more time for reflection and less information to process

over the course of a school day, but teachers still have extended time for planning.

Queen (2000) argues that the modified block can be harmful to students if they miss a

day of school because the students are actually missing two or more days under this

model. In addition, since teachers see students only two to three times a week, there is a

lack of continuity for the students as well as the teachers. Zepeda and Mayers (2000)

warn about the potential pitfalls a modified or alternating schedule can present. Teachers

and students may wonder what day it is early on in the year, and teachers and students rarely meet on consecutive days. In addition, there is little opportunity for acceleration or repetition of courses, and students are expected to master six to eight classes a year (p. 49). The National Education Association (NEA) reported pros and cons to this type of schedule. The pros included:

- Teachers see fewer students during the day, giving them more time for individualized instruction.

- With the increased span of teaching time, longer cooperative learning activities can be completed in one class period.

- Students have more time for reflection and less information to process over the course of the school day.

- Teachers have extended time for planning.

The cons included:

- Teachers see students only two to three days a week which fosters a lack of continuity from day to day.

- If a student misses a day under an A/B schedule, that is actually missing two, or sometimes even more days (NEA, 2015).

Analysis of scheduling types. 4 X 4 block scheduling advocates criticize the difficult pace of a typical school day on traditional scheduling. Dr. Joseph Carroll (1990) argued that an average student is in eight different locations pursuing eight different activities during the six-and-a-half-hour school day. He claims this "hectic, impersonal, inefficient instructional environment" (p. 2) provides inadequate time to deeply explore content and discourages a variety of learning activities throughout a lesson. On the other hand, scheduling on block allows longer, more concentrated classes with more flexibility for cooperative learning, team teaching, multidisciplinary classes, projects, labs, and

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fieldwork. In addition, Carroll also argues that the longer periods also allow teachers to develop better relationships with their students. Advocates of block scheduling also indicate that teachers are able to get to know their students more personally and have more time to give students individual attention (Payne & Jordan, 1996; Weller & McLeskey, 2000).

Canady and Rettig (1986) stressed that block scheduling allows students to enroll in a greater number and variety of elective courses. Supporters also state that students who fail a course will be able to retake it earlier or receive immediate remediation as opposed to those students on a yearlong schedule (Evans et al., 2002; Irshmer, 1996; Queen & Isenhour, 1998; Zepeda & Mayers, 2006). In addition, block scheduling encourages teachers to broaden their pedagogical repertoire and promote learning through smaller and more in-depth classes where teachers and students have more time to form relationships (Canady & Rettig, 1995; Evans et al., 2002; Queen & Isenhour, 1998; Rettig & Canady, 2003; Rettig & Canady, 1996; Zepeda & Mayers, 2006). O'Neil (1995) advocated that a wider variation of activities could be used on a block schedule because there is more time for hands-on activities, such as cooperative learning, and other strategies aimed at encouraging student involvement.

Improving student achievement was the primary reason that schools began switching to block scheduling in the 1990's. Several studies have been conducted to measure the amount of success block scheduling has had on student achievement. Research indicated that approximately 50% of secondary schools in the United States were operating on some type of block or modified block schedule in 2005 (Dexter, Tai, & Sadler, 2006). Student achievement scores on the block schedule (measured by state

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standardized EOC exams, graduation tests, state-mandated yearly performance tests, the SAT, and AP exams) have yielded mixed results (Veal & Schreiber, 1999).

In 2000 Lawrence & McPherson conducted a key study comparing student achievement on block and traditional scheduling. The researchers attempted to gain an understanding of which schedule (block or traditional) has greater potential to positively influence student achievement.   Conducted in North Carolina, the study consisted of data from Algebra I, Biology, English, and United States History courses. The researchers used a cluster sample model to select the population for the study. The study revealed that the students receiving instruction on the traditional schedule scored higher on the EOC's in the aforementioned subject areas. The study also revealed, however, that students' final grades were higher in some block courses when compared to the final grades of students in the traditional courses (Lawrence & McPherson, 2000). Limitations to the study included time spent in class by the students and the staff development provided to the teachers transitioning from traditional scheduling to block scheduling. The findings of this study did not isolate block scheduling as a single solution to increasing student achievement but as one piece of the puzzle to produce excellent results.

There were several available studies, which focused specifically on student achievement on varying schedules. In 1996 Schroth & Dixon found that standardized math scores were slightly higher in schools with block scheduling. Hottenstein (1998) conducted a 5-year study of a Pennsylvania high school comparing Preliminary Scholastic Aptitude Test (PSAT) scores from two years prior to three years after implementation of block scheduling. The findings were not statistically significant.

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Evans et al. (2002) found New Jersey students in three different schools increased scores on the SAT and increased their passage rate by 6% on the New Jersey High School Proficiency Test (HSPT).

Cooper (1996) examined flexible scheduling in West Virginia in a collaborative research study with the University of West Virginia. The purpose of this study was to assess the relationship between an A/B schedule model implemented at Morgantown High School and student achievement. In this study Cooper analyzed the American College Test (ACT) and Comprehensive Test of Basic Skills (CTBS) exam scores from 1990-1995 to gauge student achievement on the varying schedules. The findings indicated that the ACT and CTBS scores remained close to the national average; the AP Chemistry scores, which were already 10-15% above the national average, remained the same.

In a study conducted by the College Board in 1998, students in extended traditional-schedule AP Biology and AP Calculus classes did significantly better than those students on a 4 X 4 block schedule. In contrast, as cited by Evans et al. (2002), Edwards (1995) reported an increased number of students passing the AP tests with a score of 3 or 4 in the Orange County, Virginia, school system, which utilized the 4 X 4 block schedule. He also found improvements in AP exam scores after block scheduling was implemented in various schools. Studies conducted on AP scores under traditional and block schedules produced mixed results.

In a doctoral study, Cosimano (2004) analyzed the academic achievement of students from five schools on a 4 X 4 block schedule, A/B block schedule, traditional schedule, and a modified block with traditional schedule in Palm Beach County. Ninth

and tenth grade scores from the Florida Comprehensive Assessment Test (FCAT) in reading and math were used to measure academic achievement. Cosimano found that significant differences in student achievement existed on the varying schedules. The FCAT ninth grade mean score from the school on the modified block schedule was higher than the FCAT ninth grade mean score from all the other schools, except for one of the schools with a traditional schedule. The same was true for the FCAT tenth grade mean score for both math and reading. Cosimano concluded that students on the modified block schedule, in comparison to students on the other two block schedules, achieved higher scores. This conclusion supports Oven (2004) who found that academic achievement was positively impacted by a modified block schedule because of increased instructional time.

Arnold (2005), as stated in Cosimono (2002), collected student performance data from twelve Virginia public schools which utilized a traditional seven-period schedule or an alternating block schedule. Test for Achievement and Performance (TAP) scores were used to measure student achievement in each of the schools. Mean scores from six subject areas of the TAP were evaluated: reading comprehension, mathematics, written expression, utilization of sources of information, social studies, and science. The mean scores from 1991-1996 revealed an increase in scores for the schools on the A/B schedule for the first year but a decline in scores by the second year. Results also revealed that the schools on the A/B schedule for their first year in 1996 outperformed the schools which had been on the A/B schedule for three-to-four years. There was no statistical difference found between the schools on either the traditional or A/B schedule.

Wright (2010) conducted a longitudinal study that evaluated the impact of scheduling on student achievement. The study was conducted in South Carolina over a twenty-year period. The graduation rates, SAT scores, and Basic Skills Assessment Program (BSAP)/High School Assessment Program (HSAP) scores were examined for ten years on a traditional schedule and ten years on an A/B schedule. The SAT math mean scores showed an increase of nineteen points on the modified block schedule. The BSAP/HSAP scores showed significant improvement during the block schedule years. The South Carolina Department of Education discontinued the use of the BSAP/HSAP as an exit examination for high school students in 2012.

Norton (2010) conducted a study to determine if significant differences existed in ELA and math scores on the HSAP exit exam among South Carolina schools with semester block schedules, modified A/B block schedules, or traditional seven-period schedules. A comparison of the English and math passage rates for 131 schools yielded no significant differences between the mean scores on the SAT and HSAP scores.

Different studies with a variety of scheduling options and combinations have yielded inconsistent results. While studies of student achievement in ELA on year-end tests and high-stakes tests and the SAT have been statistically significant, in the study of math and science, there is little evidence to support that students show any improvement on the block schedule (Eineder & Bishop, 1997; Gruber & Onwuegbuzie, 2001; Lawrence & McPherson, 2000; Zelkowski, 2010). Additionally, numerous researchers have found that there was little improvement and even a slightly negative effect in courses which require re-teaching of skills and concepts (Gruber & Onwuegbuzie, 2001; Lawrence & McPherson, 2000; Zelkowski, 2010).

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Zelkowski (2010) stated, "The research community is confused by the mixed findings of block scheduling" (p. 10). He noted little difference in teaching styles and practices between block and traditional classes. Zelkowski also noted that professional development seemed to be the key factor often neglected in block scheduling implementation (Zelkowski, 2010). There are very few empirical studies that suggest that students enrolled in block schedule outperform those enrolled in traditional or modified block schedules (Bowman, 1998). In a review of literature on the effects of block scheduling, Trenta and Newman (2002) reported, "Over the last decade, a number of studies and evaluations have been done on block scheduling in which some have found evidence of improved student achievement. Others found no significant improvement or significant decline" (p. 55).

Summary

The literature presented indicates that Actual Cohort Graduation Rate is influenced by many factors. One of the most important factors is course performance in critical courses such as Algebra I in the ninth grade year of high school. An extensive review of the literature from past to present on scheduling types indicates that the block schedule is perceived as more beneficial to students and teachers. The literature outlines the benefits of extended planning time, fewer students, and opportunities for project-based activities for teachers. For students, the benefits lie in less homework, opportunities to take more courses, and fewer discipline problems; however, the benefits are not directly related to the impact this schedule may have on student achievement

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(Canady & Rettig, 1995; Kruse & Kruse, 1995; Bowman, 1998; Zelkowski, 2010; Eineder & Bishop, 1997; Gruber & Onwuegbuzie, 2001; Lawrence & McPherson, 2000). There was a gap in the literature, however, on modified (A/B) block scheduling and student achievement.

Previous studies have demonstrated that minority students from low socioeconomic backgrounds are less likely to graduate. Thus, efforts to positively influence high school completion for all students are needed. This study will examine mathematic achievement of first-year high school students to determine if there is a relationship between their success on the SC Algebra I EOC and the type of scheduling model used to deliver Algebra I classes. The analysis will determine if a statistically significant difference in student achievement exists between students on a 4 X 4 block and modified (A/B) block schedule. Student success will be measured by exam scores on the Algebra I End-of-Course Test. This study will also examine if statistically significant differences in performance exist, measured by exam scores, on the South Carolina Algebra I EOC assessment by ethnicity, gender, and SES. The results of this study will help educators design schedules that are more effective for all students.

Chapter Three outlines and explains the design and methodology of the research. This section includes the study design, rationale, participation explanations, data gathering methods, and data-analysis procedures. The positionality of the research, the subjectivity, ethical considerations, and the limitations of the study are also addressed in Chapter Three.

CHAPTER 3

METHODOLOGY

This chapter examines the research design and methodology used in this study to investigate the relationship between scheduling and student exam scores on the South Carolina Algebra I EOC assessment. In addition, an analysis of descriptive statistics including gender, ethnicity, and SES will be conducted to provide further insight into student exam scores on the South Carolina Algebra I EOC assessment. The researcher acknowledges that there are many variables involved in student achievement on assessments. One variable examined is SES. Turkheimer, Haley, Waldron, D'Onofrio & Gottsman (2003) state that children raised in poverty are severely limited in their intellectual potential by their environment and other factors. Researchers, educators and policymakers assert that one of the most important factors in the academic success of high school students lies in the structure of the school schedule (Zepeda & Mayers, 2006). Goodlad (1984) stated that the school "time is virtually the most important resource" (p. 30).

This chapter includes information on the following topics: research questions, research design, quantitative research, population, procedures, instrumentation, validity and reliability, data analysis, and limitations. As stated in prior chapters, the purpose of this study is to analyze mathematic achievement as measured by exam scores on the South Carolina Algebra I EOC exam of first-year high school students enrolled in

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Algebra I on 4 X 4 block schedules and modified (A/B) block schedules with consideration of ethnicity, gender, and SES.

Research Question

The following research questions guided the investigation:

1. Is there a significant relationship between South Carolina Algebra I EOC exam scores and schedule type, examining a 4 X 4 block schedule and modified (A/B) schedule?

Descriptive statistics were also reported for data from 2011-2016 regarding gender, ethnicity, and SES.

Hypothesis. The following hypothesis was utilized to execute this study:

H_1 states that there will be a significant relationship between schedule type and SC Algebra I EOC scores.

Alternate H_1 states that will not be a significant relationship between schedule type and SC Algebra I EOC scores.

Research Design

The research design of this study was non-experimental and utilized descriptive statistics. The research design is non-experimental because the researcher had no control over the independent variables, which included 4 X 4 block and modified (A/B) block schedules. The dependent variable is the exam score on the South Carolina Algebra I EOC assessment. "Non-experimental research is frequently an important and appropriate mode of research in education" (Johnson, 2001, p. 3) due to the inability to perform

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randomized experiments and quasi-experiments. This study focused on student exam scores on the South Carolina Algebra I EOC assessment; therefore, a quantitative method of study was most appropriate.

Quantitative studies emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through questionnaires and surveys, or by manipulation of pre-existing statistical data using computational techniques. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or explaining a particular phenomenon (Babbie, 2010). The quantitative research design for this study incorporated secondary data; information on South Carolina Algebra I EOC exam scores; district reports on SES, gender, and ethnicity; and 4 X 4 block and modified (A/B) block class schedules in two secondary schools in southern South Carolina.

To achieve comparability, The South Carolina Algebra I EOC exam is reported as a scaled score. The scaled score is "obtained by statistically adjusting and converting raw scores onto a common scale to account for differences in difficulty across different test forms" (Tan & Michel, 2011, p. 3). For example, a test taker needs to answer slightly more questions correctly on an easier form to achieve the same score as a test taker on a more difficult form (Tan & Michel, 2011). Reporting a scaled score allows for meaningful interpretations and minimizes misinterpretations and inappropriate inferences (Kolen & Brennen, 2004; Peterson, Kolen, & Hoover, 1989).

Heppner, P.P and Heppner M. J. (2004) indicated "it is useful for readers to understand how participants responded as a group to the inventories in a study" (p. 245). Descriptive statistics were reported and analyzed to provide additional information about

the SC Algebra I mean exam scores from 2011-2016. The mean South Carolina Algebra I EOC exam scores of students on 4 X 4 block and modified (A/B) block schedules were examined.   Independent t-tests are generally used to measure the statistical significance of differences.

T-tests are used when a researcher wants to compare the mean differences on a dependent variable (Heppner, P.P. et al., 2004). The independent variables in this study were types of schedules, 4 X 4 and modified (A/B) block schedules.   The dependent variable was the SC Algebra I EOC exam scores.   The level of significance was set at $p<.05$, as that is the customary level used with significance in educational research (Krawthol and Anderson, 2001).   T-tests are limited in that they can only test differences in two groups. Running multiple t-tests increases the probability of a Type I error and does not allow a researcher to account for other variables that may affect the outcome. A Type I error occurs when the researcher rejects the null hypothesis when it is actually true (Rumsey, 2009). For this reason, a regression analysis was utilized instead of t-tests.

A regression analysis was conducted to measure the relationship of the independent variables, 4 X 4 block and modified (A/B) block schedules, and the dependent variable of student exam scores on the South Carolina Algebra I EOC Assessment.   The general purpose of a regression analysis is to learn more about the relationship between several independent and dependent variables (Krawthol and Anderson, 2001). Ethnicity, gender, and SES are factors that influence SC Algebra I EOC scores (Allensworth & Easton, 2005; Balfanz et al., 2015; Shepard et al., 2009); therefore, these covariates were also analyzed to assess their relationship with the

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dependent variable. The regression analysis also allowed for the researcher to complete a measure of effect inquiry through an R^2 analysis.

The statistical mathematical method of correlation, specifically a Pearson Correlation, was employed to investigate multicolinearity. In this study, the researcher investigated the relationship between student mathematic PASS test scores and SES. Since student prior knowledge, measured by 8th grade mathematic PASS scores, could be significantly correlated with SES, the researcher sought to include only one of the redundant variables. The researcher chose to compute the Pearson Correlations using a 95% Fisher confidence interval. The Pearson Correlation r values were reported in Chapter Four with the use of a table.

The data used for this research was acquired from the SCDE website and the district's data warehouse: Berkeley's Record and Information Network (BRAIN). The data was compiled and analyzed with Excel and SPSS.

Participants

The participants for this study were selected from two secondary high schools in a district which has both rural and suburban schools. The school district had eight high schools; however, six high schools were eliminated from the study because they did not follow block and modified (A/B) block schedules for the years studied.   The two schools selected for this study followed a 4 X 4 block schedule from 2011-2014 and a modified(A/B) block schedule with 8 blocks (80-90 minutes per block) which met on alternating days from 2014-2016. The participants were all first-time ninth-grade students and ranged in age from 14-16. A total of 1,679 students and their South

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Carolina Algebra I EOC exam scores were used for this study. Fifty-three percent of the students were female and 47% were male. Fifty percent of the students were Black; 42%, White; 6%, Hispanic; and 2 %, Asian. Four ethnic categories were not studied because their populations were too small to gather usable data. Seventy-one percent of the students were children in poverty (CIP) and 29% were not. Performance data from the South Carolina Algebra I EOC exams from 2011-2016 were analyzed.

Procedures

The study entitled *A Comparative Analysis of Algebra I End-of-Course Exam Scores by Schedule Type and Student Demographics* was first sent to The University of South Carolina Institutional Review Board for review on August 21, 2016, and was approved on August 31, 2016.

The researcher received permission from the Assistant Superintendent in charge of Curriculum and Technology for the school district in order to use the South Carolina Algebra I EOC scores for first-year ninth grade students who took the South Carolina Algebra I EOC exam during 2011-2016 from selected Berkeley County schools. The researcher gained access to the South Carolina Algebra I EOC exam score information and student demographics from the Data Management Coordinator for the school district. Permission was granted to access the school district's systems information database, PowerSchool and BRAIN. Students were identified by numbers; all information which might have identified an individual student or school was removed to ensure the anonymity and confidentiality of all subjects involved.

The SCDE offers a rich source of data on South Carolina Algebra I EOC exam scores by school and school district. NCLB legislation requires states to report student performance by race/ethnicity. The data for the EOC exams was arranged by the South Carolina Algebra I EOC exam score received on the first attempt of completing the assessment. Additionally, data was arranged by school and included the students' ethnicity (Black, White, Hispanic, and Asian) and type of schedule student followed: block or modified (A/B) block. The data was listed as total number and percentages by ethnicity, gender, and SES of students and their scores on the South Carolina Algebra I EOC.

The South Carolina Algebra I EOC exam scores of all students were collected and entered into Excel spreadsheets. Similarly, the data, percentage of students by ethnicity, gender, SES, and schedule type were entered into an Excel Spreadsheet. The data was then transferred to SPSS for further analysis.

Data was analyzed using descriptive statistics to provide information about the sample size, means, and standard deviations. An regression analysis was conducted to analyze the relationship between the independent and dependent variables as well as the covariates. This test also allowed the researcher to isolate the covariates to better examine the relationship between scheduling and SC Algebra I EOC exam scores. The Levene test was utilized for this study to verify the assumption that variances were equal across the groups examined.

The descriptive statistics and analysis results will be presented in tables, a box plot, and a histograms. The histogram and box plot will visually show the distribution and variability of the data as well as identify extreme values (outliers) in the data. Data

distributions were examined for skewness and kurtosis to insure scores were normally distributed and suitable for interpretation (Heppner, P.P. et al., 2004).

The statistical analysis was run using the regression procedure in SPSS since all of the independent variables and covariates were categorical. To do so, dummy-coded variables were created for the variables with more than two levels: Ethnicity and Lunch. Ethnicity had four levels, so 3 dummy variables were created (Race_A, Race_B, Race_H) and W was used for the reference level. The results for the four dummy variables is presented as a comparison to Ethnicity W. Lunch has 3 levels, so 2 dummy variables were created (SES_F and SES_P) and R was used as a reference level.

Reliability and Validity

Reliability pertains to consistency between measurements at different time intervals; more technically, reliability is the variance in scores due to true differences among individuals (Heppner P. P., et al., 2004).

Joppe (2000), as cited by Golafshani (2003), provides the following explanation of validity in quantitative research:

> Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit 'the bulls eye' of your research subject? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research or others. (p. 599)

In an effort to increase validity, the researcher found the standard deviation for independent and dependent variables, as well as the covariates, to get a sense of how much the data varied within the sample. A regression analysis was used to assess the relationship the covariates had with the dependent variable. The covariates included student demographic information on gender, ethnicity, and SES.

Limitations

This study will add to the existing body of research and information on innovative scheduling; however, this study is narrow and has limitations. The small sample size (two schools) and a lack of random selection inhibit generalizing about the findings in this research. Students in the two southeastern South Carolina schools were able to take Algebra I during the eighth grade; however, these students were omitted from this study. Other potential weaknesses of the study may include small sampling or errors in the data collection (Creswell, 2012). The results are limited to the secondary schools in one school district using 4 X 4 block or modified (A/B) block schedules during 2011-2016. The test data were collected for five school years. An evaluation of testing over a 10-20 year period would support broader application of the results. A major limitation of the study was the lack of consideration of teacher practices, pedagogy, skills, and classroom experiences. The data were limited to a first-year high school population. All students who had taken Algebra I more than once were eliminated from the data set. In addition, the use of one high stakes test, the South Carolina Algebra I EOC, was used to measure participant success in Algebra I. Also, many factors influence student achievement (Balfanz, 2009; Goodlad, 1984; Zelkowski, 2010). The researcher will not be able to

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completely isolate all the factors to identify a direct cause and effect relationship with 4 X 4 and modified (A/B) block scheduling and SC Algebra I EOC exam scores.

Summary

The American education system has evolved significantly; however, the main goal of meeting the needs of every student has remained the same. This accountability movement has been brought to the forefront of public education. Superintendents and district leaders are faced with the responsibility of producing academically proficient students who excel inside and outside of the classroom. School Boards and school leaders are responsible for implementing school schedules and programs to meet the increasing academic rigor required by the No Child Left Behind Act of 2001.

The new standards and increased level of accountability brought forth by NCLB (2001) brought about an upward trend in student performance on math assessments. According to the National Assessment of Educational Progress (NAEP), assessment scores have continued in an upward trend; however, only 36% of the nation's eighth grade students scored proficient or better on the NAEP assessment in 2013. Balfanz (2009) stated that there are many factors that contribute to student failure and a lack of success in critical high school courses.   He stated that attendance, family composition, SES, grade retention, disability status, discipline referrals, and language barriers impact student achievement (Balfanz, 2009). Zelkowsi (2010) stated that teaching pedagogy and professional development might also be contributing factors to student achievement in critical courses such as mathematics. While Goodlad (1984) stated that "time is virtually the most important resource" (p. 30) in education, scheduling is only one of the

contributing factors that may influence student achievement in mathematics and success in high school.

This study is being conducted to analyze mathematic achievement as measured by exam scores on the South Carolina Algebra I EOC exam of first-year high school students enrolled in Algebra I on 4 X 4 block and modified (A/B) schedules. In addition, this study analyzed mathematic achievement as measured by exam scores on the South Carolina Algebra I EOC exam of first-year high school students enrolled in Algebra I in relation to ethnicity, gender and SES. A more precise understanding of the relationship between scheduling and student performance in Algebra I will provide critical insight to educators who seek to improve high school completion rates. In addition, administration can use this new understanding to develop schedules for courses that are more likely to lead to improved student achievement.

Chapter Four contains the data, the associated analysis of the data, and the study findings.

CHAPTER 4

RESULTS

The purpose of this chapter is to present and analyze the findings of this research study. The overall goal of the research was to add to the current understanding of factors that influence student achievement-specifically, to analyze the relationship between schedule type and first-year-high-school students' exam scores on the South Carolina Algebra I End-of-Course (EOC) assessment. This research study utilized a quantitative methodology of study to answer the following question:

1. Is there a significant relationship between South Carolina Algebra I EOC exam scores and schedule type, examining a 4 X 4 block schedule and modified (A/B) block schedule?

Descriptive statistics were also reported for data from 2011-2016 to provide in-depth information on gender, ethnicity, and SES. The quantitative results presented in this study are based on South Carolina Algebra I EOC exam scores from two southeastern schools in South Carolina. The two schools utilized a 4 X 4 block schedule from 2011-2014 and switched to a modified (A/B) block schedule from 2014-2016. The study results included Algebra I EOC exam scores from the 3 years each school was on a 4 X 4 block schedule and for the 2 years each school employed a modified (A/B) block schedule. In addition, student demographic information was utilized for quantitative analysis.

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Multicolinearity

The statistical mathematical method of correlation, specifically a Pearson Correlation, was employed to investigate multicolinearity. The researcher investigated the relationship between 8th grade student mathematic PASS test scores and SES for both schools for the 2014-2015 school year. Forty-two students were eliminated from the data set because they did not have an 8th grade Mathematic PASS test score. The researcher chose to compute the Pearson Correlations using a 95% Fisher confidence interval. The Pearson Correlation r-value was reported in Table 4.1. The r-value was .803, indicating a significant relationship between 8th Grade Mathematics PASS test scores and SES. As a result, the researcher included only SES as a variable and did not include 8th grade mathematic PASS scores in the regression model. Creswell (2012) indicated that researchers must check and address multicolinearity before conducting a regression analysis or the model-fitting process will provide answers that are inconsistent and often not repeatable in subsequent studies.

Table 4.1

Pearson Correlation Results of Relationship between 8th grade Mathematic PASS Scores and SES

R value	0.804
Fisher 95% CI	0.734 to 0.857
Hypothesized value	0
T approximation	15.41
DF	258
p-value	<.0001
HO:	p=0

N=260

Quantitative Findings

The participants ranged in age from 14-16 and were all first-time ninth-grade students in two southeastern South Carolina high schools. A total of 1,679 students were included in this study. The South Carolina Algebra I EOC exam scores for these 1,679 students were then examined and analyzed for purposes of answering the research question in this study.

Description of Population

Table 4.2 indicates the total number of South Carolina student Algebra I EOC exam scores analyzed for this study. The exam scores were collected from 2011-2016 and include the number of students who took the South Carolina Algebra I EOC on a 4 X 4 block schedule or modified (A/B) block schedule that met the criteria for this study. Table 4.1 indicates that the number of student exam scores used for this study was generally comparable in regards to frequency. Ninety-three more exam scores were used on the block scheduling model, resulting in a difference of 5.6 %.

Table 4.2

Exam Scores by Schedule Type

	Frequency*	Percent	Cumulative Percent
Modified (A/B) Block	793	47.2	47.2
4 X 4 Block	886	52.8	100.0

N=1679

Tables 4.3 , 4.4, and 4.5 provide a breakdown of the student demographic information for each of the students who met the criteria for this study. There were 1,679 students who met the criteria for this study. Fifty percent of the students were Black;

42%, White; 6%, Hispanic; and 2 %, Asian. There was a higher percentage of Black students (42%) taking the SC Algebra I EOC in 2011-2016 in this study, than the SCDE reported there were for the entire state (35%) as a whole. The percentage of White students taking the SC Algebra I EOC from 2011-2016 in these two schools was much lower than the percentage which took the test across the state (55%). The Department of Education reports that from 2011-2016, 50%-51% of the students taking the SC Algebra I EOC were male and 49%-50% were female. There is less than a 1% difference, in regards to gender, in the state population taking the test and the participants used in this study. Seventy-one percent of the students were students receiving free or reduced lunch and 29% were not (full-pay lunch). To provide a comparison, the Department of South Carolina reports that 51%-61% of the students who took the SC Algebra I EOC in 2011-2016 were CIP. The population used for this study had a higher percentage of children in poverty when compared to the entire state in 2011-2016. The number of children in poverty was approximately 20% higher for the study population when compared to the state reported percentage of children in poverty and took the SC Algebra I EOC in 2011-2016.

Table 4.3

Exam Scores by Gender

	Frequency*	Percent	Cumulative Percent
Female	834	49.7	49.7
Male	845	50.3	100.0

*N=1679

Table 4.4

Exam Scores by Ethnicity

	Frequency*	Percent	Cumulative Percent
Asian	27	1.6	1.6
Black	843	50.2	51.8
Hispanic	102	6.1	57.9
White	707	42.1	100.0

*N=1679

Table 4.5

Exam Scores by SES

	Frequency*	Percent	Cumulative Percent
Free Lunch	1029	61.3	61.3
Full Pay Lunch	490	29.2	90.5
Reduced Lunch	160	9.5	100.0

*N=16

Analysis of Research Question

Is there a significant relationship between South Carolina Algebra I EOC exam scores and schedule type, examining a 4 X 4 block schedule and a modified (A/B) block schedule? One hypothesis was created and tested in order to investigate this research question.

H_1**:** There will be a significant relationship between schedule type and SC Algebra I EOC scores.

To answer the research question in this study, the researcher calculated the means for South Carolina Algebra I EOC exam scores on 4 X 4 block and modified (A/B) block

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schedules for students who met the criteria for this study. The means and standard

deviations for students of the 4 X 4 block and modified (A/B) block schedules are

displayed in Table 4.6 and Figure 4.1.   Table 4.6 illustrates that students on the block

schedule averaged slightly higher exam scores on the South Carolina Algebra I EOC

assessment than those students on modified (A/B) block schedule.

Table 4.6

SC Algebra I EOC Mean Scores by Schedule

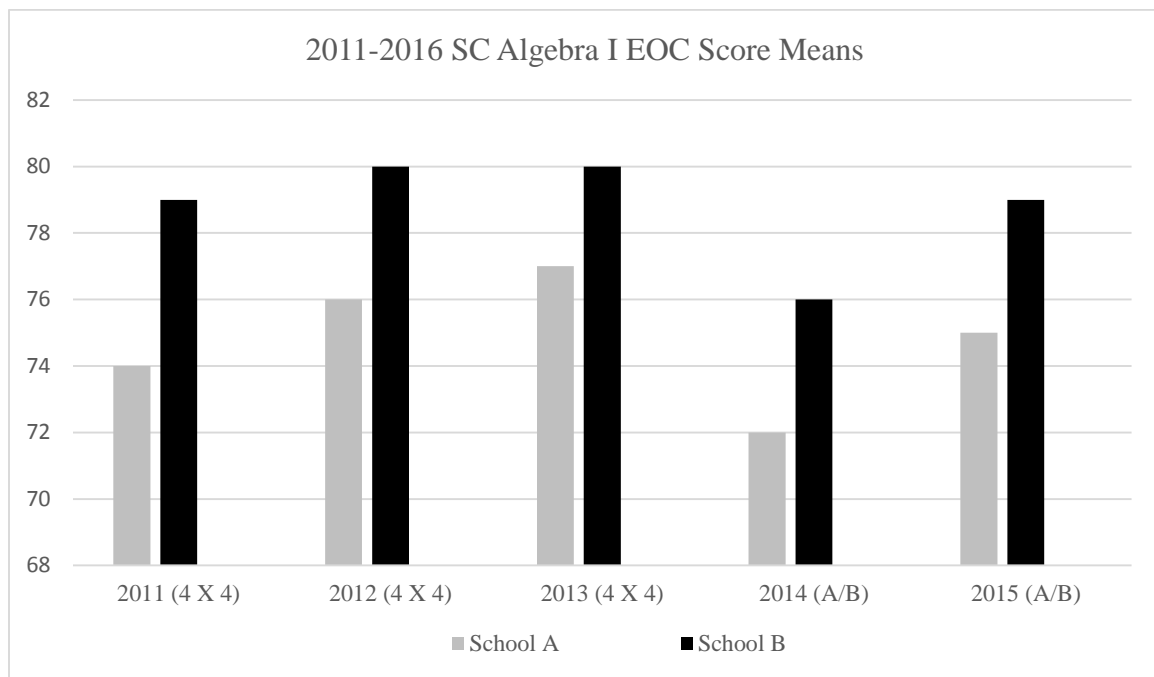|	Mean	N	SD	Std. Error Mean
Modified (A/B) Block	76.06	793	9.110	0.323
4 X 4 Block	78.27	886	9.222	0.310
Total	77.2	1679	9.233	

Figure 4.1 SC Algebra I EOC Score Means by Year and Schedule Type

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Figure 4.1 depicts the shape and distribution of the data. The mean score for both schools decreased for both schools in 2014-2015 when the modified (A/B) block schedule was implemented. The scores slightly increased the next year after having been on the modified (A/B) block schedule for one year. There are several reasons this increase may have occurred. The first is that the teachers and students may have been more comfortable with new schedule, resulting in an increase in the test scores. Secondly, the teachers may have had better prepared lessons since it was the second year teaching on this modified (A/B) schedule. Lastly, the increase may be due to improved student and teacher attendance the second year. There are many other factors that may have led to the increase in scores. Further exploration is needed to fully explain the increase in test scores

Student Demographics

Gender. Table 4.7 illustrates that female students on the block and modified (A/B) block schedules averaged slightly higher exam scores on the SC Algebra I EOC assessment than the males. The female and male students both scored slightly higher on the 4 X 4 block scheduling model. Figure 4.2 depicts the shape and distribution of the data. To provide a comparison point, the South Carolina Department of Education reports that the highest mean score for the males from 2011-2016 was 82.1 in 2011-2012. Additionally, they report that the highest mean score for females was 83.3 in 2011-2012. When observing the males and females on both schedule types, the female participants scored higher on the SC Algebra I EOC exam.

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Table 4.7

SC Algebra I EOC Mean Scores by Schedule and Gender

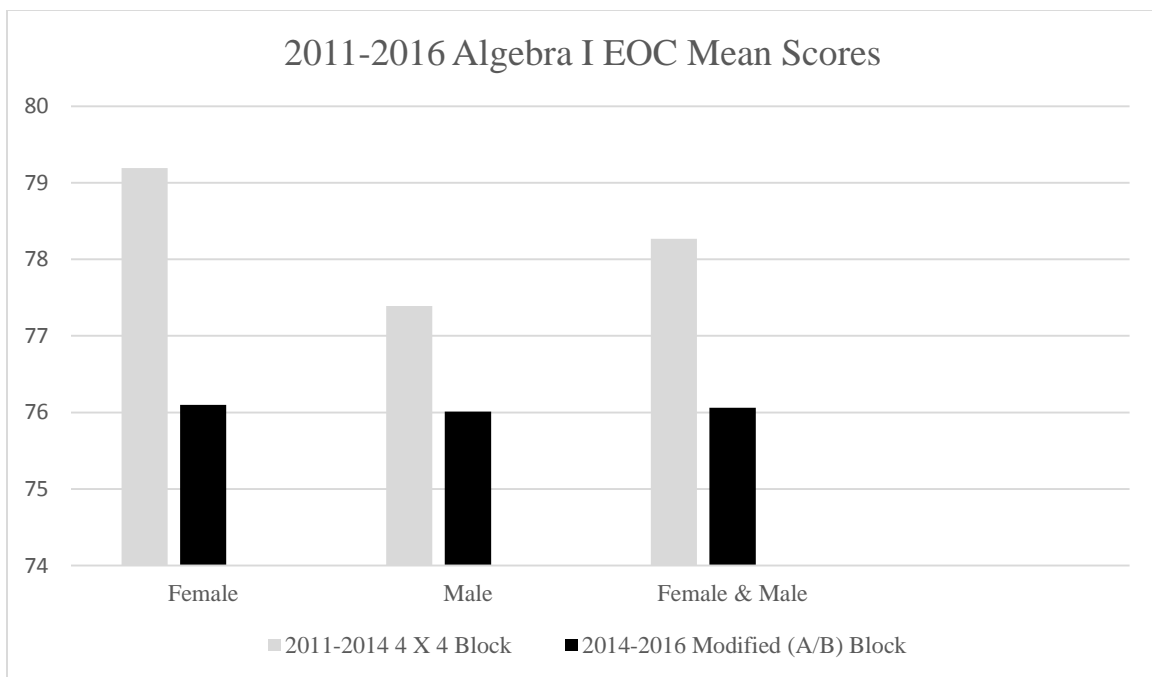|		Mean	N	SD	Std. Error Mean
Modified (A/B) Block	Female	76.1	401	9.004	0.450
	Male	76.01	392	9.228	0.466
	Total	76.06	793	9.110	
4 X 4 Block	Female	79.19	433	8.632	0.415
	Male	77.39	453	9.680	0.455
	Total	78.27	886	9.222	
Total	Female	77.71	834	8.942	
	Male	76.75	845	9.492	
	Total	77.22	1679	9.233	

Figure 4.2 SC Algebra I EOC Score Means by Gender and Schedule Type

Ethnicity. In Table 4.8, the data indicates that all four ethnic groups scored higher on the block schedule than on the modified (A/B) block schedule from 2011-2016. The SC Algebra I EOC mean exam scores on block schedule were at least two points higher for the White, Asian, and Black students. The Hispanic students scored over one point higher on the 4 X 4 block schedule than on the modified (A/B) schedule. The Black students had the largest point decrease of 2.24 points when the schools switched to a modified (A/B) block schedule.

To provide a comparison point, the Department of South Carolina reports that the highest mean score for Asian students from 2011-2016 was 91.8 in 2015-2016. Next, the highest score reported for Black students was 77.9 in 2014-2015. Hispanics had the highest mean score of 81.6 in 2013-2014 and White students achieved their highest mean score of 85.6 in 2014-2015. The SCDE reports that the highest mean score for all ethnic groups was 82.6 in 2014-2015.

When observing the students on both schedule types, the White students scored the highest on the SC Algebra I EOC exam from 2011-2016. All ethnic groups scored within two points of White students during this time period. Figure 4.3 depicts the shape and distribution of the data .

Table 4.8

SC Algebra I EOC Mean Scores by Schedule and Ethnicity

|		Mean	N	SD	Std. Error Mean
Modified (A/B) Block	Asian	76.33	6	10.577	4.318
	Black	74.70	406	7.752	0.385
	Hispanic	76.98	60	13.328	1.721
	White	77.60	321	9.483	0.529
	Total	76.06	793	9.110	
4 X 4 Block	Asian	78.38	21	8.863	1.934
	Black	76.94	437	8.951	0.428
	Hispanic	78.14	42	9.002	1.445
	White	79.78	386	4.243	0.477
	Total	78.27	886	9.222	
Total	Asian	77.93	27	9.093	
	Black	75.86	843	8.465	
	Hispanic	77.01	102	11.062	
	White	78.79	707	9.476	
	Total	77.22	1679	9.233	

70
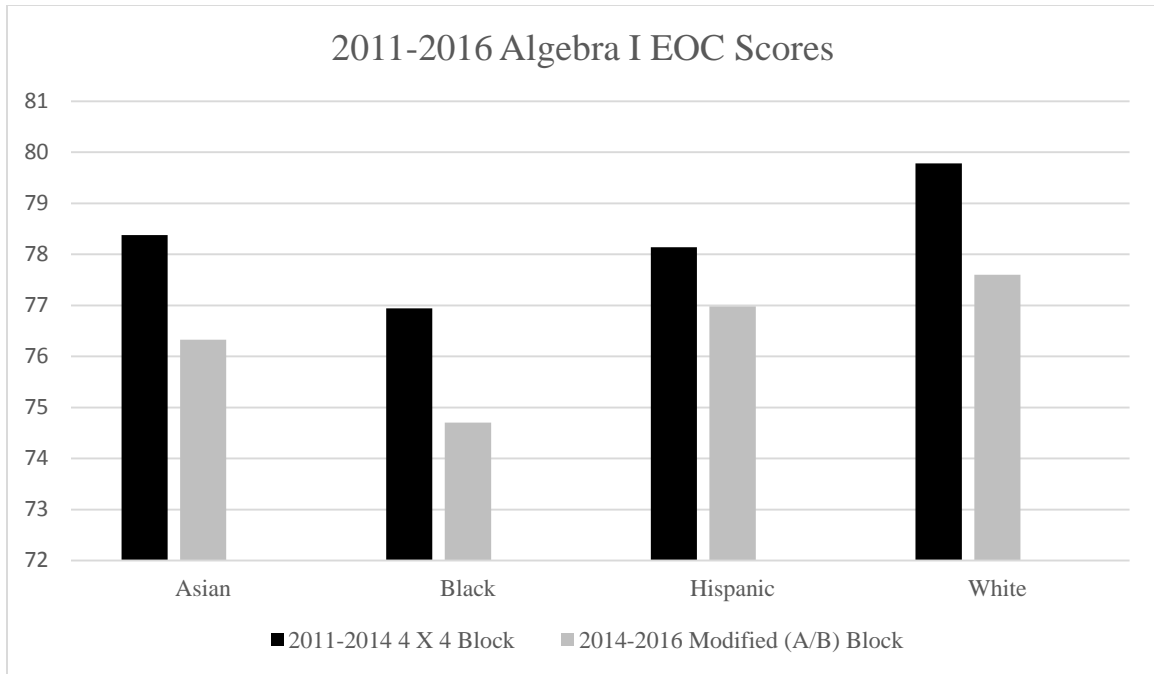
Figure 4.3 SC Algebra I EOC Mean Scores by Ethnicity and Schedule Type

Socioeconomic Status (SES). Table 4.9 illustrates that children in poverty scored about two points higher on the block schedule, while students who pay for their lunch scored less than a point higher on average while on a 4 X 4 block schedule from 2011-2016. Figure 4.4 depicts the shape and distribution of the data. To provide a comparison point, the South Carolina Department of Education reports that the highest mean score for children in poverty was 79.6 in 2014-2015. Additionally, they report that students who paid full price for their lunch achieved their highest mean score of 87.8 in 2014-2015.

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Table 4.9

SC Algebra I EOC Mean Scores by Schedule and SES

|		Mean	N	SD	Std. Error Mean
Modified (A/B) Block	Free	74.14	511	8.622	0.383
	Full Pay	79.58	206	9.198	0.641
	Reduced	77.61	76	8.938	1.025
	Free & Reduced	74.82	587	8.756	0.361
	Total	76.06	793	9.110	
Block	Free	77.28	518	9.346	0.411
	Full Pay	79.88	284	9.146	0.543
	Reduced	78.92	84	7.876	0.859
	Free & Reduced	77.51	602	9.167	0.374
	Total	78.27	886	9.222	
Total	Free	75.85	1029	9.122	
	Full Pay	79.76	490	9.160	
	Reduced	78.29	160	8.396	
	Total	77.22	1679	9.233	

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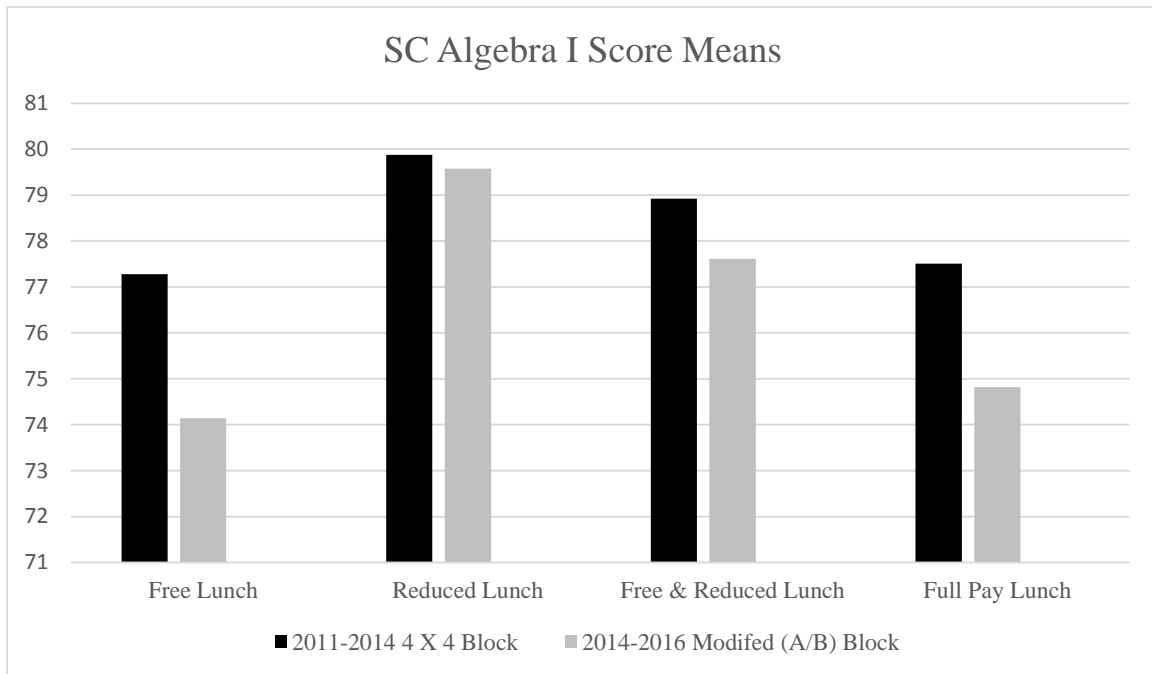
Figure 4.4 SC Algebra I EOC Score means by Year and Schedule Type

Regression Analysis

To answer the research question in this study, a regression analysis was used to measure the relationship of the independent variables, 4 X 4 block and modified (A/B) block schedules, and the dependent variable of student exam scores on the South Carolina Algebra I EOC Assessment. Ethnicity, gender, and SES are factors that influence SC Algebra I EOC scores (Allensworth & Easton, 2005; Balfanz et al., 2015; Shepard et al., 2009); therefore, these covariates were also analyzed to assess their relationship with the dependent variable.

One of the regression analysis assumptions is that there are no outliers in the data. To identify the extreme values in the data, a histogram and boxplot were generated. Figures 4.5 and 4.6 indicated four observations that may be considered outliers. One option for addressing issues with outliers is to transform the data before performing the

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analysis, and another option is to remove the outliers. Outliers can be removed when the observations are the results of measurement or data entry error. Outlier removal is also deemed appropriate if doing so does not affect the results of the analysis but may help with other analysis assumptions, such as normality. Removing the four outliers did not change the regression analysis results, but also did not affect the normality assumption. The outliers were retained for all of the other analyses.
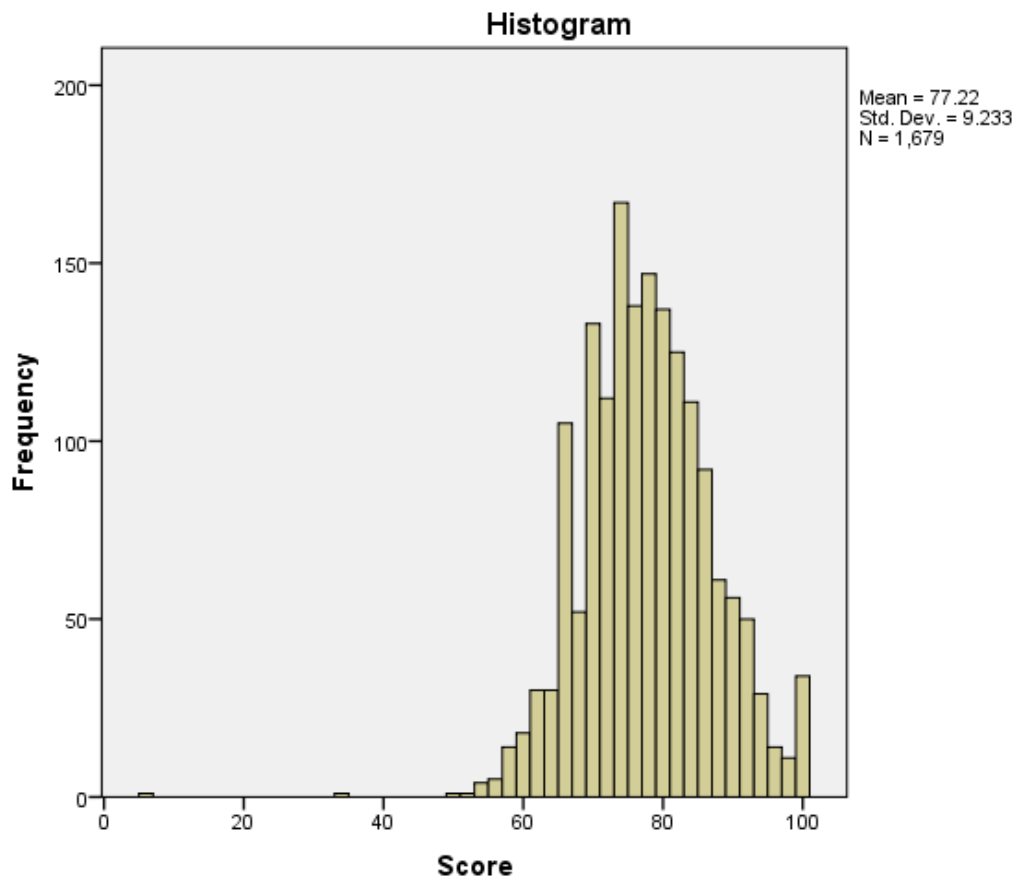

Figure 4.5. Exam scores for 4 X 4 and modified (A/B) block schedules.
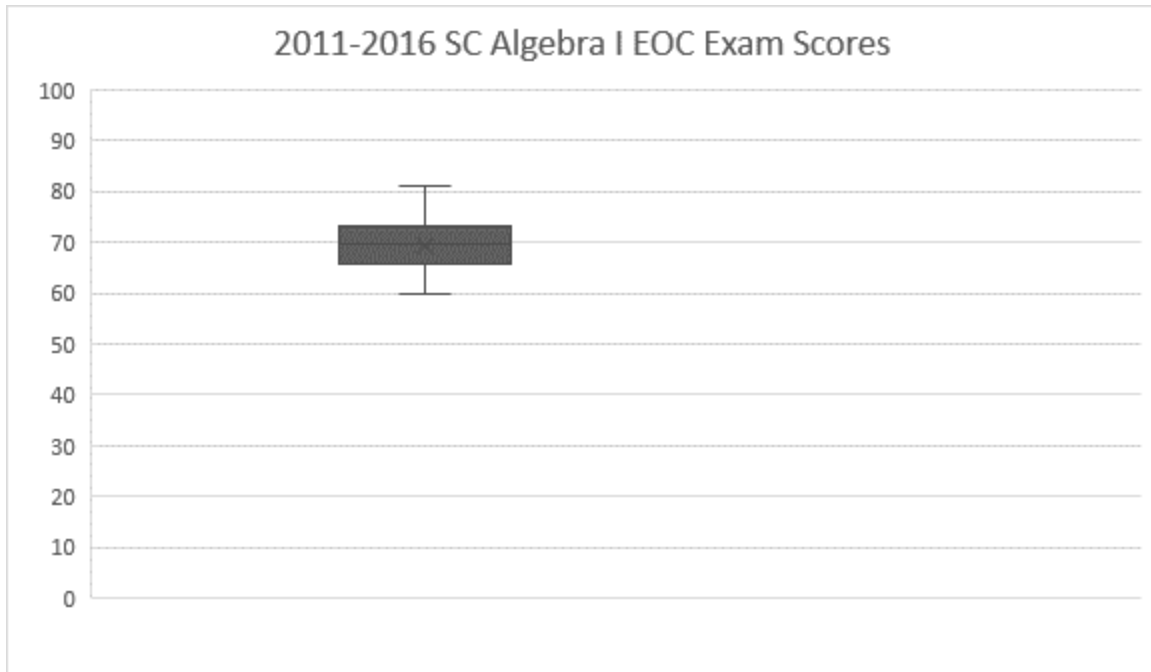
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Figure 4.6 Exam scores for 4 X 4 and modified (A/B) block schedules

A statistical analysis was run using the regression procedure in SPSS since all of the independent variables and covariates were categorical. To do so, dummy-coded variables were created for the variables with more than two levels: Ethnicity and Lunch. Ethnicity had four levels, so 3 dummy variables were created (Race_A, Race_B, Race_H) and W was used for the reference level. The results for the four dummy variables is presented as a comparison to Ethnicity W. Lunch has 3 levels, so 2 dummy variables were created (SES_F and SES_P) and R was used as a reference level. Table 4.10 provides model fit statistics and change statistics comparing the model with the covariates only to the model with the covariates and schedule. R is the multiple correlation of the dependent variable Score (SC Algebra I EOC exam scores), and the other variables in the model. R Square gives the proportion of the variation in Score that is explained by its relationship with the other variables in the model. The proportion of

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the variation in Score that is explained by the covariates only is 0.052. That is, 5.2% of the variation in Score is explained by Gender, Ethnicity, and Lunch (SES). Adding Schedule to the model increases the R Square by 0.012, indicating Schedule explains an additional 1.2% of the variation in Score. The p-value for the change in R Square is 0.000, signifying that the change in R Square by the addition of Schedule is significant, $p < 0.001$.

Table 4.10

Model 1 Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.228[a]	0.052	0.048	9.009	0.052	13.052	7	1671	0.000
2	.252[b]	0.064	0.059	8.955	0.012	21.118	1	1670	0.000

Table 4.11 indicates the parameter estimates for each variable. The parameter estimates can be examined to determine how each individual variable affects the scores examined. Given below is the table for Model 2 only of Table 4.19. The results show that after controlling for the covariates, Schedule has a significant effect on Score with a p-value of 0.000 (B=2.025, $p < 0.001$). The coefficients provided are the difference in the means between the indicated level and the reference level of the variable. The reference groups: modified (A/B) block, White students (Race_W), and students who received reduced lunch (SES_R), were used to obtain the differences in the mean scores. For example, the Schedule coefficient of 2.025 is the difference in mean Score of Block

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compared to modified (A/B) block (the reference group) students. The largest mean

difference in Score for the ethnicity coefficients was between the Black students

(Race_B) and White students (Race_W) at -2.088.

Table 4.11

Model 1 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sign.
2	(Constant)	77.739	0.816		95.265	0.000
	Schedule	2.025	0.441	0.110	4.595	0.000
	Gender	1.211	0.438	0.066	2.764	0.006
	Race_A	-1.279	1.759	-0.017	-0.727	0.467
	Race_B	-2.088	0.476	-0.113	-4.387	0.000
	Race_H	-0.368	0.965	-0.009	-0.381	0.703
	SES_F	-2.231	0.763	-0.118	-2.922	0.004
	SES_P	0.958	0.822	0.047	1.166	0.244

Tables 4.12, 4.13, 4.14, and 4.15 include the estimated marginal means and

confidence intervals. The analysis was run as a general linear model to obtain the

marginal means. The marginal means are the values compared in the regression output.

Table 4.12

Estimated Marginal Means for Schedule

			95 % Confidence Interval	
Schedule	Mean	Std. Error	Lower Bound	Upper Bound
Modified (A/B) Block	76.025	1.376	73.326	78.723
4 X 4 Block	78.050	1.353	75.397	80.703

Table 4.13

Estimated Marginal Means for Gender

			95 % Confidence Interval	
Gender	Mean	Std. Error	Lower Bound	Upper Bound
Female	77.643	1.359	74.978	80.308
Male	76.432	1.369	73.746	79.118

Table 4.14

Estimated Marginal Means for Ethnicity

			95 % Confidence Interval	
Ethnicity	Mean	Std. Error	Lower Bound	Upper Bound
Asian	77.655	1.739	74.244	81.065
Black	76.845	0.377	76.106	77.584
Hispanic	78.565	0.916	76.769	80.361
White	78.933	0.381	78.186	79.681

Table 4.15

Estimated Marginal Means for SES

| | | | 95 % Confidence Interval | |
Lunch	Mean	Std. Error	Lower Bound	Upper Bound
Free	75.231	1.339	72.605	77.857
Full Pay	78.419	1.383	75.707	81.132
Reduced	77.462	1.497	74.525	80.398

An additional analysis was completed to add year as a covariate to the model. Table 4.16 includes the covariate year with schedule, gender, and ethnicity. Adding Year to the model increased the R Square by 0.012, indicating Year explains an additional 1.2% of the variation in Score. The p-value for the change in R Square is 0.000, signifying that the change in R Square by the addition of Schedule is significant, $p<0.001$. Table 4.17 indicates the parameter estimates for each variable in the model including Year as a covariate. The parameter estimates can be examined to determine how each individual variable affects the scores examined. The results show that after controlling for the covariates, Schedule has a significant effect on Score with a p-value of 0.000 (B=5.725, $p<0.001$). The coefficients provided are the difference in the means between the indicated level and the reference level of the variable. The reference groups: modified (A/B) block, White students (Race_W), and students who received reduced lunch (SES_R), were used to obtain the differences in the mean scores. For example, the Schedule coefficient of 5.725 is the difference in mean Score of Block compared to modified (A/B) block (the reference group) students. The largest mean difference in

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Score for the ethnicity coefficients remained between the Black students (Race_B) and

White students (Race_W) at

-2.072.

Table 4.16

Model 2 Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
3	.275 a	0.076	0.071	8.901	0.076	15.178	9	166 9	0.000

Table 4.17

Model 2 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sign.
2	(Constant)	-2930.474	647.067		-4.529	0.000
	Schedule	5.725	0.908	0.310	6.302	0.000
	Gender	1.159	0.436	0.063	2.659	0.008
	Race_A	-1.325	1.748	-0.018	-0.758	0.449
	Race_B	-2.072	0.473	-0.112	-4.379	0.000
	Race_H	-0.240	0.960	-0.006	-0.251	0.802
	SES_F	-2.244	0.759	-0.118	-2.957	0.003
	SES_P	1.067	0.817	0.053	1.306	0.192
	Year	1.493	0.321	0.229	4.649	0.000

The results of the model reported in Tables 4.16 and 4.17 include nested covariates. Two factors are nested when the levels of one factor are similar but not identical, and each occurs in combination with different levels of another factor (Creswell, 2012). The two covariates, Year and Schedule, are related and thus the covariate Year can occur in the larger model Schedule. Additional testing is needed to address the nesting issue in this model.

The means compared in the first regression analysis were the estimated marginal means, not the raw means obtained from the descriptive statistics analysis. The estimated marginal means used for this analysis were adjusted for the other variables in the model. Figures 4.7 and 4.8 were used to assess the normality assumption for the residuals. Figure 4.7 indicates the overall pattern of the distribution is symmetric, but there are outliers in the data. The outliers can also be seen in the exploration of the dependent variable Score. Figure 4.7 portrays a normal, bell shaped distribution. The skewness static of this histogram was -0.127, which is an acceptable skewness value for a normally distributed set of exam scores (Kolen & Brennen, 2004, Heppner, P.P et al., 2004). The normality probability plot suggests normality as the points fall in a straight line.
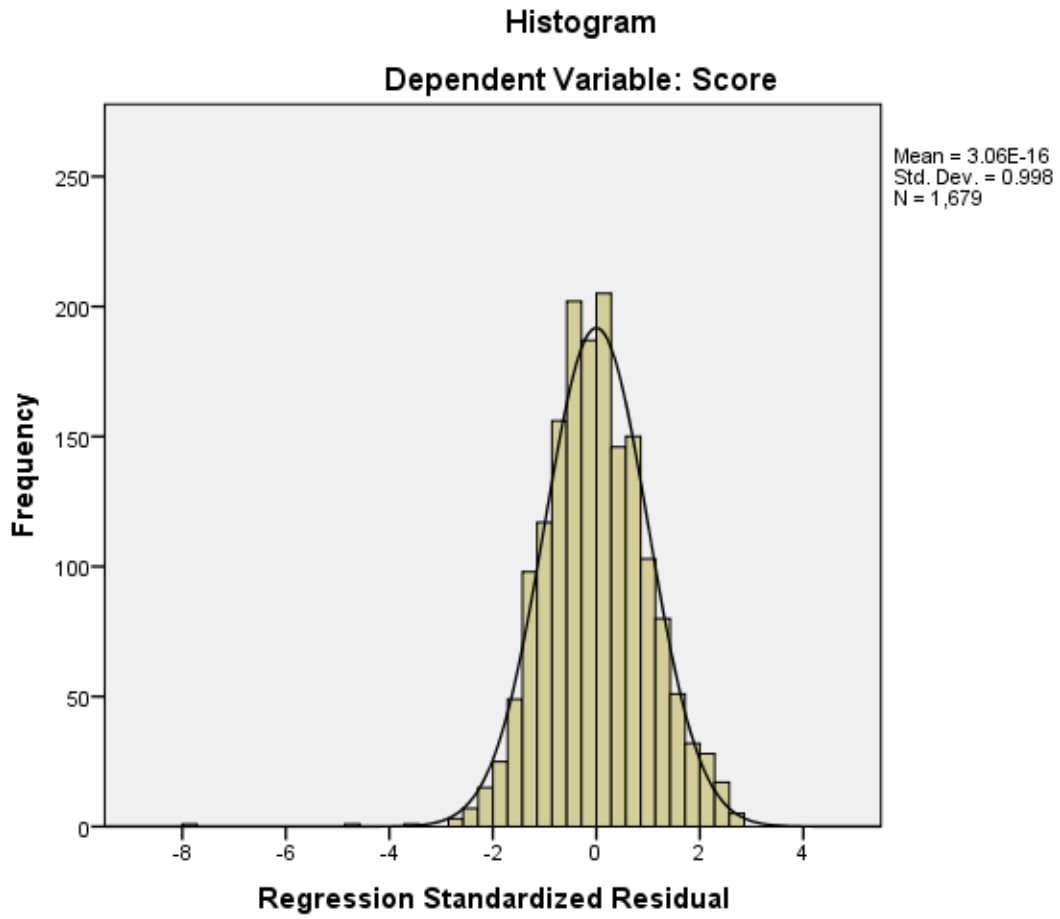
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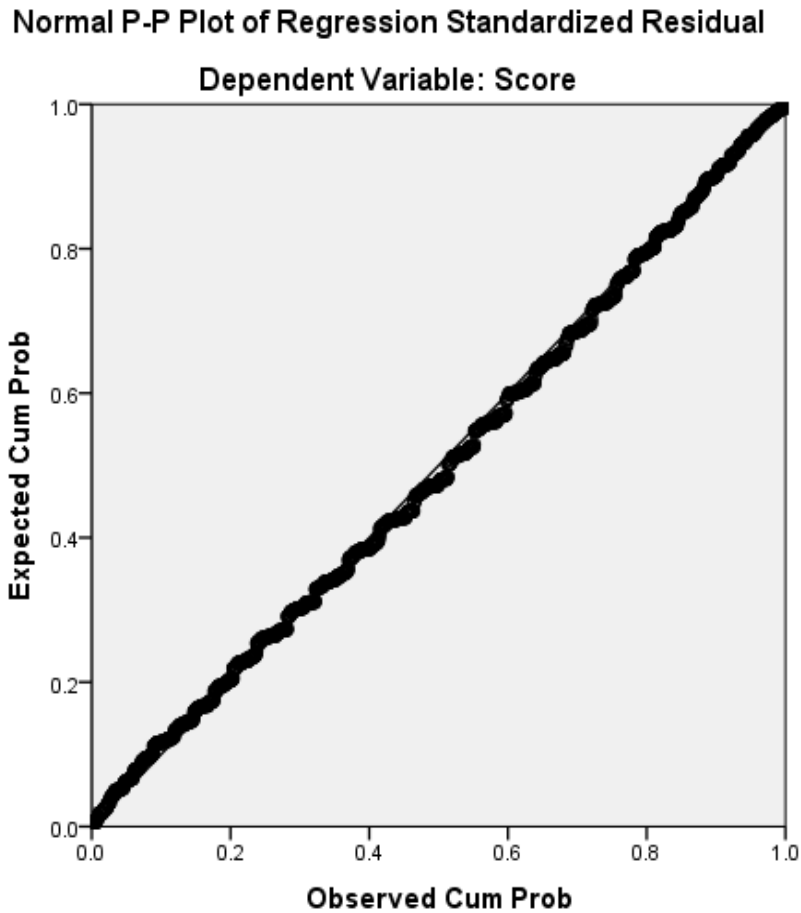Figure 4.7 SC Algebra I EOC Exam Score Distribution

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Score

Figure 4.8 Normal P-Plot of Regression Standardized Residual.

Summary

This chapter presented the findings of the research study. The reported quantitative findings are based on the South Carolina Algebra I EOC exam scores of 1,679 first-time ninth grade students in two southeastern high schools in South Carolina. The two southeastern high schools had a 4 X 4 block schedule from 2011-2014 and a modified (A/B) schedule from 2014-2016. In addition, student demographic information was obtained from the district's data warehouse: Berkeley's Record and Information Network (BRAIN).

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The results indicated that students on block schedule had a slightly higher mean score on the SC Algebra I EOC exam than those on a modified (A/B) block schedule and the difference was significant ($p < 0.001$) at the .05 level. All of the covariate means were higher on block schedule than those on modified block (A/B) schedule. There were five covariate groups with differences that were significant: White students ($p = 0.002$), male students $p = (0.036)$, female students ($p < 0.001$), Black students ($p < 0.001$), and children in poverty ($p < 0.001$).

The statistical analysis indicated that the proportion of the variation in Score explained by the covariates was 0.052, yielding that 5.2% of the variation in Score was explained by Gender, Ethnicity, and SES. Adding Schedule to the model increased the R Square by 0.012, so Schedule explained another 1.2% of the variation in Score. The p-value for the change in R Square was 0.000, which indicated that the change in R Square by the addition of Schedule was significant at the .05 significance level. After controlling for all of the covariates, Schedule still had a significant effect on Score with a p-value of 0.000 ($B = 2.025$, $p < 0.001$).

As stated in prior chapters, the purpose of this study was to assess the relationship between scheduling and first-year-high-school students' exam scores on the South Carolina Algebra I End-of-Course (EOC) exam. A discussion of these findings follows in Chapter Five

CHAPTER 5

STUDY SUMMARY

Chapter 5 starts with a brief summary of the study. The summary includes a discussion of the purpose of the research and a review of the methodology for the research. The chapter continues with a discussion of the findings as they relate to the literature. The chapter concludes with implications of the research and recommendations for further study.

Summary of the Study

The purpose of this study was to assess the relationship between scheduling and first-year-high-school students' exam scores on the South Carolina Algebra I End-of-Course (EOC) exam. Additionally, the research provided information about the relationship between ethnicity, gender, and SES with regards to first-year-high-school students' exam scores on the South Carolina Algebra I End-of-Course (EOC) assessment. The question that guided this research study was:

1. Is there a significant relationship between South Carolina Algebra I EOC exam scores and schedule type, examining a 4 X 4 block and modified (A/B) block schedule?

To conduct this research, a quantitative research methodology was utilized. One thousand-six hundred seventy-nine Algebra I exam scores were collected from the school

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district's database, BRAIN. A comparison of the study population and statewide performance of students who took the SC Algebra I EOC from 2011-2016 revealed that the mean scores for all covariates: ethnicity, gender, and SES, were higher than the student mean scores from this study population.

There were three noteworthy differences when comparing the demographics of the study population to the statewide population of students who took the SC Algebra I EOC from 2011-2016. First, the percentage of Black students examined for this study was lower than the percentage of students who took the SC Algebra I EOC throughout the state. Next, the percentage of White students examined for this study was lower than the percentage of students who took the SC Algebra I EOC across the state. Lastly, the number of children in poverty was approximately 20% higher for the study population in comparison to the state reported percentage of children in poverty who took the SC Algebra I EOC exam in 2011-2016.

There were five covariate means which were higher on the 4 X 4 block schedule than those on the modified block (A/B) schedule. There were five covariate groups with differences that were significant: White students ($p=0.002$), male students ($p=0.036$), female students ($p<0.001$), Black students ($p<0.001$), and children in poverty ($p<0.001$).

The research question was answered by calculating the mean exam scores for South Carolina Algebra I EOC exam scores on 4 X 4 block and modified (A/B) block schedules for students who met the criteria for this study. H_1 purported that there would be a significant relationship between schedule type and SC Algebra I EOC scores.

The means and standard deviations for students of the 4 X 4 block and modified (A/B) block schedules revealed that students on the block schedule averaged slightly

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higher exam scores on the South Carolina Algebra I EOC exam than those students on modified (A/B) block schedule. The data was then entered into a regression analysis which isolated of three covariates: ethnicity, gender, and SES. Through statistical analysis, the data revealed a higher mean SC Algebra I EOC exam score for the students on a 4 X 4 block schedule. According the regression results, the mean SC Algebra I EOC exam scores for the two groups differed significantly at the 0.05 level. However, the R Square test revealed that schedule type only contributed 1.2% of the variance in the SC Algebra I EOC test scores. The remaining covariates: gender, ethnicity, and SES contributed 5.2% of the variance in the SC Algebra I EOC scores between 4 X 4 block and modified (A/B) block schedules. There was a statistically significant difference in the 2011-2016 mean Algebra I EOC scores on 4 X 4 and modified (A/B) block schedules; however, only 1.2% of the variation in score was due to schedule type.

The findings substantiate earlier assertions that schedule design affects standardized exam scores (Evans et al., 2002; Schroth & Dixon, 1996; & Wright, 2010). Evans et al. purported that increased instructional time with students, more time for the development of meaningful relationships, and individualized instruction were benefits of block scheduling. Advocates of block scheduling also suggested that teachers have fewer students and more time to plan instruction in a 4 X 4 block setting. Students under the 4 X 4 received a less fragmented curriculum and an increase in project-based learning activities (Canady & Rettig, 1995; Evans et al., 2002; Queen & Isenhour, 1998; Rettig & Canady, 2003; Rettig & Canady, 1996; Zepeda & Mayers, 2006).

The findings of this study contradicted the earlier assertions of Eineder & Bishop (1997), Gruber & Onwuegbuzie (2001), Lawrence & McPherson (2000), Zelkowski

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(2010) Arnold (2005), and Norton (2010). One possible explanation for this is that many studies compare 10 years or more of data as opposed to a shorter period. This study investigated five years of data and perhaps student achievement levels out regardless of schedule design when viewed longitudinally. In addition, restructuring a school from one schedule to a different schedule requires changes in teachers', students', administrators' and parents' beliefs and practices. Simply switching schedules will not ensure success (Northwest Regional Laboratory, 1997). Teachers have to alter their instructional methods to ensure student success in any new schedule system (Schoenstein, 1995). Additionally, change is difficult and ample professional development must be provided to teachers to support changes in instructional methodology and teaching pedagogy (Norton, 2010). In 1997 the Northwest Regional Laboratory recommended involving teachers and stakeholders in the decision-making process to ensure support and successful implementation of a new schedule.

Additional statistical analysis provided data that can be used to compare exam scores among the four ethnic groups. According to the regression worksheet results for the study population, the White students had the highest mean exam score on the SC Algebra I EOC for 2011-2016. The Asian students had a mean score 1.279 points lower than the White students. The Black students had a -2.088 difference in mean score when compared to the White students and the Hispanic students had the smallest mean difference when compared to the White students at -0.368. The study results also indicated that the children in poverty had a lower mean score than the students who were not in poverty.

Findings Related to the Literature

In comparing the findings of this study with the literature in the area of scheduling and mathematic achievement, there seems to be an agreement that there needs to be more research in examining the direct relationship of scheduling on student achievement. The literature and research on the relationship between scheduling and standardized test scores yields inconsistent findings.

The findings of this study also support existing literature that many factors contribute to the success or lack of success students experience in mathematics. Student achievement on standardized test scores is affected by many variables. In this study, there was evidence of a small relationship between scheduling and the SC Algebra I EOC exam scores when gender, ethnicity, and SES were isolated; however, there are many other variables that should be isolated in future studies. The isolation of these variables will increase the validity and significance of the study.

Implications

The findings of this study revealed that students on the 4 X 4 block schedule had a higher mean score on the SC Algebra I EOC from 2011-2016 than those on a modified (A/B) schedule. The regression analysis revealed a statistical significant change in the student mean scores between students on a 4 X 4 clock and modified (A/B) block schedule. A decreased mean score on the SC Algebra I EOC is not acceptable in this era of accountability. School leaders and policy makers should consider this when contemplating a move from 4 X 4 block to modified (A/B) block schedules. One single study does not provide complete evidence of how a schedule change affects student

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achievement on the SC Algebra I EOC; however, an investigation of how students perform on the two different schedule types provides insight into the possible effects. This information may help improve SC Algebra I EOC exam scores for all students and student groups.

The implications of the research findings from this study are important for school administrators and school board members as they choose schedule models for high schools. This study provides additional information enabling local school board members and school districts to make more informed decisions about scheduling options. This is increasingly important with the trying budgetary conditions and increase in accountability of our nation's schools.

Recommendations for Further Research

This study examined the relationship between 4 X 4 and modified (A/B) block scheduling and the SC Algebra I EOC exam scores in two southeastern high schools. Additionally, the study examined the relationship between ethnicity, gender, and SES and the SC Algebra I EOC exam scores. Local school leaders and board members should examine available research before making decisions on a schedule change. Some suggestions for additional research which will help school leaders and policymakers make more educated decision are as follows:

1. Expanded studies to include SC EOC exam scores on the English I, US History, and Biology I end-of-course tests on both the 4 X 4 and modified block schedules. Including additional end-of-course tests will increase the

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validity of the study findings and enable the researcher to investigate the findings in all subject areas, not just math.

2. Longitudinal research that examines student math scores and grades throughout a students' middle school and high school tenure. The longitudinal research will provide insight into a student's performance in the past and allow an investigation of student growth on both types of schedules.

3. Cross-sectional research that studies the effects of 4 X 4 and modified block schedules on student mathematic achievement over a period of ten years or more. A study that extends over a period of ten or more years will provide more data on student scores. This will also help eliminate any score differences due to teacher experience and pedagogy.

4. Replicate studies within South Carolina and other states. In order to expand the size and diversity of the study population, a multistate study needs to be completed to compare trends within each state that administers EOC exams. These replication studies could also include a control group.

5. Additional research on how other factors such as teaching pedagogy, training, and years of experience, affect SC Algebra I EOC exam scores on 4 X 4 block and modified (A/B) block schedules. Many factors influence student achievement and it is important to consider as many factors as possible when examining student achievement.

6. Additional research to examine the effect student attendance and discipline have on SC Algebra I EOC exam scores on 4 X 4 block and modified (A/B) block schedules. Many factors influence student achievement and it is

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important to consider as many factors as possible when explaining student

achievement. Research has shown that there is a relationship between student

attendance, student discipline and student achievement.

7. Analysis should include students who have repeated Algebra I to determine

which schedule is best suited for student success. Many states have students

taking Algebra I in the eighth grade so students can complete higher levels of

mathematics in secondary school. Students in eighth grade may excel on a

yearlong schedule as opposed to a semester schedule.

8. For the purpose of this study, only students on the 4 X 4 block schedule were

compared to students on the modified (A/B) block schedule. Future research

should expand the groups of students examined to include a comparison of

students on traditional and trimester schedules to determine if there is a

relationship with student achievement. In addition, school districts should use

pilot programs and action research projects to determine which schedule is

best fit for them.

Conclusions

In 1989 a reform movement to restructure secondary school schedules was

prompted by Dr. Joseph M Carroll, retired superintendent and scholar (Carroll, 1990).

Since then, school leaders have implemented innovative schedules to help increase

student achievement. The available literature and research on the relationship between

scheduling and standardized test scores yields inconsistent findings as Zepeda and

Mayers (2006) reported in their meta-analysis of 58 empirical studies on block scheduling. In an attempt to better understand the ambiguities that exist concerning the relationship between scheduling and standardized test scores, this study examined the SC Algebra I EOC exam scores of students from two schools using block scheduling from 2011-2014 and modified (A/B) block schedules from 2014-2016. The understanding of Algebra I content is fundamental since Algebra I is considered a *gateway* course to high school graduation. Therefore, student performance on Algebra I EOC exams provided a logical indicator to analyze the relationship of scheduling and student achievement. The statistical analysis of SC Algebra I EOC exam scores indicated mean test scores were higher for students on a block schedule than students on the modified (A/B) block schedule.   The difference was significant at the .05 level; however, the R Square test revealed that schedule type only contributed 1.2% of the variance in the SC Algebra I EOC test scores. The remaining covariates: gender, ethnicity, and SES contributed 5.2% of the variance in the SC Algebra I EOC scores between 4 X 4 block and modified (A/B) block schedules.   This study provided evidence that there was a statistically significant mean difference between the students who took the SC Algebra I EOC on a 4 X 4 block schedule and modified (A/B) schedule; however, the statistical difference may have been due to the large sample size (Creswell, 2012).

One of the recommendations from the National Education Commission on Time and Learning (1994) was that "state and local boards need to work with schools to redesign education so that time becomes a factor in supporting learning, not a boundary marking its limits" (p.1). The use of non-traditional scheduling models provides one possible way to help time become a factor, rather than a boundary for learning. Even

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though Zepeda and Mayers (2006) focused their efforts on block scheduling, their questions and advice can be related to any type of schedule change. They assert:

> Implementation of a major change such as block scheduling requires detailed planning by a variety of stakeholders. Many decisions lay the groundwork for more active forms of planning. Questions that need to be answered include: Do we implement a block schedule? What type of block schedule best fits the context of our school? and, What challenges will we need to overcome to be successful? (p. 155)

School administrators and school board members should interpret these findings with caution and use the findings to guide conversations about what schedule will work best for their students. In this study, students on 4 X 4 block scheduling had a higher mean exam score on the Algebra I EOC and statistical analysis revealed a significant difference in the means. Although there is an abundance of information available about school scheduling, there is not a definitive answer to the question: "What is the best schedule for high school students?" Combining the findings of this study and the available research and literature already available will help school and district leaders determine which school schedule will best serve their population.

The intent of this study was to add to the educational research and knowledge of study in the area of school schedule types and the relationship with student achievement. This study is not an answer to the question of which schedule type is better, but rather adds to the knowledge base of understanding of the relationship between schedule type and SC Algebra I EOC exam scores. The study found that the mean Algebra I EOC exam scores on a 4 X 4 block schedule decreased when moving to an A/B block schedule

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in two southeastern South Carolina schools. Data from this study could support high

schools not making the switch from a 4 X 4 block schedule to a modified A/B block

schedule based on the examined decrease in SC Algebra EOC exam scores. This study

attempted to supply information and research that educational leaders could use to be

better equipped to make databased decisions and better understand the process for

seeking answers when it comes to making decisions on changing or not changing school

schedules.

REFERENCES

Alexander, K., & Pallas, A. (1984). Curriculum reform and school performance: an evaluation of the new basics. *American Journal of Education*, 92, 391-420.

Allensworth, E., & Easton J. (2005). The on-track indicator as a predictor of high School graduation. Chicago: Consortium on Chicago School Research at the University of Chicago. Retrieved November 2, 2015, from http://ccsr.uchicago.edu/content/publications.php?pub_id=10

Allensworth, E. (2013). The use of ninth-grade early warning indicators to improve Chicago schools, *Journal of Education for Students Placed At-Risk, 18*(1), 68-83.

Ananda, S. & Rabinowitz, S. (2000). The high stakes of high-stakes testing. WestEd Policy Brief. Retrieved March 1, 2017, from http://www.WestEd.org

Babbie, E. (2010). The Practice of Social Research. 12th ed. Belmont, CA. *Doing Quantitative Research in Education with SPSS*. 2nd edition. London: SAGE Publications.

Balfanz. R., Bridgeland, J. M., Bruce, M., & Horning Fox, J. (2012). Building a grad nation: Progress and challenge in ending the high school dropout epidemic. (Annual Report.) John Hopkins University: Balfanz. R., Bridgeland, J. M., Bruce, M., & Horning Fox, J.

Bitter, C., & O'Day, J. (2010). Raising expectations for mathematics instruction in California: Algebra and beyond. California Collaborative on District Reform. Retrieved August 15, 2014, from http://www.cacollaborative.org/publications

Cahill, M., Hamilton, L., & Lynch, J. (2006). Summary findings and strategic solutions for overage, undercredited youth. New York City: New York City Department of Education.

California Collaborative on District Reform. (2015). Retrieved October 1, 2014, from http://www.cacollaborative.org/

Canady, R. & Rettig, M. (1995). Block scheduling: A catalyst for change in high schools. Princeton, NJ: Eye on Education.

Carroll, J. (1990). The Copernican plan: Restructuring the American high school. *Phi Delta Kappan, 72*(5), 359–365.

Carroll, J. M. (1994). The Copernican Plan evaluated: The evolution of a revolution. *Phi Delta Kappan, 76*(2), 105–113.

Carter, L. (2007). Total instructional alignment: From standards to student success. Bloomington, IN: Solution Tree Press.

Cooper, S. (1996). Block in success: Plan ahead for big dividends from a new schedule. Science Teacher, 63(6), 28–31.

Cosimano, M. (2004). The impact of block scheduling on academic achievement and the perceptions of teachers and administrators in selected South Florida high schools. Dissertation Abstracts International, 65(04), Section A, 1189.

Creswell, J. W. (2012). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th ed.). Upper Saddle River, NJ: Merrill.

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. Education Policy Analysis Archives, 8(1).

Dexter, K. M., Tai, R. H., & Sadler, P. M. (2006). Traditional and block scheduling for college science preparation: A comparison of college science success of students who report different high school scheduling plans. *High School Journal. 89*(4), 22–33.

Donahue, T. (1993). Finding the way: Structure, time, and culture in school improvement, *Phi Delta Kappan*, *75*(4), 298-305.

Dufour, R. & Eaker, R. (1998). Professional learning communities at work: Best practices for enhancing student achievement. Bloomington, IN: Solution Tree. Retrieved November 1, 2014, from http://digitalcommons.georgiasouthern.edu/gerjournal/vol7/iss1/2

Education on human relations movement. 2015. Retrieved January 2015, from http://www.elearnportal.com/courses/education/school-system-administration)

Eineder, D. V., & Bishop, H. L. (1997). Block scheduling the high school: The effects on achievement, behavior, and student-teacher relationships. NASSP Bulletin, 81(589) 45-54.

Evans, D. (2002). Taking sides: Clashing views on controversial issues in secondary education. Guilford, CT: McGraw-Hill/Dushkin.

97

Evans, W., Tokarczyk, J., Rice, S., & McCray, A. (2002). Block scheduling: An evaluation of outcomes and impact. *Clearing House, 75*(6), 319–323.

Fullan, M. (2006). Change theory: A force for school improvement (series paper no. 157). Victoria, Australia: CSE Centre for Strategic Education. Retrieved September 9, 2013, from http://www.michaelfullan.ca/articles/

Goals 2000: Educate America Act of 1994, P.L. 103-227, Sec 3[9].

Goodlad, J. I. (1984). A place called school. New York, NY: McGraw-Hill.

Gruber, C., & Onwuegbuzie, A. (2001). Effects of block scheduling on academic achievement among high school students. *High School Journal, 84*(4), 32.

Hottenstein, D. S. (1998). Intensive scheduling: Restructuring America's secondary schools through time management. Thousand Oaks, CA: Corwin Press.

Howard, C. (1997). The hidden welfare state: Tax expenditures and social policy in the United States. Princeton, NJ: Princeton University Press.

Hoy, W. K., Tarter, C. J., & Woolfolk Hoy, A. (2006). Academic optimism of schools: A force for student achievement. *American Educational Research Journal, 43* (3) 425-446.

Irmsher, K. (1996). Block scheduling in high schools. Retrieved November 4, 2014 from http://eric.ed.gov/?id=ED399673.

Jorgensen, M. & Hoffman, J. (2003). History of the No Child Left Behind act of 2001 (NCLB). Assessment Report, Pearson Education Inc. 2003.

Kolen, M. & Brennan, R. (2004). Test equating, scaling, and linking (2nd ed.). New York: Springer.

Kramer, S. L. (1996). Block scheduling and high school mathematics instruction. *The Mathematics Teacher, 89*(9), 758-768.

Lawrence, W. & McPherson, D. (2000). A comparative study of block scheduling and traditional scheduling on academic achievement. *Journal of Instructional Psychology. 27*(3), 178.

Loveless, T. (2008, September). The misplaced math student: Lost in eighth-grade algebra (Special Release: the 2008 Brown Center Report on American Education). Washington, DC: Brown Center on Education Policy at Brookings.

Marion, R. (2002). *Leadership in education: organizational theory for the practitioner*. Upper Saddle River, N.J.: Prentice Hall.

Marzano, R. J. (2003). What works in schools: Translating research into action. Alexandria, VA: Association of Supervision and Curriculum Development.

Marzano, R.J., Waters, T. & McNulty, B.A.(2005). School leadership that works: From research to results. Alexandria, VA: Association of Supervision and Curriculum Development.

McNeil, L. M. (2000). Contradictions of school reform: Educational costs of standardized testing. New York: Routledge.

Murphy, J., Beck, L. G., Crawford, M., Hodges, A., & McGaughy, C. L. (2001). The productive high school: Creating personalized academic communities. Thousand Oaks, CA: Corwin.

National Center for Education Statistics (2007).

National Commission on Excellence in Education. (1984). A nation at risk. The imperative for education reform. Washington, DC: U.S. Government Printing Office.

National Education Commission on Time and Learning (NECTL). (1994). Prisoners of time. Washington, DC. Retrieved November 4, 2015, from http://www.ed.gov/pubs/PrisonersOfTime/index.html

National Mathematics Advisory Panel (2008). Retrieved November 10, 2015, from https://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf

Neild, R. C., & Balfanz, R. (2006). Unfulfilled promise: The dimensions and characteristics of Philadelphia's dropout crisis, 2000–2005. Baltimore: Johns Hopkins University, Center for Social Organization of Schools. Retrieved November 4, 2015, from http://files.eric.ed.gov/fulltext/ED538341.pdf

Norton, M. (2010). A study of the impact of block scheduling on student academic achievement in public high schools. (Doctoral dissertation). Available from ProQuest Digital Dissertations and Theses. (UMI No. 3397428)

Northwest Regional Laboratory, (1997). *Scheduling alternatives: Options for student success.* Retrieved September 1, 2016, from http://www.nwrel.org/request/feb97/article3.html.

O'Neil, J. (1995). Finding time. *Educational Leadership*, 53(3), 11–15.

Oven, T. (2004). Block scheduling-Minnesota schools. Retrieved October 6, 2014 from www.education.umn.edu

Orfield, G., & Wald, J. (2000). Testing, testing: The high-stakes testing mania hurts poor and minority students the most. Nation, 270(22), 38-40.

Payne, D., & Jordan, M. M. (1996). The evaluation of a high school block schedule: Convergence of teacher and student data. *American Secondary Education*, *25*(2), 16–19.

Petersen, N., Kolen M., & Hoover, H. (1989). Scaling, norming, and equating. In R.L. Linn (Ed.), *Educational Measurement* (3rd ed., pp.221-262). New York: Macmillan.

Petrilli, M., Wright, B. (2016). America's mediocre test scores. *Education Next, 16*(1), 46-52.

Posner, G. J. (2004). Analyzing the curriculum (3rd ed.). New York, NY: McGraw-Hill Companies, Inc.

Queen, J.A. (2000). Block scheduling revisited. *Phi Delta Kappan, 82*, 214–222.

Queen, J. A., & Isenhour, K. G. (1998). 4 X 4 block schedule. *Eye on Education, Larchmont*.

Rettig, M.D., & Canady, R. L. (1996). All around the block: The benefits and challenges of a non-traditional school schedule. *School Administrator, 8*, 8–15.

Rettig, M. & Canady, L. (2001). Block scheduling: More benefits than challenges. Response to Thomas (2001). NASSP Bulletin, 85(628), 7886.

Rettig, M. D., & Canady, R. L. (2003). Block scheduling's missteps, successes and variables. *School Administrator 60*, 26–31.

Roderick, M, Nagaoka, J, Coca, V and Moeller, E. (2008). From high school to the future: Potholes on the road to college. Chicago: The Consortium on Chicago School Research.

Rothstein, R. (2000). Grading education: Getting accountablity right. Washington, D.C.: Economic Policy Institute, and New York: Teachers College Press.

Rumberger, R. W. (2008). Why students drop out of school. In Orfield, G. (Ed.), Dropouts in America: Confronting the Graduation Rate Crisis (pp. 131−156). Cambridge, MA: Harvard Education Press.

Schoenstein, R. (1995). The new school on the block. *The Executive Educator, 17(8)*, 18-20.

Schroth, G., & Dixon, J. (1996). The effects of block scheduling on student performance. *International Journal of Education Reform, 5*, 472–476.

Shepard, L., Hannaway , J., and Baker, E. (2009). Standards, assessment and accountability. An Education policy white paper. (1-16) Washington, DC: National Academy of Education.

Sherman, D. (1983). Origins of the dropout problem. *History of Education Quarterly*, *33*(3), 353-373.

Shortt, T. & Thayer Y. (1998). Block scheduling can enhance school climate," *Educational Leadership*, *56*(4), 76-81.

Short, D. J., & Fitzsimmons, S. (2007). Double the work: Challenges and solutions to acquiring language and academic literacy for adolescent English language learners: A report to Carnegie Corporation of New York. Washington, DC: Alliance for Excellent Education.

Silva, E. (2007). On the clock: Rethinking the way schools use time. Education Sector. Retrieved November 4, 2015, from http://www.educationsector.org/research/research_show.htm?doc_id=442238

Silva, E., White, T., and Toch, T. (2015). The carnegie unit: A century-old standard in a changing education landscape. Stanford, California: Carnegie Foundation for the Advancement of Teaching.

Silver, D., Saunders, M., & Zarate, M. (2008). What factors predict high school graduation in the Los Angeles Unified School District." California Dropout Research Project, Santa Barbara, CA.

South Carolina Department of Education. (2015). Retrieved October 6, 2014, from http://ed.sc.gov/policy/

South Carolina Education Accountability Act. (1998). Retrieved November 4, 2015, from http://www.scstatehouse.gov/code/t59c018.php

Swanson, C. (2004). Who graduates? Who doesn't? A statistical portrait of public high school graduation, class of 2001. Washington, D.C., The Urban Institute. Retrieved November 4, 2015, from http://www.urban.org/url.cfm?ID=410934

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The American Heritage New Dictionary of Cultural Literacy, Third Edition. Retrieved
October 10, 2014 from Dictionary.com
website http://www.dictionary.com/browse/socioeconomic-status

Trenta, L., & Newman, I. (2002). Effects of a high school block scheduling programs on
students: A four-year longitudinal study of the effects of block scheduling on
student outcome variables. *American Secondary Education, 31*(1), 54.

Trump, J. (1959). Images of the future: A new approach to the secondary school.
Washington, DC: National Association of Secondary School Principals.

Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman I. (2003).

Socioeconomic status modifies heritability of IQ in young children. *Psychological
Science, 14*(6), 623-8.

UNICEF (2005b): The State of the World of the Children 2005 - Childhood under Threat,
UNICEF, New York, NY.

United States Department of Education (1965). Elementary and Secondary Act of 1965.
Retrieved October 1, 2014, from
https://www2.ed.gov/about/offices/list/oii/nonpublic/eseareauth.pdf

United States Department of Education. National Commission on Excellence in
Education. (1983). A nation at risk : The imperative for educational reform : a
report to the Nation and the Secretary of Education, United States Department of
Education. Washington, DC: The Commission : [Supt. of Docs., U.S. G.P.O.
distributor] Retrieved June 26, 2012, from
http://teachertenure.procon.org/sourcefiles/a-nation-at-risk-tenure-april-1983.pdf

United States Department of Education. (1997). Mathematics equals opportunity (White
Paper prepared for U.S. Secretary of Education Richard W. Riley). Washington,
DC: U.S. Department of Education. Retrieved September 17, 2015 from
http://eric.ed.gov/?id=ED415119

United States Department of Education. (2002). No child left behind, Accountability and
AYP. Oct 2002, Retrieved October 6, 2014 from
http://www2.ed.gov/admins/lead/account/ayp/edlite- index.html

United States Department of Education. (2010a). A blueprint for reform: The
reauthorization of the Elementary and Secondary Education Act. Retrieved from
http://www2.ed.gov/

United States Department of Education. (2015). Every Student Succeeds Act of 2015.
Retrieved October 1, 2014, from https://www.ed.gov/ESSA

Vandemoortele, J. (2000): Absorbing Social Shocks, Protecting Children and Reducing Poverty, UNICEF, New York, NY. Retrived November 10, 2014, from http://www.unicef.org/evaldatabase/files/Global_2000_Absorbing_Social_Shocks .pdf

Veal, W. & Schreiber, J. (1999). Block scheduling effects on a state mandated test of basic skills. *Education Policy Analysis Archives, 7*(29), 1–14.

Vigdor, J. (2013). Solving America's math problem. *Education Next, 13*(1), Retrieved November 1, 2014 from http://search.proquest.com/docview/1238139601?accountid=14793

Weller, D., & McLeskey, J. (2000). Block scheduling and inclusion in a high school: Teacher perceptions of the benefits and challenges. Remedial and Special Education, 21, 209–218.

Witte, R.S., & Witte, J.S. (2015). Statistics. Hoboken, NJ: Wiley & Sons, Inc.

Wright, M. (2010). A longitudinal study of block scheduling in one South Carolina high school: A descriptive twenty-five year case study from traditional to block. (Doctoral dissertation). Available from ProQuest Dissertations & Theses (UMI No. 3404192)

Zelkowski, J. (2010). Secondary mathematics: Four credits, block schedules, continuous enrollment? What maximizes college readiness? *The Mathematics Educator, 20*(1), 8-21.

Zepeda, S., & Mayers, R. (2000). Supervision and staff development in the block. *Eye on Education*, *Larchmont*.

Zepeda, S., & Mayers, R. (2001). New kids on the block schedule: Beginning teachers face challenges. *High School Journal, 84*(4), 1.

Zepeda, S. & Mayers, R. (2006). An analysis of research on block scheduling. *Review of Educational Research, 76*(1), 137.

Zinth, J. D. (2012). 50-state mathematics requirements for the standard high school diploma. Denver, CO: Education Commission of the States. Retrieved February 17, 2016, from http://www.ecs.org/clearinghouse/01/01/28/10128.pdf

APPENDIX A- EIRB USC APPROVAL LETTER

UNIVERSITY OF
SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
DECLARATION of NOT HUMAN SUBJECTS

This is to certify that research proposal: **Pro00059100**

Entitled: *A Comparative Analysis of Algebra I End-of-Course Test Scores By Schedule Type*

Submitted by:
Principal Investigator: Dawn Smith
                          College of Education
                          Education Leadership & Policies / Education Administration
                          Wardlaw
                          Columbia, SC 29208

was reviewed on **08/31/2016** by the Office of Research Compliance, an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced study meets the Not Human Research criteria set forth by the Code of Federal Regulations (45 CFR 46) of:

   a. the specimens and/or private information/data were not collected specifically for the currently proposed research project through an interaction/intervention with living individuals AND

   b. the investigator(s) including collaborators on the proposed research cannot readily ascertain the identity of the individual(s) to whom the coded private information or specimens pertain

No further oversight by the USC IRB is required; however, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project.

If you have questions, contact Arlene McWhorter at arlenem@sc.edu or (803) 777-7095.

Sincerely,

Lisa M. Johnson
IRB Manager

University of South Carolina ● 1600 Hampton Street, Suite 414 ● Columbia, South Carolina 29208 ● 803-777-7095
An Equal Opportunity Institution

APPENDIX B- REQUEST FOR PERMISSION TO USE DATA

Kevin O'Gorman | Dawn Smith   9/1/2016

Re: Dissertation help

I've requested access for you...will let you know when I hear back.

Kevin L. O'Gorman, Ph.D.
Chief Academic Officer
Berkeley County School District
Office: (843) 899-8599

Follow me on Twitter @kevinogor

On Sep 1, 2016, at 3:21 PM, Dawn Smith <SmithDaw@bcsdschools.net> wrote:

Good Afternoon Dr. O'Gorman,

I spoke with ███ earlier and he told me he spoke with you briefly about getting me administrative rights to PowerSchool so I can pull the new data my dissertation committee requested. I appreciate any help you can give me as I know you were not the original person who granted me permission to conduct the study on BCSD Algebra I EOC scores.

This is the initial email I sent to ████ not knowing he had already left the district...

██████, thank you for all of your help gathering the data I needed for my dissertation thus far. I had my proposal defense yesterday and it went well; however, my committee would like me to increase the amount of data included in the study for two schools.

The two schools are ██████████████. This is because Dr. Murray informed the rest of my committee that these two schools were on A/B schedule for two years and they want me to further investigate the impact of A/B schedule.

I have been able to pull all of the Algebra I EOC data from the South Carolina Department of Education, but am not able to tell the grade level of the students...also the ethnic code.

This is exactly what I will need to pull.

APPENDIX C- PERMISSION TO USE DATA

Missy Fort | Dawn Smith; Diane Driggers; Kevin O'Gorman ▾   9/1/2016

FW: Dissertation help   ✓

Suggested Meetings

Dawn:

Your PowerSchool rights have been updated as per the request from Dr. O'gorman. Please note that Free & Reduced lunch information in PowerSchool is only for the current year. PowerSchool does not retain prior year data for Basic student demographic information.

Missy

From: Diane Driggers
Sent: Thursday, September 1, 2016 3:42 PM
To: Missy Fort <Fortm@bcsdschools.net>
Subject: FW: Dissertation help

From: Kevin O'Gorman
Sent: Thursday, September 1, 2016 3:37 PM
To: Diane Driggers <diane@bcsdschools.net>
Subject: Fwd: Dissertation help

Diane -
Please see the request below.
Can you please provide administrative viewing rights in PowerSchool to Dawn Smith for ▓▓▓▓▓▓
Kevin

Kevin L. O'Gorman, Ph.D.
Chief Academic Officer
Berkeley County School District
Office: (843) 899-8599

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