The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures: A Mixed Methods Study

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ABSTRACT

High schools around the nation are attempting to find a solution to the "9th-grade bulge," and the ever-growing systematic problem of 9th grade retention. The purpose of this study was to investigate the impact of the daily bell schedule on ninth-grade student achievement and overall school performance. A mixed method, sequential explanatory design was utilized to compare the two most common bell schedules; 7-period and 4 X 4 block. The quantitative portion of the study examined 9th grade achievement on the Georgia Milestones End-of-Course (EOC) Assessments and the overall school performance was measured by the College Career Performance Index (CCRPI) and its components. Twelve principals were interviewed for the qualitative section to gain more insight on the quantitative results.

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DEDICATION

This dissertation is dedicated to my lovely wife, Staci, and my three awesome children: Reagan, Westin, and Lauren. Thank you so much for your patience, love, and encouragement to finish my journey. I hope I made you all proud.

Chapter I

INTRODUCTION

The transition from middle school to high school is one of the most perilous and challenging times in a student's academic career (Hertzog & Morgan, 1998). The National High School Center (2012) reported, "In 1982, ninth-grade enrollment was 4% higher than eighth-grade enrollment. In 2011, this bulge had grown to a 12% increase in enrollment in the ninth grade" (p. 1). The report indicated that roughly 22% of ninth graders repeat the ninth grade, which is greater than any other grade. The success in transitioning students from middle school to high school will influence their future academic goals and their high school's accountability status (Georgia Department of Education, 2018b).

The smoothness of a student's transition from middle to high school is a strong indicator of their likelihood of graduating high school and college (Grossman et al., 2009). According to Grossman, factors effecting the successful transition are the physical space of the high school, peer and teacher relationships, increased workload, and changes in instructional strategies. All these factors can affect how schools structure the school day, whether it is a traditional seven-period or 4 x 4 block schedule.

Conceptual Framework

The conceptual framework for this study was based on a study conducted by Dr. James Finch in 2015 comparing different facility arrangements school districts utilize for

incoming ninth-grade students and how each may affect student success for first-time ninth graders. The researcher desired to determine if smaller learning communities and isolating the first-time ninth-graders would impact their success in high school and increase the number of core Carnegie credits the student earned. The study found no statistical significance to support a specific facility arrangement; however, it referred to Akos and Galassi (2004), who discovered three key variables affecting the middle to high school transition; academic, procedural, and social. Since the facility arrangement proved insignificant, it led to the investigation of the student's daily schedule.

High schools throughout Georgia predominantly use two markedly different class schedules. This study sought to determine if a traditional seven-period or 4 x 4 block schedule would benefit ninth-grade students and affect their success as they transition to high school.

Akos and Galassi (2004) encourage school districts to focus on procedural planning, emphasizing social adjustments such as meeting new friends, teachers and becoming familiar with their new environment. Part of the environment for a high school is the bell schedule. Khazzaka (1997) claims a bell schedule is one of the primary procedural structures in the school. He believes a bell schedule should be built with flexibility in mind to eliminate isolation and be cognizant of how our brains process information (Khazzaka, 1997). A failure to address procedural needs could significantly decrease academic achievement (Akos & Galassi, 2004). Khazzaka (1997) contends the bell schedule controls four critical aspects of the school day for both student and teacher: time, use of space, the grouping of students, and the role of the staff members in the learning process. Traditional seven-period scheduling moves students from class to class

approximately seven times a day, having seven different teachers, textbooks, materials, and teaching strategies (Khazzaka, 1997). O'Neil (1995) states that teachers in a traditional seven-period schedule can teach six periods a day with up to 150 or 180 students; in this arrangement, teachers struggle to build student relations, learn their students' strengths and weaknesses, and provide individual attention. In contrast, Khazzaka (1997) claims teachers in a 4 x 4 block schedule have three classes with only 90 students, which allows for more one-on-one instruction and increased instructional planning time.

As Akos and Galassi (2004) stated, one of three critical components for transitioning from middle to high school is academics. Kruse and Kruse (1995) contend that a schedule provides more time to various subject areas and allows teachers to discover new ways to manage instruction more effectively and improve the quality of learning. Carroll (1994) states that the traditional seven-period day evolved during the industrial revolution and was seen as a form of production where teachers were held responsible for obtaining a quantifiable product in a given time. Like teachers, Edwards (1995) claims that students in a block schedule have only four courses, allowing more time for individual learning. Edwards (1995a) continues by stating that block schedules offer students more academic choices and enable the student to earn eight credits per year.

In contrast, in a traditional seven-period schedule, the student can earn seven credits. Khazzaka (1997) claims a block schedule would allow students needing acceleration to move at their own pace. He also believed it allowed students to prepare for college courses in their third and fourth year of high school and provided more

opportunities for the struggling students to redeem credits they failed repeating the course (Khazzaka, 1997).

Akos and Galassi (2004) continue by stating that one of three critical components for transitioning from middle to high school is social. Newman et al. (2000) determined that one of the major concerns for all students was interactions with new people. Starkman, Scales, and Roberts (1999) found the chief measure of academic success in high school was not intellectual indicators but successful social adjustments. Schedules play a critical role in the social aspect of high school students. Procedural planning can assist with complex social adjustments when students transition from middle to high school, such as meeting new teachers, making new friends, and learning a new environment (Akos & Galassi, 2004). Khazzaka (1997) states that a schedule can affect students socially by reducing or increasing the number of interactions a student has daily. For example, in the traditional seven-period schedule, students move to seven different classes with between 150 to 180 other students and seven different teachers. However, with a 4 x 4-block schedule, the student only has four classes with approximately 90 other students and learns from four different teachers (Khazzaka, 1997). Boarman and Kirkpatrick (1995) found that block scheduling reduces foot traffic in high schools by 40%, resulting in remarkably fewer disciplinary referrals due to reduced social interaction.

Sustaining academic achievement for students transitioning to high school is imperative (Newman, Myers, Newman, Lohman, & Smith, 2000). Ninth-grade student success not only affects each student personally, but first-year students also have a significant impact on school accountability. High schools in Georgia are held accountable

by a College Career Readiness Performance Index (CCRPI). CCRPI utilizes student performance on eight state-mandated assessments, student growth percentiles in those eight tested courses, the school's four and five-year cohort graduation rates, and student and parent climate surveys (GaDOE, 2018a). When focusing on ninth-graders, their success, or the lack thereof, can affect several of the indicators of the CCRPI, mainly in student achievement, with ninth graders usually taking three of the eight courses their first year in high school. Therefore, success in the ninth grade is vital for the individual student with implications of future success in education and for Georgia high schools to achieve adequate yearly progress.

Statement of the Problem

According to the UCLA Center for Mental Health in Schools (2015), the 9th grade bulge, or bottleneck, is a name given the increasing percentage of ninth graders compared to the number of students enrolled in 8th grade the previous year. In an earlier study conducted by Dr. James Finch (2015) at Valdosta State University, his research examined whether high school facility arrangements effected ninth-grade student achievement, high stakes test scores, credit accrual, and graduation rate. However, Finch's (2015) study found no statistical significance to support a specific facility arrangement on the effect of student achievement in 9th-grade literature, credit accrual, or graduation rate. Therefore, to continue Dr. Finch's work, this study examined whether school schedules affect the "ninth-grade bulge." This study looked at schools utilizing a traditional seven-period schedule or a 4 x 4 block schedule to determine if there is a significant difference in ninth-grade student achievement scores, CCRPI scores, school climate ratings, four-year cohort graduation rates, and overall retention rates.

Purpose of the Study

Before 2012, Georgia high schools were held accountable for students' performance on the eleventh grade Georgia High School Graduation Test (GHSGT). A high school was then provided a score based on the GHSGT results and a few other components to determine a school's annual yearly progress (AYP). As a result, there was minimal emphasis or importance placed on ninth-grade student achievement. However, the No Child Left Behind (NCLB) waiver was implemented in 2012 along with Georgia's College and Career Readiness Performance Index (CCRPI). The CCRPI measures student academic performance on eight End-of-Course-Tests (EOCT) with two assessments in each of the four major content areas. As a result of NCLB and CCPRI, high schools are required to test each student in eight subjects: ninth-grade literature, American Literature, Biology, Physical Science, U.S. History, Economics, Coordinate Algebra / Algebra I, and Analytic Geometry / Geometry (Georgia Department of Education, 2018). In contrast, the GHSGT assessed students in 11th-grade math and English language arts (Georgia Department of Education, 2018).

Once the shift occurred from the NCLB and AYP to the CCRPI and EOCTs, districts and schools needed to prepare a holistic educational plan to address all grades and academic courses, especially ninth graders. With the new CCRPI and EOCT, high schools must assess the eight required courses, and typically three of the courses are taught in the ninth grade. In addition, ninth-grade state assessments place a tremendous emphasis on ninth-grade achievement and how well students transition from eighth to ninth grade.

Although there could be many variables effecting ninth-grade achievement, the purpose was to determine if bell schedules effect first-time ninth graders' academic success. Success was defined by the number of students achieving a level two, three, or four (developing, proficient or distinguished learner) on the Georgia Milestones End-of-Course assessment in 9th Grade Literature, Algebra I, and Biology. In addition, for overall school success, the following measures were utilized; the school's CCRPI score, 4-year cohort graduation rate, climate score, and overall retention rate. All data were analyzed to determine if there was a significant difference between Georgia schools using a 4 x 4 block schedule or a traditional seven-period schedule. Schools utilizing a traditional seven-period schedule served as the control group for the study.

With the understanding that one of the most challenging transitions for students in a k-12 environment is between eighth and ninth grade, it makes sense how it can impact students' ability to earn necessary high school credits and effect their achievement on state standardized assessments (Wheelock & Miao, 2005). Not only will their performance impact their academic future, but it will also impact their school's accountability and CCRPI scores. Findings from this study could prove invaluable to educators as they determine which bell schedule would be most beneficial for their student body, predominantly the economically disadvantaged subgroups.

Research Questions

1. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) for ninth-grade students on selected performance measures (ninth-grade literature, algebra, biology)?

a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth Grade Literature End-of-Course Assessment (EOC)?

b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra End-of-Course Assessment (EOC)?

c. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Biology End-of-Course Assessment (EOC)?

2. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the school's four-year cohort graduation rate?

c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the school's school climate rating?

d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by high school's location (urban, rural, or suburban) on the school's overall retention rate?

3. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by the levels of the percentage of students receiving free or reduced lunch on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

    b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by the levels of the

percentage of students receiving free or reduced lunch on the school's four-year cohort graduation rate?

c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's school climate rating?

d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4 x 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall retention rate?

4. In what ways does the interview data reporting the views of the high school principals explain the quantitative results about how their schedule type, location, and percentage of students receiving free or reduced lunch affect their ninth-grade student achievement and overall school performance.

Significance of the Study

Transitioning from eighth to ninth grade is the most challenging transition in a student's educational career (Wheelock, 2005). With a ninth-grade failure rate three to five times higher than any other grade level (Southern Regional Education Board, 2002), it was fundamental to investigate why the transition is so challenging and how it can be improved. Time is a central resource to the educational process. According to Joyner et al. (2011), there is no definitive answer on the impact of time spent in class and student achievement. Determining how to spend instructional time is a vital decision for high schools and school districts. Most school districts predominately choose one of two

schedules, the traditional seven-period schedule or the 4 x 4 block schedule. Since 2012 high school accountability has increased in form and function, but before 2012 high schools only needed to focus on eleventh-grade math and English. Now the responsibility is distributed between all grades and contents through EOCT assessments and CCRPI scores. As a result, districts and schools should choose a bell schedule to assist students with their transition to high school, increase student academic success in class and on state standardized assessments, improve 4-year cohort graduation rates, and increase student success at the next level.

Methodology

Georgia high schools utilize several bell schedule configurations; however, the two most common schedules are the traditional seven-period and the 4 x 4 block schedules. This study sought to determine the impact these schedule types have on 9th-grade student achievement. As a high school principal in Georgia, all grades must achieve at high levels due to the state accountability process as measured by their CCRPI score. Each grade has been included in the accountability process. Still, it places most of the responsibility on ninth graders because three of the eight Georgia Milestones End-of-Course assessments are being administered to ninth graders in algebra I, 9th grade literature, and biology (Georgia Department of Education, 2018). The quantitative research for this study examined ninth-grade achievement data of high schools using either a traditional seven-period or a 4 x 4 block schedule. The qualitative portion allowed the researcher to explore the perceptions of principals using one of the two schedules and add clarity to the quantitative results.

A sequential explanatory design for mixed methods research was utilized for this study. During the first phase of the study, the researcher used archived data obtained from the Georgia Department of Education to determine if there is a significant difference between schools using one of the two identified schedules on ninth-grade student achievement using a factorial ANOVA. Currently, in Georgia, there are 384 high schools, of which 154 schools using a 4 X 4 block schedule, 174 schools using a seven-period schedule, and 56 schools using either a hybrid, a six-period, eight period, or an A/B/D block schedule. For this study, alternative schools, online / virtual high schools, and Georgia Network for Educational and Therapeutic Support (GNETS) schools were not included in the population. Once the quantitative results were determined, the qualitative portion of the study examined the principal's perceptions of each group, which attempted to clarify the quantitative results.

Definition of Terms

In order to assist the reader, several operational definitions have been provided.

Alternate Day Schedule. A schedule where students take eight 90-minute classes and attend four classes daily on an "alternating" every other day schedule (The Glossary of Education Reform, 2013).

Carnegie Unit. A unit of credit is awarded for a minimum of 150 clock hours of instruction (Georgia Department of Education, 1998).

College and Career Readiness Performance Index (CCRPI). CCRPI is a comprehensive school improvement, accountability, and communication platform for all educational stakeholders to promote college and career readiness for all Georgia public school students (Georgia Department of Education, 2018).

Core Courses. Courses in the five distinct academic areas of English language arts, mathematics, science, social studies, and world languages (Georgia Department of Education, 1998).

Economically Disadvantaged (ED). Determined by a student's eligibility for the free-and-reduced meal program through school nutrition (Dasher, 2018).

Georgia Milestone's End-of-Course Assessments (EOC). A state-approved comprehensive summative assessment program covering ten high school subjects designated by the State Board of Education: Ninth Grade Literature and Composition, American Literature and Composition, Algebra I or Coordinate Algebra, Geometry or Analytic Geometry, Biology, Physical Science, United States History, and Economics/Business/Free Enterprise (Georgia Department of Education, 2018).

Ninth Grade Carnegie Core Four Credit. Credits earned in mathematics, science, social studies, and language arts (Georgia Department of Education, 2018).

Post-High School Readiness. The level at which students can enroll in a two or four-year program at a technical school, college, or university without remediation (Southern Regional Education Board, 2020).

*Students with Disabilities (SWD). "*A student or youth from 3 through 21 years of age is considered to have a disability under the Individuals with Disabilities Act (IDEA) if the student or youth meets one or more of the categories of eligibility consistent with State Board Rule 160-4-7-.02. Therefore, such students are eligible to receive special education services" (Dasher, 2018).

Traditional schedule. A traditional schedule where students attend seven classes daily for 40 – 55 minutes each day (The Glossary of Education Reform, 2013).

Transitions. A change in grade level and facility or environments. This study will examine the transition between eighth and ninth grade.

4 x 4 Block Schedule. "A schedule in which students take four 90-minute classes every day and finish a course in one semester rather a full school year" (The Glossary of Education Reform, 2013).

4-Year Cohort Graduation Rate. According to Georgia's Department of Education and for a CCRPI rating, a 4-year cohort graduation rate is calculated by dividing the number of students who entered the ninth grade four years before the graduation year (i.e., 2018 graduates who entered ninth grade the 2014-2015 school year) and who graduate with a regular education diploma by the number of students who were first-time ninth graders four years earlier plus transfers, minus legitimate transfers out (i.e., verified withdrawals, homeschoolers, emigrates, or death) (Georgia Department of Education, 2018). Simply put, it is the "percentage of students in the identified cohort earning a regular diploma in four years" (U.S. Department of Education, 2018).

Organization of the Study

In order to assist the reader, this dissertation is organized as follows. Chapter one comprises the conceptual framework, the statement of the problem, the purpose of the study, research questions, significance of the study, a brief explanation of the methodology utilized, and the definition of significant terms used throughout the study. Chapter two presents the literature examining the history of school schedules, theories behind school reform, an explanation of the ninth-grade bulge, issues with high school transitions, and ninth-grade achievement and post-high school readiness. Chapter three will provide a detailed explanation of the research design used to conduct and facilitate

the study, a description of the quantitative and qualitative procedures employed, the instrumentation utilized for the study. Chapter four will be a concise, detailed report of the study's findings. In conclusion, chapter five will provide a straightforward narrative on the findings and implications for further research.

Chapter II

REVIEW OF RELATED LITERATURE

This review examined the literature concerning high school schedules and their impact on student achievement and overall high school performance measures. The first section dissects high school schedules and their origins. The second section investigated the theories behind school reform and high school schedules. The third section examined different high school schedules focusing on 4 x 4 block and a traditional seven-period schedule. The fourth section examined the severe issue of ninth-grade retention and the difficulties of the transition from middle school into ninth grade.

The purpose of this study is to examine the effect a high school schedule can have upon several identified measures of success. It will investigate the following: Ninth Grade Literature EOC scores; Algebra I EOC scores; Biology EOC scores; the school's overall CCRPI score; its four-year cohort graduation rate; and overall school climate rating. In addition, this study attempted to determine if a particular bell schedule is more beneficial for ninth-grade student achievement and how it affects the schools' overall performance. Finally, this chapter will offer a historical perspective of school schedules, the founding theories behind those schedules, and the difficulties middle school students face when transitioning into the ninth grade.

Historical Review of High School Scheduling

The U.S. Department of Education (USDE, 2017) reports that local schools have been around since before the United States gained independence from British control. In

1867, the United States created the Office of Education, now known as the Department of Education (DOE), to assist the states and local communities in establishing effective schools. Since its inception, the DOE has created and established several safeguards to ensure equitable access to opportunities and funding for all students and schools. Before the inception of the DOE, local schools consisted mainly of one-room schools encompassing all ages and grades and usually taught by a young unmarried female. Their primary focuses were reading, writing, arithmetic, and manners (USDE, 2017).

Silva, White, and Toch (2015) provide a short synopsis of school scheduling by denoting how the Carnegie Foundation for the Advancement of Teaching, in 1906, provided a definition for a credit hour of learning and labeled it as a "Carnegie Unit." The Carnegie Unit is defined as 120 contact hours with an instructor, typically broken into one hour a day, five days a week for 24 weeks. High schools throughout the United States use a set number of Carnegie Units/credits as their local graduation requirements. For example, in Georgia (GaDOE, 2010), local school systems must require students to earn a minimum of 23 credits or Carnegie Units: four units in Math, English/Language Arts, and Science, three units of Social Studies, three units of world languages or CTAE (Career, Technical, and Agricultural Education) courses, four elective units, and one unit of health and physical education. However, states vary in the minimum number of Carnegie Units required for students to graduate.

Amy Laitinen (2013) wrote that the Carnegie Unit was not initially created to track, monitor, or determine student learning, but rather to assess faculty workloads for college and university professors seeking to qualify for admission into a free pension system for retirement administered by the Carnegie Foundation. Undoubtedly, it has

morphed into a system to track and monitor student learning from higher education. It eventually became the central unit utilized for course completion and graduation requirements for American high schools. Hackmann (2004) explained how the Carnegie unit came from the scientific management era and a desire to standardize education for "efficiency, mass production, and work uniformity" needed to educate a growing school-age population (p. 699).

Hackmann (2004) indicated that high school schedules were left unchanged until the beginning of the 1950s and the introduction of modular scheduling. Modular scheduling, based on instructional responsiveness and the completion of instructional modules, meant class schedules could evolve around the number of modules necessary to complete the course. The modules required to complete a course could range from 10, 15, or 20 modules. With the variation in requirements for each course came more flexible scheduling, with class times scattered throughout the day or week and class times varying in length to meet the needs of the necessary modules. According to Hackmann (2004), modular scheduling peaked in the early 1970s when approximately 15% of high schools in the United States were utilizing the method. Unfortunately, modular scheduling quickly faded due to the wide variations of class times and schedules, leaving students unsupervised, creating many disciplinary and safety issues.

J. B. Conant (1959) recounts how the 1950s brought about great concern because the United States was falling behind in establishing a rigorous, competitive education system. However, the launch of Sputnik in 1957, followed by another launch soon after, was enough for education and school reform to take a top priority in legislative reform and governmental policy. As a result, in 1958, the National Defense Education Act

(NDEA) was introduced, encouraging educational innovation in math, science, and foreign/world languages with the auspice of being competitive in the new nuclear age of technology (USDE, 2009).

Following the NDEA and the challenge for schools to become more innovative and competitive in education, several reform movements began in the 1960s and 1970s. One significant reform movement targeted school schedules. Led by Dr. J. Lloyd Trump, a University of Illinois professor and Associate Director of the National Association of Secondary School Principals, he advocated for a change in the structure and organization of the school day. He believed schools needed to move away from the traditional scheduling and use various class times to focus more on building relationships and problem-based learning (Queen, 2000). This reform was coined The Trump plan, but it did not survive due to a substantial variance in class times structured around 20, 40, and 60-minute intervals allotted for independent practice, small group, and whole group instruction. However, according to Rikard and Banville (2005), The Trump Plan catalyzed other scheduling alternatives and encouraged several pilot studies to determine how to utilize the best time allocated for educational purposes.

C.C. McKnight (1987) referred to a study conducted by the Association for the Evaluation of Educational Achievement (AEEA) that involved 12 countries and focused on mathematical achievement for students in the twelfth grade. The study assessed six different mathematical topics ranging from number systems to calculus and statistics. McKnight (1987) shared the study results, which listed Hong Kong and Japan first and second place, respectively. From all the advanced industrial countries participating in the study, The United States finished dead last. Growing concern for the education system in

the United States coupled with the study results prompted then-Secretary of Education Terrell H. Bell, under the authority of President Ronald Reagan, to create the National Commission on Excellence in Education (NCEE). One of the first responsibilities of the council was to conduct their study of standardized test scores in America. It was determined that there had been a steady decline since the 1950s (McKnight, 1987).

Using the study results and assessing the growing public concern, the National Commission on Excellence in Education (1983) issued *A Nation at Risk*, which was a report on the status of the American education system. It compared the United States to other high-ranked industrialized nations using 19 academic assessments. Another focus of the study was on time committed to mathematics during the school day. On average, the high-ranked industrialized nations spent three times more class time on mathematics than the United States. These findings were theoretically the most significant reason behind a push for different scheduling options to increase engagement, more time on tasks, and increased opportunities to implement new pedagogical methods (NCEE, 1983).

Joseph Carroll (1989) proposed the Copernican Plan to allow educators to move toward longer instructional blocks to differentiate instruction to meet the needs of their students. Coinciding with Carroll's (1989) proposed plan was a school building instructional reform, which increased block-scheduling options in the 1980s (Williamson, 2009). According to the Smith et al. (1997), the most common class schedules used in American high schools were the traditional 7-period or 4 x 4 block schedules.

Traditional period schedules consist of six to seven classes a day lasting 50–70 minutes, whereas a typical block schedule has only four such periods lasting 90 minutes each. Rettig and Canady (2003a) reiterated American high schools currently utilize the

120-hour standard for course credit and typically provide students the opportunity to earn seven to eight credits per academic school year. The National Commission on Excellence in Education (1983) found American students' typical school calendar consists of 180 days with six hours of instruction per day. In contrast, students in other countries report 220 days per year and receive eight hours of instruction per day. The results were that students in the United States spent considerably less time on instruction in core subjects.

Due to the findings of the report, *A Nation at Risk,* educational reform was initiated with a strong focus on school schedules, more specifically, the benefits and challenges of a traditional 45 to 50-minute class period in comparison to a 90-minute block/period (Stanley, Spradlin, & Plucker, 2007). For example, Trenta and Newman (2002) point out that four courses offered in 90 minutes for 90 days is equal to a traditional seven-period, 50-minute period, for 180 days.

Education reform remained at the forefront into the early 1990s and continued to draw public concern. These reforms encouraged the creation of the national council for a more extended school year bill, also known as the Education Council Act of 1991. Using this bill, Secretary of Education Richard W. Riley created the National Education Commission on Time and Learning (NECTL) and soon after that released a report entitled, *Prisoners of Time*. It was dedicated to investigating academic course structures and school scheduling options to assist academic success for schools and communities (Stanley, Spradlin, & Plucker, 2007). The report stated, "The reform of the last decade is destined to flounder unless it's harnessed to more time for learning" (Education Commission of the States, D. C. O., 2005, p.7). It inspired teachers to expand their thinking and find new methods to restructure the academic day and time spent in classes.

Thanks in large part to both reports commissioned by two different Secretaries of Education, *A Nation at Risk* and *Prisoners of Time*, served as a catalyst and resulted in tremendous changes for our national educational system. They were very influential in encouraging educators across America to take a long, hard look at alternative schedules to the traditional 45 to 50-minute period, such as block scheduling and alternative day schedules, to determine how each type of schedule affected students' academic success (Stanley et al., 2007). Researchers reported, "fifty percent of high schools in the United States were on some type of block or modified schedule" (Dexter, Tai, & Sadler, 2006, p. 23) by 2006.

Theories of Schedule Reform

Two main theories emerge when researching the influences of school schedule reform, especially for high schools. These are described as behaviorism and constructivism (Hackmann, 2004). Hackman (2004) listed behaviorists such as B.F. Skinner, Ivan Pavlov, and John Watson as leaders of the reform for schools to utilize seven to eight periods a day and deliver instruction in small segments. They believed that information presented in small segments with an opportunity to practice and then repeat the process for the next small segment of information. Smaller segments could result in increased retention and higher achievement, which meant behaviorists relied heavily on repetition with the teacher as the source of information (Hackman, 2004).

In contrast to the behaviorist's theory, the constructivist theories, led by Vygotsky and Piaget, encouraged longer blocks of time "based on the premise that individuals must be socially engaged in learning" (Hackmann, 2004, p. 697), with the intent of gaining a deeper understanding of the material. According to Zuckerman, Chudinova, and Khavkin

(1998), Vygotsky believed students develop academically through engagement with consistent and systematic inquiry; in other words, the learners guide their learning through questioning, experimentation, and problem-solving.

Many believe block scheduling is based on the constructivist theory; however, this is not the case. According to Hackmann (2004), the two movements block scheduling and the constructivists' movement "appear to have occurred in parallel, yet independent, movements" (p. 698). Block scheduling is very prevalent in the United States among high schools. However, the faculty and staff cannot verbalize why a 4 x4 block could be superior to a traditional seven-period schedule or what results from block scheduling should produce. Hackmann (2004) claims there is no theoretical basis behind block scheduling and argues that research is insufficient to determine whether or not it is effective in increasing student achievement. Many teachers cannot use the time effectively due to not having a conceptual framework for how extended class periods might increase student achievement and facilitate learning. Hackmann (2004) maintains that the constructivist movement and block schedule reform were independent of one another, but that constructivism should "logically be considered as a vehicle to promote constructivist practices" (p.698).

Airasian and Walsh (1997) believe constructivism is more descriptive than prescriptive, while behaviorism tends to be more prescriptive. Constructivism wants to promote increased comprehension and mastery of the standards instead of low-level rote memorization of facts. Hackmann (2004) elaborates by encouraging teachers to become a "guide on the side" rather than a "sage on a stage." The National Association of Secondary School Principals (Anonymous, 1996) continues the sentiment by inspiring

teachers to become coaches of their content and help facilitate students through the learning process, encouraging them to take ownership of their learning. Unfortunately, the author did not provide strategies to help teachers implement their prescribed concept, nor did the author refer to constructivism as its source of inspiration for the pedagogical suggestion.

Airasian and Walsh (1997) suggest there must be a difference between behaviorist and constructivist instructional practices. In some cases, more teacher-centered instruction is required before allowing the students to explore and attempt student-centered learning activities. Ironically, according to Cunningham and Cordeiro (2003), the standards-based classroom movement was based on the constructivist movement. However, due to a lack of training and understanding of the constructivist approach, teachers reverted to direct instruction to cover the immense number of standards required to teach. Another reason teachers do not engage in constructivist strategies is due to the rigid, controlled segments of a traditional school schedule. Elmore (1995) and Windschitl (1999), among other educational reformists, advocated for increased class times to provide enough time for constructivist-learning strategies, which encourage deeper learning and increase student achievement.

Block vs. Traditional Schedules

"Nothing has as much potential to impact a school's students and their learning as the schedule. It is the schedule that facilitates or inhibits the instructional program, promotes or limits collaboration, and builds community or fosters isolation" (Williamson, 2009, p. 1). Williamson (2009) suggests that a school's schedule reflects the values and beliefs of the teachers and administrators and that a schedule will illustrate where a

school's priorities lie. He argues that the most successful schools use time as a resource and not a management tool. The schedule is built around the needs of the students and community, not a bus or lunch schedule. Schools that view time in such a manner place a high value on teacher autonomy and professionalism, allowing them to make decisions on instructional time.

There is a plethora of schedules utilized by high schools across the nation. The four main types are a traditional six, seven, or eight-period day schedule, the 4 x 4 block schedule, a modified block schedule, or a trimester schedule, otherwise referred to as the Copernican Plan (Ford, 2015). Students sit in a 45 to 55-minute class period with the same teacher for 180 school days in a traditional schedule. For example, for a seven-period, traditional schedule, the student would attend seven classes per day for approximately 50 minutes per class. In addition, four classes are general core content, academic classes, and three are elective courses (see Table 1). Therefore, teachers and students accrue roughly 9000 minutes of seat time during a 180-day school calendar.

Table 1

Example of a student's schedule at a traditional seven-period high school.

Class Period	Course Title
1st	Ninth Grade English Language Arts (ELA)
2nd	Honors Biology
3rd	Weight Training
4th	A.P. Human Geography
5th	Spanish II
6th	Accelerated Geometry
7th	Occupational Safety

In contrast to a traditional seven-period schedule where students meet every day for 180 days, a 4 x 4-block schedule only has four classes each day and meets for approximately 90 minutes per class period. Therefore, students can complete four courses a semester and eight courses per year. In addition, compared to a traditional schedule, which provides approximately 9000 instructional minutes per year, a 4 x 4-block schedule only provides teachers and students with around 8100 minutes of seat time. Generally, a student would attempt two academic courses and two elective courses per semester (see Table 2).

Table 2

Example of a student's schedule at a 4 x 4-block high school.

Class Period	Course Title for 1st semester	Course Title for 2nd Semester
1st	Ninth Grade English Language Arts	Intro to Construction
2nd	Honors Biology	A.P. Human Geography
3rd	Weight Training	Physical Education / Health
4th	Spanish II	Accelerated Geometry

Students in a modified block schedule are very similar to students with a 4 x 4 block schedule. However, instead of attending four classes per semester, they attend all eight classes for the entire year by alternating the days they attend each set of classes. In general, this type of modified block schedule has an "A" day and "B" day schedule, which is where the title of the A/B Block schedule originated. Considering a modified block schedule is just as the title insinuates, a modified block provides the same amount of seat time per year as a 4 x 4 block, but it spreads it out over 180 days through an alternating each day rather than changing schedules between each semester (see Table 3).

Table 3

Example of a student's schedule at a modified A/B block high school

Class Period	"A" Block Course Titles	"B" Block Course Titles
1st	Ninth Grade English Language Arts	Intro to Construction
2nd	Honors Biology	A.P. Human Geography
3rd	Weight Training	Physical Education / Health
4th	Spanish II	Accelerated Geometry

Traditional Scheduling

Kruse and Kruse (1995) maintain that the traditional schedule has been around since the industrial age and uses product-oriented thinking. Teachers have a set number of instructional minutes to cover a pre-determined curriculum. Students go from class to class, teacher to teacher, for six, seven, or eight periods a day for 180 days. If students have sufficiently exhibited mastery of the standards for the class, credit is awarded; this was the standard operating procedure for high schools in the earliest years of education. Cromwell (1997) contends that utilizing a traditional schedule is more beneficial for total seat time. In comparison, a traditional seven-period schedule allows students to engage in 9000 instructional minutes, whereas a block schedule only provides for 8100 instructional minutes.

Cromwell (1997) pointed out that shorter class periods daily would be more advantageous for students with specific learning disabilities, such as Attention Deficit Hyperactivity Disorder (ADHD), where it would be easier to focus for 50 minutes than for a 90-minute class. Cromwell (1997) concludes by identifying a few other areas where a traditional schedule may be more beneficial. First, a traditional schedule would allow students to fine-tune their time management skills, learn how to balance their schedules and prioritize their daily tasks. Second, increased transitions, in some ways, prepare students for life after high school. Lastly, Cromwell (1997) indicates a traditional schedule would help students with attendance issues because students miss less instruction and work with a 50-minute class compared to a 90-minute class. Ford (2015) reiterates how instructional time directly correlates and influences high school graduation rates and student academic success overall. However, the way educators utilize the time

they are allotted is key to their students being successful. In his 2015 study, Ford examined how schools use block scheduling. Traditional schedules differ in achievement levels on five of the Georgia End of Course Exams and the Georgia High School Writing Test. Ford examined two high schools from the same rural county in South Georgia. The results of his study indicate a significant difference in mean scores by school year in two of the twelve subjects in the schools that transitioned from block scheduling to traditional scheduling. These results were helpful for board members to use as reference when making decisions related to instruction and achievement. The results also benefited school leaders in the decision-making process for deciding which schedule would be most beneficial for student achievement.

Lawrence and McPherson (2000) conducted a study to determine if block scheduling impacted academic achievement. Their study focused on two high schools in the same district in the southern part of North Carolina. To compare the two schedules, the researchers used T-tests with a 0.5 level of significance on the group means on each of their four-core academic, state-mandated, end-of-course assessments. Surprisingly, the comparison revealed that students on the traditional schedule scored significantly higher in each academic area. However, these findings were contrary to the researchers' hypothesis based on John Carroll's research in 1996, which determined block scheduling was more effective based on comparing final class averages rather than standardized test results. Both studies focused on the relationship between time and learning, and Lawrence and McPherson used John Carroll's (1983) model to explain the connection.

Degree of learning = Time Spent Learning/ Time Needed to Learn

To explain this model, if a child spends 30 minutes learning 40 new vocabulary words and needs 30 minutes to master the task, 100% learning will occur. On the contrary, if the child spends 60 minutes learning 100 new vocabulary words, but it takes 120 minutes to master the task, 50% of learning will occur.

Block Scheduling

Cunningham and Nogle (1996) reported that when schools convert from a traditional seven-period day schedule to a four-block schedule, several vital elements must consider for the transition to be successful. Five of these elements consists of the following: allowing input from teachers, students, and parents to create a sense of ownership; to provide sufficient staff development for teaching on an extended block; time for schools to plan for the switch; opportunities for all stakeholders to share concerns and successes; and the opportunity/time for evaluation of student and teacher successes. Khazzaka (1997) argues that teachers working in a block schedule have additional time to fully develop concepts and ask good questions to check for understanding. The extra time within the block schedule is critical for struggling students and accelerated students. Struggling students will have more time to digest what is taught, and the accelerated students will have more time to explore advanced content (Khazzaka, 1997).

Cunningham and Nogle (1996) reiterate the value and importance of adequate staff development to create a successful change. A significant reason is that teachers need training on utilizing 90 minutes effectively and still covering all the required material. For example, attempts at converting from a traditional seven-period day to a block schedule are thwarted by teachers not using all 90 minutes of instruction, which causes a

decrease in academic achievement. Another reason is that staff development should be ongoing and not just a one-time encounter, so the development of effective teaching techniques should be identified in short and long-term planning and professional learning.

Lawrence and McPherson (2000) conducted a comparative study between the block and traditional scheduling on North Carolina's end-of-course tests in Algebra I, Biology, English I, and U.S. History. With a .05 level of significance, their findings revealed that students on a traditional schedule scored significantly higher than those on a block schedule. However, Lawrence and McPherson (2000) stated their data might be skewed because the study was conducted the first year of implementation of block scheduling, which is a very demanding year for teachers and students. After all, students and teachers are adjusting to fewer classes for a more extended period of time. For example, teachers had to plan and implement a 90-minute lesson compared to 50-55 minutes.

Carroll (1994) conducted a similar study to Lawrence and McPherson (2000). The major difference was that Carroll utilized final classroom grades rather than standardized test scores on this comparison. Carroll's (1994) study found block schedules more beneficial for students' final classroom grades, which he states relate more closely to class curricula than the standardized tests. Lawrence and McPherson (2000) refer to Carroll's (1994) study to illustrate disagreement within the academic community on which schedule is most beneficial to student achievement. Lawrence and McPherson (2000) indicate that Carrol's findings may be because classroom grades were used instead of standardized tests. Classroom grades are more narrowly associated with class curriculum rather than class schedules.

The Education Commission of the States, D. C. O. (2005, p.7) stated:

> "Learning in America is a prisoner of time. For the past 150 years, American public schools have held time constant and letting learning vary. The rule only rarely voiced is simple: learn what you can in the time we make available. It should surprise no one that bright, hardworking students do reasonably well. Everyone else from the typical student to the dropout – runs into trouble. The degree to which today's American school is controlled by the dynamics of clock and calendar is surprising even to people who understand school operations."

Rettig and Canady (2003b) stated that teachers who advocate for block schedules say that it provides more time to plan and implement extended lessons with multiple instructional strategies to meet the individual needs of their students. Another claim is that the increased time allows for more in-depth learning and provides the student and teacher more confidence in the learning process (Imbimbo & Gilkes, 2009). Teachers also claim that more substantial teacher-student relationships are formed during block scheduling are more robust due to the extended time in class and fewer students to interact with each semester (Santos & Rettig, 1999).

Canady and Rettig (1996) report that the block schedule served as a catalyst for instructional change in high schools across the country and is a significant component for many reform efforts. Hackmann and Schmitt (1997) describe the block schedule as "a needs-driven, research-based approach to the problem of restructuring the time element in

the secondary school paradigm" (p.8). Canady and Rettig (1996) contend block schedules significantly reduce the number of classes taught daily but greatly increase the time in each class. Ford (2015) pointed out how a 4 x 4 block schedule is intended for teachers to transition to different activities every 12-15 minutes providing their learners with multiple opportunities to grasp the concept and allow the teacher time to differentiate the material to meet the needs of all learners.

A comprehensive comparative study using a multiple group comparative design to determine the effectiveness of block scheduling as perceived by teachers and teachers' perceptions of the factors most critical in implementing block scheduling was conducted in 1999 by Wilson and Stokes. The study was divided into two phases. Phase 1 concentrated on examining the effectiveness of block scheduling and the factors critical in implementing and maintaining it as a useful time design. The purpose of Phase 2 was to determine teachers' perceptions of the major advantages of block scheduling and their perceptions of the most significant measurable outcomes on the block schedule. During Phase 2, Wilson and Stokes (1999) found that teachers who changed from a traditional to a block schedule believed the change was positive. In addition, surveys supported teachers' beliefs that they were more creative and effective with block scheduling (Wilson & Stokes, 1999). Wilson and Stokes (1999) continued by citing sources where teachers and students believed the school atmosphere and climate were much more positive on a block schedule rather than a traditional schedule. Wilson and Stokes (1999) concluded by stating that teachers who had been involved with both types of schedules believed block scheduling was more effective than a traditional schedule. They continue by sharing how block schedules allow for more time on task, create a more positive

school climate, and help teachers and students have a more positive feeling toward their school.

Wilson and Stokes (1999) encourage ample planning time, and significant professional learning for teachers is vital when implementing block scheduling. They continued by sharing a few factors they believe are essential to maintaining an effective block schedule. Two factors Wilson and Stokes (1999) emphasized were keeping the planning period sacred and using multiple instructional strategies during the 90-minute instructional block. In addition, Wilson and Stokes (1999) state their research shared one crucial factor; teachers need continuous professional learning to effectively organize a block schedule not to waste instructional time and keep students on task.

Block Scheduling and Student Achievement

Educational reform spanning over thirty years provides no conclusive evidence, and mixed results/findings mainly focused on school schedules (Ford, 2015). Corley (2003) reinforces Ford's findings by stating that student achievement data from block scheduling provides mixed results from researchers. Therefore, the search continues for ways to increase student achievement. Gullatt (2006) asserts from his thorough research literature review that more extended class periods can provide more educational opportunities since they take more courses, allows teachers time to offer and implement a wider variety of instructional strategies, gives students an increased chance to repeat failed courses, and increase opportunities for the teacher to cross interdisciplinary lines by team teaching with teachers in other subjects/content areas.

David Flocco (2012) indicates a significant body of research suggesting block scheduling positively impacts student achievement and provides teachers considerable

time to build the positive relationships necessary for students to increase their depth of knowledge. To support Flocco (2012), McGorry and McGorry (1998) completed a study that provided evidence of students in a block schedule performing significantly higher than their counterparts in a traditional setting. In addition, McGorry and McGorry (1998) used a pilot team of four teachers, one from each content area math, English, social studies, and science, to implement an intensive scheduling model. The intensive scheduling model consisted of a six-day cycle so that students were scheduled for all core subjects for the entire school year. However, Gruber and Onwuegbuzie (2001) refuted their findings. They found data from similar schools inconclusive over a prolonged period, and there was no significant difference in student achievement between the two schedule types (Gruber & Onwuegbuzie, 2001). Therefore, Gruber and Onwuegbuzie (2001) conducted a study to determine the effects of block scheduling on academic achievement between 115 high school students on block scheduling and 146 students on traditional scheduling. In addition, a series of independent t-tests were conducted to compare grade point averages and scores on the Georgia High School Graduation Test.

Even with mixed results, Flocco (2012) continued to research differences between block and traditional schedules. He conducted a study at Montclair Kimberly Academy in New Jersey, which operated with a traditional schedule in 2003 and then moved to a block schedule in 2006. In his research, Flocco (2012) found that parents were concerned their students would not receive the rigor necessary to compete in Advanced Placement (A.P.) courses or perform well on the SAT. To his surprise, students took more A.P. courses and performed better on the SAT once the school transitioned to a block schedule. Flocco (2012) attributes these improvements to the block schedule reducing

stress on the students and providing more time for students to digest the material. Flocco (2012) also found that students missed less class time due to extra-curricular activities with a block schedule. Teachers believed they had more time to go deeper into the material than only providing them with surface learning (Flocco, 2012). Flocco (2012) completed his research using both quantitative and qualitative measures. A 34-question instrument from Mind Garden, Inc. was used for the quantitative measure, and 60 interviews were conducted for the qualitative measure. The study's goal was to compare the stress levels of sophomores and juniors at two independent schools in New Jersey. One school followed a more traditional schedule of seven 50-minute periods, and the other school used a modified block combining one day of 40-minute periods and two days each of 70- and 100- minute periods.

According to Shortt and Thayer (1998), an academic advantage for block schedules is the opportunity it provides struggling students in credit recovery. For example, if a student performs poorly in the fall in a particular course, block scheduling allows the student an opportunity to retake the course in the spring. In comparison, a student in a traditional seven-period schedule would have to suffer the entire school year and attempt to recoup the credit in a very condensed summer school course. Rettig and Canady (2003) reaffirmed this observation and agreed there was a superior advantage for block scheduling over a traditional yearlong schedule based on their research of Virginia's 303 high schools. Of these high schools, 237 have implemented block scheduling since 1985, and 231 continue to use some form of block scheduling.

Ford (2015) cited a study from North Carolina, a state that experienced a rapid transition, where over ten years, they went from six schools on a block schedule in the

early ’90s to over 280 by 2000. According to Ford (2015), the study focused on student achievement between the state assessments on the two different schedules, block, and a traditional seven-period schedule. Results indicated block had a significant advantage in Algebra I, Economics, and Political Science; however, there was no significant difference in U.S. History or Biology.

Robert Decker Smith (2009) conducted another similar study in Mississippi. He examined MSAT scores from nearly 70 schools and perception data from 100 high schools. Both groups were fairly even, with the MSAT schools having 34 block and 35 traditional. While analyzing the perception data, schools were exactly even, with 50 schools having each schedule. Smith (2009) systematically analyzed the MSAT scores and found mixed results; however, schools implementing a block schedule had a significantly higher average mean scores on the MSAT in the areas of Biology, U.S. History, and the multiple-choice section of English II.

Conversely, there were no significant differences in Algebra I or the essay portion of the English II assessment (Smith, 2009). When analyzing overall passing grades, students on a block schedule had a higher percent passing the areas of Algebra I, Biology, and the multiple-choice section of English II. Nonetheless, there was no significant difference in the areas of U.S. History or the essay portion of English II. Therefore, there is no conclusive evidence to support block over a traditional seven-period schedule, while block did render higher, more consistent results. When Smith (2009) evaluated the survey results, he found teachers preferred block to a traditional seven-period schedule. Still, he advised schools looking to make a change to provide considerable support and

professional learning to teachers on managing their class time for the transition to be successful (Smith, 2009).

Advantages of Block Scheduling

Rettig and Canady (1997) proclaim that a block schedule offers many advantages. Their research indicates teachers have increased, uninterrupted instructional time with fewer transitions resulting in fewer openings and closings activities usually needed to review material with a traditional schedule. They share how reducing class changes produces less stress, provides a cleaner school environment due to decreased student traffic, dramatically reduces the number of tardy students, and less overall student disciplinary referrals (Rettig & Canady, 1997). In addition, fewer classes equal fewer students for teachers to maintain records and grades, which equals increased feedback and differentiated instruction. Finally, Rettig and Canady (1997) make a point to share how fewer classes mean students concentrate more on the four classes. If they struggle, they have more opportunities to recoup the credit the following semester rather than attending summer school (Rettig & Canady, 1997). Another significant benefit is that both students and teachers get a fresh start each semester rather than once a year.

When dissecting the advantages of block scheduling, there are several key areas to focus on; academics, behavior/discipline, and school climate. According to Queen (2009), students have increased academic performance while on a block schedule due to focusing only on four classes rather than six or seven. Ford (2015) and Dunham (2009) declared that more extended class periods allow teachers to meet the academic needs of all students by providing the time necessary to incorporate different instructional strategies and allowing teachers' time to utilize various learning activities for students

different learning styles. Wallicia (2011) found that a more significant percentage of Black and Hispanic students performed better within the block model when comparing demographics' passing and advanced passing scores. The study conducted by Wallicia (2011) looked specifically at block and traditional scheduling and achievement as measured by the percentage of students earning a proficient or advanced score in mathematics and reading on the Standards of Learning Test in Virginia's Region IV schools.

Another key advantage, according to school personnel, is the ability to build relationships between students and instructors. Using research from 2006, Ford (2015) found evidence of a strong correlation between the times spent in class, which positively impacts classroom instruction and student achievement. Utilizing a block schedule, teachers have fewer students for a more extended period, allowing time to foster a relationship and have more one-on-one, in-depth instructional time (Dunham, 2009). Kelchner (2003) reported that teachers on block scheduling have more time to plan, lecture less, and have fewer discipline problems, which increases achievement and overall graduation rate. In conjunction, Dunham (2009) states that behavior issues decrease because fewer classes mean fewer transitions, which reduces time spent in the halls and provides fewer opportunities for students to engage in out-of-class disruptions. Reducing the overall number of discipline issues and time spent out of class for disciplinary consequences increases the overall instructional time and improves the school's climate and culture.

In addition to academics, behavior, and school climate, a block schedule has advantages over the traditional schedule is with students' physical well-being. Rickard

and Banville (2005) found that physical education classes had a distinct advantage with longer classes. It allowed the instructors and students time to dress out, warm up/stretch, have instructional time/skill development, and game time. In addition, longer classes in physical education provide more time for increased repetitions and more prolonged physical activity, which correlates to healthier students both physically and mentally.

Dunham (2009) suggested a list of benefits from a block schedule:

- Less classes equals less hallway transitions
- Less time in the hallway equals increased instructional time
- Longer classes equal increased learning activities and deeper learning
- Students and teachers have less classes to prepare for on a daily basis
- Increased planning time for teachers
- Teachers have fewer students, which allows for better relationships
- Fewer students equal more one-on-one instructional time for teachers
- Increased project-based learning

Even with these benefits, reviews are mixed on whether block schedules are more academically advantageous than a traditional seven-period schedule. Bottge, Gugerty Serlin, and Kyoung-Suk (2003) argue that the length of the class is not the issue but rather how the teacher utilizes their given time.

Rettig and Canady (1997) identify several instructional issues related to a block schedule maintaining students' attention for an extended time, providing balance schedules for students, reviewing material previously taught, and student retention. Queen (2009) made an incremental and valuable assessment that if teachers do not receive the proper professional learning on utilizing a 90-minute class session, they will

continue to provide the same instruction, usually lecture, and allow the students to work on homework for the remainder of the time. With proper professional learning, teachers would learn how to utilize the time efficiently with several different learning activities to address different learning styles and allow students a more profound learning experience (Queen, 2009).

Ninth Grade Retention and Transition

Since the early 1990s, there has been a great concern over the number of students who are not successful in transitioning from middle school to high school. Neild (2009) agrees that the consensus is that students that do not make successful transitions into high school are at significant risk for dropping out. According to Wheelock and Miao (2005), the "ninth grade bulge" contributes to the nation's steady decline in the graduation rate. Neild (2009) defines the bulge, or bottleneck, as the term researchers use to describe the percentage increase in students in ninth grade over the number who were enrolled in eighth grade. Many states have as many as a 32 percent increase in enrollment in ninth grade from eighth grade the previous year. The bulge partially exists because more and more students are unsuccessful in meeting requirements, earning the required Carnegie units, to be promoted to tenth grade. Pharris-Ciurej et al. (2012) concluded that less than 50% of students who begin ninth grade graduate four years later. To reduce the bulge, school leaders can take action by making the bulge visible and using data for school improvement (Pharris-Ciurej et al., 2012). Another step school leaders can take by making "improved holding power and graduation rates central to the mission of each district and school and Ninth-grade restructuring in particular" (Wheelock, 2005, pg. 3). Restructuring the ninth grade into smaller communities allows for a lower teacher-student

ratio resulting in stronger relationships that help make school completion an actuality for students.

Wheelock and Miao (2005) claim school officials are not transparent with their actual graduation rates/data and provide their communities with a disservice. According to their research, a ninth grade "bulge" is occurring nationwide. To address the issue, school officials must make it "visible" and then make plans to support their ninth-grade students to transition to the next grade successfully. In addition, decreased graduation rates result in increased costs for each student, their families, and the community (Wheelock & Miao, 2005).

Neild (2009) concluded there is growing evidence that students who are not successful during their freshman year have minimal odds of earning a high school diploma. About one-third of the nation's dropouts were never promoted beyond ninth grade. In 2011, the bulge had grown from a 4% increase in 1982 to a 12% increase in enrollment in 2011 (Pharris-Ciurej et al., 2012). Neild (2009) notes the following four theories can explain this increase in enrollment: results of decreased parental supervision but increased peer influences; students transitioning to a new school where new bonds and relationships must be formed; students being inadequately prepared for high school; and the organization of the high school causing difficulty in the transition.

Neild (2009) contends; the first theory discusses the difficulty of the ninth-grade transition and how it is one of many life-course changes. The transition into ninth grade coincides with physical change, in conjunction with external changes, that occur with a steady decline in parental involvement (Neild, 2009). Parents feel the need to provide more autonomy to their children as they make this transition. Neild (2009) states, as

parents allow more independence to their children, there is an increase in peer influence that results in risk-taking behavior and declining student performance.

The second theory on why the ninth-grade transition is so complex, according to Neild (2009), is the transition to a new school. When a child enters a new school, new bonds and relationships are formed because previous bonds and relationships are broken. As students seek to develop new bonds and relationships, the uncertainty and feeling of isolation may manifest into behavior problems, lack of attendance, and poor course grades.

Neild's (2009) third theory describes inadequate preparation for high school as a primary cause of struggle in the transition into high school. Students that have struggled academically and were inadequately challenged before high school quickly become inundated in the ninth grade. This theory suggests that the academic demands of high school can become overwhelming and discouraging to the student. Students could be taught coping and academic skills to prepare them for the transition better. Coping skills assist the student in responding to the demands of high school in a more positive manner. In contrast, the building of academic skills required of freshman courses can help the student succeed in the challenging coursework.

The final theory (Neild, 2009) of contribution to the transition to ninth grade suggests how a high school is organized. Its climate can influence the difficulty a student may face as they transition into ninth grade (Neild, 2009). For example, school schedules set up in traditional seven periods where students transition hurriedly from teacher to teacher every hour can leave the student feeling alienated and unidentified, resulting in

lower self-confidence and performance. On the other hand, a positive school climate with high student and teacher trust levels creates a smooth transition experience.

Neild (2009) suggests that each theory be addressed with a policy response to prevent a poor transition. For example, if the primary source of difficulty is the student's struggle to adapt to change, schools should provide the freshman group with mentors to support and aid in decision-making. Suppose transition into the new school is the primary source of the difficulty. In that case, schools can offer activities such as a ninth-grade specific introductory day or an engaging summer program before the ninth-grade year and following the ninth-grade year. Neild (2009) states that if students are inadequately prepared for high school, middle school administrators and teachers are needed to create and streamline the expectations to ensure that students are exposed to proper rigor to prepare them for the challenge of high school courses. Schools can also provide special supports for at-risk students targeting the inadequacies of the students. If the organization or climate of the school is the root of the struggle, the school could create a ninth-grade academy or similar smaller learning community for first-year students (Neild, 2009).

Uvaas and McKevitt (2013) believe that high school transitions can be critical for social and academic success throughout high school. The term transition refers to the movement of all students from one school to the next. When interviewed, students expressed three areas of concern regarding transitioning (Akos & Galassi, 2004). The first is centered around academics, including new teachers, higher expectations, increased homework, and more challenging coursework. The second area of concern is procedural. Students must become familiar with the layout of the building and the procedures for moving from class to class. The third and final concern is social and is related to learning

the social expectation of the school, making new friends, and adjusting to new classmates.

Uvaas and McKevitt (2013) generated five recommendations for practitioners to develop transition programming for schools. The first recommendation is for schools to develop a transition program and curriculum. An essential component for the transition program is that it should last a minimum of eight weeks and be school-based. The second recommendation is to promote academic development. To promote academic achievement, teachers should teach academic study skills and strategies in addition to the content. Promoting school connectedness is the third recommendation for developing transition programs and focuses on increased connections between the students and school staff, which decreases the chances of a student dropping out. The fourth recommendation is for schools to examine their structure and take an in-depth look into the number of school transitions students must make within the district. Although it may be overwhelming for districts to restructure schools to minimize transitions, it would benefit students academically and reduce the percentage of students retained in ninth grade. Lastly, Uvaas and McKevitt (2013) suggest that schools identify students experiencing multiple stressors when developing transition programs. To identify these students, schools first collect data to determine which students are most at risk and then devise a plan to provide intensive support to reduce their stressors.

When examining the transition from middle school to high school, it is beneficial to be aware of and review the perceptions of students and parents. According to a study conducted by Akos and Galassi (2004), students approach the transition to high school optimistically yet with concerns. Students are optimistic because they will have more

freedom, choices, and the opportunity to be involved in more activities. However, the concerns for students are rooted in higher expectations from teachers and parents, the fear of being bullied, and preparing for college. Although there is limited research on parent perceptions of the transition into high school, the available research reveals that parents are concerned about the increase in expectations (Akos & Galassi, 2004).

With decreases in graduation rates, schools are looking into what factors contribute to students dropping out and how it can be prevented. Grossman and Cooney (2009) noted several factors that middle school students possess that make the transition into high school more accessible. Students that have substantial academic achievement, attendance, scholastic competence, time-management, planning, problem-solving skills, healthy strategies for coping with problems, accurate expectations about high school, and an effective strategy for achieving a balanced academic and social life are far more likely to experience success as they transition into high school (Grossman & Cooney, 2009). Transitions are inevitable but knowing the traits that contribute to a successful transition can help schools identify students that could potentially be unsuccessful and offer support before their academic decline.

Mizelle (1999) concluded that the middle school environment, transition programs, and parent involvement could positively impact a student's transition into high school. Mizelle's 1995 study found that students had the same teachers for sixth, seventh, and eighth grade and experienced more hands-on, life-related learning activities. In addition, cooperative learning groups were more successful in the transition than their peers that attended a more traditional middle school setting (Mizelle, 1995). Transition programs offered by the school can address the needs of students as well as parents. For

students, the programs can alleviate the stress of unknown expectations, clear up misconceptions instilled by peers and perhaps parents, and provide information on opportunities for the diverse activities the school offers (Mizelle, 1999). Regarding meeting the parent's needs, the transition programs can be led by parents of students in higher grade levels to provide advice on a successful transition. Parents attending a conference with the high school counselor can help them understand how scheduling decisions impact their students' academic future (Mizelle, 1999).

Summary

This literature review highlighted the history and methodologies associated with high schools nationwide, especially the starch differences between a traditional seven-period schedule and a 4 x 4 block schedule. It outlined the challenges and difficulties students face as they transition to high school and our nation's grandiose issue with ninth-grade retention. This study aims to determine which type of schedule structure is most beneficial to high school students, most especially ninth graders. This study adds to the literature on high school schedules by examining the two primary schedule structures used throughout the United States, a traditional seven-period schedule or a 4 x 4-block schedule.

Chapter three will outline how the study will be conducted, from the overall research design, participants, instrumentation used, and how the data will be collected and analyzed. In chapter four, the results will be shared in a systematic, logical order. Finally, chapter five will conclude the study with an interpretation of the findings, any shortcomings of the research process, and ideas for future research.

Chapter III

METHODOLOGY

This chapter contains a description of the methodology used in the study. The first section describes the research design and the rationale behind the design. Section 2 will discuss the population, sample, and sampling procedures. Section 3 will describe the instruments utilized to conduct the study. The fourth section will discuss how the data was collected for both the quantitative and qualitative sections of the study. Finally, the fifth section will describe in detail the quantitative and qualitative data analysis and the statistical considerations and assumptions.

The following research questions guided the study:

Research Questions

1. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) for ninth-grade students on selected performance measures (ninth-grade literature, algebra, biology)?
    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth Grade Literature End-of-Course Assessment (EOC)?

b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra End-of-Course Assessment (EOC)?

c. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Biology End-of-Course Assessment (EOC)?

2. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

    b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the school's four-year cohort graduation rate?

c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the school's school climate rating?

d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by high school's location (urban, rural, or suburban) on the school's overall retention rate?

3. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by the levels of the percentage of students receiving free or reduced lunch on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

    b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's four-year cohort graduation rate?

    c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by the levels of the

percentage of students receiving free or reduced lunch on the school's school climate rating?

d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs. 4x4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall retention rate?

4. In what ways does the interview data reporting the views of the high school principals explain the quantitative results about how their schedule type, location, and percentage of students receiving free or reduced lunch affect their ninth-grade student achievement and overall school performance.

Research Design

A mixed-method research approach called an explanatory sequential design was utilized in this study, and it uses both quantitative and qualitative data. Creswell and Plano Clark (2011) identified two phases for the explanatory sequential design, collection, and analysis of quantitative data to address the research questions, followed by the collection and analysis of qualitative data, which were used in an attempt to explain the quantitative data.

For the quantitative section, the independent variables were the school's schedule, what type of community they serve, and the percentage of students receiving free or reduced lunch. For research question 1 and research question 2, each school was divided into six categories based on schedule type (block or traditional seven periods) and school location (urban, suburban, or rural); 4x4 block urban, 4x4 block suburban, 4x4 block rural, traditional seven periods urban, traditional seven-period suburban, and traditional

seven-period rural schools. For question 3, each school was categorized by their schedule type, and the percentage of students receiving free or reduced lunch was divided into four quartiles. The dependent variables for the quantitative section of the study were the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestone's Ninth Grade Literature, Algebra I, and Biology EOC's, each school's overall CCRPI score, four-year cohort graduation rate, the school climate rating, and the overall percentage of students being retained. Each school's schedule type, location, and free and reduced lunch levels are considered nominal data. Whereas the percentage of students scoring developing, proficient, or distinguished on the Ninth Grade Literature, Algebra I, and Biology EOC's are ratio level data, as well as is the school overall CCRPI score, the school's overall retention rate, four-year cohort graduation rate, and school's climate rating.

For the qualitative portion of the study, purposeful sampling was utilized to select 12 principals. Two principals were chosen from each of the six categories created by schedule type (4 x 4 block or traditional 7-period) and school location (urban, suburban, or rural); 4 x 4 block urban, 4 x 4 block suburban, 4 x 4 block rural, traditional 7-period urban, traditional 7-period suburban, and traditional 7-period rural schools. Proper consent was obtained from each principal and their school district before conducting the semi-structured interviews (See Appendix C & D). Purposeful sampling allowed the researcher to identify and select from a limited group of individuals with the knowledge and experience, the availability and willingness, and the communicative skills necessary to provide insightful and reflective beliefs and opinions (Cresswell & Plano Clark, 2011). Utilizing data from the quantitative portion of the study helped create the proper

interview questions for the principals to explain better the similarities or differences between schedules, student achievement, and school performance. Once questions were developed, a pilot study was conducted with four experienced (at least three years in the position) high school principals from around the area (See Appendix A & B). The researcher had a previously established collegial relationship. A final draft of the interview questions was submitted to the panel for validation based on their feedback and input. Once the interview questions were validated and approved by the professional panel of four experienced high school principals, the semi-structured interview process began.

Participants

Quantitative Component

According to the Georgia Department of Education (GaDOE), there are 476 ninth through twelfth grade high schools in Georgia. There are 384 brick-and-mortar public high schools in Georgia. There are 154 schools using a 4x4 block schedule, 174 schools using a seven-period schedule, and 56 schools using either a hybrid, a six-period, eight period, or an A/B/D block schedule. For the purpose of this study, the population of the two main schedule types was used: 4x4 block (154 schools) and a traditional seven-period schedule (174 schools).

Qualitative Component

Qualitative procedures consisted of a purposeful sample of twelve principals, two principals were purposefully selected from each group of schedule type and location (4x4 block urban, 4x4 block suburban, 4x4 block rural, traditional seven periods urban, traditional seven-period suburban, and traditional seven-period rural schools) and

interviewed using a semi-structured interview approach. Purposeful sampling allowed the researcher to identify and select from a limited group of individuals with the knowledge and experience, the availability and willingness, and the communicative skills necessary to provide insightful and reflective beliefs and opinions (Cresswell & Plano Clark, 2011). Utilizing a semi-structured interview approach consisted of a formal interview setting, a list of questions provided to the interviewee before the interview, and a general script for the interviewer to follow (Cresswell & Plano Clark, 2011). Overall, the interviews helped provide a deeper understanding of the quantitative findings and better explain any similarities or differences between schools with differing schedules and geographical statuses. All proper consent forms and permissions from each school and district were obtained before the interviews.

Instrumentation

Quantitative Component

According to the GaDOE (2018), the Georgia Milestones Assessment System (GMAS) is a comprehensive summative assessment designed and administered to grades three through high school. Each assessment is designed to measure how well students have mastered the knowledge and skills identified in each grade level's content standards. At the high school level, there are 10 GMAS assessments known as End-of-Course (EOC) assessments, with the following assessments in each content area; ninth Grade Literature and Composition, American Literature and Composition, Algebra or Coordinate Algebra, Geometry or Analytic Geometry, Biology, Physical Science, U.S. History, and Economics.

The GaDOE (2018) continued by stating that the GMAS features open-ended (constructed response) items in ELA and mathematics courses, a writing component based on passages and prompts within each grade level assessed. In addition, norm-referenced and criterion-referenced items in each content and grade level, as well as technologically based items that require multiple parts/multiple answers, drag, and drop scenarios, and graphing items (GaDOE, 2018). All of which is done primarily through the online administration, which provides most of the necessary accommodations for students being served by an Individualized Education Program (IEP), 504, or Individual Accommodation Plan (IAP). However, paper copies are provided as backup and for those students that require a hard copy.

Furthermore, the GaDOE (2018) states that the purpose of these assessments is to inform students, parents, and teachers of how well each student mastered the state-adopted standards. Therefore, it serves as a critical key component of Georgia's accountability system, the College and Career Ready Performance Index (CCRPI). End-of-Course assessments are administered at the completion of the course, regardless of the student's grade, and with the high school EOC's serving as 20% of the student's final grade in the course. Local school districts are responsible for selecting their local testing schedule based on the state-designated testing window.

Scores are provided to the students, parents, and schools, and each individual score is categorized into four distinct achievement levels: beginning learners (level I), developing learners (level II), proficient learners (level III), and distinguished learners (level IV). Each category provides insight to all stakeholders on how well the student has mastered the standards. For example, a beginning learner does not yet demonstrate

proficiency in the necessary knowledge and skills and needs substantial academic support to prepare for the next grade level or course. According to the GaDOE, a developing learner demonstrates partial proficiency on the standards assessed but will need additional academic support to become fully proficient. As the name describes, a proficient learner is a learner who demonstrates proficiency on the standards and is prepared for the next grade level or course. Finally, distinguished learners exhibit advanced proficiency or mastery of the standard and are well prepared for the next grade level or course. According to the GaDOE (2018), any level above a level I is considered passing and/or proficient and is enough to be promoted to the next grade level or course.

The GaDOE (2018) uses each student's individual score as an integral part of each school's CCRPI score in three distinct areas: content mastery, progress, and closing the gaps. Content mastery assesses if the students in the school are achieving at the level of proficiency needed to be successful in the next grade level or course. Content mastery scores are based on each individual student's score on their EOC. They are earned in the following manner: zero points for beginning learners, half a point for each developing learner, a whole point for each proficient learner, and one and a half points for each distinguished learner. Progress measures how the students have grown since their last EOG or EOC assessment in a particular content area compared to other students of similar achievement levels across the state using a Student Growth Percentile (SGP). Closing the gaps uses students' achievement scores by comparing subgroups and sets the expectation that all students and subgroups improve their achievement rates.

Validity

The validity, simply stated, is the ability of the assessment to measure what it claims to measure. According to the GaDOE (2018), validity has several key components; it exists in a context, is a matter of degree (to what extent does it measure its intended goal) and is a multi-faceted process over a period of time. Therefore, validity cannot be summed up with one coefficient or number but rather in careful documentation of the development process. The GMAS context is simple; the Georgia State Legislature mandates the GaDOE to assess and measure how well students acquire the skills and knowledge outlined in the content standards.

The assessments must match the content standards it is intended to measure to be valid. As a result, test development began with the state's mandated content standards, and to ensure this; the GaDOE relied heavily on the input of educators from around the state. Educators nominated to participate were divided into committees to review content standards and discuss concepts, knowledge, and skills needing to be assessed. These committees then created a blueprint for their assessment to the GaDOE, who shared it with professional assessment specialists who created the assessments. Once the assessments were written, they were returned to the committees for review to ensure content standard alignment, the suitability of the assessment, and to check for biases. Committee-approved items were then field-tested to ensure each item was clear, appropriate, and not misleading. The committee then placed the items in one of three groups: acceptable, revise for re-field testing, or rejected.

Once the items had been field-tested and deemed acceptable, the assessment was ready for publishing. The next step was administering the assessment, scoring the assessments, and providing scores to all stakeholders (school districts, schools, students,

and parents) annually. GMAS scores are reported in two ways as a scale score and a performance level (beginning learner, developing, proficient, or distinguished learner). The GaDOE ensures the GMAS are valid instruments for the purpose for which the GaDOE developed the tests (GaDOE, 2018). GaDOE judiciously documented each phase of test development and has supporting evidence on file. The GaDOE conducted an independent study to ensure the GMAS was closely aligned to the GaDOE content standards (GaDOE, 2018). The results of the six studies confirmed that the GaDOE engaged in a professional standard for quality and rigor and that the EOC adequately reflected the Georgia state academic content standards and ensured the GMAS's content validity (GaDOE, 2018). The GaDOE will continue this ongoing process of analyzing the assessments and collecting evidence over an extended period of time to ensure content validity (GaDOE, 2018).

Reliability

Reliability is the ability to provide stable, consistent results for a group of test-takers over time. For the GaDOE GMAS, one reliability measure was Cronbach's alpha reliability coefficient established in 1951 and is computed using Crocker and Algina's formula from 1986 (GaDOE, 2018). A reliability coefficient articulates the consistency of test scores by producing a unitless index ranging from 0 to one. The mean, minimum, and maximum values across all forms and administrations for the GMAS were provided and organized by subject areas, and these range from 0.88 to 0.94 for the 2018-2019 Georgia Milestones assessment, which suggests the assessments are sufficiently reliable for their intended purpose (GaDOE, 2018).

Qualitative Component

According to Creswell & Plano Clark (2011), more focus is placed on validity than reliability for qualitative research to ensure the study's account and the participants are accurate, trustworthy, and credible. Validity and reliability ensure transparency of the process and reduce the researcher's opportunities to insert their biases into the study. Therefore, it is imperative to document the procedure for each step of the process to maintain the study's dependability. Research question 4 was developed to gain insight from the expertise and experiences of seasoned principals as to "how" they believe a specific schedule can affect student achievement and overall school performance. It was worded in such a way as to be impartial for either schedule. Based on research question 4, interview questions were composed, and before conducting the research, several education experts were asked to provide feedback on the interview questions.

A semi-structured interview approach allowed the participants to understand the topic and information being studied to ensure the interview process was trustworthy. Each principal was provided with the questions before the interview, and the interviewer used a script to ensure consistency with each interview. Each interview question was open-ended, neutral, clear, and concise. Bias can threaten the credibility of qualitative findings (Creswell, 2009). Therefore, the interviewer was transparent with each interviewee and shared that he is a principal in a rural high school utilizing a traditional 7-period schedule. To avoid bias, the interviewer remained neutral by following the script, reading the same questions, recording responses, and not inserting their own opinions during the interview. Each interview was recorded and transcribed to create a manuscript of the interview process. After the interview process and once the manuscripts were compiled, each participant had the opportunity to review the document

to ensure accuracy and thoroughly explain the findings. An intercoder agreement was utilized to guarantee credibility, interview transcripts were checked thoroughly for mistakes and cross-examined for overarching themes.

Data Collection

Quantitative Component

Data collection began upon receiving approval from the Valdosta State University Institutional Review Board (IRB) (See Appendix E). There were no potential ethical concerns predicted since the treatment groups had already been established, and all the quantitative data was considered public knowledge. All the quantitative data needing to be gathered was archived from the GaDOE and was available on the GaDOE website or the Governor's Office of Student Achievement (GOSA) websites. GMAS scores were collected, and the scores are released on an annual basis on the GaDOE website. From the GaDOE website, the researcher collected the 9th Grade Literature, Algebra I, Biology EOC scores, overall CCRPI, four-year cohort graduation rates, school climate ratings, and the overall percentage of students being retained. For geographical data (rural, suburban, urban), the researcher used the National Center for Educational Statistics (NCES). Schools are held accountable for ensuring the data the GaDOE has is accurate, and they must sign off on the data after each school term. If schools sign off on inaccurate data, it could affect their accountability status. All data for this study was collected from the 2018-2019 school year, the most recent data available.

Qualitative Component

Once the quantitative data was gathered and analyzed, the qualitative data was collected from the principals agreeing to participate and be interviewed for the study. The

questions were composed to be impartial but to assist in explaining and interpreting the quantitative results. Each participant was provided with the questions before the interview to allow them to research and formulate an educated response. All interviews were recorded and transcribed to create a manuscript of the interview process and responses. Once the manuscript was compiled, the participants were allowed to review it for accuracy. All documents will be confidential, appropriately secured, and stored securely to protect all confidential information at the conclusion of the study.

Data Analysis

Quantitative Component

A 2x3 factorial ANOVA was conducted for research question 1 and research question 2, and a 2x4 factorial ANOVA was conducted for research question 3. In addition, descriptive statistics were provided for each of the main groups; schedule type (4x4 block and traditional 7-period), school location (rural, suburban, and urban), and percentage of students receiving free or reduced lunch (grouped by quartiles) and each combination of groups. Descriptive statistics included, but not be limited to, sample size (*N*), mean (*M*), standard deviation (*S.D.*), minimum and maximum values, range, Skewness, Kurtosis, and standard error (S.E.).

The results from the ANOVA were reported for each main effect and interaction, including the degrees of freedom, the degrees of freedom for error, the *F* value, and the *p-value*. A 95% confidence level was utilized; therefore, if the interaction is significant at $p < .05$, the effect was visually inspected using profile plots to determine if the interactions are ordinal (lines do not cross) or disordinal (lines cross) and if it is a fixed or

random effect. Effect size were reported using omega squared (ω^2) utilizing the following scale of small ($\omega^2 \leq 0.06$), medium ($\omega^2 \leq 0.14$), or large ($\omega^2 > 0.14$).

The Tukey's "Honestly Significant Difference" (HSD) post hoc test was run on all groups (main and interaction) the ANOVA found to be significant. Tukey's HSD will use the mean differences within (MS_w), the sample size for each group (n_k), and the q value from the studentized range q table. In order to find the q value, the table requires the degrees of freedom (df) within groups and the number of groups found in the ANOVA F table. Once these three items were found, they were used to calculate the HSD, which compared each group's means. If the difference between the groups means is greater than the HSD, it is considered honestly significantly different. Results of Tukey's HSD with an alpha of $\alpha = .05$ were reported and include the mean (M), standard deviation ($S.D.$), and p value. In addition, the graphic output of an interaction plot was visually inspected to explore mean differences, and omega squared (ω^2) was reported for effect size.

Statistical considerations and assumptions were evaluated for each main group and combination (interaction) of groups. Data were checked for missing data, and outliers were evaluated by examining z-scores and box plots. The dependent variables must be measured at the continuous level (interval or ratio variables) and have independence of observation. Independent variables should be categorical data. Normality was assessed using Q-Q Plots, Shapiro-Wilks, and/or Jarque Bera tests. Homogeneity of variance (HOV) was assessed using Levene's and Hartley's F Max tests (See Appendix F).

Qualitative Component

Research question 4 utilized interview data from high school principals to explain the quantitative results comparing schedule type and school location with ninth-grade

student achievement (9th Grade Literature, Algebra I, and Biology EOC) data and overall school performance measures (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate). Twelve principals, two from each group of schedule type and location (4x4 block urban, 4x4 block suburban, 4x4 block rural, traditional seven periods urban, traditional seven-period suburban, and traditional seven-period rural schools) were interviewed in a semi-structured interview process. The expectations of the information gleaned from the interviews provided support for or refuted the quantitative findings. Each interview consisted of seven uniform questions piloted and field-tested with a control group of five principals from Coastal Plains Regional Educational Support Agency (RESA). Once the pilot had been conducted, the principal's feedback was used to edit and finalize the interview questions. After the pilot group had approved the final revisions to the questions, the official interviews were conducted with the twelve random principals from around the state. Each interview was audio-recorded, transcribed, and included in a manuscript. The transcribed interviews were sent back to the participating principals for clarification and validation. In addition, an analysis of continual reflection about the data helped organize the data into categories and find similar themes. An inter-coding agreement was developed to ensure themes were uniform and consistent.

Summary

This chapter outlined the research questions, research design, participants, instrumentation, data collection, and data analysis for the study's quantitative and qualitative portions. All four research questions center around school schedules and how they affect 9th-grade student achievement and overall school performance. A sequential explanatory design is a mixed-methods approach designed to utilize quantitative and

qualitative data to provide a more in-depth understanding of how high school schedules and school location affect ninth-grade student achievement and/or overall school performance. Participants for this study consisted of students enrolled in 9^{th}-12^{th} grade brick-and-mortar high schools in Georgia utilizing a 4 x 4 block schedule or a traditional 7-period schedule. This study used the GaDOE EOC assessments to analyze the schools on 9th Grade Literature, Algebra I, and Biology results, which should provide the data necessary to assess which schedule and school location, if any, is most beneficial for ninth-grade student success. For overall school performance, an investigation into each school's CCRPI, four-year cohort graduation rate, and school climate score helped determine which schedule and location are most beneficial for overall school performance. A factorial ANOVA was used to make the comparisons in the study. For the qualitative section, principals from around the state were interviewed and asked to share their opinions on the data and explain any similarities or differences found in the study.

Chapter IV

Results

There were two purposes in this mixed method study. The primary purpose was to determine if there was a significant difference in ninth-grade student achievement and overall school performance measures between high schools utilizing a traditional 7-period schedule compared to schools utilizing a 4 X 4 block. The secondary purpose was to provide high school principals the opportunity to explain in their own words the similarities and differences to determine if one schedule type is superior to the other for ninth-grade student success and overall school performance.

The following questions were answered in this study:

1. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) for ninth grade students on selected performance measures (ninth grade literature, algebra, biology)?
    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth grade students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth Grade Literature End-of-Course Assessment (EOC)?
    b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's

location (urban, rural, or suburban) on the percentage of ninth grade students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra End-of-Course Assessment (EOC)?

c. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth grade students scoring developing, proficient, or distinguished on the Georgia Milestones Biology End-of-Course Assessment (EOC)?

2. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

   a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

   b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's four-year cohort graduation rate?

   c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's school climate rating?

d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's overall retention rate?

3. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?
    a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?
    b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's four-year cohort graduation rate?
    c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's school climate rating?
    d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the

percentage of students receiving free or reduced lunch on the school's overall retention rate?

4. In what ways does the interview data reporting the views of the high school principals explain the quantitative results about how their schedule type, location, and percentage of students receiving free or reduced lunch affect their ninth-grade student achievement and overall school performance.

This chapter presents findings of this study. The first section of this chapter will explain the demographic characteristics of the schools in each group. The second and third section will report the results of the 2x3 factorial ANOVA for Questions 1 and 2. The fourth section will report the results for the 2x4 factorial ANOVA for Question 3. The quantitative findings will be followed by the responses from the principals in the qualitative portion. Interview questions were developed based on the quantitative findings, and the final section will outline the data gathered from the responses in the principal interviews.

Quantitative Results

According to the Georgia Department of Education (GaDOE) there are 476 ninth through twelfth grade high schools in the state of Georgia. There are 384 brick and mortar public high schools in Georgia, of which, there are 154 schools using a 4 X 4 block schedule, 174 schools using a seven-period schedule, and 56 schools using either a hybrid, a six period, eight period, or an A/B/D block schedule. For the purpose of this study only the two main schedule types were utilized: 4 X 4 block (154 schools) and a traditional seven-period schedule (174 schools).

For Research Question 1 and 2 the researcher used scores from the Georgia Milestone's End-of Course assessments, component scores from the College Career Readiness Index (CCRPI), and the schools overall CCRPI score. However, not all schools receive scores for each of the Georgia Milestone EOC's. It is based on student participation and subgroup sizes, therefore, the sample size for each subquestion for Research Question 1 will vary slightly (see Table 1). Secondly, schools in their first year of operation do not receive a score for certain components of the CCRPI index or an overall score. Therefore, there was one school in the study, a 7-period suburban school, which did not have a four-year cohort graduation rate or overall CCRPI score (see Table 1).

The second factor of Research Questions 1 and 2 was based on the school's location or setting. To determine the setting or location (rural, suburban, or urban) of the 328 schools in used in the study the researcher used the National Center for Educational Statistics (NCES) and according the NCES there are 156 rural, 120 suburban, and 52 urban schools (see Table 4).

Table 4

Sample Size of Schools for Research Questions 1 and 2

Research Question	7-period	4 X 4 block	Rural	Suburban	Urban
	n	*n*	*n*	*n*	*n*
RQ1a – 9th Grade Literature EOC	174	154	156	120	52
RQ1b – Algebra I EOC	149	126	138	92	45
RQ1c – Biology EOC	154	132	121	116	49
RQ2a – CCRPI Scores	174	154	156	120	52
RQ2b – 4-year Cohort Grad Rate	173	154	156	119	52
RQ2c – School Climate Rating	174	154	156	120	52
RQ2d – Retention Rate	174	154	156	120	52

Note. Sample size for each subquestion was based on participation.

For Research Question 3 it was necessary to analyze the percentage of students receiving Free or Reduced lunch for the 328 schools being used in the study and they were divided into four quartiles based on their percentages. Quartile 1 consist of the schools where 0 to 38.79% of their student population qualifies for free or reduced lunch, Quartile 2 ranges from 38.78 to 59.41%, Quartile 3 ranges from 59.42 to 90.64%, and Quartile 4 is from 90.65 to 100% of their student population (see Table 5).

Table 5

Sample Size of Schools for Research Questions 3

Research Question	7-period	4 X 4 block	Q[a]1	Q2	Q3	Q4
	n	*n*	*n*	*n*	*n*	*n*
RQ3a – CCRPI Scores	173	154	79	84	80	84
RQ3b – 4-year Cohort Grad Rate	173	154	79	84	80	84
RQ3c – School Climate Rating	173	154	79	84	80	84
RQ3d – Retention Rate	173	154	79	84	80	84

Note. [a] Quartiles for Students Receiving Free or Reduced Lunch

Results by Question

1a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth Grade Literature End-of-Course Assessment (EOC)?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth-Grade Literature EOC. Descriptive statistics were computed on the two variables and the overall mean for the

328 ninth through twelfth grade high schools in Georgia with ninth graders being assessed on the Georgia Milestones Ninth-Grade Literature EOC and scoring developing, proficient, or distinguished was *M* = 85.88 percent (*SD* = 9.06). Schools utilizing a traditional seven-period schedule (n = 174) had a range from 56.3% to 100% with an average mean of 85.54 (*SD* = 9.45). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 65.2% to 100% with an average mean of 86.26 (*SD* = 8.61). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 67.7% to 100% with an average mean of 86.62 (*SD* = 7.43). High schools located in a suburban area of Georgia (n = 120) had a range from 67% to 100% with an average mean of 87.15 (*SD* = 8.62). High schools located in an urban area of Georgia (n = 52) had a range from 56.3% to 100% with an average mean of 80.72 (*SD* = 12.35) (see Table 6).

Table 6

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Ninth-Grade Literature EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	85.54	9.45	56.3	100.0	-0.64	-0.09
4 X 4 block	154	86.26	8.61	65.2	100.0	-0.51	-0.47
Rural	156	86.62	7.43	67.7	100.0	-0.40	-0.28
Suburban	120	87.15	8.62	67.0	100.0	-0.38	-0.90
Urban	52	80.72	12.35	56.3	100.0	-0.19	-1.12

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth-Grade Literature EOC. Schools utilizing a traditional seven-period schedule in a

rural area (n = 82) had a range from 68.33% to 100% with an average mean of 86.61 (*SD* = 7.41). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 71.4% to 100% with an average mean of 87.83 (*SD* = 8.12). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 56.3% to 100% with an average mean of 78.21 (*SD* = 12.88). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 67.7% to 98.1% with an average mean of 86.62 (*SD* = 7.51). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 67% to 100% with an average mean of 86.45 (*SD* = 9.13). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 65.2% to 100% with an average mean of 84.44 (*SD* = 10.75) (see Table 7).

Table 7

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Ninth-Grade Literature EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	86.61	7.41	68.33	100.0	-0.24	-0.43
7 periods: suburban	61	87.83	8.12	71.40	100.0	-0.34	-1.08
7 periods: urban	31	78.21	12.88	56.30	100.0	0.06	-1.19
4 X 4 Block: rural	74	86.62	7.51	67.7	98.1	-0.56	-0.19
4 X 4 Block: suburban	59	86.45	9.13	67.0	100.0	-0.36	-0.94
4 X 4 Block: urban	21	84.44	10.75	65.2	100.0	-0.43	-1.06

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth-Grade Literature EOC. Statistical considerations and assumptions were checked before running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and nine schools

were identified as outliers. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data sets had a normal distribution. Both skewness and kurtosis results indicated a slight negative skewness, and the kurtosis had a platykurtic distribution (see Table 2). A Shapiro-Wilk test conducted to check the normality and within some of the interaction groups there was evidence that the assumption of normality had been violated with statistically significant results: seven-period and suburban schools ($W(61) = .95$, $p = .01$), 4 X 4 block and rural schools ($W(74) = .96$, $p = .02$), and 4 X 4 block and suburban schools ($W(59) = .93$, $p = .03$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 5.48$, $p < .01$), meaning the assumption of equal variances was not met. The Georgia Milestones 9th Grade Literature EOC scores met the assumption of an independent observation. The Georgia Milestone's 9th Grade Literature EOC scores were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized due to the assumption of normality being violated with negatively skewed, platykurtic kurtosis distribution, and statistically significant results from the Shapiro-Wilkes and Levene's test. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean for the 328 ninth through twelfth grade high schools in Georgia with ninth graders being assessed on the Georgia Milestones Ninth-Grade Literature EOC and scoring developing, proficient, or distinguished was $M = 656848.63$ percent ($SD = 204812.85$). Schools utilizing a traditional seven-period schedule (n = 174) had a range from 163057.8 to 1032602 with an average mean of 650811.52 ($SD = 210816.91$). Schools utilizing a 4 X 4 block

schedule (n = 154) had a range from 260929 to 1032602 with an average mean of 663669.78 (*SD* = 198273.85). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 294404.6 to 1032602 with an average mean of 666791.11 (*SD* = 175567.1). High schools located in a suburban area of Georgia (n = 120) had a range from 284748.3 to 1032602 with an average mean of 685759.56 (*SD* = 205440.3). High schools located in an urban area of Georgia (n = 52) had a range from 163057.8 to 1032602 with an average mean of 560303.7 (*SD* = 255009.1) (see Table 8).

Table 8

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Ninth-Grade Literature EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	650811.5	210816.9	163057.9	1032602	-0.08	-0.75
4 X 4 block	154	663669.8	198273.9	260929.0	1032602	-0.09	-0.84
Rural	156	666791.1	175567.1	294404.6	1032602	0.03	-0.67
Suburban	120	685759.6	205440.3	284748.3	1032602	-0.07	-1.14
Urban	52	560303.7	255009.1	163057.8	1032602	0.25	-1.08

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Ninth-Grade Literature EOC. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 303287.2 to 1032602 with an average mean of 666632.2 (*SD* = 177672.2). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 349244 to 1032602 with an average mean of 700004.8 (*SD* = 197515.3). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 163057.8 to

1032602 with an average mean of 512163.8 (*SD* = 259936.8). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 294404.6 to 970680.1 with an average mean of 666967.3 (*SD* = 174416.0). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 284748.3 to 1032602 with an average mean of 671031.5 (*SD* = 214016). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 260929 to 1032602 with an average mean of 631367.2 (*SD* = 235754.8) (see Table 9).

Table 9

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Ninth-Grade Literature EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	666632.2	177672.2	303287.2	1032602	0.18	-0.66
7 periods: suburban	61	700004.8	197515.3	349244.0	1032602	-0.09	-1.25
7 periods: urban	31	512163.8	259936.8	163057.8	1032602	0.52	-0.90
4 X 4 Block: rural	74	666967.3	174416.0	294404.6	1032602	-0.14	-0.74
4 X 4 Block: suburban	59	671031.5	214016.0	284748.3	1032602	-0.03	-1.14
4 X 4 Block: urban	21	631367.2	235754.8	260929	1032602	-0.05	-1.14

Note. [a]Minimum Value; [b]Maximum Value

Statistical considerations and assumptions were checked before computing a factorial analysis of variance (ANOVA). There was no missing data for this question. The data were converted to z-scores to examine outliers and after the transformation, there were no identified outliers. Skewness was slightly negatively distributed, and kurtosis was found to have a platykurtic distribution (see Table 4). The Shapiro-Wilk test indicated non-normality ($W(328) = 0.99$, $p < .01$), as well as the Jarque Bera Test (JB(2, n = 328, 6.61, p < .05), meaning the assumption of normality was violated. Furthermore, the assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 2.86$, $p = .015$), meaning the assumption of equal

variances was not met. The Georgia Milestones 9th Grade Literature EOC scores met the assumption of an independent observation. The Georgia Milestone's 9th Grade Literature EOC scores were on the interval level of measurement.

Considering the original and transformed data did not meet the statistical assumptions it was determined to use the Aligned Rank Transform (ARTools) for Nonparametric Factorial AVOVA. The results of the ARTools factorial ANOVA found there was no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), F (2, 322) = 2.43, p = .09, η^2 = .02. For the main effect on high school schedules on the mean scores on the Georgia Milestones 9th Grade Literature EOC there was no statistical significance, F (1, 322) = 0.61, p = .43, η^2 < .001. However, there was a significant main effect on a high school's location on the mean scores on the Georgia Milestones 9th Grade Literature EOC, F (2, 322) = 5.81, p < .0013, η^2 = .04.

Post hoc comparisons were conducted using the Tukey HSD of the main effects based on school locations. There was a significant difference on 9th Grade Literature EOC scores between high schools located in rural Georgia (M = 666791, SD = 175567) and those in a urban area (M = 560304, SD 255009); t(322) = 2.90, p = .01. There was a significant difference between high schools located in suburban parts of Georgia (M = 685760, SD = 205440) urban areas of Georgia (M = 560304, SD 255009); t(322) = 3.34, p < .0012. However, it indicated there was no significant difference between schools in rural Georgia (M = 666791, SD = 175567) and those in a suburban part of Georgia (M = 685760, SD = 205440); t(322) = -0.75, p = .73.

1b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth-grade students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra End-of-Course Assessment (EOC)?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra EOC. Descriptive statistics were computed on the two variables and the overall mean for the 275 ninth through twelfth grade high schools in Georgia with ninth graders being assessed on the Georgia Milestones Algebra EOC and scoring developing, proficient, or distinguished was M = 70.87 percent (SD = 17.86). Schools utilizing a traditional seven-period schedule (n = 149) had a range from 21.6% to 98.4% with an average mean of 67.46 (SD = 18.93). Schools utilizing a 4 X 4 block schedule (n = 126) had a range from 34.8% to 100% with an average mean of 74.91 (SD = 15.64). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 138) had a range from 40.4% to 99.9% with an average mean of 73.32 (SD = 14.3). High schools located in a suburban area of Georgia (n = 92) had a range from 28.5% to 100% with an average mean of 73.32 (SD = 17.5). High schools located in an urban area of Georgia (n = 45) had a range from 21.6% to 99.1% with an average mean of 58.35 (SD = 22.92) (see Table 10).

Table 10

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Algebra EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	149	67.46	18.93	21.6	98.4	-0.45	-0.61
4 X 4 block	126	74.91	15.64	34.8	100.0	-0.61	-0.46
Rural	138	73.32	14.30	40.4	99.9	-0.26	-0.62
Suburban	92	73.32	17.50	28.5	100.0	-0.58	-0.82
Urban	45	58.35	22.92	21.6	99.1	0.02	-1.37

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra EOC. Schools utilizing a traditional seven-period schedule in a rural area (n = 71) had a range from 48.6% to 98.4% with an average mean of 71.63 (*SD* = 13.8). Schools utilizing a traditional seven-period schedule in a suburban area (n = 51) had a range from 28.5% to 97.9% with an average mean of 70.76 (*SD* = 18.36). Schools utilizing a traditional seven-period schedule in an urban area (n = 27) had a range from 21.6% to 94.1% with an average mean of 50.25 (*SD* = 22.43). Schools utilizing a 4 X 4 block schedule in a rural area (n = 67) had a range from 40.4% to 99.9% with an average mean of 75.11 (*SD* = 14.71). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 41) had a range from 44.3 to 100% with an average mean of 76.5 (*SD* = 16.02). Schools utilizing a 4 X 4 block schedule in an urban area (n = 18) had a range from 34.8% to 99.1% with an average mean of 70.51 (*SD* = 18.14) (see Table 11).

Table 11

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Algebra EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	71	71.63	13.80	48.6	98.4	-0.02	-0.77
7 periods: suburban	51	70.76	18.36	28.5	97.9	-0.43	-1.00
7 periods: urban	27	50.25	22.43	21.6	94.1	0.51	-1.12
4 X 4 Block: rural	67	75.11	14.71	40.4	99.9	-0.51	-0.37
4 X 4 Block: suburban	41	76.50	16.02	44.3	100.0	-0.71	-0.74
4 X 4 Block: urban	18	70.51	18.14	34.8	99.1	-0.43	-0.93

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra EOC. Statistical considerations and assumptions were checked before running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data sets had a normal distribution. Kurtosis results indicated the data had a platykurtic distribution (see Table 6). A Shapiro-Wilk test conducted to check the normality and within some of the interaction groups there was evidence that the assumption of normality had been violated with statistically significant results : seven-period and rural schools ($W(71) = .96$, $p = .03$), seven-period and suburban schools ($W(51) = .94$, $p = .02$), seven-period and urban schools ($W(27) = .92$, $p = .03$), 4 X 4 block and rural schools ($W(67) = .96$, $p = .05$), 4 X 4 block and suburban schools ($W(41) = .90$, $p < .01$), and 4 X 4 block and urban schools ($W(18) = .96$, $p = .57$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of

variance ($F(5,269) = 2.81$, $p = .02$), meaning the assumption of equal variances was not met. The Georgia Milestones Algebra I EOC scores met the assumption of an independent observation. The Georgia Milestone's Algebra I EOC scores were on the interval level of measurement.

Due to the assumption of normality being violated with platykurtic kurtosis distribution and statistically significant results from the Shapiro-Wilkes test. Coupled with the assumption of homogeneity of variance violated as assessed by the Levene's Test. It was necessary to utilize the Yeo-Johnson Power Transformation. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean for the 275 ninth through twelfth grade high schools in Georgia with ninth graders being assessed on the Georgia Milestones Algebra EOC and scoring developing, proficient, or distinguished was M = 1423.57 percent (SD = 582.54). Schools utilizing a traditional seven-period schedule (n = 149) had a range from 163.3 to 2459.8 with an average mean of 1315.65 (SD = 598.84). Schools utilizing a 4 X 4 block schedule (n = 126) had a range from 379.49 to 2532.72 with an average mean of 1550.36 (SD = 537.76). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 138) had a range from 495.21 to 2528.13 with an average mean of 1485.38 (SD = 499.4). High schools located in a suburban area of Georgia (n = 92) had a range from 266.19 to 2532.72 with an average mean of 1505.67 (SD = 587.78). High schools located in an urban area of Georgia (n = 45) had a range from 163.3 to 2491.58 with an average mean of 1063.86 (SD = 681.03) (see Table 12).

Table 12

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Algebra EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	149	1315.65	598.84	163.30	2459.80	-0.03	-0.94
4 X 4 block	126	1550.36	537.76	379.49	2532.72	-0.29	-0.80
Rural	138	1485.38	499.40	495.21	2528.13	0.06	-0.76
Suburban	92	1505.67	587.78	266.19	2532.72	-0.32	-1.11
Urban	45	1063.86	681.03	163.3	2491.58	0.34	-1.21

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Algebra EOC. Schools utilizing a traditional seven-period schedule in a rural area (n = 71) had a range from 689.4 to 2459.8 with an average mean of 1422.71 (*SD* = 481.82). Schools utilizing a traditional seven-period schedule in a suburban area (n = 51) had a range from 266.19 to 2437.21 with an average mean of 1421.82 (*SD* = 606.31). Schools utilizing a traditional seven-period schedule in an urban area (n = 27) had a range from 163.3 to 2268.63 with an average mean of 833.58 (*SD* = 643.91). Schools utilizing a 4 X 4 block schedule in a rural area (n = 67) had a range from 495.21 to 2528.13 with an average mean of 1551.79 (*SD* = 512.61). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 41) had a range from 583.95 to 2532.72 with an average mean of 1609.97 (*SD* = 553.49). Schools utilizing a 4 X 4 block schedule in an urban area (n = 18) had a range from 379.49 to 2491.58 with an average mean of 1409.28 (*SD* = 596.43) (see Table 13).

Table 13

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Algebra EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	71	1422.71	481.82	689.40	2459.80	0.28	-0.68
7 periods: suburban	51	1421.82	606.31	266.19	2437.21	-0.15	-1.24
7 periods: urban	27	833.58	643.91	163.30	2268.63	0.84	-0.65
4 X 4 Block: rural	67	1551.79	512.61	495.21	2528.13	-0.17	-0.74
4 X 4 Block: suburban	41	1609.97	553.49	583.95	2532.72	-0.49	-0.94
4 X 4 Block: urban	18	1409.28	596.43	379.49	2491.58	-0.10	-1.06

Note. [a]Minimum Value; [b]Maximum Value

Statistical considerations and assumptions were checked before computing a factorial analysis of variance (ANOVA). There was no missing data for this question. The data were converted to z-scores to examine outliers and after the transformation, there were no outliers identified. Kurtosis was found to have a platykurtic distribution (see Table 8). The results of the Robust Jarque Bera Test provided evidence of normality between the interaction groups: seven-period and rural schools ($JB(2, n = 71) = 1.38, p = .50$), seven-period and suburban schools ($JB(2, n = 51) = 2.38, p = .31$), seven-period and urban schools ($JB(2, n = 27) = 3.80, p = .15$), 4 X 4 block and rural schools ($JB(2, n = 67) = 1.17, p = .56$), 4 X 4 block and suburban schools ($JB(2, n = 41) = 2.23, p = .33$), and 4 X 4 block and urban schools ($JB(2, n = 18) = 0.27, p = .88$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,269) = 1.25, p = .29$), meaning the assumption of equal variances was met. The Georgia Milestones Algebra I EOC scores met the assumption of an independent observation. The Georgia Milestone's Algebra I EOC scores were on the interval level of measurement.

The results of the factorial ANOVA found there was no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and

the school's location (rural, suburban, or urban), F (2, 269) = 2.78, p = .06, η^2 = .02. However, a significant main effect on high school schedules on the mean scores on the Georgia Milestones Algebra EOC, F (1, 269) = 12.481, p < .001, η^2 = .04. As well as a significant main effect on a high school's location on the mean scores on the Georgia Milestones Algebra EOC, F (2, 269) = 10.774, p < .001., η^2 = .07.

Post hoc comparisons were calculated using the Tukey HSD for each of the main effects. There was a significant difference on the Algebra I EOC between high schools using a 4 X 4 block schedule (M = 1550, SD = 538) and high schools using traditional seven-period schedule (M = 1316, SD = 599), t(269) = 3.997, p < .001. There was a significant difference on the Algebra I EOC between high schools located in rural Georgia (M = 1485, SD = 499) and high schools located in urban areas (M = 1064, SD = 681); t(269) = 3.822, p < .001. There was a significant difference between high schools located in the suburban parts of Georgia (M = 1506, SD = 588) and high schools located in urban areas (M = 1064, SD = 681); t(269) = 3.889, p < .001. However, there was no significant difference between schools in rural Georgia (M = 1485, SD = 499) and high schools located in a suburban parts of Georgia (M = 1506, SD = 588); t(269) = -0.386, p = .92.

1c. Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the percentage of ninth grade students scoring developing, proficient, or distinguished on the Georgia Milestones Biology End-of-Course Assessment (EOC)?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Biology EOC. Descriptive statistics were computed on the two variables and the overall mean for the 286 ninth through twelfth grade high schools in Georgia with ninth graders being assessed on the Georgia Milestones Biology EOC and scoring developing, proficient, or distinguished was *M* = 74.45 (*SD* = 20.02). Schools utilizing a traditional seven-period schedule (n = 154) had a range from 10.8% to 100% with an average mean of 73.76 (*SD* = 20.5). Schools utilizing a 4 X 4 block schedule (n = 132) had a range from 27.3% to 100% with an average mean of 75.24 (*SD* = 19.48). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 121) had a range from 28.5% to 100% with an average mean of 78.43 (*SD* = 17.89). High schools located in a suburban area of Georgia (n = 116) had a range from 27.3% to 100% with an average mean of 76.38 (*SD* = 16.93). High schools located in an urban area of Georgia (n = 49) had a range from 10.8% to 98.5% with an average mean of 60.01 (*SD* = 25.11) (see Table 14).

Table 14

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Biology EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	154	73.76	20.50	10.8	100	-1.03	0.57
4 X 4 block	132	75.24	19.48	27.3	100	-0.87	-0.28
Rural	121	78.43	17.89	28.5	100	-1.11	0.49
Suburban	116	76.38	16.93	27.3	100	-0.66	-0.51
Urban	49	60.01	25.11	10.8	98.5	-0.37	-1.07

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Biology EOC. Schools utilizing a traditional seven-period schedule in a rural area (n = 66) had a range from 45.5% to 100% with an average mean of 80.59 (*SD* = 15.18). Schools utilizing a traditional seven-period schedule in a suburban area (n = 59) had a range from 42.3% to 100% with an average mean of 77.13 (*SD* = 15.34). Schools utilizing a traditional seven-period schedule in an urban area (n = 29) had a range from 10.8% to 93.5% with an average mean of 51.38 (*SD* = 24.96). Schools utilizing a 4 X 4 block schedule in a rural area (n = 55) had a range from 28.5% to 100% with an average mean of 75.84 (*SD* = 20.53). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 57) had a range from 27.3% to 98.7% with an average mean of 75.61 (*SD* = 18.54). Schools utilizing a 4 X 4 block schedule in an urban area (n = 20) had a range from 32.5% to 98.5% with an average mean of 72.53 (*SD* = 19.92) (see Table 15).

Table 15

Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Biology EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	66	80.59	15.18	45.5	100	-0.89	-0.08
7 periods: suburban	59	77.13	15.34	42.3	100	-0.43	-0.93
7 periods: urban	29	51.38	24.96	10.8	93.5	-0.08	-1.32
4 X 4 Block: rural	55	75.84	20.53	28.5	100	-1.01	-0.08
4 X 4 Block: suburban	57	75.61	18.54	27.3	98.7	-0.74	-0.58
4 X 4 Block: urban	20	72.53	19.92	32.5	98.5	-0.64	-0.76

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block)

and the location of the schools (rural, suburban, or urban) and the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Biology EOC. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data sets had a normal distribution. Skewness test results indicated a negative skewness and kurtosis test indicated a platykurtic distribution. Observation of histograms and Q-Q plots illustrated evidence of an unequal distribution of scores and non-normality. The results of the Shapiro-Wilk test indicated evidence of non-normality within some of the interaction groups: seven-period and rural schools ($W(66) = .90$, $p < .01$), seven-period and suburban schools ($W(59) = .95$, $p = .01$), seven-period and urban schools ($W(29) = .95$, $p = .16$), 4 X 4 block and rural schools ($W(55) = .87$, $p < .01$), 4 X 4 block and suburban schools ($W(57) = .91$, $p < .01$), and 4 X 4 block and urban schools ($W(20) = .92$, $p = .12$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,280) = 2.80$, $p = .02$), meaning the assumption of equal variances was not met. The Georgia Milestones Biology EOC scores met the assumption of an independent observation. The Georgia Milestone's Biology EOC scores were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean for the 286 ninth through twelfth grade high schools in Georgia with

ninth graders being assessed on the Georgia Milestones Biology EOC and scoring developing, proficient, or distinguished was *M* = 7312.24 (*SD* = 3443.67). Schools utilizing a traditional seven-period schedule (n = 154) had a range from 107.95 to 12792.37 with an average mean of 7204.3 (*SD* = 3451.8). Schools utilizing a 4 X 4 block schedule (n = 132) had a range from 756.73 to 12792.37 with an average mean of 7438.16 (*SD* = 3440.81). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 121) had a range from 829.93 to 12792.37 with an average mean of 8002.55 (*SD* = 3261.41). High schools located in a suburban area of Georgia (n = 116) had a range from 756.73 to 12792.37 with an average mean of 7527.64 (*SD* = 3186.69). High schools located in an urban area of Georgia (n = 49) had a range from 107.95 to 12374.02 with an average mean of 5097.65 (*SD* = 3623.45) (see Table 16).

Table 16

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Biology EOC by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	154	7204.30	3451.80	107.95	12792.37	-0.29	-0.98
4 X 4 block	132	7438.16	3440.81	756.73	12792.37	-0.39	-1.01
Rural	121	8002.55	3261.41	829.93	12792.37	-0.56	-0.68
Suburban	116	7527.64	3186.69	756.73	12792.37	-0.25	-1.12
Urban	49	5097.65	3623.45	107.95	12374.02	0.27	-1.12

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the percentage of students scoring developing, proficient, or distinguished on the Georgia Milestones Biology EOC. Schools utilizing a traditional seven-period schedule in a rural area (n = 66) had a range from 2282.12 to 12792.37 with

an average mean of 8325.05 (*SD* = 2994.46). Schools utilizing a traditional seven-period schedule in a suburban area (n = 59) had a range from 1947.68 to 12792.37 with an average mean of 7598.97 (*SD* = 3021.52). Schools utilizing a traditional seven-period schedule in an urban area (n = 29) had a range from 107.95 to 11034.54 with an average mean of 3850.68 (*SD* = 3230.35). Schools utilizing a 4 X 4 block schedule in a rural area (n = 55) had a range from 829.93 to 12792.37 with an average mean of 7615.55 (*SD* = 3544.11). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 57) had a range from 756.73 to 12429.36 with an average mean of 7453.81 (*SD* = 3374.52). Schools utilizing a 4 X 4 block schedule in an urban area (n = 20) had a range from 1101.05 to 12374.02 with an average mean of 6905.76 (*SD* = 3460.66) (see Table 17).

Table 17

Transformed Descriptive Statistics of the Percentage of Ninth-Grade Students Scoring Developing or Higher on the GMAS Biology EOC by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	66	8325.05	2994.96	2282.12	12732.37	-0.49	-0.78
7 periods: suburban	59	7598.97	3021.52	1947.68	12792.37	-0.11	-1.22
7 periods: urban	29	3850.68	3230.35	107.95	11034.54	0.56	-0.84
4 X 4 Block: rural	55	7615.55	3544.11	829.93	12792.37	-0.52	-0.91
4 X 4 Block: suburban	57	7453.81	3374.52	756.73	12429.36	-0.33	-1.18
4 X 4 Block: urban	20	6905.76	3460.66	1101.05	12374.02	-0.16	-1.15

Note. [a]Minimum Value; [b]Maximum Value

Statistical considerations and assumptions were checked before computing a factorial analysis of variance (ANOVA). There was no missing data for this question. The data were converted to z-scores to examine outliers and after the transformation, there were no outliers identified. Kurtosis was found to have a platykurtic distribution (see Table 12). The results of the Robust Jarque Bera Test provided evidence of normality between the interaction groups: seven-period and rural schools ($JB(2, n = 66) = 3.32, p = .19$), seven-period and suburban schools ($JB(2, n = 59) = 2.72, p = .26$), seven-

period and urban schools ($JB(2, n = 29) = 1.82, p = .40$), 4 X 4 block and rural schools ($JB(2, n = 55) = 3.19, p = .20$), 4 X 4 block and suburban schools ($JB(2, n = 57) = 2.93, p = .23$), and 4 X 4 block and urban schools ($JB(2, n = 20) = 0.50, p = .77$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,280) = 0.343, p = .887$), meaning the assumption of equal variances was met. The Georgia Milestones Biology EOC scores met the assumption of an independent observation. The Georgia Milestone's Biology EOC scores were on the interval level of measurement.

The results of the factorial ANOVA found there was a statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), $F(2, 280) = 5.92, p < .001, \eta^2 = .04$, and a significant main effect on high school's location on the mean scores on the Georgia Milestones Biology EOC, $F(2, 280) = 14.297, p < .001, \eta^2 = .09$. However, it determined there was not a significant main effect on a high school schedule on the mean scores on the Georgia Milestones Biology EOC, $F(1, 280) = 0.369, p = .54, \eta^2 < .001$.

Utilizing Tukey's HSD it identified five out of fifteen different interaction effects as significant. There was a significant difference on the Georgia Milestones Biology EOC between high schools utilizing a 7-period schedule in a rural area (M=8325.05, SD = 2994.69) and schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); $t(280) = 6.189, p < .001$. There was also a significant difference between schools using a 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52) and schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); $t(280) = 5.093, p < .001$. Schools using a 4 X 4 Block schedule

in a rural area (M = 7615.55, SD = 3544.11) were significantly different compared to schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); $t(280) = 5.056$, $p < .001$. Schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52) were significantly different to schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); $t(280) = 4.868$, $p < .001$. Lastly, schools utilizing a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) were significantly different than schools utilizing a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); $t(280) = 3.239$, $p = .02$.

However, the other ten interaction effects on the Georgia Milestones Biology EOC were not significant. Schools using a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) compared to schools using a traditional 7-period schedule in a rural setting (M=8325.05, SD = 2994.69); $t(280) = 1.714$, $p = .52$. Schools using a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) compared to schools using a 4 X 4 Block schedule in a rural area (M = 7615.55, SD = 3544.11); $t(280) = 0.838$, $p = .96$. Schools using a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) compared to schools using a 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52); $t(280) = 0.826$, $p = .96$. Schools using a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) compared to schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52); $t(280) = 0.650$, $p = .99$. Schools using a 4 X 4 Block schedule in a rural area (M = 7615.55, SD = 3544.11) compared to schools using a traditional 7-period schedule in a rural setting (M=8325.05, SD = 2994.69); $t(280) = 1.198$, $p = .84$. Schools using a 4 X 4 Block schedule in a rural

area (M = 7615.55, SD = 3544.11) compared to schools using a traditional 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52); $t(280) = 0.027$, $p = 1.0$. Schools using a 4 X 4 Block schedule in a rural area (M = 7615.55, SD = 3544.11) compared to schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52); $t(280) = 0.264$, $p = .99$. Schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52) compared to schools using a traditional 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52); $t(280) = 0.241$, $p = .99$. Schools using a traditional 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52) compared to schools using a traditional 7-period schedule in a rural setting (M=8325.05, SD = 2994.69); $t(280) = 1.249$, $p = .81$. Lastly, Schools using a traditional 7-period schedule in a rural setting (M=8325.05, SD = 2994.69) compared to schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52); $t(280) = 1.485$, $p = .67$.

2a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is each school's overall College & Career Ready Performance Index (CCRPI). Descriptive statistics were computed on the two independent variables and the overall CCPRI score for the 328 ninth through twelfth grade high schools in Georgia and the overall results were M = 75.01 (SD = 10.15).

Schools utilizing a traditional seven-period schedule (n = 174) had a range from 50 to 96.3 with an average mean of 74.09 (*SD* = 10.25). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 51.9 to 97.2 with an average mean of 76.06 (*SD* = 9.97). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 56.2 to 95.9 with an average mean of 75.1 (*SD* = 8.07). High schools located in a suburban area of Georgia (n = 120) had a range from 55.2 to 97 with an average mean of 77.36 (*SD* = 10.77). High schools located in an urban area of Georgia (n = 52) had a range from 50 to 97.2 with an average mean of 69.36 (*SD* = 12.11) (see Table 18).

Table 18

Descriptive Statistics of the School's CCRPI Score by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	74.09	10.25	50.0	96.3	-0.39	-0.39
4 X 4 block	154	76.06	9.97	51.9	97.2	0.00	-0.46
Rural	156	75.10	8.07	56.2	95.9	-0.18	-0.16
Suburban	120	77.36	10.77	55.2	97.0	0.06	-1.03
Urban	52	69.36	12.11	50.0	97.2	0.26	-0.71

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the school's overall CCRPI score. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 56.2 to 95.9 with a mean of 75.18 (*SD* = 8.33). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 57.6 to 96.3 with an average mean of 76.9 (*SD* = 10.58). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 50.0 to 85.5 with an average mean of 65.65 (*SD* = 10.07). Schools utilizing a 4 X 4 block schedule in a rural area (n =

74) had a range from 57.8 to 90.6 with an average mean of 75.0 (*SD* = 7.82). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 55.2 to 97.0 with an average mean of 77.84 (*SD* = 11.03). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 51.9 to 97.2 with an average mean of 74.83 (*SD* = 13.01) (see Table 19).

Table 19

Descriptive Statistics of the School's CCRPI Score by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	75.18	8.33	56.2	95.9	-0.12	-0.05
7 periods: suburban	61	76.90	10.58	57.6	96.3	0.05	-1.11
7 periods: urban	31	65.65	10.07	50.0	85.5	0.19	-0.61
4 X 4 Block: rural	74	75.00	7.82	57.8	90.6	-0.26	-0.43
4 X 4 Block: suburban	59	77.84	11.03	55.2	97.0	0.06	-1.03
4 X 4 Block: urban	21	74.83	13.01	51.9	97.2	-0.12	-1.11

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the location of the schools (rural, suburban, or urban) and the school's overall CCRPI score. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test indicated evidence of a normal distribution with no significant results ($W(328) = 0.99$, $p = .06$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 4.43$, $p < .001$), meaning the assumption of equal

variances was not met. The CCRPI scores met the assumption of an independent observation. The CCRPI scores were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean CCRPI score for the 328 ninth through twelfth grade high schools in Georgia was M = 102.92 (SD = 15.11). Schools utilizing a traditional seven-period schedule (n = 174) had a range from 66.18 to 134.94 with a mean of 101.54 (SD = 15.24). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 68.91 to 136.31 with a mean of 104.48 (SD = 14.87). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 75.13 to 134.33 with a mean of 103.01 (SD = 12.01). High schools located in a suburban area of Georgia (n = 120) had a range from 73.68 to 136.0 with a mean of 106.43 (SD = 16.09). High schools located in an urban area of Georgia (n = 52) had a range from 66.18 to 136.31 with a mean of 94.56 (SD = 17.95) (see Table 20).

Table 20

Transformed Descriptive Statistics of the School's CCRPI Score by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	101.54	15.24	66.18	134.94	-0.05	-0.41
4 X 4 block	154	104.48	14.87	68.91	136.31	0.03	-0.47
Rural	156	103.01	12.01	75.13	134.33	-0.15	-0.16
Suburban	120	106.43	16.09	73.68	136.00	0.08	-1.03
Urban	52	94.56	17.95	66.18	136.31	0.29	-0.69

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or

urban) were computed using the school's overall CCRPI score. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 75.13 to 134.33 with a mean of 103.14 (*SD* = 12.41). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 77.17 to 134.94 with a mean of 105.74 (*SD* = 15.8). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 66.18 to 118.55 with a mean of 89.05 (*SD* = 14.84). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 77.46 to 126.27 with a mean of 102.86 (*SD* = 11.63). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 73.68 to 136.0 with a mean of 107.15 (*SD* = 16.49). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 68.91 to 136.31 with a mean of 102.7 (*SD* = 19.35) (see Table 21).

Table 21

Transformed Descriptive Statistics of the School's CCRPI Score by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	103.14	12.41	75.13	134.33	-0.09	-0.06
7 periods: suburban	61	105.74	15.80	77.17	134.94	0.07	-1.11
7 periods: urban	31	89.05	14.84	66.18	118.55	0.22	-0.59
4 X 4 Block: rural	74	102.86	11.63	77.46	126.27	-0.24	-0.44
4 X 4 Block: suburban	59	107.15	16.49	73.68	136.00	0.08	-1.03
4 X 4 Block: urban	21	102.70	19.35	68.91	136.31	-0.10	-1.12

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the school's overall College & Career Readiness Performance Index (CCRPI). Due to the assumption of Homogeneity of variance being violated with the original data it was transformed utilizing the Yeo-Johnson's Power Transformation. Statistical considerations

and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and two outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test indicated evidence of a normal distribution: 7-period rural high schools ($W(82) = 0.99$, $p = .70$), 7-period suburban high schools ($W(61) = 0.96$, $p = .08$), 7-period urban high schools ($W(31) = 0.95$, $p = .12$), 4 X 4 block rural high schools ($W(74) = 0.98$, $p = .35$), 4 X 4 block suburban high schools ($W(59) = 0.96$, $p = .05$), and 4 X 4 block urban high schools ($W(21) = 0.97$, $p = .66$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 4.49$, $p < 0.001$), meaning the assumption of equal variances was not met. The CCRPI scores met the assumption of an independent observation. The CCRPI scores were on the interval level of measurement.

Considering the original and transformed data did not meet the statistical assumptions it was determined to use the Aligned Rank Transform (ARTools) for Nonparametric Factorial AVOVA. The results of the ARTools factorial ANOVA found there was a statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), $F(2, 322) = 3.664$, $p = .03$, $\eta^2 = .02$. For the main effect on high school schedules on the school's mean CCRPI score there was no statistical significance, $F(1, 322) = 2.728$, $p = .09$, $\eta^2 = .01$. However, there was a significant main effect on a high school's location on the school's mean CCRPI score, $F(2, 322) = 8.860$, $p < .001$, $\eta^2 = .05$.

Post-hoc comparisons using the Tukey HSD for the interaction effect between school schedules and their location in Georgia on the school's CCRPI score indicated there were two interactions with significant differences. Schools utilizing a 7-period schedule in a suburban area (M = 105.74, SD = 15.80) were significantly different from schools utilizing a 7-period schedule in an urban area (M = 89.05, SD = 14.84); $t(322)$ = 3.494, p = .01. Schools utilizing a 4 X 4 block schedule in a suburban area (M = 107.15, SD = 16.49) were significantly different from schools utilizing a 7-period schedule in an urban area (M = 89.05, SD = 14.84); $t(322)$ = 3.449, p = .01.

All other thirteen interactions effects were found to be not significant at ($p >$ 0.05). Schools using a 4 X 4 block in a rural area (M = 102.86, SD = 11.63) compared to schools using a 7-period schools in a rural setting (M = 103.14, SD = 12.41); $t(322)$ = 0.041, p = 1.0. Seven-period schools in a suburban area (M = 105.74, SD = 15.80) compared to 7-period schools in a rural setting (M = 103.14, SD = 12.41); $t(322)$ = 1.101, p = .88. Schools using a 4 X 4 block in a suburban area (M = 107.15, SD = 16.49) compared to 7-period schools in a rural setting (M = 103.14, SD = 12.41); $t(322)$ = 1.058, p = .90. Seven-period schools in a rural setting (M = 103.14, SD = 12.41) compared to 7-period schools in a urban area (M = 89.05, SD = 14.84); $t(322)$ = 2.772, p = .06 . Seven-period schools in a rural setting (M = 103.14, SD = 12.41) compared to schools using a 4 X 4 block in a urban area (M = 102.70, SD = 19.35); $t(322)$ = 1.892, p = .41. Seven-period schools in a suburban setting (M = 105.74, SD = 15.80) compared to schools using a 4 X 4 block in a suburban area (M = 107.15, SD = 16.49); $t(322)$ = 0.030, p = 1.0. Seven-period schools in a suburban setting (M = 105.74, SD = 15.80) compared to schools using a 4 X 4 block in an urban area (M = 102.70, SD = 19.35); $t(322)$ = 2.564, p

= .11. Schools using a 4 X 4 block in an urban area (M = 102.70, SD = 19.35) compared to 7-period schools in an urban setting (M = 89.05, SD = 14.84); $t(322) = 0.431$, $p = .10$. Seven-period schools in a suburban setting (M = 105.74, SD = 15.80) compared to schools using a 4 X 4 block in a rural area (M = 102.86, SD = 11.63); $t(322) = 1.038$, $p = .90$. Schools using a 4 X 4 block in a rural area (M = 102.86, SD = 11.63) compared to schools using a 4 X 4 block in a suburban area (M = 107.15, SD = 16.49); $t(322) = 0.997$, $p = .92$. Schools using a 4 X 4 block in a rural area (M = 102.86, SD = 11.63) compared to schools using a 7-period schedule in a urban setting (M = 89.05, SD = 14.84); $t(322) = 2.762$, $p = .06$. Schools using a 4 X 4 block in a rural area (M = 102.86, SD = 11.63) compared to schools using a 4 X 4 block in a urban area (M = 102.70, SD = 19.35); $t(322) = 1.898$, $p = .41$. Lastly, schools using a 4 X 4 block in a suburban area (M = 107.15, SD = 16.49) compared to schools using a 4 X 4 block in a urban area (M = 102.70, SD = 19.35); $t(322) = 2.532$, $p = .12$.

2b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's four-year cohort graduation rate?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is each school's four-year cohort graduation rate. Descriptive statistics were computed on the two independent variables and the overall CCPRI score for the 327 ninth through twelfth grade high schools in Georgia and the overall mean 4-year cohort graduation rate was M = 87.43 (SD = 7.42). Schools utilizing a traditional seven-period schedule (n = 173) had a range from 69.2% to 100% with a

mean of 87.66 (*SD* = 6.82). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 59% to 100% with a mean of 87.16 (*SD* = 8.06). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 74.2% to 100% with a mean of 89.58 (*SD* = 5.56). High schools located in a suburban area of Georgia (n = 119) had a range from 59% to 100% with a mean of 85.96 (*SD* = 8.47). High schools located in an urban area of Georgia (n = 52) had a range from 69.2% to 100% with a mean of 84.33 (*SD* = 7.95) (see Table 22).

Table 22

Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	173	87.66	6.82	69.2	100	-0.58	0.06
4 X 4 block	154	87.16	8.06	59.0	100	-0.96	0.97
Rural	156	89.58	5.56	74.2	100	-0.41	-0.22
Suburban	119	85.96	8.47	59.0	100	-0.80	0.46
Urban	52	84.33	7.95	69.2	100	-0.25	-0.65

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the school's four-year cohort graduation rate. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 76.9% to 98.7% with a mean of 89.91 (*SD* = 5.29). Schools utilizing a traditional seven-period schedule in a suburban area (n = 60) had a range from 70.8% to 100% with a mean of 86.95 (*SD* = 7.14). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 69.2% to 97.1% with a mean of 83.09 (*SD* = 7.39). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 74.2% to 100% with a mean of 89.21 (*SD* = 5.86).

Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 59% to 100% with a mean of 84.95 (*SD* = 9.6). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 71.8% to 100% with a mean of 86.16 (*SD* = 8.57) (see Table 23).

Table 23

Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	89.91	5.29	76.9	98.7	-0.28	-0.58
7 periods: suburban	61	86.95	7.14	70.8	100.0	-0.40	-0.46
7 periods: urban	31	83.09	7.39	69.2	97.1	-0.33	-0.53
4 X 4 Block: rural	74	89.21	5.86	74.2	100.0	-0.47	-0.15
4 X 4 Block: suburban	59	84.95	9.60	59.0	100.0	-0.80	0.08
4 X 4 Block: urban	21	86.16	8.57	71.8	100.0	-0.34	-0.98

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the location of the schools (rural, suburban, or urban) and the school's four-year cohort graduation rate. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test resulted with significant results in 4 X 4 block and suburban schools ($W(59) = 0.94$, $p < .05$). Therefore, a Robust Jarque Bera Test was conducted and resulted in significant results for the same interaction ($JB(2, n = 59) = 7.23$, $p < .05$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,321) = 4.66$, $p < .001$), meaning the assumption of equal variances was not met. The four-year

cohort graduation rates met the assumption of an independent observation. The four-year cohort graduation rates were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean four-year cohort graduation rate for the 327 ninth through twelfth grade high schools in Georgia was M = 63749184.36 (SD = 20610976.81). Schools utilizing a traditional seven-period schedule (n = 173) had a mean of 64052312 (SD = 19672754). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 63408658 (SD = 21676184). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a mean of 69273988 (SD = 17544900). High schools located in a suburban area of Georgia (n = 119) had a mean of 60208809 (SD = 22191578). High schools located in an urban area of Georgia (n = 52) had a mean of 55276787 (SD = 21087728) (see Table 24).

Table 24

Transformed Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	173	64052312	19672754	22408524	108089846	0.03	-0.59
4 X 4 block	154	63408658	21676184	11362416	108089846	-0.14	-0.43
Rural	156	69273988	17544900	30176188	108089846	0.06	-0.57
Suburban	119	60208809	22191578	11362416	108089846	-0.01	-0.63
Urban	52	55276787	21087728	22408524	108089846	0.40	-0.28

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or

urban) were computed using the school's four-year cohort graduation rate. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a mean of 70202609 (*SD* = 17049805). Schools utilizing a traditional seven-period schedule in a suburban area (n = 60) had a mean of 62128770 (*SD* = 204226688). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a mean of 51506768 (*SD* = 18447860). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a mean of 68244976 (*SD* = 18138438). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a mean of 58256305 (*SD* = 23873541). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a mean of 60842053 (*SD* = 23852231) (see Table 25).

Table 25

Transformed Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	70202609	17049805	35150412	102199394	0.09	-0.80
7 periods: sub.[c]	60	62128770	20422668	24702962	108089846	0.15	-0.69
7 periods: urban	31	51506768	18447860	22408524	95291953	0.32	-0.38
4 X 4 Block: rural	74	68244976	18138438	30176188	108089846	0.05	-0.47
4 X 4 Block: sub.	59	58256305	23873541	11362416	108089846	-0.05	-0.81
4 X 4 Block: urban	21	60842053	23852231	26226023	108089846	0.20	-0.76

Note. [a]Minimum Value; [b]Maximum Value; [c]suburban

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the school's four-year cohort graduation rate. Due to the assumption of Homogeneity of variance being violated with the original data it was transformed utilizing the Yeo-Johnson's Power Transformation. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The

data were converted to z-scores to examine outliers and one outlier was identified after the transformation. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test illustrated a normal distribution with no significant results ($W(327) = 0.99$, $p = .25$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,321) = 2.40$, $p < .05$), meaning the assumption of equal variances was not met. The four-year cohort graduation rates met the assumption of an independent observation. The four-year cohort graduation rates were on the interval level of measurement.

Considering the original and transformed data did not meet the statistical assumptions it was determined to use the Aligned Rank Transform (ARTools) for Nonparametric Factorial AVOVA. The results of the ARTools factorial ANOVA found the interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban) is not statistically significant, F (2, 321) = 1.646, $p = .19$, $\eta^2 = .01$. For the main effect on high school schedules on the school's four-year cohort graduation rate there was no statistical significance, F (1, 321) = 0.017, $p = .89$, $\eta^2 = .00$. However, there was a significant main effect on a high school's location on the school's four-year cohort graduation rate, F (2, 321) = 11.857, $p < .001$, $\eta^2 = .07$.

Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in rural Georgia (M = 69273988, SD = 17544900) was significantly different than high schools located in urban areas of

Georgia (M = 55276787, SD = 21087728); $t(322) = 3.243$, $p < .001$. High schools located in suburban parts of Georgia (M = 60208809, SD = 22191578) were significantly different to the schools located in urban areas of Georgia (M = 55276787, SD = 21087728); $t(322) = 4.202$, $p < .001$. However, it indicated there was no significant difference between schools in rural Georgia (M = 69273988, SD = 17544900) and those located in a suburban part of Georgia (M = 60208809, SD = 22191578); $t(322) = 1.482$, $p = .30$.

2c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's school climate rating?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural, suburban). The dependent variable is each school's school climate rating. Descriptive statistics were computed on the two independent variables and the overall school climate rating for the 328 ninth through twelfth grade high schools in Georgia and the overall mean school climate rating was M = 85.50 (SD = 4.21). Schools utilizing a traditional seven-period schedule (n = 174) had a range from 69.9 to 94.5 with a mean of 85.77 (SD = 4.42). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 75 to 94.3 with a mean of 85.19 (SD = 3.94). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 77.6 to 94.5 with a mean of 86.05 (SD = 3.67). High schools located in a suburban area of Georgia (n = 120) had a range from 76 to 94.5 with a mean of 85.61 (SD = 4.17). High schools located in an urban area of

Georgia (n = 52) had a range from 69.9 to 92.2 with a mean of 83.59 (*SD* = 5.22) (see Table 26).

Table 26

Descriptive Statistics of the School's Climate Rating by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	85.77	4.42	69.9	94.5	-0.74	0.83
4 X 4 block	154	85.19	3.94	75.0	94.3	-0.21	0.07
Rural	156	86.05	3.67	77.6	94.5	-0.03	-0.36
Suburban	120	85.61	4.17	76.0	94.5	-0.39	-0.27
Urban	52	83.59	5.22	69.9	92.2	-0.64	0.07

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the school's climate rating. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 77.6 to 94.5 with a mean of 86.2 (*SD* = 3.93). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 76.6 to 94.5 with a mean of 86.4 (*SD* = 3.98). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a range from 69.9 to 92.2 with a mean of 83.4 (*SD* = 5.67). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 80.2 to 94.3 with a mean of 85.9 (*SD* = 3.37). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 76.0 to 93.1 with a mean of 84.8 (*SD* = 4.24). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 75.0 to 92.0 with a mean of 83.9 (*SD* = 4.61) (see Table 27).

Table 27

Descriptive Statistics of the School's Climate Rating by Schedule and Location

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	86.2	3.93	77.6	94.5	-0.31	-0.27
7 periods: suburban	61	86.4	3.98	76.6	94.5	-0.54	-0.08
7 periods: urban	31	83.4	5.67	69.9	92.2	-0.66	-0.13
4 X 4 Block: rural	74	85.9	3.37	80.2	94.3	0.41	-0.63
4 X 4 Block: suburban	59	84.8	4.24	76.0	93.1	-0.23	-0.39
4 X 4 Block: urban	21	83.9	4.61	75.0	92.0	-0.40	-0.38

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the location of the schools (rural, suburban, or urban) and the school's climate rating. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test resulted with significant results ($W(328) = 0.99$, $p < 0.05$), therefore, a Robust Jarque Bera Test was conducted, which provided evidence of non-normality ($JB(2, n = 328) = 20.22$, $p < .05$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 1.67$, $p = .14$), meaning the assumption of equal variances was met. The school climate ratings met the assumption of an independent observation. The school climate ratings were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects.

The overall mean climate rating for the 328 ninth through twelfth grade high schools in Georgia was *M* = 52992670.21 (*SD* = 10666167.49). Schools utilizing a traditional seven-period schedule (n = 174) had a mean of 53789447 (*SD* = 11107250). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 52092416 (*SD* = 10105131). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a mean of 54250589 (*SD* = 9809409). High schools located in a suburban area of Georgia (n = 120) had a mean of 53272238 (*SD* = 10686972). High schools located in an urban area of Georgia (n = 52) had a mean of 48573758 (*SD* = 12065411) (see Table 28).

Table 28

Transformed Descriptive Statistics of the School's Climate Rating by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	53789447	11107250	22116608	79884576	-0.21	-0.11
4 X 4 block	154	52092416	10105131	29839394	79165742	0.24	-0.09
Rural	156	54250589	9809409	34496807	79884576	0.31	-0.34
Suburban	120	53272238	10686972	31569513	79884576	-0.01	-0.44
Urban	52	48573758	12065411	22116608	71913988	-0.12	-0.40

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the school's climate rating. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a mean of 54753616 (*SD* = 10375978). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a mean of 55284492 (*SD* = 10398636). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a mean of 48297201 (*SD* = 12893240). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a mean of 53693180 (*SD* =

9178983). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a mean of 51191772 (*SD* = 10668099). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a mean of 48982009 (*SD* = 11025747) (see Table 29).

Table 29

Transformed Descriptive Statistics of the School's Climate Rating by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	54753616	10375978	34496807	79884576	0.06	-0.41
7 periods: sub.[c]	61	55284492	10398636	32643943	79884576	-0.16	-0.35
7 periods: urban	31	48297201	12893240	22116608	71913988	-0.17	-0.63
4 X 4 Block: rural	74	53693180	9178983	39693346	79165742	0.65	-0.28
4 X 4 Block: sub.	59	51191772	10668099	31569513	74956450	0.15	-0.42
4 X 4 Block: urban	21	48982009	11025747	29839394	71250964	0.04	-0.38

Note. [a]Minimum Value; [b]Maximum Value; [c]suburban

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the school's climate rating. Due to the assumption of normality being violated with the original data it was transformed utilizing the Yeo-Johnson's Power Transformation. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and one outlier was identified after the transformation. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test illustrated a normal distribution with no significant results ($W(328) = 0.99$, $p = .33$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 0.845$, $p = .52$), meaning the assumption of equal variances was

met. The school climate ratings met the assumption of an independent observation. The school climate ratings were on the interval level of measurement.

The results of the factorial ANOVA found no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), F (2, 322) = 1.16, p = .31, η^2 = .00, nor a significant main effect based on high school schedules on the mean climate rating for Georgia high schools, F (1, 322) = 2.70, p = .10, η^2 = .00. However, based on the school's location, it determined there was a significant main effect on the school's mean climate rating, F (2, 322) = 6.07, $p < .001$, η^2 = .04.

Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in rural Georgia (M = 54250589, SD = 9809409) were significantly different than high schools located in urban areas of Georgia (M = 48573758, SD = 12065411); t(322) = 3.279, p < .001. High schools located in a suburban part of Georgia (M = 53272238, SD = 10686972) were significantly different than schools located in urban Georgia (M = 48573758, SD = 12065411); t(322) = 2.608, p = .03. However, it indicated schools in rural Georgia (M = 54250589, SD = 9809409) were not significantly different than high schools located in a suburban part of Georgia (M = 53272238, SD = 10686972); t(322) = 0.774, p = .72.

2d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by high school's location (urban, rural, or suburban) on the school's overall retention rate?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the location of the school (urban, rural,

suburban). The dependent variable is each school's overall retention rate. Descriptive statistics were computed on the two independent variables and the overall retention rate for the 328 ninth through twelfth grade high schools in Georgia and the overall mean retention rate was *M* = 4.86 (*SD* = 3.73). Schools utilizing a traditional seven-period schedule (n = 174) had a range from 0 to 15 with a mean of 4.75 (*SD* = 3.6). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 0 to 17 with a mean of 4.99 (*SD* = 3.89). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a range from 0 to 11.2 with a mean of 3.44 (*SD* = 2.83). High schools located in a suburban area of Georgia (n = 120) had a range from 0 to 14.1 with a mean of 5.56 (*SD* = 3.53). High schools located in an urban area of Georgia (n = 52) had a range from 0 to 17 with a mean of 7.5 (*SD* = 4.65) (see Table 30).

Table 30

Descriptive Statistics of the School's Overall Retention Rate by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	4.75	3.60	0	15.0	0.71	0.02
4 X 4 block	154	4.99	3.89	0	17.0	0.79	0.25
Rural	156	3.44	2.83	0	11.2	0.57	-0.28
Suburban	120	5.56	3.53	0	14.1	0.47	-0.63
Urban	52	7.5	4.65	0	17.0	0.27	-0.81

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or urban) were computed using the school's overall retention rate. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a range from 0 to 11.2 with a mean of 3.65 (*SD* = 3.12). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a range from 0 to 11.7 with a mean of 4.78 (*SD* = 2.91). Schools utilizing a traditional seven-period schedule in

an urban area (n = 31) had a range from 1.5 to 15 with a mean of 7.59 (*SD* = 4.46). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a range from 0 to 8.9 with a mean of 3.21 (*SD* = 2.47). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a range from 0 to 14.1 with a mean of 6.37 (*SD* = 3.94). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a range from 0 to 17 with a mean of 7.36 (*SD* = 5.04) (see Table 31).

Table 31

Descriptive Statistics of the School's Retention Rate by Schedule and Location

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	3.65	3.12	0.0	11.2	0.60	-0.49
7 periods: suburban	61	4.78	2.91	0.0	11.7	0.41	-0.61
7 periods: urban	31	7.59	4.46	1.5	15.0	0.19	-1.22
4 X 4 Block: rural	74	3.21	2.47	0.0	8.9	0.29	-0.68
4 X 4 Block: suburban	59	6.37	3.94	0.0	14.1	0.24	-1.06
4 X 4 Block: urban	21	7.36	5.04	0.0	17.0	0.35	-0.65

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the location of the schools (rural, suburban, or urban) and the school's climate rating. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and it showed the data to be positively skewed with a platykurtic distribution. Both the Shapiro-Wilkes, ($W(328) = 0.98$, $p < .001$), and Robust Jarque Bera Test ($JB(2, n = 328) = 35.2$, $p < .001$), provided evidence of non-normality. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 6.60$, $p < .01$), meaning

the assumption of equal variances was not met. The schools overall retention rates met the assumption of an independent observation. The schools overall retention rates were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and school location) and interaction effects. The overall mean retention rate for the 328 ninth through twelfth grade high schools in Georgia was $M = 2.32$ ($SD = 1.38$). Schools utilizing a traditional seven-period schedule (n = 174) had a mean of 2.3 ($SD = 1.35$). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 2.3 ($SD = 1.42$). Ninth through twelfth grade high schools located in a rural area of Georgia (n = 156) had a mean of 1.8 ($SD = 1.26$). High schools located in a suburban area of Georgia (n = 120) had a mean of 2.63 ($SD = 1.23$). High schools located in an urban area of Georgia (n = 52) had a mean of 3.17 ($SD = 1.46$) (see Table 32).

Table 32

Transformed Descriptive Statistics of the School's Retention Rate by Schedule or Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	174	2.30	1.35	0	5.17	-0.10	-0.70
4 X 4 block	154	2.36	1.42	0	5.54	-0.07	-0.68
Rural	156	1.80	1.26	0	4.36	-0.13	-1.01
Suburban	120	2.63	1.23	0	4.99	-0.19	-0.63
Urban	52	3.17	1.46	0	5.54	-0.39	-0.69

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the Yeo-Johnson Power Transformation interaction effect between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their location in Georgia (rural, suburban, or

urban) were computed using the school's overall climate rating. Schools utilizing a traditional seven-period schedule in a rural area (n = 82) had a mean of 1.86 (*SD* = 1.34). Schools utilizing a traditional seven-period schedule in a suburban area (n = 61) had a mean of 2.4 (*SD* = 1.1). Schools utilizing a traditional seven-period schedule in an urban area (n = 31) had a mean of 3.24 (*SD* = 1.35). Schools utilizing a 4 X 4 block schedule in a rural area (n = 74) had a mean of 1.74 (*SD* = 1.17). Schools utilizing a 4 X 4 block schedule in a suburban area (n = 59) had a mean of 2.87 (*SD* = 1.32). Schools utilizing a 4 X 4 block schedule in an urban area (n = 21) had a mean of 3.08 (*SD* = 1.63) (see Table 33).

Table 33

Transformed Descriptive Statistics of the School's Retention Rate by Schedule and Location

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: rural	82	1.86	1.34	0	4.36	-0.05	-1.10
7 periods: suburban	61	2.40	1.10	0	4.48	-0.27	-0.51
7 periods: urban	31	3.24	1.35	1.11	5.17	-0.24	-1.15
4 X 4 Block: rural	74	1.74	1.17	0	3.81	-0.30	-1.08
4 X 4 Block: suburban	59	2.87	1.32	0	4.99	-0.32	-0.79
4 X 4 Block: urban	21	3.08	1.63	0	5.54	-0.44	-0.76

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the location of the schools (rural, suburban, or urban) and the school's overall retention rate. The data were transformed utilizing the Yeo-Johnson's Power Transformation in order to address the statistical assumptions not met with the original data. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and one outlier was identified after the

transformation. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution with a slightly positive skewness and platykurtic distribution. The results of the Shapiro-Wilk test were significant at ($W(328) = 0.97$, $p < .001$)violating the assumption of normality. Therefore, a Robust Jarque Bera Test was utilized finding no significant results, ($JB(2, n = 322) = 3.44$, $p = .18$), meaning the assumption was normality was met. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(5,322) = 1.28$, $p = .27$), meaning the assumption of equal variances was met. The schools overall retention rates met the assumption of an independent observation. The schools overall retention rates were on the interval level of measurement.

The results of the factorial ANOVA found no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), $F(2, 322) = 2.15$, $p = .12$, $\eta^2 = .01$, nor a significant main effect based on high school schedules on the mean overall retention rate for Georgia high schools, $F(1, 322) = 0.42$, $p = .52$, $\eta^2 = .00$. However, there was a significant difference on the main effect based on a school's location on the school's overall retention rate, $F(2, 322) = 27.9$, $p < .001$, $\eta^2 = .15$.

Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in a suburban part of Georgia ($M = 2.63$, $SD = 1.23$) were significantly different to the high schools located in rural Georgia ($M = 1.8$, $SD = 1.26$); $t(322) = 5.379$, $p < .001$. Schools located in rural Georgia ($M = 1.8$, $SD = 1.26$) were significantly different compared to the high schools located in

urban Georgia (M = 3.17, SD = 1.46); $t(322) = 6.533$, $p < .001$. Schools located in suburban part of Georgia (M = 2.63, SD = 1.23) were significantly different compared to the high schools located in a urban Georgia (M = 3.17, SD = 1.46); $t(322) = 2.424$, $p = .03$.

3a. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall College & Career Ready Performance Readiness Index (CCRPI) Score?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the percentage of students receiving free and reduced lunch where the schools were divided into four quartiles based on their percentages (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%). The dependent variable is each school's overall CCRPI score. Descriptive statistics were computed on the two independent variables and the overall CCRPI score for the 327 ninth through twelfth grade high schools in Georgia and the overall mean CCRPI score was M = 74.96 (SD = *10.08*). Schools utilizing a traditional seven-period schedule (n = 173) had a range from 50.0 to 96.3 with a mean of 73.99 (SD = 10.14). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 51.9 to 97.2 with a mean of 76.05 (SD = 9.93). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a range from 71.4 to 97.2 with a mean of 85.76 (SD = 6.62). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a range from 62.1 to 94.3 with a mean of 77.10 (SD = 6.58). High schools in the third quartile of students receiving free or

reduced lunch (n = 80) had a range from 55.2 to 84.8 with a mean of 71.55 (*SD* = 6.42). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a range from 50.0 to 81.7 with a mean of 65.09 (*SD* = 8.10) (see Table 34).

Table 34

Descriptive Statistics of the School's CCRPI Score by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	173	73.99	10.14	50.0	96.3	-0.04	-0.37
4 X 4 block	154	76.05	9.93	51.9	97.2	-0.01	-0.48
Quartile 1	79	85.76	6.62	71.4	97.2	-0.12	-0.92
Quartile 2	84	77.10	6.58	62.1	94.3	0.15	-0.17
Quartile 3	80	71.55	6.42	55.2	84.8	-0.15	-0.45
Quartile 4	84	65.90	8.10	50.0	81.7	0.08	-0.67

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's overall CCRPI Score. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a range from 71.4 to 96.3 with a mean of 85.15 (*SD* = 6.93). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a range from 62.1 to 86.7 with a mean of 75.61 (*SD* = 6.01). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a range from 57.6 to 84.8 with a mean of 72.59 (*SD* = 6.44). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a range from 50.0 to 81.7 with a mean of 65.08 (*SD* = 8.08). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a range from 73.7 to 97.2 with a mean of 86.42 (*SD* = 6.29). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a range from 62.7 to 94.3 with a mean of 78.40 (*SD* = 6.85). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a range

from 55.2 to 82.8 with a mean of 70.47 (*SD* = 6.03). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a range from 51.9 to 80.4 with a mean of 67.22 (*SD* = 8.07) (see Table 35).

Table 35

Descriptive Statistics of the School's CCRPI Score by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	85.15	6.93	71.4	96.3	-0.19	-1.01
7 periods: Quartile 2	39	75.61	6.01	62.1	86.7	-0.10	-0.79
7 periods: Quartile 3	41	72.59	6.44	57.6	84.8	-0.32	-0.26
7 periods: Quartile 4	52	65.08	8.08	50.0	81.7	0.15	-0.49
4 X 4 Block: Quartile 1	38	86.42	6.29	73.7	97.2	0.06	-1.14
4 X 4 Block: Quartile 2	45	78.40	6.85	62.7	94.3	0.18	-0.21
4 X 4 Block: Quartile 3	39	70.47	6.30	55.2	82.8	0.00	-0.61
4 X 4 Block: Quartile 4	32	67.22	8.07	51.9	80.4	-0.03	-1.06

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the percentage of students receiving free or reduced lunch on the overall CCRPI score. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and it showed the data to have a slightly platykurtic distribution. The results of the Shapiro-Wilk test were non-significant ($W(327) = 0.99$, $p = 0.15$). The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,322) = 0.79$, $p = .60$), meaning the assumption of equal variances was met. The CCRPI scores met the assumption of an independent observation. The CCRPI scores were on the interval level of measurement.

The results of the factorial ANOVA found no statistically significant interaction between the type of schedule (traditional seven-period or 4 X 4 block) and the percentage of students receiving free and reduced lunch where the schools were divided into four quartiles based on their percentages (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on their overall CCRPI score, F (3, 319) = 1.99, p = .11, η^2 = .01, nor was there a significant main effect based on high school schedules on the mean overall CCRPI score, F (1, 319) = 1.79, p = .18, η^2 = .00. However, it determined there was a significant main effect based on the percentages of students receiving free or reduced lunch divided into quartiles on the school's CCRPI score, F (3, 319) = 119.01, $p < .001$, η^2 = .52.

Post hoc comparisons using the Tukey HSD of the main effects based on the percentage of students receiving free or reduced lunch indicated the means were significantly different for between each quartile at ($p < .001$). Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 2 (M = 77.1, SD = 6.62); t(319) = 8.063, $p < .001$. Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 3 (M = 71.55, SD = 6.42); t(319) = 12.954, $p < .001$. Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 17.799, $p < .001$. Quartile 2 (M = 77.10, SD = 6.58) was significantly different than quartile 3 (M = 71.55, SD = 6.42); t(319) = 5.050, $p < .001$. Quartile 2 (M = 77.10, SD = 6.58) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 9.982, $p < .001$. Quartile 3 (M = 71.55, SD = 6.42) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 4.891, $p < .001$.

3b. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's four-year cohort graduation rate?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the percentage of students receiving free and reduced lunch where the schools were divided into four quartiles based on their percentages (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%). The dependent variable is each school's four-year cohort graduation rate. Descriptive statistics were computed on the two independent variables and the four-year cohort graduation rate for the 327 ninth through twelfth grade high schools in Georgia and the overall mean four-year cohort graduation rate was $M = 87.45$ ($SD = 7.37$). Schools utilizing a traditional seven-period schedule (n = 173) had a range from 69.2 to 98.7 with a mean of 87.7 ($SD = 6.72$). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 59 to 100 with a mean of 87.17 ($SD = 8.06$). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a range from 82.6 to 100 with a mean of 92.04 ($SD = 4.17$). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a range from 75.7 to 100 with a mean of 89.84 ($SD = 5.12$). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a range from 59.0 to 100 with a mean of 84.82 ($SD = 8.11$). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a range from 65.8 to 97.1 with a mean of 83.25 ($SD = 7.62$) (see Table 36).

Table 36

Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
Seven-period	173	87.70	6.72	69.2	98.7	-0.59	0.08
4 X 4 block	154	87.17	8.06	59.0	100.0	-0.95	0.82
Quartile 1	79	92.04	4.17	82.6	100.0	-0.16	-0.65
Quartile 2	84	89.84	5.12	75.7	100.0	-0.30	-0.12
Quartile 3	80	84.82	8.11	59.0	100.0	-0.55	0.34
Quartile 4	84	83.25	7.62	65.8	97.1	-0.43	-0.37

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's four-year cohort graduation rate. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a range from 84.4 to 98.7 with a mean of 92.13 (*SD* = 3.98). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a range from 80.9 to 98.1 with a mean of 89.83 (*SD* = 4.4). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a range from 70.9 to 98.6 with a mean of 86.32 (*SD* = 7.15). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a range from 69.2 to 97.1 with a mean of 8.71 (*SD* = 6.95). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a range from 82.6 to 100 with a mean of 91.94 (*SD* = 4.42). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a range from 75.7 to 100 with a mean of 89.86 (*SD* = 5.72). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a range from 59.0 to 100 with a mean of 83.25 (*SD* = 8.84). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a range from 65.8 to 96.9 with a mean of 82.5 (*SD* = 8.65) (see Table 37).

Table 37

Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	92.13	3.98	84.4	98.7	-0.05	-1.02
7 periods: Quartile 2	39	89.83	4.40	80.9	98.1	-0.04	-0.69
7 periods: Quartile 3	41	86.32	7.15	70.9	98.6	-0.19	-0.65
7 periods: Quartile 4	52	83.71	6.95	69.2	97.1	-0.21	-0.32
4 X 4 Block: Quartile 1	38	91.94	4.42	82.6	100.0	-0.24	-0.56
4 X 4 Block: Quartile 2	45	89.86	5.72	75.7	100.0	-0.39	-0.25
4 X 4 Block: Quartile 3	39	83.25	8.84	59.0	100.0	-0.59	0.16
4 X 4 Block: Quartile 4	32	82.50	8.65	65.8	96.9	-0.50	-0.86

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7-periods and block) and the percentage of students receiving free or reduced lunch on the four-year cohort graduation rate. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and it showed the data to be negatively skewed. The results of the Shapiro-Wilk test indicated non-normality ($W(327) = 0.99$, $p < .05$); therefore, a Robust Jarque Bera Test was utilized, and the results were significant at ($JB(2, n = 327) = 56.95$, $p < .05$), meaning the assumption of normality was violated. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 4.9$, $p < .005$), meaning the assumption of equal variances was not met. The four-year cohort graduation rates met the assumption of an independent observation. The four-year cohort graduation rates were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and percentage of students receiving free and reduced lunch by quartile) and interaction effects. The overall mean four-year cohort graduation rate was *M* = 91458943.22 (*SD* = 29849076.39). Schools utilizing a traditional seven-period schedule (n = 173) had a mean of 91900715 (*SD* = 28275642). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 90962668 (*SD* = 31609093). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a mean of 110530228 (*SD* = 21481279). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a mean of 100307611 (*SD* = 24135556). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a mean of 81168554 (*SD* = 30901128). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a mean of 74474557 (*SD* = 27477097) (see Table 38).

Table 38

Transformed Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 period	173	91900715	28275642	31450507	147741396	0.02	-0.63
4 X 4 block	154	90962668	31609093	15737616	156427428	-0.13	-0.43
Quartile 1	79	110530228	21481279	67951415	156427428	0.13	-0.79
Quartile 2	84	100307611	24135556	46475319	156427428	0.20	-0.32
Quartile 3	80	81168554	30901128	15737616	156427428	0.29	-0.47
Quartile 4	84	74474557	27477097	25266707	137568183	0.28	-0.29

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's

four-year cohort graduation rate. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a mean of 110826741 (*SD* = 20675788). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a mean of 99637153 (*SD* = 21117050). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a mean of 86333666 (*SD* = 29940144). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a mean of 75565346 (*SD* = 26363934). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a mean of 110210306 (*SD* = 22592581). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a mean of 100888674 (*SD* = 26701857). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a mean of 75738563 (*SD* = 31344978). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a mean of 72702027 (*SD* = 29541617) (see Table 39).

Table 39

Transformed Descriptive Statistics of the School's Four-Year Cohort Graduation Rate by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	110826741	20675788	74644282	147741396	0.17	-1.09
7 periods: Quartile 2	39	99637153	21117050	62065786	143860573	0.29	-0.65
7 periods: Quartile 3	41	86333666	29940144	34950527	147089036	0.33	-0.83
7 periods: Quartile 4	52	75565346	26363934	31450507	137568183	0.49	-0.06
4 X 4 Block: Quartile 1	38	110210306	22592581	67951415	156427428	0.10	-0.69
4 X 4 Block: Quartile 2	45	100888674	26701857	46475319	156427428	0.12	-0.46
4 X 4 Block: Quartile 3	39	75738563	31344978	15737616	156427428	0.30	-0.32
4 X 4 Block: Quartile 4	32	72702027	29541617	25266707	136335668	0.06	-0.80

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and

Quartile 4: 90.65-100%) on the four-year cohort graduation rate. The data were transformed utilizing the Yeo-Johnson's Power Transformation in order to address the statistical assumptions not met with the original data. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test ($W(327) = 0.992$, $p = .08$) were not significant, meaning the assumption was normality was met. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 1.62$, $p = .13$), meaning the assumption of equal variances was met. The four-year cohort graduation rates met the assumption of an independent observation. The four-year cohort graduation rates were on the interval level of measurement.

The results of the factorial ANOVA found no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on the four-year cohort graduation rate, $F(3, 319) = 0.793$, $p = .50$, $\eta^2 = .01$, nor a significant main effect based on high school schedules on the mean four-year cohort graduation rate, $F(1, 319) = 1.17$, $p = .28$, $\eta^2 = .00$. However, it determined there was a significant main effect on the percent of students receiving free and reduced lunch on the four-year cohort graduation rate, $F(3, 319) = 33.23$, $p < .001$, $\eta^2 = .24$.

Post hoc comparisons using the Tukey HSD of the main effects based on the percent of students receiving free and reduced lunch indicated high schools in quartile 1 (M = 110530228, SD = 21481279) were significantly different compared to high schools in quartile 3 (M = 81168554, SD = 30901128); $t(319) = 7.074$, $p < .001$. High schools in quartile 1 (M = 110530228, SD = 21481279) were significantly different compared to the high schools in in quartile 4 (M = 74474557, SD = 27477097); $t(319) = 8.711$, $p < .001$. High schools in quartile 2 (M = 100307611, SD = 24135556) were significantly different compared to high schools in quartile 3 (M = 81168554, SD = 30901128); $t(319) = 4.680$, $p < .001$. High schools in quartile 2 (M = 100307611, SD = 24135556) were significantly different compared to the high schools quartile 4 (M = 74474557, SD = 27477097); $t(319) = 6.346$, $p < .001$. However, schools in quartile 1 (M = 110530228, SD = 21481279) were not significantly different compared to the high schools in quartile 2 (M = 100307611, SD = 24135556); $t(319) = 2.49$, $p = .06$. High schools in in quartile 3 (M = 81168554, SD = 30901128) were not significantly different compared to the high schools quartile 4 (M = 74474557, SD = 27477097); $t(319) = 1.66$, $p = .35$.

3c. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the by the levels of the percentage of students receiving free or reduced lunch on the school's school climate rating?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the percentage of students receiving free and reduced lunch where the schools were divided into four quartiles based on their percentages (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%,

and Quartile 4: 90.65-100%). The dependent variable is each school's school climate rating. Descriptive statistics were computed on the two independent variables and the school climate rating for the 327 ninth through twelfth grade high schools in Georgia and the overall mean school climate rating was *M* = 85.47 (*SD = 4.12*). Schools utilizing a traditional seven-period schedule (n = 173) had a range from 74.4 to 94.5 with a mean of 85.73 (*SD* = 4.41). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 75.9 to 94.4 with a mean of 85.17 (*SD* = 3.77). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a range from 82.7 to 94.5 with a mean of 87.9 (*SD* = 2.86). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a range from 75.7 to 93.2 with a mean of 86.08 (*SD* = 3.7). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a range from 74.6 to 92.8 with a mean of 84.52 (*SD* = 4.33). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a range from 74.4 to 92.3 with a mean of 83.46 (*SD* = 4.07) (see Table 40).

Table 40

Descriptive Statistics of the School's Climate Rating by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 period	173	85.73	4.41	74.4	94.5	-0.69	0.25
4 X 4 block	154	85.17	3.77	75.9	94.4	-0.15	-0.11
Quartile 1	79	87.90	2.86	82.7	94.5	0.18	-0.70
Quartile 2	84	86.08	3.70	75.7	93.2	-0.22	-0.38
Quartile 3	80	84.52	4.33	74.6	92.8	-0.60	-0.23
Quartile 4	84	83.46	4.07	74.4	92.3	-0.17	0.06

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's

school climate rating. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a range from 83.6 to 94.5 with a mean of 88.24 (*SD* = 2.71). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a range from 75.7 to 93.2 with a mean of 86.39 (*SD* = 4.0). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a range from 74.6 to 92.8 with a mean of 84.89 (*SD* = 4.61). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a range from 74.4 to 92.3 with a mean of 83.91 (*SD* = 4.66). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a range from 82.7 to 94.4 with a mean of 87.53 (*SD* = 3.0). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a range from 79.0 to 92.4 with a mean of 85.81 (*SD* = 3.44). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a range from 75.9 to 90.3 with a mean of 84.14 (*SD* = 4.04). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a range from 77.4 to 86.8 with a mean of 82.73 (*SD* = 2.76) (see Table 41).

Table 41

Descriptive Statistics of the School's Climate Rating by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	88.24	2.71	83.6	94.5	0.22	-0.64
7 periods: Quartile 2	39	86.39	4.00	75.7	93.2	-0.59	-0.12
7 periods: Quartile 3	41	84.89	4.61	74.6	92.8	-0.70	-0.16
7 periods: Quartile 4	52	83.91	4.66	74.4	92.3	-0.31	-0.32
4 X 4 Block: Quartile 1	38	87.53	3.00	82.7	94.4	0.21	-0.90
4 X 4 Block: Quartile 2	45	85.81	3.44	79.0	92.4	0.22	-0.74
4 X 4 Block: Quartile 3	39	84.14	4.04	75.9	90.3	-0.50	-0.48
4 X 4 Block: Quartile 4	32	82.73	2.76	77.4	86.8	-0.45	-0.57

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block)

and the percentage of students receiving free or reduced lunch on the school's climate rating. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and it showed the data to be positively skewed. The results of the Shapiro-Wilk test were not significant ($W(327) = 0.992$, $p = .09$), indicating the assumption of normality was met. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 2.29$, $p < .05$), meaning the assumption of equal variances was not met. The school climate ratings met the assumption of an independent observation. The school climate ratings were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and percentage of students receiving free and reduced lunch by quartile) and interaction effects. The overall mean school climate rating was $M = 79169109.01$ ($SD = 15984211.37$). Schools utilizing a traditional seven-period schedule (n = 173) had a mean of 80398101 ($SD = 16920202$). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 77788488 ($SD = 14795799$). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a mean of 88669156 ($SD = 12653805$). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a mean of 81408095 ($SD = 14956426$). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a mean of 75575967 ($SD = 15934827$). High schools in the

fourth quartile of students receiving free or reduced lunch (n = 84) had a mean of 71417595 (*SD* = 14947652) (see Table 42).

Table 42

Transformed Descriptive Statistics of the School's Climate Rating by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 period	173	80398101	16920202	42586104	120658452	-0.23	-0.26
4 X 4 block	154	77788488	14795799	46448209	120102659	0.25	-0.17
Quartile 1	79	88669156	12653805	67474439	120658452	0.39	-0.45
Quartile 2	84	81408095	14956426	45918201	113586252	0.11	-0.61
Quartile 3	80	75575967	15934827	43086164	111476037	-0.22	-0.51
Quartile 4	84	71417595	14947652	42586104	108881033	0.35	0.26

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's school climate rating. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a mean of 90111978 (*SD* = 12195005). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a mean of 82846011 (*SD* = 15878660). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a mean of 77159007 (*SD* = 17009249). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a mean of 73457052 (*SD* = 17208215). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a mean of 87112427 (*SD* = 13113948). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a mean of 80161901 (*SD* = 14170333). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a mean of 73911745 (*SD* = 14757900). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a mean of 68103478 (*SD* = 9630040) (see Table 43).

Table 43

Transformed Descriptive Statistics of the School's Climate Rating by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	90111978	12195005	70730862	120658452	0.44	-0.40
7 periods: Quartile 2	39	82846011	15878660	45918201	113586252	-0.24	-0.56
7 periods: Quartile 3	41	77159007	17009249	43086164	111476037	-0.31	-0.51
7 periods: Quartile 4	52	73457052	17208215	42586104	108881033	0.15	-0.35
4 X 4 Block: Quartile 1	38	87112427	13113948	67474439	120102659	0.41	-0.63
4 X 4 Block: Quartile 2	45	80161901	14170333	55285034	109396258	0.46	-0.63
4 X 4 Block: Quartile 3	39	73911745	14757900	46448209	98964495	-0.18	-0.71
4 X 4 Block: Quartile 4	32	68103478	9630040	50575677	83304143	-0.23	-0.74

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on the school's climate rating. The data were transformed utilizing the Yeo-Johnson's Power Transformation in order to address the statistical assumptions not met with the original data. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots, and all evidence illustrated a normal distribution. The results of the Shapiro-Wilk test were not significant at ($W(327) = 0.994$, $p = .19$), meaning the assumption was normality was met. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 1.85$, $p = .08$), meaning the assumption of equal variances was met. The school climate ratings met the assumption of

an independent observation. The school climate ratings were on the interval level of measurement.

The results of the factorial ANOVA found no statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on the school climate rating, F (3, 319) = 0.136, p = .94, η^2 = .00. However, it determined there was a significant main effect on the school's climate rating based on the percent of students receiving free and reduced lunch, F (3, 319) = 21.86, $p < .001$, η^2 = .17 and a significant main effect on the school's climate rating based on high school schedules, F (1, 319) = 4.74, p = .03, η^2 = .01.

Post hoc comparisons using the Tukey HSD of the main effect for the school's climate rating based on the percent of students receiving free and reduced lunch. Results indicated the schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different compared to the high schools in quartile 2 (M = 81408095, SD = 14956426); t(319) = 3.089, p = .01. High schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different to the high schools in quartile 3 (M = 75575967, SD = 15934827); t(319) = 5.621, $p < .001$. High schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different to the high schools in quartile 4 (M = 71417595, SD = 14947652); t(319) = 7.648, $p < .001$. High schools in quartile 2 (M = 81408095, SD = 14956426) were significantly different to the high schools in quartile 3 (M = 75575967, SD = 15934827); t(319) = 2.603, p = .047. High schools in quartile 2 (M = 81408095, SD = 14956426) were significantly different compared to the high schools in quartile 4 (M =

71417595, *SD* = 14947652); *t*(319) = 4.665, *p* < .001. However, there was not a significant difference between high schools in quartile 3 (*M* = 75575967, *SD* = 15934827) compared to the high schools in quartile 4 (*M* = 71417595, *SD* = 14947652); *t*(319) = 2.046, *p* = .17.

Lastly, on the other main effect based on school schedule type there was a significant difference on climate scores between schools using a 4 X 4 block (*M* = 77788488, *SD* = 14795799) and schools using a 7-period schedule (*M* = 80398101, *SD* = 16920202); *t*(319) = 2.184, *p* = .03.

3d. Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4 X 4 block) by the levels of the percentage of students receiving free or reduced lunch on the school's overall retention rate?

The two independent variables in this question are the type of schedule (traditional seven-period or 4 X 4 block) and the percentage of students receiving free and reduced lunch where the schools were divided into four quartiles based on their percentages (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%). The dependent variable is each school's school climate rating. Descriptive statistics were computed on the two independent variables and the school climate rating for the 327 ninth through twelfth grade high schools in Georgia and their overall mean retention rate was *M* = 0.05 (*SD = 0.04*). Schools utilizing a traditional seven-period schedule (n = 173) had a range from 0 to 0.15 with a mean of 0.05 (*SD* = 0.03). Schools utilizing a 4 X 4 block schedule (n = 154) had a range from 0 to 0.17 with a mean of 0.05 (*SD* = 0.04). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a range from 0 to

0.11 with a mean of 0.04 (*SD* = 0.03). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a range from 0 to 0.10 with a mean of 0.04 (*SD* = 0.03). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a range from 0 to 0.14 with a mean of 0.05 (*SD* = 0.03). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a range from 0 to 0.17 with a mean of 0.06 (*SD* = 0.04) (see Table 44).

Table 44

Descriptive Statistics of the School's Retention Rate by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 period	173	0.05	0.03	0	0.15	0.56	-0.13
4 X 4 block	154	0.05	0.04	0	0.17	0.65	-0.11
Quartile 1	79	0.04	0.03	0	0.11	0.69	-0.29
Quartile 2	84	0.04	0.03	0	0.10	0.43	-0.62
Quartile 3	80	0.05	0.03	0	0.14	0.53	0.05
Quartile 4	84	0.06	0.04	0	0.17	0.07	-0.90

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's overall retention rate. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a range from 0 to 0.11 with a mean of 0.04 (*SD* = 0.03). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a range from 0 to 0.09 with a mean of 0.03 (*SD* = 0.02). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a range from 0 to 0.07 with a mean of 0.04 (*SD* = 0.02). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a range from 0 to 0.15 with a mean of 0.06 (*SD* = 0.04). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a range from 0 to 0.10

with a mean of 0.04 (*SD* = 0.03). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a range from 0 to 0.10 with a mean of 0.04 (*SD* = 0.03). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a range from 0 to 0.14 with a mean of 0.06 (*SD* = 0.04). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a range from 0 to 0.17 with a mean of 0.06 (*SD* = 0.05) (see Table 45).

Table 45

Descriptive Statistics of the School's Retention Rate by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	0.04	0.03	0	0.11	0.60	-0.58
7 periods: Quartile 2	39	0.03	0.02	0	0.09	0.53	-0.60
7 periods: Quartile 3	41	0.04	0.02	0	0.07	-0.47	-0.56
7 periods: Quartile 4	52	0.06	0.04	0	0.15	-0.07	-1.07
4 X 4 Block: Quartile 1	38	0.04	0.03	0	0.10	0.75	-0.07
4 X 4 Block: Quartile 2	45	0.04	0.03	0	0.10	0.29	-0.81
4 X 4 Block: Quartile 3	39	0.06	0.04	0	0.14	0.23	-0.99
4 X 4 Block: Quartile 4	32	0.06	0.05	0	0.17	0.26	-0.75

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (7 periods and block) and the percentage of students receiving free or reduced lunch on the school's overall retention rate. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Skewness and kurtosis were examined, as well as observation of histograms and Q-Q plots, and it showed the data to be positively skewed. The results of the Shapiro-Wilk test were significant at ($W(327) = 0.99$, $p < .05$); therefore, a Robust Jarque Bera Test was utilized, and the results were significant as well, at ($JB(2, n = 327, p < .05)$, meaning the assumption of normality was

violated. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 7.25$, $p < .05$), meaning the assumption of equal variances was not met. The schools overall retention rates met the assumption of an independent observation. The schools overall retention rates were on the interval level of measurement.

The Yeo-Johnson Power Transformation was utilized in order to attempt to meet the statistical assumptions. Once the data were transformed, descriptive statistics were gathered for each main effect (schedule type and percentage of students receiving free and reduced lunch by quartile) and interaction effects. The overall mean retention rate was $M = 0.05$ ($SD = 0.04$). Schools utilizing a traditional seven-period schedule (n = 173) had a mean of 0.05 ($SD = 0.03$). Schools utilizing a 4 X 4 block schedule (n = 154) had a mean of 0.05 ($SD = 0.04$). Ninth through twelfth grade high schools in the first quartile of students receiving free or reduced lunch (n = 79) had a mean of 0.04 ($SD = 0.03$). High schools in the second quartile of students receiving free or reduced lunch (n = 84) had a mean of 0.04 ($SD = 0.03$). High schools in the third quartile of students receiving free or reduced lunch (n = 80) had a mean of 0.05 ($SD = 0.03$). High schools in the fourth quartile of students receiving free or reduced lunch (n = 84) had a mean of 0.06 ($SD = 0.04$) (see Table 46).

Table 46

Transformed Descriptive Statistics of the School's Retention Rate by Schedule or Percentage of Students Receiving Free or Reduced Lunch

Group	n	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 period	173	0.05	0.03	0	0.15	0.56	-0.13
4 X 4 block	154	0.05	0.04	0	0.17	0.65	-0.11
Quartile 1	79	0.04	0.03	0	0.11	0.69	-0.29
Quartile 2	84	0.04	0.03	0	0.10	0.43	-0.62
Quartile 3	80	0.05	0.03	0	0.14	0.53	0.05
Quartile 4	84	0.06	0.04	0	0.17	0.07	-0.90

Note. [a]Minimum Value; [b]Maximum Value

Descriptive statistics for the interaction between ninth through twelfth grade high schools in Georgia using a traditional seven-period schedule or 4 X 4 block and their percentage of students receiving free or reduced lunch were computed using the school's overall retention rate. Schools utilizing a traditional seven-period schedule in the first quartile (n = 41) had a mean of 0.04 (*SD* = 0.03). Schools utilizing a traditional seven-period schedule in the second quartile (n = 39) had a mean of 0.03 (*SD* = 0.02). Schools utilizing a traditional seven-period schedule in the third quartile (n = 41) had a mean of 0.04 (*SD* = 0.02). Schools utilizing a traditional seven-period schedule in the fourth quartile (n = 52) had a mean of 0.06 (*SD* = 0.04). Schools utilizing a 4 X 4 block schedule in the first quartile (n = 38) had a mean of 0.04 (*SD* = 0.03). Schools utilizing a 4 X 4 block schedule in the second quartile (n = 45) had a mean of 0.04 (*SD* = 0.03). Schools utilizing a 4 X 4 block schedule in the third quartile (n = 39) had a mean of 0.06 (*SD* = 0.04). Schools utilizing a 4 X 4 block schedule in the fourth quartile (n = 32) had a mean of 0.06 (*SD* = 0.05) (see Table 47).

Table 47

Transformed Descriptive Statistics of the School's Retention Rate by Schedule and Percentage of Students Receiving Free or Reduced Lunch

Group	N	*M*	*SD*	Min[a]	Max[b]	Skewness	Kurtosis
7 periods: Quartile 1	41	0.04	0.03	0	0.11	0.60	-0.58
7 periods: Quartile 2	39	0.03	0.02	0	0.09	0.53	-0.60
7 periods: Quartile 3	41	0.04	0.02	0	0.07	-0.47	-0.56
7 periods: Quartile 4	52	0.06	0.04	0	0.15	-0.07	-1.07
4 X 4 Block: Quartile 1	38	0.04	0.03	0	0.10	0.75	-0.07
4 X 4 Block: Quartile 2	45	0.04	0.03	0	0.10	0.29	-0.81
4 X 4 Block: Quartile 3	39	0.06	0.04	0	0.14	0.23	-0.99
4 X 4 Block: Quartile 4	32	0.06	0.05	0	0.17	0.26	-0.75

Note. [a]Minimum Value; [b]Maximum Value

A factorial analysis of variance (ANOVA) was computed to determine whether there was a significant difference between the two schedule types (traditional seven-period schedule vs 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on the school's retention rate. The data were transformed utilizing the Yeo-Johnson's Power Transformation in order to address the statistical assumptions not met with the original data. Statistical considerations and assumptions were checked prior to running the ANOVA. There was no missing data for this question. The data were converted to z-scores to examine outliers and no outliers were identified. Normality tests such as skewness, kurtosis, and the Shapiro-Wilk test were conducted to assure the data had a normal distribution, as well as observation of histograms and Q-Q plots. The results of the Shapiro-Wilk test indicated non-normality ($W(327) = 0.99$, $p < .01$) and the Robust Jarque Bera Test was significant at ($JB(2, n = 327, p < .05$), meaning the assumption was normality was not met. The assumption of homogeneity of variance (HOV) was assessed using Levene's test for equality of variance ($F(7,319) = 7.25$, $p < .001$), meaning the assumption of equal variances was not met. The school's overall

retention rates met the assumption of an independent observation. The school's overall retention rates were on the interval level of measurement.

Considering the original and transformed data did not meet the statistical assumptions it was determined to use the Aligned Rank Transform (ARTools) for Nonparametric Factorial AVOVA. The results of the ARTools factorial ANOVA found no significance difference when comparing the interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) on the school's overall retention rate, F (3, 319) = 1.36, p = .25, η^2 = 0.01. For the main effect on high school schedules on the school's overall mean retention rate there was no statistical significance, F (1, 319) = 0.268, p = .61, η^2 = 0.00. However, there was a significant main effect on the percent of student receiving free or reduced lunch on the school's overall retention rate, F (3, 319) = 9.202, p < .001, η^2 = 0.08.

Post hoc comparisons using the Tukey HSD of the main effects on the school's overall retention rate based on the percent of students receiving free and reduced lunch indicated schools in quartile 1 (M = 0.04, SD = 0.03) were significantly different compared to the high schools in quartile 3 (M = 0.05, SD = 0.03); t(319) = 3.339, p = .01. High schools in quartile 1 (M = 0.04, SD = 0.03) were significantly different compared to the high schools in quartile 4 (M = 0.06, SD = 0.04); t(319) = 4.257, p < .001. High schools in quartile 2 (M = 0.04, SD = 0.03) were significantly different compared to the high schools in quartile 3 (M = 0.05, SD = 0.03); t(319) = 3.043, p = .01. High schools in quartile 2 (M = 0.04, SD = 0.03) were significantly different compared to the high

schools in quartile 4 (M = 0.06, SD = 0.04); $t(319) = 3.975$, $p < .001$. However, schools in quartile 1 (M = 0.04, SD = 0.03) were not significantly different compared to the high schools in quartile 2 (M = 0.04, SD = 0.03); $t(319) = 0.343$, $p = .99$, and high schools in quartile 3 (M = 0.05, SD = 0.03) were not significantly different compared to high schools in quartile 4 (M = 0.06, SD = 0.04); $t(319) = 0.929$, $p = .79$.

Qualitative Results

The second part of this study consisted of principal interviews to obtain insight into school schedules, 9th-grade student achievement, and overall school success. According to Creswell & Plano Clark (2011), to complete the sequential explanatory design used for this study, it was imperative to follow the quantitative data analysis with a qualitative portion to understand better the results and how high school schedule types, in combination with school location or the percentage of students receiving free or reduced lunch, can affect 9th-grade student achievement and overall school performance measures.

Participants

Twelve principals, two from each schedule type (traditional 7-period and 4 X 4 block) and school location (rural, suburban, and urban), were randomly selected to participate in a seven-question interview to provide a more comprehensive understanding of the quantitative findings. Before selecting the interviewees, a validation study was conducted to ensure the questions were free from bias and reactivity (Maxwell, 2005). Maxwell (2005) states the validation study should happen before and after the interviews to ensure no leading questions or prior biases were included in the interviews since it can threaten the validity of the questions and interpretation of the responses.

Demographic Characteristics

Data collection for the study took place during the 2018-2019 school year. As stated previously, 12 total principals, with two from each schedule type (traditional 7-period and 4 X 4 block) and school location (rural, suburban, and urban) were randomly selected and received an email concerning the study with a request to consent to a seven-question interview to provide insight on high school schedules, ninth-grade student achievement, and overall school performance measures. Once the participants agreed to participate in the interview, they received a follow-up email with a link to schedule a date and time for the interview, a consent statement, and the interview questions. Two principals represented each of the six different schedule types and school location combinations: seven-period rural, seven-period suburban, seven-period urban, 4 X 4 block rural, 4 X 4 block suburban, and 4 X 4 block urban. In addition, the following demographic data were obtained from each of the principals before the interviews.

The six principals from high schools utilizing a 4 X 4 block schedule had an average of 24 years of total educational experience and an average of 8.5 years as a principal. In addition, four principals earned their doctorate in educational leadership, and the other two had an education specialist in leadership. Four were male, two were female, five were White, and one was Black (see Table 48).

Table 48

Descriptive Statistics of Principals Interviewed from High Schools Using a 4 X 4 Block Schedule

	Miller	Craft	McCloud	Flanders	Roberts	Fowler
Gender	Male	Male	Female	Male	Female	Male
Race	White	White	White	White	Black	White
Experience[a]	26	20	24	14	33	24
Tenure[b]	7	5	11	2	13	15
Setting	Rural	Rural	Suburban	Suburban	Urban	Urban
Degree[c]	Doctorate	Specialist	Specialist	Doctorate	Doctorate	Doctorate

Note. Pseudonym names used in place of principal's real name; [a]Total years of educational experience; [b]Years as a principal; [c]Highest degree earned

The six principals from high schools utilizing a traditional 7-period schedule had an average of 21 years of total educational experience and an average of 4.3 years as a principal. In addition, one of the principals had earned their doctorate in educational leadership, and five had an education specialist in leadership. Four were male, two were female, four were White, and two were Black (see Table 49).

Table 49

Descriptive Statistics of Principals Interviewed from High Schools Using a Traditional 7-Period Schedule

	Leaf	Sermons	Grayson	Chester	Simon	Layton
Gender	Male	Female	Female	Male	Male	Male
Race	Black	White	White	White	Black	White
Experience[a]	16	21	18	20	22	27
Tenure[b]	4	5	4	1	7	5
Setting	Rural	Rural	Suburban	Suburban	Urban	Urban
Degree[c]	Specialist	Specialist	Specialist	Specialist	Doctorate	Specialist

Note. Pseudonym names used in place of principals' real name; [a]Total years of educational experience; [b]Years as a principal; [c]Highest degree earned

Results by Question

The following research question is research question 4 and serves as the qualitative question for this study:

> 4. In what ways does the interview data reporting the views of the high school principals explain the quantitative results about how their schedule type, location, and percentage of students receiving free or reduced lunch affect their ninth-grade student achievement and overall school performance.

Principal interviews were semi-structured with seven interview questions, which were created to answer Research Question 4. Responses to each interview were arranged by schedule type (traditional seven-period and 4 X 4 block). Principals were given pseudonyms to keep their identities confidential. Principals were given the interview questions and a summary of the quantitative results prior to the interview in order to give the interviewee time to thoroughly formulate a response to the questions and the data presented. After the interviews were completed and the transcriptions were compiled, themes were identified for each question and sorted by schedule type. For consistency, the themes will be reported by interview question and in the same sequence for each question; summary of responses/themes by 4 X 4 block principals followed by the seven-period principals.

Interview Questions.

1. Which schedule does your school currently utilize?

Principals were randomly selected from each of the six categories defined by schedule type (traditional 7-period or 4 X 4 block) and location/setting (rural, suburban, or urban). Demographics for the 4 X 4 block principals can be found in Table 43, and the

same information for the traditional 7-period principals can be found in Table 44. Each interview began with this question to ensure the information was in the transcripts for accuracy and transparency.

2. As a (rural, suburban, or urban) school, why does your school utilize its current schedule? What are two advantages of your current schedule? What are two disadvantages of your current schedule?

Principals utilizing the 4 X 4 block schedule had three common themes for interview question 2. Each principal's primary reason for choosing the 4 X 4 block schedule was to offer students more opportunities to earn credits. Principal McCloud stated her school system transitioned to a block system when the number of required credits required for graduation increased in order to provide their students more opportunities to earn the credits. Principal Fowler comments were very similar to Principal McCloud but expounded on the need to provide students more opportunities to participate in elective courses such as band, chorus, art, and technical courses, which had diminished when the number of core academic credits needed for graduation had increased. Secondly, Principal Fowler stated that it minimized the number of courses a student-focused on when studying and preparing for high-stakes testing. Principal Roberts indicated students in a 4 X 4 block schedule have less classes to take and more instructional time in class, which allows students to focus on only a few high-stakes test at a time. Another common reason for choosing the 4 X 4 block schedule was to reduce transitions and time in the halls, and as a result decreasing disciplinary issues. Principal Craft adamantly stated a 4 X 4 block schedule reduced disciplinary behaviors for the simple fact there were less transitions, “obviously you know a lot of the problems that occur in school is during

transition times." Lastly, and probably most importantly, the 4 X 4 block schedule was chosen to increase teacher planning and grading time and reduce the number of students a teacher was responsible for, thereby, in turn, reducing the student-to-teacher ratio. According to the principals interviewed, the increase in planning time and decrease in the number of students allows for better instruction and higher quality of instructional feedback. Principal Miller, having worked in several different scheduling styles (eight period, seven period, alternating block, and a pure 4 X 4 block) stated the 4 X 4 block is the most teacher friendly, and it makes the teachers happy!

All six principals provided two advantages of a 4 X 4 block schedule in the interviews. Three of the principals; Miller, McCloud, and Flanders stated one of the advantages of utilizing the 4 X 4 block schedule was providing students increased opportunities to earn credits. Whether it is more academic electives such as, Advance Placement courses or credit recovery for the struggling students. Three other principals (Craft, McCloud, and Roberts) stated one advantage of the 4 X 4 block schedule was that the class periods are more extended. During the extended time, the teacher can go deeper into the concept or allow students to apply their learning through lengthier learning activities or labs. Two of the principals, Miller and Fowler, shared that a 4 X 4 block decreases transitions and in direct result, decreases disciplinary issues. Principal Roberts and Fowler agreed a 4 X 4 block provided teachers with fewer students, which allowed the opportunity for the teacher to build on their student relationships, more time to grade papers, and fewer classes to focus on at a time. In addition, Principal Flanders suggested students get a "fresh start" at mid-year with four new classes and teacher.

When asked for two disadvantages of the 4 X 4 block schedule, the principals shared four common themes. The one disadvantage all principals agreed upon was the difficulty for teachers to plan and engage students for the entirety of a 90-minute class. Principals Miller, Craft, and McCloud were all concerned with the engagement, or lack thereof, during a 90-minute lesson. Craft stated, "if the teacher is not properly engaging their students there could be a tremendous waste of instructional time." McCloud reiterated the sentiment by saying teachers must be intentional about how they teach and use 90-minutes of uninterrupted instructional time. The second most common theme was the fear of learning gaps from a student having a course in the fall of their freshmen year and not having the following course until possibly the spring of their next year. Principal Miller used a world language as an example and a student taking Spanish I the fall of their freshmen year, but then cannot fit Spanish II into their schedule until the spring of their sophomore year, such a large gap could pose issues with student success. Principal Flanders argued student and teacher relationships are harder to build and maintain in such a shortened time frame, and students must adjust to perhaps four new teachers each semester, which for some students and teachers can be a difficult task. Finally, Principal Fowler shared the concern of students not wanting to use one of their two electives to participate in fine arts year-round. For example, they may participate in the fall for marching band but might not want to continue in the spring for concert band, which hurts the continuity and success of those programs. Collectively, the 4 X 4 Block principals shared six perceived disadvantages; content gaps over time due to scheduling issues, wasted instructional time in 90-minutes of uninterrupted class time, building and maintaining relationships during over one semester, possible social issues for students

who find building relationships difficult, scheduling all students twice a year, and making it difficult for fine arts programs to grow and sustain when students have the opportunity to change electives in the middle of the year.

Principals from a seven-period schedule shared their reasons for utilizing the schedule, and it came down to three main factors: superintendent preference, teacher training, and student attention spans. Principals Sermons, Chester, and Layton stated their superintendents made the decision for a seven-period schedule. Sermons and Chester both stated their superintendents mandated it and did not share any reason as to why, but Layton said, “it’s cheaper not having as many teachers as a 4 X 4 block schedule.” Principals Leaf and Simon stated a 7-period schedule would be more successful for high school students and allowed for shorter classes to address their students' short attention spans. Principal Grayson basically stated her school was on 7-period before she arrived and there was no reason, she was aware of for the decision to utilize the 7-period schedule.

Traditional seven-period principals continued by giving two advantages to their current schedule. There were three main themes from the six interviews: it allows more diversity of classes throughout the day by attending seven rather than four, shorter periods are more suited to the student's shorter attention spans, and it is better to have math all year long. Principals Leaf, Sermons, Chester, and Simon all agreed a 7-period schedule is better suited for a high school students short attention span. Chester stated, “the seven-period schedule for our students gives the student a smaller dose of academics per day over a longer period of time, and the smaller doses help the students attention span, and provides a longer period of time for students to be immersed in content.” As

Principal Chester eluded, Principal Grayson agrees, “you’ve got 36 weeks to teach your material, rather than 18,” both principals agreed the longer time period is more beneficial when teaching for retention and deeper learning. Principal Leaf and Sermons agreed a 7-period schedule provides more elective choices throughout the day, which they think is more beneficial to students. Principal Layton shared two advantages, which differed from the other principals, he argued a 7-period schedule encouraged stronger student/teacher relationships and decreased the opportunity for gaps in learning (other than the summer) since students took all seven of their classes’ year long, which he considers as extremely important for subjects such as math and world languages. Principal Simon had one advantage the other did not share, which is a 7-period schedule helped weak teachers be more effective since it is easier to plan for 45 to 50 minutes of instruction rather than a 90-minute lesson.

For disadvantages, the interviews found five consistent themes. The two most common disadvantages had three principals in agreement. Sermons, Grayson and Simon, all agreed it is a more intense schedule due to students having to prepare and study for all four academics and three electives at one time compared to preparing for two academics and two electives on a 4 X 4 block schedule. Principals Chester, Grayson, and Layton agreed a major disadvantage is with teachers having more preps and students they are responsible for with a decrease in planning and grading time. Chester stated, “it is hard for teachers to have a larger number of students because it means they a have a larger number of papers to grade and relationships to build.” Principals Leaf and Layton argued it makes it difficult for students transferring in from a 4 X 4 block schedule in the middle of the year to catch up and acclimate to a seven-period schedule. Principals Sermons and

Simon recognize the 7-period schedule provides their students with fewer choices over a four-year time span than students on a 4 X 4 block with 28 overall choices compared to 32 choices on a block schedule. Principal Leaf determined one disadvantage is if students and teachers have a personality conflict or if teachers have a "rough" class, they are stuck all year with the same student or class, rather than switching in the middle of the year like a 4 X 4 block.

3. Does the Free and Reduced Lunch status affect which schedule is utilized? Does the Free and Reduced Lunch status effect student performance?

According to the principals utilizing a 4 X 4 block schedule, their students' free and reduced lunch status had no effect on schedule choice. Principal Miller expounded on question three and shared how his school's Free and Reduced Lunch status did not play a role in the decision for which schedule to utilize, but in retrospect it was the best decision since it provides more opportunities for remediation and credit recovery for their struggling students. Principal Craft was adamant that his school's Free and Reduced Lunch numbers had no role in their decision-making process, however, over the years the school and district liked the 4 X 4 block so much it was even implemented in the middle school in order to prepare their students for high school.

When asked if Free and Reduced Lunch status effects student achievement the 4 X 4 block principals had differing opinions. Principals Flanders and Craft agreed it does not impact student achievement. Craft argues strongly student success falls back on motivation, which is largely impacted by teachers building relationships with their students, "to the point where the students are willing to do whatever the teacher asks him/her to do because they feel like the teacher truly cares for them." The remaining

principals agreed the Free and Reduced Lunch status is a measure of poverty, which does play a role in student achievement. Principal Fowler, Roberts, Flanders, and Miller all agreed students coming from low-socioeconomic homes come to us behind and must try harder in order to be successful. Miller stated, “I think there's so many extenuating circumstances in a child's life for the economically disadvantaged, but our wealthier children definitely perform better.”

It was consistent with all traditional seven-period principals, even the two from the urban schools, they all agreed the Free and Reduced Lunch status of their students did not affect the decision of which schedule to utilize. However, all the principals agreed it does affect their students' academic performance. Principal Leaf stated, “with low socioeconomic status, which comes usually from single parent homes, there are not as many resources and unfortunately, there is lower goal setting an expectation.” Principal Sermons argued how can students perform well academically when they aren’t fed well or have proper hygiene, shelter or clothing. Principal Grayson took it a step further and stated not only do the students from low socioeconomic homes have lower goals/expectations from home, but we as teachers have lower expectations for the students as well, which is a disservice and unexpectable. Overall, all the principals agreed it affected student performance due to the lack of resources their students receiving free and reduced lunches had compared to the students from more affluent homes. These resources include, but are not limited to, nutritional food, tutoring, online resources, books, technology, and other instructional/school supplies.

4. What is the one most effective way you prepare first-year students for high-stakes testing?

Principals utilizing the 4 X 4 block schedule shared many different strategies for preparing their students for high-stakes testing. Overall, there were three common themes between their responses. Principal Miller argues their most effective strategies were teachers building strong teacher/student relationships and ensuring highly effective tier I instruction. Principals Craft and Roberts reported their most effective strategies were intentionally avoiding having first-year students take a class that requires an EOC assessment, and a high prioritization on vertical alignment and planning to ensure standards are thoroughly covered from year to year in preparation for the assessments. However, in math both principals found it hard to avoid the EOC in Algebra I for the freshmen students, therefore, in order to provide the at-risk student more support they both utilize a "math support" course in the fall and then the students take Algebra I in the spring, which provides the at-risk students 90-minutes of math year long. Both principals have found, as the data illustrates, this is a very effective strategy. Principals Fowler, Flanders, and McCloud placed a strong emphasis on remediation, extra/extended learning time and individualized student academic advisement. Most principals agreed there must be time set apart for remediation and extra support for struggling students. Principal Fowler stated his school accompanies the remediation with a prep time for students who must take an EOC, such as Algebra, their freshmen year.

There were four main common themes from the traditional seven-period principals in preparing their freshmen students for high stakes testing. One central theme, shared by four of the principals (Layton, Leaf, Grayson, and Chester) was requiring struggling or failing students to attend free tutoring sessions, or providing/scheduling extra learning time into the regular school day. Principal Layton’s school utilizes a block during lunch

where students return to their advisement class for a segment called lunch and learn. The students have 45 minutes to eat lunch and work on their schoolwork. During this time the advisement teacher ensures the students participate in EOC prep work and SAT / ACT practice. In addition, Principal Grayson stated it is essential to keep the ratio of students to teacher low and she requires the veteran, more skilled teachers to instruct the end-of-course classes to ensure her most skillful teachers prepare the students for the assessment. Principal Simon said his best tactic was the relationships his faculty builds with their students, which allows his faculty to have an intimate knowledge of each student's needs. Principal Sermons argues the best preparation is quality tier I, standards-based instruction followed by quality formative assessments, then using the data from the formative assessments to inform and guide her teacher's instruction. Sermons says it well, "To prepare freshmen for high stakes testing is to adequately teach the standards and prepare them for what it is they're going to be tested on."

5. Do you feel your current schedule influences ninth-grader culture and behavior? If so, how?

All principals utilizing a 4 X 4 block schedule agreed their schedule has a positive impact on culture and discipline. Principal McCloud continued by stating "students were less stressed and not as overwhelmed since they only had two academics to focus on at a time." Principal McCloud said, "teachers were less stressed since they had fewer students' they were responsible for at a time, and more time to plan, grade papers, prepare for labs/learning activities." Principals Craft, Flanders, Roberts, and Fowler all agreed the culture was more favorable for teachers and students, which has a positive impact on student discipline. All four principals (Craft, Flanders, Roberts, & Flanders)

continued by stating a 4 X 4 block reduced disciplinary problems not only by an improved climate and culture, but by decreasing the number of transitions during the day, which decreases the number of students who interact daily and provides less opportunities for negative behaviors.

Principals from the seven-period schedule were very blunt and passionate concerning behavior and culture. The consensus from all the seven-period principals is that the schedule might have a negative impact on behavior in their schools. Principal Leaf said, "high schoolers look for those opportunities when they're not supervised to find trouble." High school students tend to get in trouble when there is free time or lack of supervision, which is increased when there are seven transitions a day. Principal Sermons had similar beliefs stating, "referrals increase because there's more opportunity the more you transition." Leaf, Sermons, Chester, and Layton all agreed with the increase in transitions comes an increase in opportunities for discipline issues. However, Principals Grayson and Simon were undecided, they contended that if the climate is good then the increased transitions should not have a negative impact on behavior. Even though 66% of the principals agreed the schedule had a negative impact on behavior with increased transitions, 83% of the principals stated the schedule did not impact the culture of their school. Principals Leaf, Grayson, Simon, Sermons and Chester all stated the culture comes from the top down and is created mainly by the principal's decisions and actions.

6. Do you feel your current schedule influences ninth-graders performance on selected academic measures (Ninth Grade Literature, Algebra I, and Biology End-of-Course assessments)? If so, how?

All the 4 X 4 block principals agreed their schedule positively influences ninth-graders performance on EOC's since they have fewer academics to focus on at a time, have more time for any needed remediation, and break up testing into two different windows in the winter and spring. Principal Miller explained he tries to avoid any freshmen taking an EOC in "order to give the students time to acclimate to high school and provide more time for the students to mature." Principals Craft, McCloud, and Roberts overwhelmingly agreed their schedule did influence ninth-grade performance positively since students normally only have to focus on two academics and have more time for remediation. Principals Fowler and Flanders expounded on the view of Craft, McCloud and Roberts by sharing with students only focusing on two academics per semester it decreases the chances of students having more than one EOC to prepare for when testing occurs in the winter and spring, which positively impacts and increases student achievement.

Principals utilizing a seven-period had varied responses when asked if their schedule effected or influenced student performance on the EOC's. Principal Layton firmly stated it has a positive impact, stating "they have the whole year to get all the standards." In contrast, Principal Sermons viewed it strictly from when the assessments are given and argued it is tough for students on a 7-period schedule since they may have up to three EOC's to take in one week (9^{th} grade literature, Algebra I, and Biology), whereas students on a 4 X 4 block would/could only have one, maybe two assessments to prepare for and complete in one week. Principal Leaf broke the day down and compared the two schedules, stating "with 4 X 4 block students spend one-fourth of their day focused on one EOC subject, where in contrast students on a 7-period day only focus on the tested

subject for one-seventh of the day." Principal Chester said, "it's really difficult to say with 100% accuracy that the 7-period schedule is the only influence on student achievement, I think there are a lot of factors weighing in, which will give you an inconclusive answer." He went on to say it is hard in a 7-period schedule due to the amount of time it takes to effectively teach a lesson with all the vital components (warm-up, intro, work session, and conclusion) on a 7-period schedule. Principals Grayson and Simon both agreed their students' scores were negatively affected by their schedule and adamantly agreed student achievement would increase if they switched to a 4 X 4 block schedule, so their students only had to focus on two academics at a time and reduce the number of EOC's they possibly had to take during a given testing period.

7. How does your current schedule type ensure students are on track to graduate after the ninth-grade year?

A couple of common themes for 4 X 4 block principals emerged when asked how their schedule ensures students remain on track for graduation. Principals Craft, McCloud, and Fowler agreed their schedule ensured their students were on track because they had the opportunity to earn eight credits a year in contrast to the seven-period schedule. Principal McCloud said it was easy math, "32 chances to earn their required credits is better than 28 chances." Principal Fowler's response was very similar stating "it is easier for students to earn six out of eight, than to try and earn five out of seven credits each year." Principals Miller, Flanders, and Roberts stated an advisement class was utilized to help coach the students and track their progress on their graduation plan or checklist, remediate at-risk students, and/or prepare for their standardized assessments

(EOC, SAT, ACT, End-of-Pathways, etc..). Overall, all principals agreed their schedule provided the best opportunity to keep their students on track to graduate on time.

For traditional seven-period principals, there were two main themes for this question. First, Principals Sermons, Grayson, Chester, and Simon stated it is necessary to ensure all students are appropriately scheduled according to their earned credits and graduation plan. Sermons was emphatic scheduling is the most important component of keeping students on track and continually monitoring their schedule from year to year. Principal Grayson stated, "we're being really intentional with how we schedule our students and if they fail an EOC course we're putting them back in front of the teacher." Secondly, Principals Leaf, Grayson, Chester, and Layton stated it is vital to have an effective grade repair and credit recovery program to provide multiple opportunities for students to earn their required credits. Lastly, two principals (Layton and Simon) shared a concern for the number of required credits their students had to earn. For example, in Georgia, students must obtain 23 high school credits. However, local districts can add to these credits for students to graduate. Therefore, some communities adhere to the 23 required credits, but others require 24, 26, or even 28 credits, mainly depending on which schedule type their high school utilizes. Unfortunately, this creates a discrepancy when comparing schools since their graduation requirements are not all equal. Overall, the principals agreed schools must be intentional with scheduling and must have a plan to provide effective grade repair and credit recovery programs in order to ensure students remain on track for graduation.

Summary

The results reported in this chapter were presented following a sequential explanatory design. Quantitative results were presented first, followed by the qualitative results. The significant findings of the study revealed overall there is no significant difference between a traditional seven-period schedule or a 4 X 4 block schedule, even when examining the interaction of schedules with the school's location (rural, suburban, or urban) or coupled with the percentage of students receiving free or reduced lunch.

When examining all the interaction effects only two subquestions had significant results. When comparing ninth grade achievement on the Georgia Milestones Biology EOC the following interaction groups were determined to be significant: 7-period rural compared to 7-period urban high schools, 7-period suburban compared to 7-period urban high schools, 4 X 4 block rural compared to 7-period urban, 4 X 4 block suburban compared to 7-period urban, and 4 X 4 block urban compared to 7-period urban. Lastly, there was a significant difference found for the interaction effect when comparing CCRPI scores between 7-period suburban and 7-period urban high schools and between 4 X 4 block suburban and 7-period urban high schools.

After examining for significant interaction effects, it was necessary to examine the main effects if the interaction was found not to be significant. For Research Questions 1 and 2 the two main effects were schedule type and location (rural, suburban, or urban). For the main effect based on schedule type there was only one significant finding. When comparing high schools on the 9^{th} grade student achievement on the Georgia Milestones Algebra I EOC it was determined 4 X 4 block schedule were significantly different from the traditional seven-period schedule. However, when examining the main effect based

on schools' location (rural, suburban, urban) significant results were found on all subquestions. In general, rural and suburban schools were found to be significantly different compared to urban schools for ninth grade student achievement and overall school performance measures.

For Research Question 3 the two main effects were schedule type and the percentage of students receiving free and reduced lunch by quartiles. There was one significant result when examining the main effect based on schedule type. When comparing Climate Ratings, the 4 X 4 block was found to be significantly different than the traditional 7-period schedule. When examining the main effect based on the percentage of students receiving free and reduced lunch significant results were found for each subquestion. Overall, the schools in quartiles 4 and 3 were significantly different than the schools in quartile 2 and especially quartile 1, which indicates poverty and socio-economic status effects student achievement and school performance.

Findings from the qualitative portion of the study solidified the quantitative results by principals believing there is no one best schedule. Each schedule has its unique advantages and disadvantages. However, when assessing the quantitative and qualitative findings, it is clear why there was a significant difference in the Algebra I EOC scores. The majority of the 4 X 4 block principals had a plan to double block the at-risk math students to receive 90 minutes of math their freshmen year, which explains the significant difference between the scores. Lastly, most principals, whether 7-period or 4 X 4 block, agreed the reduction of classes and transition between classes decreased discipline and improved the school climate, which explains the significant results on Research Question 3C pertaining to overall school climate scores.

Chapter V

DISCUSSION

In Georgia, before 2012, high schools were measured annually according to how students performed on the Georgia High School Graduation Test (GHSGT) which was administered to students during the eleventh-grade year. Therefore, high schools had three years to prepare their students for high-stakes testing. This test determined the student's eligibility for graduation and provided a measure of school performance based on the students' overall performance. The No Child Left Behind (NCLB) waiver was implemented in 2012 and changed how schools and student performance were measured.

Due to NCLB in 2012, there was a shift from Annual Yearly Progress (AYP) to Georgia's College and Career Readiness Performance Index (CCRPI). This change resulted in how student achievement was measured by transitioning from the GHSGT to the Georgia Milestones End-of-Course-Tests (EOCT). Unlike the GHSGT administered only to eleventh graders. The EOCT was administered in eight courses consisting of two in each core content, spanning ninth through twelfth grade: Algebra I, Geometry, 9th Grade Literature, American Literature, U.S. History, Economics, Biology, and Physical Science. Of these EOCT's, three were generally administered to ninth graders; 9th Grade Literature, Algebra I, and Geometry.

Schools needed to focus more on ninth-grade achievement considering the new accountability process and the emphasis placed on ninth-grade performance. Combined with the new accountability process and EOCT's is the national dilemma of what is

referred to as "the ninth-grade bulge," which is a term used to describe percentage increase in students in ninth grade over the number enrolled in eighth grade (Neild, 2009). For example, many states have as many as a 32 percent increase in enrollment in ninth grade from eighth grade the previous year. According to Wheelock and Miao (2005), the "ninth-grade bulge" contributes to the nation's steady decline in the graduation rate.

The purpose of this study was to determine if bell schedules affect first-time ninth graders' academic success and overall school performance. Success for ninth grade student achievement was defined by the number of students scoring a level two, three, or four (developing, proficient or distinguished learner) on the Georgia Milestones End-of-Course assessment in 9th Grade Literature, Algebra I, and Biology. In addition, for overall school success, each school was compared using the following measures: the College Career Readiness Performance Index (CCRPI) score, 4-year cohort graduation rate, climate score, and overall retention rate.

Literature Review

The review of literature focused on how high school schedules affected individual student achievement and overall school performance. In organizing the literature, there were four distinct areas: the origins of the high school schedule, theories behind school reform and scheduling, the examination of the two most widely utilized schedules in Georgia, the traditional seven-period and 4 X 4 block schedules, and lastly, the issue of ninth-grade retention.

According to Silva, White, and Toch (2015), school schedules began with the Carnegie Foundation for the Advancement of Teaching in 1906, this group provided a

definition for a credit hour of learning and labeled it as a "Carnegie Unit." The Carnegie Unit is defined as 120 contact hours with an instructor, typically broken into one hour a day, five days a week for 24 weeks. In Georgia (GaDOE, 2011), local school systems must require students to earn a minimum of 23 credits or Carnegie Units: four units in Math, English/Language Arts, and Science, three units of Social Studies, three units of world languages, or CTAE (Career, Technical, and Agricultural Education) courses, four elective units, and one unit of health and physical education. However, states vary in the minimum number of Carnegie Units required for students to graduate. Although the Carnegie Unit is utilized to track and monitor student learning, it was initially designed to assess faculty workloads for college and university professors (Laitinen, 2013). Due to a desire for "efficiency, mass production, and work uniformity" in the scientific management era, the Carnegie Unit became a way to ensure the education of the growing school-aged population (Hackmann, 2004, p. 699).

Hackmann stated high school schedules were relatively left alone until the beginning of the 1950s with the introduction of modular scheduling, which hit its peak in the early 1970s and quickly faded due to the wide variations of class times and schedules. This left students unsupervised, creating many disciplinary and safety issues (2004). The 1950s were popular for school reform because the Unites States was falling behind in instituting a rigorous, competitive education system (Conant, 1959). Education took top legislative priority in 1957 due to the launching of Sputnick, which resulted in the National Defense Education Act (NDEA) in 1958. The NDEA encouraged educational innovation in math, science, and world languages in order to be competitive globally in the nuclear age of technology (USDE, 2009).

Even after the NDEA, there was a steady decline in the United States on standardized tests compared to competing industrialized nations (McKnight, 1987). Due to the steady decline, President Ronald Reagan authorized the Secretary of Education, Terrell H. Bell, to create the National Commission of Excellence in Education (McKnight, 1987). In 1983 the NCEE released a report, *A Nation at Risk*, which compared the United States to other high-ranked industrialized nations using 19 academic assessments and compared the time each country committed to mathematics during the school day. The study found the other countries committed three times more class time to mathematics than the United States, which generated concern and a call for reform in the United States for different scheduling options (NCEE, 1983). For example, the NCEE (1983) found that schools in the United States typically follow a 180-day school calendar with six hours of instruction, whereas in other countries, students are in attendance 220 days for eight hours a day.

In response to the report, *A Nation at Risk,* educational reform was initiated in the mid to late 1980s and early 1990s with a strong focus on school schedules, more specifically, a comparison between the traditional 45 to 50-minute class period to a 90-minute block (Stanley, Spradlin, & Plucker, 2007). The continuing concern for education reform in the 1990s led to the creation of the Education Council Act of 1991, which Richard W. Riley used as Secretary of Education, to create the NECTL (National Education Commission on Time and Learning). Soon after this group released a report entitled, *Prisoners of Time* (Stanley et al., 2007). *Prisoners of Time* intends on helping foster academic success for schools and communities by focusing the investigation on

course structures and scheduling options. It inspired educators to rethink the academic day and find new ways to structure the time spent in class (Stanley et al., 2007).

The reports, *A Nation at Risk* and *Prisoners of Time*, both played a vital role in bringing about tremendous changes for the United States educational system. For example, Stanley, Spradlin, and Plucker (2007) argue that the two reports encouraged educators to investigate alternative schedules to the 45 to 50-minute class and how each schedule affects students' academic success. In fact, by 2006, at least 50% of high schools in the U.S. were on some type of modified or block schedule (Dexter, Tai, & Sadler, 2006).

According to Hackmann (2004), there are two distinct theories on scheduling reform: behaviorism and constructivism. Leaders of the behaviorist theory, B.F. Skinner, Ivan Pavlov, and John Watson theorize that schools are more successful when information is shared in smaller segments allowing time to practice and repeat instruction if necessary. Therefore, schools should utilize seven to eight smaller class periods. In contrast, constructivists led by Vygotsky and Piaget argued for more extensive time frames to allow individuals the opportunity to be socially engaged in their learning and gain a deeper understanding of the material (Hackmann, 2004).

Based on these different theories, many schedules are utilized in high schools throughout the United States. However, there are four main types; the traditional seven-period schedule (can be six or eight periods), the 4 X 4 block, a modified block (alternates days rather than changing at the end of a semester), or a trimester schedule (also known as the Copernican Plan) (Ford, 2015). The two most predominantly used in

Georgia (GaDOE, 2018) are the traditional seven-period (see Table 1) and the 4 X 4 block schedule (see Table 2).

The traditional seven-period schedule consists of seven 45 to 55-minute classes for the entire 180-day school year, which provides approximately 9,000 minutes of seat time per class. In contrast, the 4 X 4 block schedule consists of four 90-minute classes per day for 90 days and then four new classes for the remaining 90 days of school, which provides approximately 8,100 minutes of seat time. Generally, students would attempt two academics and two electives per semester.

Since the industrial age, the traditional schedule has been around and uses product-oriented thinking, with teachers having a set number of instructional minutes to cover a pre-determined curriculum (Kruse & Kruse, 1995). Kruse and Kruse (1995) continue with the product-oriented thinking by describing how students go from class to class for six, seven, or eight periods a day for 180 and earn a credit based on their mastery of the standards. Cromwell (1997) contends a traditional schedule provides more seat time than a block schedule strictly by looking at the number of instructional minutes; a traditional schedule provides approximately 9000 compared to a 4 X 4 block, which is approximately 8100.

In conjunction with more seat time, Cromwell (1997) argues that a traditional schedule with shorter class periods is more advantageous for students with specific learning disabilities, such as students with ADHD. Cromwell (1997) states that a traditional schedule helps students fine-tune their time management skills by balancing a busy schedule. In addition, it would be more beneficial for students with attendance

issues since they would not miss as much instruction as a student block schedule for any particular subject.

Rettig and Canady (2003) stated that teachers who advocate for block schedules say that it provides more time to plan and implement extended lessons with multiple instructional strategies to meet the individual needs of their students. Another claim is that the increased time allows for more in-depth learning and provides the student and teacher more confidence in the learning process (Imbimbo & Gilkes, 2009). Teachers also claim that more substantial teacher-student relationships are formed during block scheduling are more robust due to the extended time in class and fewer students to interact with each semester (Santos & Rettig, 1999).

Canady and Rettig (1996) contend block schedules significantly reduce the number of classes taught daily but greatly increase the time in each class. Ford (2015) pointed out how a 4 X 4 block schedule is intended for teachers to transition to different activities every 12-15 minutes providing their learners with multiple opportunities to grasp the concept and allow the teacher time to differentiate the material to meet the needs of all learners. Wilson and Stokes (1999) encourage ample planning time, and significant professional learning for teachers is vital when implementing block scheduling. They continued by sharing a few factors they believe are essential to maintaining an effective block schedule. Two factors Wilson and Stokes (1999) emphasized were keeping the planning period sacred and using multiple instructional strategies during the 90-minute instructional block. In addition, Wilson and Stokes (1999) state their research shared one crucial factor; teachers need continuous professional

learning to effectively organize a block schedule not to waste instructional time and keep students on task.

According to Wheelock and Miao (2005), the "ninth-grade bulge" significantly contributes to the nation's continually decreasing graduation rate. Neild (2009) defines the bulge, or bottleneck, as the increase in the number of students in ninth grade over the number enrolled in eighth grade the year prior. Many states have witnessed a 32 percent increase in ninth grade from eighth grade the previous year. The bulge partially exists because more and more students are unsuccessful in meeting requirements, earning the required Carnegie units, to be promoted to tenth grade. Pharris-Ciurej et al. (2012) concluded that less than 50% of students who begin ninth grade graduate four years later. To reduce the bulge, school leaders can make the bulge visible and use data for school improvement (Pharris-Ciurej et al., 2012).

Neild (2009) provided evidence that students who were not successful during their freshman year had minimal odds of earning a high school diploma by sharing how one-third of the nation's dropouts were never promoted beyond ninth grade. In 2011, the bulge had grown from a 4% increase in 1982 to a 12% increase in enrollment in 2011 (Pharris-Ciurej et al., 2012). Neild (2009) reports four theories can explain this increase in enrollment: results of decreased parental supervision but increased peer influences; students transitioning to a new school where new bonds and relationships must be formed; students being inadequately prepared for high school; and the organization of the high school may cause a difficulty in the transition. In Neild's (2009) opinion, school districts should address the four theories with a policy response to prevent a poor transition from eighth to ninth grade.

Akos and Galassi (2004) interviewed students regarding transitioning to the ninth grade. They discovered there were three main areas of concern: academics (new teachers, higher expectations, more homework, increasingly more rigorous assessments), procedural (school layout and class transitions), and social (making new friends and the overall social aspect of high school). Uvaas and McKevitt (2013) contend school systems must develop a transition program and curriculum to prepare students for the transition and provide five necessary components the program needs to be effective. A successful transition program needs to be school based for a minimum of eight weeks, promote academic development and achievement, promote school pride and connectedness, and districts must examine the number of school transitions students experience in their district and minimize the number if possible, and lastly, early identification of students experiencing multiple stressors and provide support (Uvaas & McKevitt, 2013).

Methodology

A sequential explanatory design for mixed methods research was utilized for this study. A sequential explanatory design was conducted to investigate the relationship between high school schedules, school location, and the percentage of students receiving free or reduced lunch on 9th-grade student achievement and overall school performance. Creswell and Plano Clark (2011) claim a mixed-methods design focuses on combining quantitative and qualitative data in a single study, which provides a greater understanding than one single approach by allowing the qualitative data to explain and clarify the quantitative results. There were two main purposes of this study. The primary purpose was to determine if there was a significant difference between schools utilizing different schedules on 9th-grade student achievement and overall school performance measures.

The secondary purpose was to allow selected principals to explain the similarities or differences between the two schedule types (7-period or 4 X 4 block).

During the study's first phase, the researcher used archived data obtained from the Georgia Department of Education. Archival data used for this study were Georgia Milestone's End-of-Course assessment data for 9th Grade Literature, Algebra I, and Biology, CCRPI scores, school climate ratings, four-year cohort graduation rates, and overall retention rates for each school. The qualitative data collection method was through a purposeful sampling of 12 principals from around the state; two from each schedule type (7-period or 4 X 4 block) and location (rural, suburban, or urban) to participate in an interview to support or refute the quantitative findings. A factorial ANOVA was utilized to answer Research Questions 1, 2, and 3. The qualitative portion of the study was comprised of 12 principals participating in an interview consisting of seven open-ended questions aimed at supporting or refuting the quantitative results, which addressed Research Question 4.

According to the Georgia Department of Education (GaDOE), there are 476 ninth through twelfth grade high schools in Georgia. There are 384 brick-and-mortar public high schools in Georgia. There are 154 schools using a 4 X 4 block schedule, 174 schools using a seven-period schedule, and 56 schools using either a hybrid, a six-period, eight period, or an A/B/D block schedule. Only the two main schedule types were examined in this study: 4 X 4 block (154 schools) and a traditional seven-period schedule (174 schools).

For Research Question 1 and 2, the researcher used scores from the Georgia Milestone's End-of-Course assessments and the overall and component scores from the

College Career Readiness Index (CCRPI). However, not all schools receive scores for each of the Georgia Milestone EOCs. First, it is based on student participation and subgroup sizes; therefore, the sample size for each subquestion for Research Question 1 will vary slightly (see Table 1). Secondly, schools in their first year of operation do not receive a score for specific components of the CCRPI index or an overall score. Therefore, one school in the study, a 7-period suburban school, did not have a four-year cohort graduation rate or overall CCRPI score (see Table 1).

The second factor of Research Questions 1 and 2 was based on the school's location or setting. To determine the setting or location (rural, suburban, or urban) of the 328 schools used in the study, the researcher used the National Center for Educational Statistics (NCES) and according to the NCES, there are 156 rural, 120 suburban, and 52 urban schools (see Table 1).

For Research Question 3, it was necessary to analyze the percentage of students receiving Free or Reduced lunch for the 328 schools used in the study. Therefore, the schools were divided into four quartiles based on the percentages. Quartile 1 consisted of the schools where 0 to 38.79% of the student population qualified for free or reduced lunch, Quartile 2 ranges from 38.78 to 59.41%, Quartile 3 ranges from 59.42 to 90.64%, and Quartile 4 is from 90.65 to 100% of the student population (see Table 2).

Results

Quantitative Findings

For Research Questions 1 and 2, the two dependent variables were schedule type and location (rural, suburban, or urban). When examining the interaction effects for Research Questions 1 and 2, there were only two significant findings: subquestions 1c

and 2a. Considering there were only two significant findings for interaction effects it was necessary to examine the main effects. For the main effect based on schedule type there was only one significant result found on subquestion 1b, comparing means scores on the Georgia Milestones Algebra I EOC. However, when examining the main effect based on location all the subquestions had significant results (1a, 1b, 2b, 2c, and 2d).

On subquestion 1a the original and transformed data did not meet the statistical assumptions. It was determined to use the Aligned Rank Transform (ARTools) for Nonparametric factorial AVOVA. There was a significant main effect on a high school's location on the mean scores on the Georgia Milestones 9th Grade Literature EOC, F (2, 322) = 6.508, $p < .001$, $\eta^2 = .04$. Post hoc comparisons were conducted using the Tukey HSD of the main effects based on school locations. There was a significant difference on 9th Grade Literature EOC scores between high schools located in rural Georgia (M = 666791, SD = 175567) and those in a urban area (M = 560304, SD = 255009); t(322) = 2.90, p = .01. There was a significant difference between high schools located in suburban parts of Georgia (M = 685760, SD = 205440) urban areas of Georgia (M = 560304, SD = 255009); t(322) = 3.34, $p < .0012$. However, it indicated there was no significant difference between schools in rural Georgia (M = 666791, SD = 175567) and those in a suburban part of Georgia (M = 685760, SD = 205440); t(322) = -0.75, p = .73. Based on these findings rural and suburban schools perform similarly on the 9th Grade Literature, however they both perform significantly better than urban schools in Georgia.

Subquestion 1b compared high school's mean scores on the Georgia Milestones Algebra I EOC. The results of the factorial ANOVA found significant results on the mean scores of the Georgia Milestones Algebra EOC for both main effects based on

schedule type, F (1, 269) = 10.898, $p < .001$, $\eta^2 = .04$, and their location, F (2, 269) = 10.774, $p < .001$, $\eta^2 = .07$. Post hoc comparisons were calculated using the Tukey HSD for each of the main effects. There was a significant difference on the Algebra I EOC between high schools using a 4 X 4 block schedule (M = 1550, SD = 538) and high schools using traditional seven-period schedule (M = 1316, SD = 599), t(269) = 3.997, $p < .001$. Based on these results one can determine 4 X 4 block schools perform significantly better on the Georgia Milestones Algebra I EOC than schools using a traditional 7-period schedule.

There was a significant difference on the Algebra I EOC between high schools located in rural Georgia (M = 1485, SD = 499) and high schools located in urban areas (M = 1064, SD = 681); t(269) = 3.822, $p < .001$. A significant difference was noted between high schools located in the suburban parts of Georgia (M = 1506, SD = 588) and high schools located in urban areas (M = 1064, SD = 681); t(269) = 3.889, $p < .001$. There was no significant difference between schools in rural Georgia (M = 1485, SD = 499) and high schools located in the suburban parts of Georgia (M = 1506, SD = 588); t(269) = 0.386, p = .92. After examining these findings, it is evident rural and suburban schools are similarly equal in performance and perform significantly better than the urban counterparts.

Subquestion 1c was one of the two subquestions with significant interaction results. It compared mean scores for 9th-grade student achievement utilizing the Georgia Milestone's End-of-Course assessment in Biology. The results of the factorial ANOVA found there was a statistically significant interaction between schedule type (traditional

seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban) on the Georgia Milestones Biology EOC, F (2, 280) = 5.92, $p < .001$, $\eta^2 = .04$.

Tukey's HSD identified five out of fifteen different interaction effects as significant. There was a significant difference on the Georgia Milestones Biology EOC between high schools utilizing a 7-period schedule in a rural area (M = 8325.05, SD = 2994.69) and schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); t(280) = 6.19, $p < .001$. There was also a significant difference between schools using a 7-period schedule in a suburban area (M = 7598.97, SD = 3021.52) and schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); t(280) = 5.09, $p < .001$. Schools using a 4 X 4 Block schedule in a rural area (M = 7615.55, SD = 3544.11) were significantly different compared to schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); t(280) = 5.06, $p < .001$. Schools using a 4 X 4 Block schedule in a suburban area (M = 7453.81, SD = 3374.52) were significantly different to schools using a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); t(280) = 4.87, $p < .001$. Lastly, schools utilizing a 4 X 4 Block schedule in an urban area (M = 6905.76, SD = 3460.66) were significantly different than schools utilizing a traditional 7-period schedule in an urban setting (M = 3850.68, SD = 3230.68); t(280) = 3.24, p = .02. Based on these results 7-period urban schools perform significantly lower on the Biology EOC than the other five interactions (7-period rural, 7-period suburban, 4 X 4 block rural, 4 X 4 block suburban, and 4 X 4 block urban).

Subquestion 2a examined if schedule type and location affected overall school performance using the CCRPI score. It was the other subquestion found to have

significant interaction results. Due to the assumption of equal variances not being met with either the original or transformed data, it was determined to use the Aligned Rank Transform (ARTools) for Nonparametric factorial AVOVA. The results of the ARTools factorial ANOVA found a statistically significant interaction between schedule type (traditional seven-period schedule or 4 X 4 block) and the school's location (rural, suburban, or urban), F (2, 322) = 3.664, p = .03, η^2 = .02.

Post-hoc comparisons using the Tukey HSD for the interaction effect between school schedules and their location in Georgia on the school's CCRPI score indicated two interactions with significant differences. Schools utilizing a 7-period schedule in a suburban area (M = 105.74, SD = 15.80) were significantly different from schools utilizing a 7-period schedule in an urban area (M = 89.05, SD = 14.84); t(322) = 3.494, p = .01. Schools utilizing a 4 X 4 block schedule in a suburban area (M = 107.15, SD = 16.49) were significantly different from schools utilizing a 7-period schedule in an urban area (M = 89.05, SD = 14.84); t(322) = 3.449, p = .01. The remaining thirteen interactions effects were found to be not significant at (p > .05). From these findings it can be determined suburban schools, whether 4 X 4 block or 7-period, have a significantly higher CCRPI score than 7-period urban schools. A further examination of the results showed 7-period urban schools perform similarly to 4 X 4 block rural, 4 X 4 block urban, and 7-period rural. These results tend to show the discrepancy between suburban and urban schools; however, it may be beneficial for the 7-period urban schools to consider a 4 X 4 block schedule due to the simple fact there is no significant difference between the 4 X 4 block urban schools and the suburban schools CCRPI scores.

For subquestion 2b the original and transformed data did not meet statistical assumptions. Therefore, it was determined to use the ARTools for Nonparametric factorial AVOVA. The results of the ARTools factorial ANOVA found there was a significant main effect on a high school's location on the school's four-year cohort graduation rate, F (2, 321) = 11.857, $p < .001$, $\eta^2 = .07$. Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in rural Georgia (M = 69273988, SD = 17544900) was significantly different than high schools located in urban areas of Georgia (M = 55276787, SD = 21087728); t(322) = 3.243, $p < .001$. High schools located in suburban parts of Georgia (M = 60208809, SD = 22191578) were significantly different to the schools located in urban areas of Georgia (M = 55276787, SD = 21087728); t(322) = 4.202, $p < .001$. However, it indicated there was no significant difference between schools in rural Georgia (M = 69273988, SD = 17544900) and those located in a suburban part of Georgia (M = 60208809, SD = 22191578); t(322) = 1.482, $p = .30$. Considering the significant results, urban schools have a significantly lower 4-year cohort graduation rate than rural and suburban schools.

Subquestion 2c compared the school's mean climate ratings. The results of the factorial ANOVA determined there was a significant main effect on the school's mean climate rating, F (2, 322) = 6.07, $p < .001$, $\eta^2 = .04$. Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in rural Georgia (M = 54250589, SD = 9809409) were significantly different than high schools located in urban areas of Georgia (M = 48573758, SD = 12065411); t(322) = 3.279, $p < .001$. High schools located in a suburban part of Georgia

(M = 53272238, SD = 10686972) were significantly different than schools located in urban Georgia (M = 48573758, SD = 12065411); $t(322) = 2.608$, $p = .03$. However, it indicated schools in rural Georgia (M = 54250589, SD = 9809409) were not significantly different than high schools located in a suburban part of Georgia (M = 53272238, SD = 10686972); $t(322) = 0.774$, $p = .72$. Like subquestion 2b, urban schools have a significantly lower climate rating than rural and suburban schools equating to urban schools struggling to maintain a safe, positive learning environment compared to their counterparts in the rural and suburban parts of the state.

Subquestion 2d compared the schools mean overall retention rate. The results of the factorial ANOVA found there was a significant difference on the main effect based on a school's location on the school's overall retention rate, $F(2, 322) = 27.9$, $p < .001$, $\eta^2 = .15$. Post hoc comparisons using the Tukey HSD of the main effects based on school locations indicated the means for high schools located in a suburban part of Georgia (M = 2.63, SD = 1.23) were significantly different to the high schools located in rural Georgia (M = 1.8, SD = 1.26); $t(322) = 5.379$, $p < .001$. Schools located in rural Georgia (M = 1.8, SD = 1.26) were significantly different compared to the high schools located in urban Georgia (M = 3.17, SD = 1.46); $t(322) = 6.533$, $p < .001$. Schools located in suburban part of Georgia (M = 2.63, SD = 1.23) were significantly different compared to the high schools located in a urban Georgia (M = 3.17, SD = 1.46); $t(322) = 2.424$, $p = .04$. According to these results, suburban schools retain significantly less students than rural or urban schools.

Research Question 3 examined if the schedule and percentage of students receiving free and reduced lunch affected overall school performance using CCRPI

scores, four-year cohort graduation rates, school climate ratings, and overall retention rates. No significant interaction effects were found, therefore, each of the main effects were examined. The main effect based on schedule type had one subquestion (3c) with a significant result examining. For the main effect based on the percentage of students receiving free or reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%) all four subquestions had significant results.

For subquestion 3a, the results of the factorial ANOVA found there was a significant main effect based on the percentages of students receiving free or reduced lunch on the school's CCRPI score, F (3, 319) = 119.01, $p < .001$, $\eta^2 = .52$. Post hoc comparisons using the Tukey HSD of the main effects based on the percentage of students receiving free or reduced lunch indicated the means were significantly different between each quartile at ($p < .001$). Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 2 (M = 77.1, SD = 6.62); t(319) = 8.063, $p < .001$. Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 3 (M = 71.55, SD = 6.42); t(319) = 12.954, $p < .001$. Quartile 1 (M = 85.76, SD = 6.62) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 17.799, $p < .001$. Quartile 2 (M = 77.10, SD = 6.58) was significantly different than quartile 3 (M = 71.55, SD = 6.42); t(319) = 5.050, $p < .001$. Quartile 2 (M = 77.10, SD = 6.58) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 9.982, $p < .001$. Quartile 3 (M = 71.55, SD = 6.42) was significantly different than quartile 4 (M = 65.9, SD = 8.10); t(319) = 4.891, $p < .001$. Considering these results, schools in quartile 1 (smallest percentage of students receiving free or reduced lunch) perform significantly better than the other three quartiles

(2, 3, and 4), and quartile 2 performs significantly better than quartile 3 and 4, and lastly, quartile 3 is significantly better than 4. According to these results it can be determined the percentage of students receiving free or reduced lunch significantly impacts overall school performance and poverty plays a large role in student achievement.

For subquestion 3b, the results of the factorial ANOVA found there was a significant main effect based on the percentages of students receiving free or reduced lunch on the four-year cohort graduation rate, F (3, 319) = 33.23, $p < .001$, $\eta^2 = .24$. Post hoc comparisons using the Tukey HSD of the main effects based on the percent of students receiving free and reduced lunch indicated high schools in quartile 1 (M = 110530228, SD = 21481279) were significantly different compared to high schools in quartile 3 (M = 81168554, SD = 30901128); t(319) = 7.074, $p < .001$. High schools in quartile 1 (M = 110530228, SD = 21481279) were significantly different compared to the high schools in in quartile 4 (M = 74474557, SD = 27477097); t(319) = 8.711, $p < .001$. High schools in quartile 2 (M = 100307611, SD = 24135556) were significantly different compared to high schools in quartile 3 (M = 81168554, SD = 30901128); t(319) = 4.680, $p < .001$. High schools in quartile 2 (M = 100307611, SD = 24135556) were significantly different compared to the high schools quartile 4 (M = 74474557, SD = 27477097); t(319) = 6.346, $p < .001$. However, schools in quartile 1 (M = 110530228, SD = 21481279) were not significantly different compared to the high schools in quartile 2 (M = 100307611, SD = 24135556); t(319) = 2.488, $p = .06$. High schools in in quartile 3 (M = 81168554, SD = 30901128) were not significantly different compared to the high schools quartile 4 (M = 74474557, SD = 27477097); t(319) = 1.658, $p = .35$. Based on these results, schools in quartiles 1 and 2 perform similarly when comparing 4-year

cohort graduation rates, as do schools in quartiles 3 and 4. It is evident schools in quartiles 1 and 2 have a significantly higher 4-year cohort graduation rate than schools in quartiles 3 and 4. Again, illustrating the effect poverty plays on student success and academic achievement.

For subquestion 3c, the results of the factorial ANOVA found there was a significant main effect based on the percentages of students receiving free or reduced lunch on the school's climate rating, F (3, 319) = 21.86, $p < .001$, $\eta^2 = .17$. Post hoc comparisons using the Tukey HSD of the main effect for the school's climate rating based on the percent of students receiving free and reduced lunch. Results indicated the schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different compared to the high schools in quartile 2 (M = 81408095, SD = 14956426); t(319) = 3.089, p = .01. High schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different to the high schools in quartile 3 (M = 75575967, SD = 15934827); t(319) = 5.621, $p < .001$. High schools in quartile 1 (M = 88669156, SD = 12653805) were significantly different to the high schools in quartile 4 (M = 71417595, SD = 14947652); t(319) = 7.648, $p < .001$. High schools in quartile 2 (M = 81408095, SD = 14956426) were significantly different to the high schools in quartile 3 (M = 75575967, SD = 15934827); t(319) = 2.603, p = .047. High schools in quartile 2 (M = 81408095, SD = 14956426) were significantly different compared to the high schools in quartile 4 (M = 71417595, SD = 14947652); t(319) = 4.665, $p < .001$. However, there was not a significant difference between high schools in quartile 3 (M = 75575967, SD = 15934827) compared to the high schools in quartile 4 (M = 71417595, SD = 14947652); t(319) = 2.046, p = .17. After examining these results, it is apparent schools in quartile 1

have a significantly better climate than the other three quartiles, and quartile 2 is significantly better than quartiles 3 and 4. However, quartiles 3 and 4 have similar climate ratings. Therefore, the percentage of students receiving free and reduced lunch significantly impacts a school's climate.

Subquestion 3c was the only subquestion for Research Question 3 to render significant results for the main effect based on schedule type. The results of the factorial ANOVA found a significant main effect on the school's climate rating based on high school schedules, F (1, 319) = 4.74, p = .03, η^2 = .01. Post hoc comparisons using the Tukey HSD of the main effect for the school's climate rating based on school schedule type there was a significant difference on climate scores between schools using a 4 X 4 block (M = 77788488, SD = 14795799) and schools using a 7-period schedule (M = 80398101, SD = 16920202); t(319) = 2.184, p = .03. These results illustrate how 4 X 4 block schools have a significantly better climate rating than the 7-period counterparts, meaning 4 X 4 block schools have a more positive, less stressful environment than schools using a 7-period schedule.

For subquestion 3d, the original and transformed data did not meet statistical assumptions. It was determined to use the ARTools for Nonparametric factorial AVOVA and it found there was a significant main effect based on the percentages of students receiving free or reduced lunch on the school's overall retention rate, F (3, 319) = 9.202, p < .001, η^2 = 0.08. Post hoc comparisons using the Tukey HSD of the main effects on the school's overall retention rate based on the percent of students receiving free and reduced lunch indicated schools in quartile 1 (M = 0.04, SD = 0.03) were significantly different compared to the high schools in quartile 3 (M = 0.05, SD = 0.03); t(319) =

3.339, $p = .01$. High schools in quartile 1 ($M = 0.04$, $SD = 0.03$) were significantly different compared to the high schools in quartile 4 ($M = 0.06$, $SD = 0.04$); $t(319) = 4.257$, $p < .001$. High schools in quartile 2 ($M = 0.04$, $SD = 0.03$) were significantly different compared to the high schools in quartile 3 ($M = 0.05$, $SD = 0.03$); $t(319) = 3.043$, $p = .01$. High schools in quartile 2 ($M = 0.04$, $SD = 0.03$) were significantly different compared to the high schools in quartile 4 ($M = 0.06$, $SD = 0.04$); $t(319) = 3.975$, $p < .001$. However, schools in quartile 1 ($M = 0.04$, $SD = 0.03$) were not significantly different compared to the high schools in quartile 2 ($M = 0.04$, $SD = 0.03$); $t(319) = 0.343$, $p = .99$, and high schools in quartile 3 ($M = 0.05$, $SD = 0.03$) were not significantly different compared to high schools in quartile 4 ($M = 0.06$, $SD = 0.04$); $t(319) = 0.929$, $p = .79$. Based on these results, schools in quartiles 1 and 2 perform similarly when comparing overall retention rates, as do schools in quartiles 3 and 4. Schools in quartiles 1 and 2 have a significantly lower overall retention rate than schools in quartiles 3 and 4 illustrating the effect poverty plays on student success and academic achievement.

Overall, for Research Question 3, when examining the high school's overall performance measures, schools in quartiles 3 and 4 were significantly different from those in quartile 2, and even more so from quartile 1. These results indicate poverty and socioeconomic status effects student achievement and overall school performance.

Qualitative Findings

Research Question 4 served as the qualitative portion of the study. Creswell & Plano Clark (2011), to complete the sequential explanatory design used for this study, it was imperative to follow the quantitative data analysis with a qualitative portion to

understand better the results and how high school schedule types, in combination with school location or the percentage of students receiving free or reduced lunch, can affect 9th-grade student achievement and overall school performance measures. Twelve principals from across Georgia, consisting of two principals from each combination of schedule type (7-period and 4 X 4 Block) and location (rural, suburban, urban), were interviewed using a script comprised of seven questions.

Before selecting the interviewees, a validation study was conducted to ensure that the questions were free from bias and reactivity. As a result, no leading questions or prior biases were included in the interviews (Maxwell, 2005). Once the participants agreed to participate in the interview, they received an email with a link to schedule a date and time for the interview, a consent statement, and the interview questions. Each interview began with the same question to ensure the information was accurate and transparent; Which schedule does your school currently utilize? Demographics for the 4 X 4 block principals can be found in Table 43, and the same information for the traditional 7-period principals can be found in Table 44.

Interview question 2 asked each principal to share two advantages and two disadvantages of their current schedule. For the 4 X 4 block principals, three main advantages emerged; students have more opportunities to earn credits, it reduces the number of courses a student must focus on when preparing for high-stakes testing, and it provides teachers more planning time for grading paper and reduces the number of students a teacher is responsible for at a time. Principal Roberts indicated that students in a 4 X 4 block schedule have fewer classes to take and more instructional time in class, which allows students to focus on only a few high-stakes tests at a time. Principal Craft

adamantly stated that a 4 X 4 block schedule reduced disciplinary behaviors for the simple fact there were fewer transitions, "obviously, you know a lot of the problems that occur in school is during transition times."

When asked for two disadvantages of the 4 X 4 block schedule, the principals shared four common themes. The one disadvantage all principals agreed upon was the difficulty for teachers to plan and engage students for the entirety of a 90-minute class. Principals Miller, Craft, and McCloud were all concerned with the engagement, or lack thereof, during a 90-minute lesson. Craft stated, "if the teacher is not properly engaging their students, there could be a tremendous waste of instructional time." The second most common theme was the fear of learning gaps from a student having a course in the fall of their freshmen year and not having the following course until possibly the spring of their next year. Principal Miller used a world language as an example and a student taking Spanish I in the fall of their freshman year but then cannot fit Spanish II into their schedule until the spring of their sophomore year. Such a large gap could pose issues with student success. The other two perceived disadvantages principals shared were scheduling students twice a year and possible social issues for students who have difficulty building relationships.

Principals from a seven-period schedule shared three main advantages; more diverse classes for students in a day, shorter classes fit a high schooler's attention span better, and it eliminates the possibility of learning gaps by having classes year long. Principals Leaf, Sermons, Chester, and Simon agreed that a 7-period schedule is better suited for a high school student's short attention span. Chester stated, "the seven-period schedule for our students gives the student a smaller dose of academics per day over a

longer period of time, and the smaller doses help the student's attention span and provide a longer period of time for students to be immersed in the content." Principal Layton stated one of his perceived advantages was stronger student/teacher relations since classes were held all 36 weeks. Lastly, Principal Simon argued that a shorter class period was more advantageous for weaker teachers since they only had to plan for a 45 to 55-minute lesson compared to 90 minutes of instruction.

When asked for disadvantages, principals shared five consistent reasons. For the first two reasons, three of six principals agreed they were disadvantages. Principal Sermons, Grayson, and Simon all agreed that the 7-period schedule is a more intense schedule due to students having to prepare and study for four academics and three electives at one time. Principals Chester, Grayson, and Layton agreed a significant disadvantage is with teachers having more preps, more students they are responsible for, and less time for planning and grading. Chester stated, "it is hard for teachers to have a larger number of students because it means they have a larger number of papers to grade and relationships to build." Another disadvantage is for transferring students. Those who transfer from a 4 X 4 to a 7-period schedule can be far ahead or behind their classmates, depending on when they transfer. The last two disadvantages consist of fewer overall opportunities for students to earn credits and the inability to have a fresh start in the middle of the year.

Interview question 3 asked the principals to share if the free and reduced lunch status of their student body affected which schedule was utilized and if it affected their students' academic performance. According to both the 4 X 4 block principals and the seven-period principals, their students' free and reduced lunch status did not affect the

school's choice of schedule. However, Principal Miller, a 4 X 4 block principal, shared how the free and reduced lunch status did not affect their decision. However, in retrospect, it should have since it provides students with more opportunities to earn credits and participate in remedial and credit recovery programs.

When the principals were asked if their student's free and reduced lunch status affected their student achievement, there were differing opinions from both schedule types. Craft argues student success depends on motivation, which is impacted mainly by teachers building relationships with their students, "to the point where the students are willing to do whatever the teacher asks him/her to do because they feel like the teacher truly cares for them." The remaining principals agreed that the Free and Reduced Lunch status is a measure of poverty, which does play a role in student achievement. Principal Fowler, Roberts, Flanders, and Miller all agreed that students from low-socioeconomic homes come to us behind and must try harder to succeed. Principal Leaf stated, "with low socioeconomic status, which usually comes from single-parent homes, there are not as many resources, and unfortunately, there is lower goal setting an expectation." Principal Sermons argued that students could perform well academically when not fed well or have proper hygiene, shelter, or clothing.

Interview question 4 requested that principals share one of their most effective strategies for preparing first-year high school students for high-stakes testing. When the 4 X 4 block principals were asked, there were three common strategies; build strong teacher/student relationships in order to increase student motivation, high-quality tier 1 instruction and vertical alignment ensuring the standards are taught thoroughly, and if it all possible, avoid having first-year high school students sit for an exam, especially

during the fall testing window. Principal Craft expounded on the last strategy by stating first year high school students or "freshmen" need time to acclimate to the high school and their surroundings before participating in a high-stakes test. However, three of the principals shared how difficult it was for first-year students to avoid Algebra I. Therefore, they implemented a "math support" or remedial math class in the fall to prepare their students for Algebra I in the spring. This strategy ensured their students had 90 minutes of math year-round and attributed to the quantitative findings from subquestion 1b. Principals Fowler, Flanders, and McCloud emphasized remediation, extra/extended learning time, and individualized student academic advisement.

Principals from a seven-period schedule shared four main strategies they employ to prepare their students for high stakes testing; keep teacher/student ratios low, use your most veteran teachers for EOC courses, teacher/student relationships, and an emphasis was placed on providing extra learning time or remediation sometime during the school day. Principal Sermons argues the best preparation is a quality tier I, standards-based instruction followed by quality formative assessments, then using the data from the formative assessments to inform and guide her teacher's instruction. Sermons says it well, "To prepare freshmen for high stakes testing is to adequately teach the standards and prepare them for what it is they are going to be tested on."

Interview Question 5 inquired if principals felt their schedule influenced ninth-grade culture and behavior. All the 4 X 4 block principals shared how their schedule positively impacts culture and behavior. First, it impacts culture due to the decreased stress on students and teachers with having fewer classes. Principal McCloud continued by stating, "students were less stressed and not as overwhelmed since they only had two

academics to focus on at a time." In addition, principal McCloud said, "teachers were less stressed since they had fewer students' they were responsible for at a time, and more time to plan, grade papers, prepare for labs/learning activities." Principals Craft, Flanders, Roberts, and Fowler agreed that the culture was more favorable for teachers and students, positively impacting student discipline.

Five of the seven-period principals stated that culture comes from the top down and is created mainly by the principal's decisions and actions. However, Two-thirds of the seven-period principals shared how the schedule might have a negative impact on behavior in their schools. For example, principal Leaf said, "high schoolers look for those opportunities when they are not supervised to find trouble." Principal Sermons had similar beliefs stating, "referrals increase because there is more opportunity the more you transition." Leaf, Sermons, Chester, and Layton all agreed that with the increase in transitions comes an increase in opportunities for discipline issues. However, a few principals were undecided and contended that the increased transitions should not negatively impact behavior if the climate is good. Overall, 83% of the principals stated that the schedule did not impact their school's culture.

Interview question 6 asked the principals if their schedule influenced ninth-grade performance on the Georgia Milestones EOC's. All the 4 X 4 block principals agreed their schedule positively influences ninth-graders performance on EOC's since they have fewer academics to focus on at a time, have more time for any needed remediation, and break up testing into two different windows in the winter and spring. Principal Miller explained he tries to avoid any freshmen taking an EOC in "order to give the students time to acclimate to high school and provide more time for the students to mature."

Principals Fowler and Flanders expounded on the view of Craft, McCloud and Roberts by sharing with students only focusing on two academics per semester decreases the chances of students having more than one EOC to prepare for when testing occurs in the winter and spring, which positively impacts and increases student achievement.

Principals utilizing a seven-period schedule had varied responses for question six. A few principals shared how the students should perform better since they have the course throughout the year. However, one of the principals countered their argument by sharing that it may be more difficult and stressful if the student must prepare to take two or more (which is possible) in the same week, rather than one in the winter and the other in the spring. Principals Grayson and Simon both agreed their students' scores were negatively affected by their schedule and adamantly agreed that student achievement would increase if they switched to a 4 X 4 block schedule. Hence, their students only had to focus on two academics at a time and reduce the number of EOC's they possibly had to take during a given testing period.

The last interview question centered around high school graduation and how schools ensured students remained on track after their ninth-grade year. Three of the 4 X 4 block principals (Craft, McCloud, and Fowler) agreed it was simple; their schedule provided more opportunities to earn the state-required 23 credits. Principal McCloud said it was easy math, "32 chances to earn their required credits is better than 28 chances." The three remaining principals stated that their advisement classes helped ensure students remained on track and registered for the appropriate courses throughout their high school careers.

The seven-period principals shared two main strategies for ensuring their students stayed on track; a procedure to ensure students are registered for the correct courses each year with a well-maintained graduation plan and an effective grade repair and credit recovery program. Principal Sermons was emphatic scheduling is the most critical component of keeping students on track and continually monitoring their schedule from year to year. In addition, principals Leaf, Grayson, Chester, and Layton stated it is vital to have an effective grade repair and credit recovery program to provide multiple opportunities for students to earn their required credits. However, a few of the seven-period principals commented on the number of required credits necessary for graduation. The state requires 23 credits, but local boards can impose local requirements. Therefore, they stated that some 4 X 4 block schools only require the state minimum while others require 24 or more credits, but students on a 7-period schedule have four fewer opportunities than the 4 X 4 block student. Which they stated could make it more difficult to ensure students graduate on time.

Limitations and Assumptions

I have only worked in one of the schedule types examined in this study, a traditional seven-period schedule at two different high schools. Therefore, I acknowledge a certain amount of bias could exist, especially during the qualitative portion of this study since the high school I attended as a student utilized the 4 X 4 block schedule.

I acknowledge the schedule type was the primary focus of the study and did not take into consideration or examine teacher effectiveness, teacher experience, professional learning or development, instructional strategies, or interventions utilized to increase student achievement.

Schedule types were examined for the characteristics of the number of classes each student attended each day for the prescribed amount of time. It was assumed their schedule and times were accurately stated through self-reporting measures. This study used publicly shared archival data from the 2018 EOC spring administration. One final limitation to the study was the data collection timing. The EOC results used in this study were collected from the spring 2018 administration. Qualitative interviews were conducted in the spring of 2021 due to unforeseen family medical issues. Although this sequencing is common in a sequential explanatory design, the gap in time between the two could have been shortened.

Suggestions for Future Research

Considering attendance and behavior were not directly examined during this study, future research could examine how each affected ninth-grade student achievement. One of the interviewed principals suggested the single most important factor of keeping students on track is by continually monitoring their schedule and graduation checklist from year to year. Future research could investigate the high school registration and master schedule process' in conjunction with the school's graduation checklist procedure and process. Another principal stated it is essential to keep the ratio of students to teacher low. Refresh the research on student/teacher ratios and how they affect ninth-grade student achievement may be beneficial.

One principal shared having assigned their more skilled teachers to instruct the end-of-course classes to ensure they prepare their students for the assessment. This had the researcher questioning if this is common practice for high schools? If so, is it done in ninth-grade courses where student achievement and success are vital? It was suggested to

examine the instructional strategies employed in the ninth-grade classes to determine which strategies garner the largest effect size for student success. Lastly, four principals stated it is vital to have an effective grade repair and credit recovery program to provide multiple opportunities for students to earn their required credits and stay on track for graduation. Each of these suggestions garner further investigation and could pay large dividends for high schools ensuring ninth grade success and improving overall school performance.

Conclusion

This study was an extensive and comprehensive examination on two of the primary schedule types (7-period and 4 X 4 block) utilized in Georgia high schools and how they affect ninth-grade student achievement and overall school performance measures. The relationship between the schedule type and school location (rural, suburban, and urban), as well as the percentage of students receiving free and reduced lunch was examined. Seven dependent variables were considered with schedule type and school location. Four dependent variables were examined with schedule type and the percentage of students receiving free and reduced lunch divided into quartiles. Twelve interviews with high school principals were conducted in order to confirm or refute the quantitative findings. There are 384 brick and mortar public high schools in Georgia of which 154 schools using a 4 X 4 block schedule and the 174 schools using a seven-period schedule were examined in the study.

Four main Research Questions guided this study. Research Question 1 sought to quantify the difference between schedule types and school locations using mean scores from the Georgia Milestones End-of-Course assessments in 9th Grade Literature, Algebra

I, and Biology. Research Question 2 attempted to quantify the relationship between the same independent variables (schedule type and school location) using the mean scores from overall school performance measures such as their CCRPI scores, school climate ratings, four-year cohort graduation rates, and overall retention rates. Research Question 3 was very similar to question 2, but rather than using school location, it was the percentage of students receiving free and reduced lunch divided into quartiles. Finally, Research Question 4 provided an understanding of whether a particular schedule type could increase ninth-grade student achievement and overall school performance.

As noted in the research, the "ninth-grade bulge" contributes to the nation's steady decline in the graduation rate (Wheelock & Miao, 2005). The findings of this study could have substantial implications for high schools in Georgia and possibly across the nation. Of course, local school districts have the autonomy to change their schedule type at any time based on what is best for their students and community. It was evident from the interview process that most local school districts decide on a schedule based on two factors: student population and campus size or financial and personnel concerns.

In examining the quantitative results of this study, it is clear there is no significant difference between the two types of schedules. Only two interaction effects were found to be significant when comparing school schedules combined with their location (rural, suburban, and urban). One of the significant results were found when comparing mean scores on the Georgia Milestones Biology EOC signifying 7-period urban schools performed well below their counterparts 7-period rural, 7-period suburban, 4 X 4 block rural, 4 X 4 block suburban, and 4 X 4 block urban schools. The other significant interaction result was found when comparing mean CCRPI scores signifying, again, 7-

period urban schools were performing well below 7-period suburban and 4 X 4 suburban. There was not a significant difference between 7-period urban schools and the three other combinations: 7-period rural, 4 X 4 block rural, and 4 X 4 block urban.

When examining the main effects of school schedules, only two significant results were found for research questions 1, 2, and 3. One of the significant results was found on subquestion 1b when comparing means scores on the Georgia Milestones Algebra I EOC signifying 4 X 4 block schedule had significantly better scores than schools using a 7-period schedule. After conducting the interviews, it was clear why there was a significant difference. Most 4 X 4 Block schools schedule students utilizing a math support class in the fall and follow it with Algebra I in the spring. The end results are students receive 90 minutes of math for the entire school year rather than only 45 to 55-minutes compared to a 7-period schedule.

Ford (2015) cited similar results from a study in North Carolina. It focused on student achievement between the state assessments on the two different schedules, block and a traditional seven-period schedule. The results indicated block had a significant advantage in Algebra I, Economics, and Political Science, yet there was no significant difference in U.S. History or Biology (Ford, 2015). The principal interviews supported the quantitative findings from this study and Fords work. Principal McCloud stated the increase is evident of the extended instructional time, especially for at-risk students scheduled for a support math class in the fall semester and then Algebra I in the spring semester. Rather than only receiving 45 to 55-minutes of math instruction per day those on a 4 X 4 block receive 90 minutes of math per day for the entire school year. McCloud

continued by stating there is more time for remediation and intervention, thus an increase student achievement.

The other significant result on the main interaction based on schedule type was on subquestion 3c comparing school climate ratings. According to the results, 4 X 4 block schools have a significantly better climate rating than schools using a 7-period schedule. The interviews solidified the results with most principals sharing their teachers and students were happier and less stressed on a 4 X 4 block schedule due to fewer classes, fewer responsibilities, more time in each subject, and more time for teachers to plan, prepare lessons, and grade papers. Four of the 4 X 4 block principals (Craft, Flanders, Roberts, & Flanders) agree a 4 X 4 block has an improved climate and culture by decreasing the number of transitions during the day limiting daily student interaction and providing fewer opportunities for negative behaviors.

The quantitative results reflect the literature on 4 X 4 block schedules and school climate. Kelchner (2003) reported teachers on block scheduling have more time to plan, lecture less, and have fewer discipline problems resulting in increased achievement and overall graduation rate. Rettig and Canady (1997) share how reducing class changes produces less stress, provides a cleaner school environment due to decreased student traffic, dramatically reduces the number of students being tardy to class, and produces less overall student disciplinary referrals. In addition, fewer classes equal fewer students for teachers to maintain records and grades bringing about increased feedback and differentiated instruction (Rettig & Canady, 1997).

There were two other main effects examined in this study. One main effect was based on school location (rural, suburban, and urban) and the other was based on the

percentage of students receiving free and reduced lunch (FRL) (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%). It was clear how both variables had a significant effect on student achievement and school performance. All subquestions (1a – 2d) had significant and similar results when examining the main effect based on school location. Urban schools do not perform as well as rural and suburban schools on either the Georgia Milestones EOC's or the school performance measures. As far as the percentage of students receiving FRL, it was clear the schools with a smaller percentage outperformed the schools with the higher percentages. Principal interviews confirmed how the FRL status did not affect the school culture, but it does affect student achievement. According to the principals FRL affects achievement levels of students from low-income families due to a general lack of resources and support at home.

Overall, this study failed to show which schedule would lead to more significant gains in student achievement in the 9th grade or improved school performance. The overall findings should provide principals and district leaders an insight into which schedule they should examine for their own student body and community. After interviewing principals, it is clear, that each community shares similarities and many differences in educating their high school students.

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APPENDIX A:

Letter to Expert Panel

Expert Panel Review

The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures: A Mixed Methods Study Interview Questions and Results

Dear _____:

Please help. Your knowledge and expertise are needed to provide verification for the interview questions being utilized for the qualitative section of the following dissertation: *The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures: A Mixed Methods Study.*

The purpose of the interview questions is to investigate how principals explain the similarities and differences among schools by schedule type, school location, and the percentage of students receiving free and reduced lunch on several 9th grade academic and school-wide performance indicators.

A short questionnaire via a Google Form will be utilized to provide your feedback on the interview questions, which is accompanied by a short presentation of the data being shared with each interviewee. Please check for grammatical and spelling errors, in addition to inspecting the quality and precision of each question and sub question. Lastly, you will be asked if there are any additional questions needing to be added to gather applicable qualitative information from the interviewees to further understand the quantitative results.

Your feedback is vital to ensure quality feedback to complete the study. Please read the interview questions, preview the quantitative data presentation, and then complete the survey via the Google Form at http://bit.ly/HSexperts

Thank you for your time, energy, and support in preparing for the upcoming interviews.

Sincerely,

Chris Chastain
Principal
Brooks County High School
cchastain@brooks.k12.ga.us

APPENDIX B:

Expert Panel Review Results and Interview Questions

Expert Panel Review: Proposed Interview Questions

The interview questions are intended for principals of high schools utilizing either a 7-period or 4x4 block schedule and is an 10-question interview where responses will be recorded, transcribed and coded for emergent themes.

Proposed Interview Questions:

1. Which schedule does your school currently utilize?
    a. Did you have the opportunity to choose or be a part of the decision-making process for your school's current schedule?
    b. Do you believe your schools current schedule is the best schedule for your students and community? Why or why not?
    c. Do you believe the size and shape of your facility influence the choice of schedule type? (i.e., large campus' may need more time to exchange classes)
2. What are the advantages of your current schedule?
    a. What are the disadvantages of your current schedule?
3. If almost all the research questions revealed schedule types were not significant to ninth-grade student achievement and school-wide performance, why do you believe schools choose to use their current schedule?
4. Based on the results of RQ1 and RQ2, why do you believe there was significant difference between schools based on their location?
5. Based on RQ3, why do you believe there is signifianct difference between schools and the percentage of students revieving Free & Reduced Lunch?
6. After reviewing the data, do you believe there is a schedule that is better for ninth-grade student success and overall school performance? Why?
7. How do you feel your current schedule is influencing ninth graders' behavior, culture, and/or academic performance?
8. How does your current schedule type ensure students are on track to graduate after the ninth-grade year?
9. How does your school currently help transition students from middle school to high school?
10. What does your school do to prepare freshmen for high stakes testing?
    a. How do you think this relates to your current schedule type?

The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures: A Mixed Methods Study Interview Questions and Results

Below is a summary of each research question along with findings. A total of 328 Georgia high schools were used for the study. Data was taken from 2018 – 2019 school year. For the free and reduced lunch variable, schools were divided into four quartiles based on their percentage of students on free and reduced lunch (Quartile 1: 0-38.79%, Quartile 2: 38.78-59.41%, Quartile 3: 59.42-90.64%, and Quartile 4: 90.65-100%).

Purpose of the Research:

The purpose of this study is to examine the effect a high school schedule can have upon several identified measures of success.

- Ninth grade academic achievement on . . .
    - the Georgia Milestones End-of-Course Assessment in Ninth Grade Literature, Algebra I, and Biology.
- Overall school performance utilizing . . .
    - each school's overall College and Career Readiness Performance Index (CCRPI) score, four-year cohort graduation rate, school climate rating, and overall retention rate.

Research Question 1:

Is there a significant difference among high schools using type of schedule (traditional seven-period schedule vs 4x4 block) by high school's location (urban, rural, or suburban) for ninth-grade students on selected performance measures (Ninth-Grade Literature, Algebra I, Biology)?

Significant Findings for Research Question One by Schedule Type (7 periods or 4x4 block), School Location (urban, rural, suburban), and Interaction Effects

Question	**RQ1a**	**RQ1b**	**RQ1c**
Effects	**9th Lit.**	**Algebra I**	**Biology**
Main Effect (Schedules)	NO	YES	NO
7 period : 4x4 Block		X	
Main Effect (Locations)	YES	YES	YES
Suburban : Rural			
Urban : Rural	X	X	X
Urban : Suburban	X	X	X
Interaction Effects	NO	NO	YES
Block:Rural – 7 period:Rural			
7 period:Suburban – 7period:Rural			
Block:Suburban – 7 period:Rural			
7 period:Urban – 7 period:Rural			X
Block:Urban – 7 period:Rural			
7 period:Suburban – Block:Rural			
Block:Suburban – Block:Rural			
7 period:Urban – Block:Rural			X
Block:Urban – Block:Rural			
Block:Suburban – 7 period:Suburban			
7 period:Urban – 7 period:Suburban			X
Block:Urban – 7 period:Suburban			
7 period:Urban – Block:Suburban			X
Block:Urban – Block:Suburban			
Block:Urban – 7 period:Urban			X

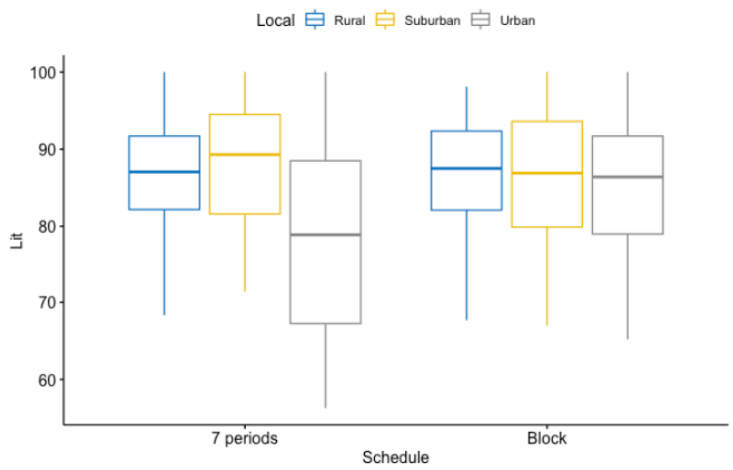

Figure 1. Box-plot of RQ1a, Ninth-Grade Literature EOC by Schedule and Location.

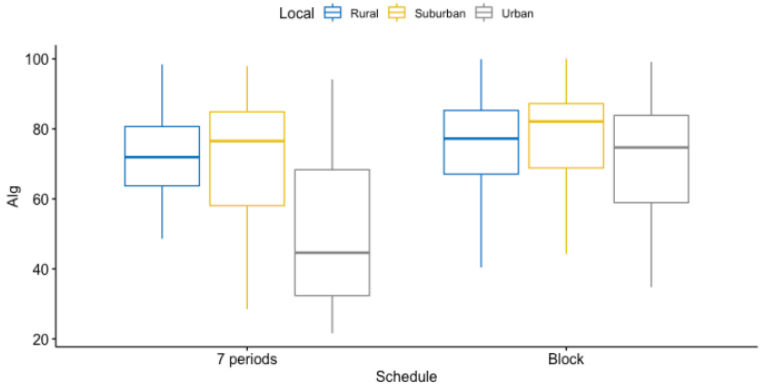

Figure 2. Box-plot of RQ1b, Algebra I EOC by Schedule and Location.

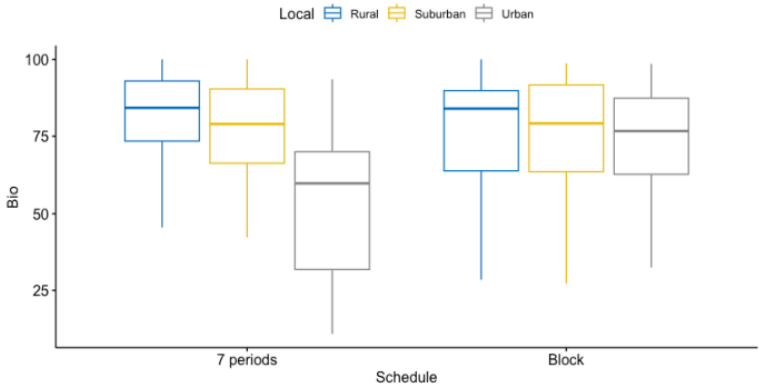

Figure 3. Box-plot of RQ1c, Biology EOC by Schedule and Location.

Question 2:

Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4x4 block) by high school's location (urban, rural, or suburban) on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

Significant Findings for Research Question One by Schedule Type (7 periods or 4x4 block), School Location (urban, rural, suburban), and Interaction Effects

Question	RQ2a	RQ2b	RQ2c	RQ2d
Effects	**CCRPI**	**Grad Rate**	**Climate**	**Retention**
Main Effect (Schedules)	NO	NO	NO	NO
7 period : 4x4 Block				
Main Effect (Locations)	YES	YES	YES	YES
Suburban : Rural		X		X
Urban : Rural	X	X	X	X
Urban : Suburban	X		X	X
Interaction Effects	YES	NO	NO	NO
Block:Rural – 7 period:Rural				
7 period:Suburban – 7period:Rural				
Block:Suburban – 7 period:Rural				
7 period:Urban – 7 period:Rural				
Block:Urban – 7 period:Rural				
7 period:Suburban – Block:Rural				
Block:Suburban – Block:Rural				
7 period:Urban – Block:Rural				
Block:Urban – Block:Rural				
Block:Suburban – 7 period:Suburban				
7 period:Urban – 7 period:Suburban	X			
Block:Urban – 7 period:Suburban				
7 period:Urban – Block:Suburban	X			
Block:Urban – Block:Suburban				
Block:Urban – 7 period:Urban				

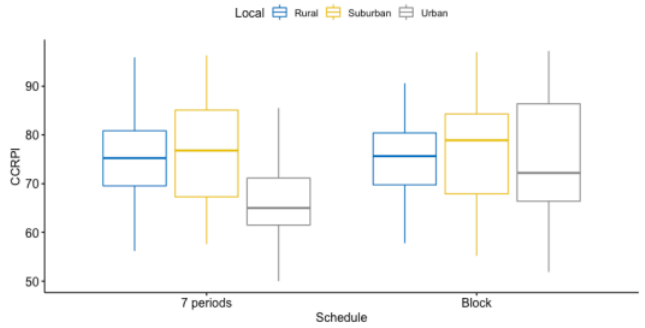

Figure 4. Box-plot of RQ2a, CCRPI Score by Schedule and Location.

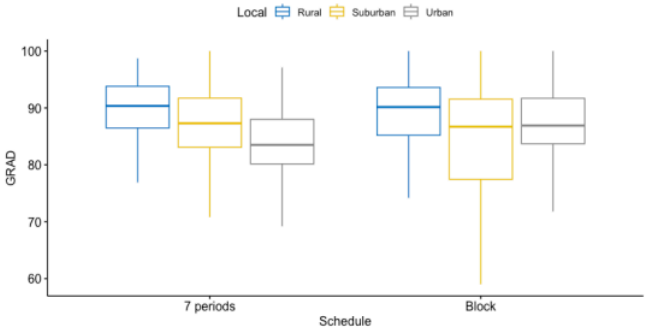

Figure 5. Box-plot of RQ2b, 4 Year Cohort Graduation Rate by Schedule and Location.

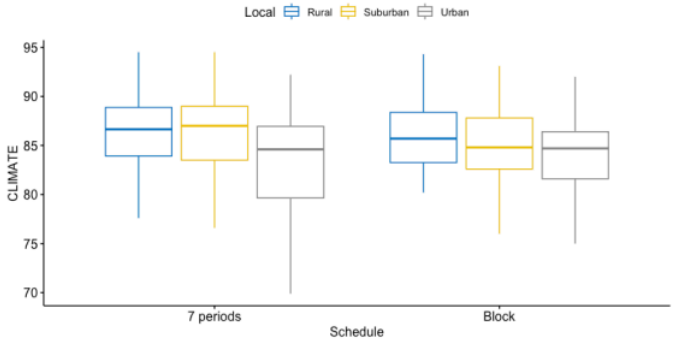

Figure 6. Box-plot of RQ2c, Overall Climate Rating by Schedule and Location.

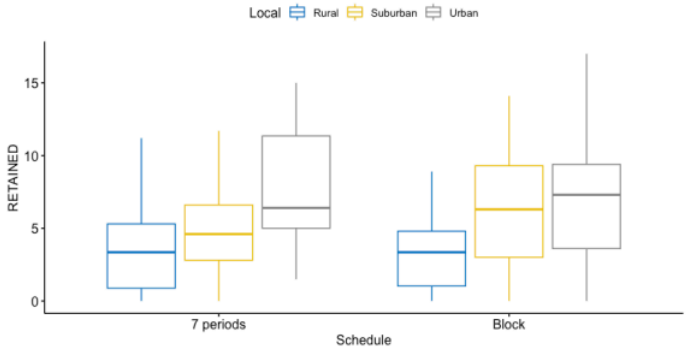

Figure 7. Box-plot of RQ2d, Percent Retained by Schedule and Location.

Question 3:

Is there a significant difference among schools using type of schedule (traditional seven-period schedule vs 4x4 block) by the levels of the percentage of students receiving free or reduced lunch on selected performance measures for all students (CCRPI, four-year cohort graduation rate, school climate rating, and overall retention rate)?

Significant Findings for Research Question One by Schedule Type (7 periods or 4x4 block), School Location (urban, rural, suburban), and Interaction Effects

Question	**RQ3a**	**RQ3b**	**RQ3c**	**RQ3d**
Effects	**CCRPI**	**Grad Rate**	**Climate**	**Retention**
Main Effect	NO	NO	YES	NO
7 period : 4x4 Block			X	
Main Effect	YES	YES	YES	YES
Quartile 1: Quartile 2	X		X	
Quartile 1: Quartile 3	X	X	X	X
Quartile 1: Quartile 4	X	X	X	X
Quartile 2: Quartile 3	X	X	X	X
Quartile 2: Quartile 4	X	X	X	X
Quartile 3: Quartile 4	X			
Interaction Effects	NO	NO	NO	NO

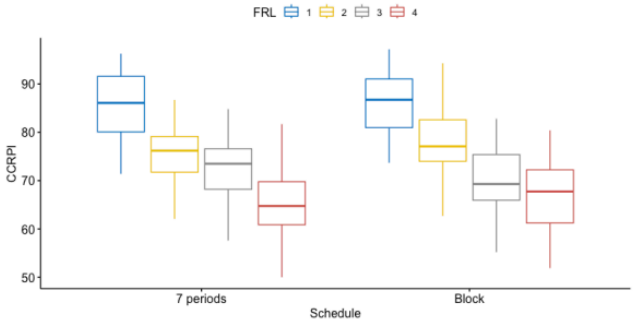

Figure 8. Box-plot of RQ3a, CCRPI Scores by Schedule and FRL Quartiles.

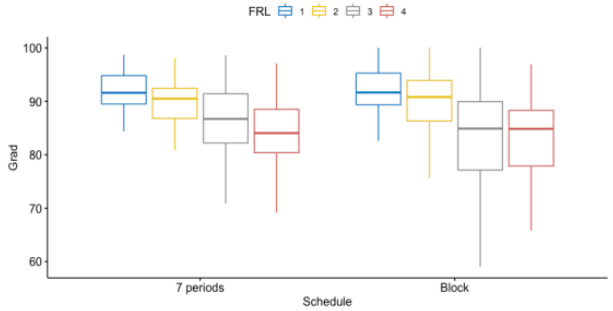

Figure 9. Box-plot of RQ3b, 4-Year Cohort Graduation Rate by Schedule and FRL Quartiles.

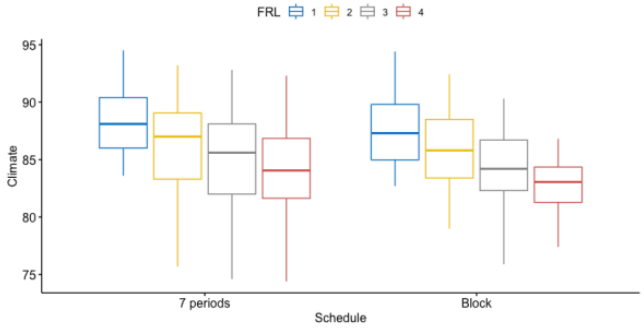

Figure 10. Box-plot of RQ3c, Overall Climate Rating by Schedule and FRL Quartiles.

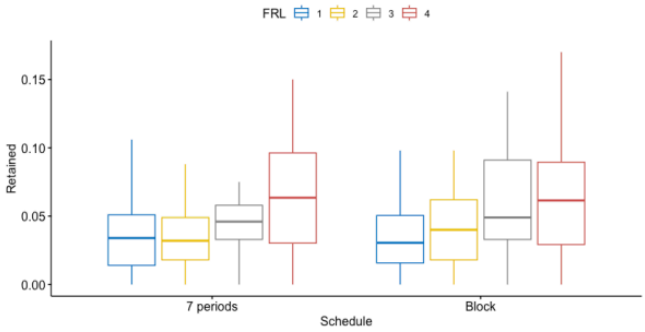

Figure 11. Box-plot of RQ3d, Percent Retained by Schedule and FRL Quartiles.

APPENDIX C:

Email Inviting Principals to Participate in Research

Dear _____,

I am conducting interviews as a part of my dissertation investigating the impact school schedules have on 9th grade student achievement and overall school performance. I believe you are in an ideal position to provide a valuable firsthand perspective. I am looking for insight from principals to explain the similarities or differences among schools utilizing a seven period or 4x4 block schedule on 9th grade student achievement based on the Georgia Milestone's End-of-Course Assessments (9th grade literature, algebra I, and biology), as well as overall school performance measures (CCRPI scores, school climate ratings, 4-year cohort graduation rates, and overall retention rates).

There is no compensation for participating in this study, but your participation will be a valuable addition to this field of research.

If you are willing to participate, I have attached a consent statement for your preview and a consent form I would ask you to complete, scan, and return. Please use the following link to choose a date and time best for you to participate in an interview:
http://bit.ly/7vsblock

Once you choose a date and time convenient for you, I will send an email 24 hours prior to the interview with a Microsoft Teams Meeting link and a copy of
the interview questions with a summary of research findings.

Please do not hesitate to ask if you have any questions.

Thank you for your time and consideration.

Sincerely,

Chris Chastain, EdS
Brooks County High School
cchastain@brooks.k12.ga.us

Questions regarding the purpose and procedures of the research should be directed to Chris Chastain at cdchasta@valdosta.edu. This study has been approved by the Valdosta State University Institutional Review Board (IRB) for the Protection of Human Research Participants. The IRB, a university committee established by Federal Law, is responsible for protecting the rights and welfare of research participants. If you have concerns or questions about your child's rights as research participant, you may contact the IRB Administrator at 229-333-7837 or irb@valdosta.edu.

APPENDIX D:

Informed Consent Form

The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures: A Mixed Methods Study

Consent to Take Part in Research

- ☐ I _____ voluntarily agree to participate in this research study.
- ☐ I have had the purpose and nature of the study explained to me in writing, and I have had the opportunity to ask questions about the study.
- ☐ I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any questions without any consequences of any kind.
- ☐ I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- ☐ I understand that participation involves me reviewing quantitative finding from the study and providing my opinion on the reason for similarities or differences amongst schools.
- ☐ I understand that I will not benefit directly from participating in this research.
- ☐ I agree to my interview being audio-recorded.
- ☐ I understand that all the information I provide for this study will be treated confidentially.
- ☐ I understand that my identity will remain anonymous and random numerical codes will be assigned to the interviewee.
- ☐ I understand that disguised extracts from my interview may be quoted in the dissertation.
- ☐ I understand that the signed consent form, original audio recording, and transcript will be retained in a locked file cabinet located at the researcher's home.
- ☐ I understand that the signed consent form, original audio recording, and transcript will be destroyed once the dissertation has been approved.
- ☐ I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Chris Chastain, Ed.S.
Researcher
Educational Leadership
Valdosta State University
cdchasta@valdosta.edu

James L. Pate, Ph.D.
Dissertation Chair
Professor of Curriculum, Leadership, and Technology
Valdosta State University
jlpate@valdosta.edu

_____ Signature of Research Participant/Date

_____ Signature of Researcher/Date

APPENDIX E:

Institutional Review Board Protocol Exemption Report

Institutional Review Board (IRB)
For the Protection of Human Research Participants

PROTOCOL EXEMPTION REPORT

Protocol Number: 04052-2020 **Responsible Researcher:** Mr. Christopher Chastain

Supervising Faculty: Dr. James L. Pate

Project Title: *The Effect of High School Schedules on Ninth Grade Student Achievement Indicators and Overall School Performance Measures.*

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **Exempt** from Institutional Review Board (IRB) oversight under Exemption **Categories 2 & 4**. Your research study may begin immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

ADDITIONAL COMMENTS:

- *Upon completion of this research study all data (email correspondence, survey data, participant name lists, transcripts, etc.) must be securely maintained (locked file cabinet, password protected computer, etc.) and accessible only by the researcher for a minimum of 3 years.*
- *The Research Statement must be read aloud to each participant at the start of each interview session. A copy of the Research Statement must be offered to each participant.*
- *Exempt research protocols prohibit the collection and/or storage of participant recordings. The recordings are allowed for the sole purpose of creating an accurate transcript. Once the interview transcript is created the recording must be deleted from all recording devises.*

☒ ***If this box is checked, please submit any documents you revise to the IRB Administrator at irb@valdosta.edu to ensure an updated record of your exemption.***

Elizabeth Ann Olphie *07.20.2020*
Elizabeth Ann Olphie, IRB Administrator

Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-253-2947.

Revised: 06.02.16

APPENDIX F:

Clean Copy of R Code for factorial ANOVA

Loading Data Set

```
View(RQname)
library(psych)
library(tidyverse)
library(ggpubr)
library(rstatix)
RQname$ID<-as.factor(RQname$ID)
RQname$School<-as.factor(RQname$School)
RQname$FRL<-as.factor(RQname$FRL)
RQname$Schedule<-as.factor(RQname$Schedule)
```

Descriptive Statistics

```
describe(RQname)
describeBy(RQname, RQname$Schedule)
describeBy(RQname, RQname$FRL)
describeBy(RQname$Retained,RQname$Schedule)
describeBy(RQname$Retained,RQname$FRL)
describeBy(RQname$Retained,RQname$Schedule:RQname$FRL)
summary(RQname)
RQname%>%
  group_by(Schedule)%>%
  get_summary_stats(Retained, type = "mean_sd")
RQname%>%
  group_by(FRL)%>%
  get_summary_stats(Retained, type = "mean_sd")
RQname%>%
  group_by(Schedule,FRL)%>%
  get_summary_stats(Retained, type = "mean_sd")
```

Identifying Outliers

```
RQname %>%
  group_by(Schedule, FRL) %>%
  identify_outliers(Retained)

RQname%>%
  group_by(RQname$Schedule, RQname$FRL) %>%
  identify_outliers(zscore)
```

Computing Zscores

```
RQname$zscore<-ave(RQname$Retained,RQname$Schedule,
            RQname$FRL, FUN = scale)
```

Creating Box-plots

```
bxp <- ggboxplot(RQname, x = "Schedule", y = "Retained", color = "FRL", palette = "jco")
bxp
boxplot(RQname$Retained ~ RQname$Schedule: RQname$FRL,  xlab="Group", ylab="
Retained Score", las=1)

model <- lm(Retained ~ Schedule*FRL,
          data = RQname)
z <- scale(RQname$Retained, center = TRUE, scale = TRUE)
print(z)

by(RQname$Retained, RQname$Schedule, center = TRUE, scale = TRUE, scale)
by(RQname$Retained, RQname$FRL, center = TRUE, scale = TRUE, scale)
by(RQname$Retained, RQname$Schedule:RQname$FRL, center = TRUE, scale = TRUE, scale)
```

Models and Charts

```
hist(RQname$Retained)

ggdensity(RQname$Retained, main = "Normality", xlab = "Retained Scores")

model <- lm(Retained ~ Schedule*FRL,
          data = RQname)
ggqqplot(residuals(model))
ggqqplot(RQname, "Retained", ggtheme = theme_bw()) +
  facet_grid(Schedule ~ FRL)
```

Shapiro Test

```
shapiro_test(residuals(model))
by(RQname$Retained, RQname$Schedule:RQname$FRL, shapiro.test)
RQname %>%
  group_by(Schedule, FRL) %>%
  shapiro_test(Retained)
```

JarqueBera Test

```
JarqueBeraTest(RQname$Retained, robust = TRUE, method = c("chisq", "mc"),
            N = 0, na.rm = FALSE)

by(RQname$Retained, RQname$Schedule:RQname$FRL, JarqueBeraTest)
```

Levenes Test

```
RQname %>% levene_test(Retained ~ Schedule*FRL)
leveneTest(RQname$Retained ~ RQname$Schedule:RQname$FRL, center=median)
leveneTest(RQname$Retained ~ RQname$Schedule*RQname$FRL, center=mean)
```

Factorial ANOVA

```
aov(formula = Retained ~ Schedule + FRL + Schedule:FRL, data = RQname, na.action =
na.exclude)
DP <- aov(Retained ~ Schedule + FRL+ Schedule:FRL , data= RQname, na.action= na.exclude)
Anova(DP)
summary(DP)
```

TukeyHSD

```
TukeyHSD(DP)
plot(TukeyHSD(DP))
model.tables(DP, type = "means")
```

YJ_Juiced Transformed Code

Loading Data Set

```
library(tidymodels)
set.seed(1234)
yj_rec <- recipe(Retained ~ Schedule + FRL, data = RQname) %>%
  step_YeoJohnson (all_numeric())
yj_rec
yj_prep <- prep(yj_rec, retain = TRUE)
yj_prep
yj_juiced <- juice(yj_prep)
```

Descriptive Statistics

```
describe(yj_juiced)
describeBy(yj_juiced, yj_juiced$Schedule)
describeBy(yj_juiced, yj_juiced$FRL)
describeBy(yj_juiced$Retained,yj_juiced$Schedule)
describeBy(yj_juiced$Retained,yj_juiced$FRL)
describeBy(yj_juiced$Retained,yj_juiced$Schedule:yj_juiced$FRL)
summary(yj_juiced)
yj_juiced%>%
  group_by(Schedule,FRL)%>%
  get_summary_stats(Retained, type = "mean_sd")
yj_juiced%>%
  group_by(Schedule)%>%
  get_summary_stats(Retained, type = "mean_sd")
```

Identifying Outliers

```
yj_juiced %>%
  group_by(Schedule, FRL) %>%
  identify_outliers(Retained)

yj_juiced%>%
  group_by(yj_juiced$Schedule, yj_juiced$FRL) %>%
```

```
  identify_outliers(zscore)
```

Computing Zscores

```
yj_juiced$zscore<-ave(yj_juiced$Retained,yj_juiced$Schedule,
                      yj_juiced$FRL, FUN = scale)
z <- scale(yj_juiced$Retained, center = TRUE, scale = TRUE)
print(z)

by(yj_juiced$Retained, yj_juiced$Schedule, center = TRUE, scale = TRUE, scale)
by(yj_juiced$Retained, yj_juiced$FRL, center = TRUE, scale = TRUE, scale)
by(yj_juiced$Retained, yj_juiced$Schedule:yj_juiced$FRL, center = TRUE, scale = TRUE,
scale)
```

Creating Box-plots

```
bxp <- ggboxplot(yj_juiced, x = "Schedule", y = "Retained", color = "FRL", palette = "jco")
bxp

boxplot(yj_juiced$Retained ~ yj_juiced$Schedule: yj_juiced$FRL,  xlab="Group", ylab="
Retained Score", las=1)
```

Models and Charts

```
hist(yj_juiced$Retained)

ggdensity(yj_juiced$Retained, main = "Normality", xlab = "Retained Scores")

model <- lm(Retained ~ Schedule*FRL,
            data = yj_juiced)
ggqqplot(residuals(model))
ggqqplot(yj_juiced, "Retained", ggtheme = theme_bw()) +
  facet_grid(Schedule ~ FRL)
```

Shapiro Test

```
shapiro_test(residuals(model))
by(yj_juiced$Retained, yj_juiced$Schedule:yj_juiced$FRL, shapiro.test)
yj_juiced %>%
  group_by(Schedule, FRL) %>%
  shapiro_test(Retained)
```

JarqueBera Test

```
JarqueBeraTest(yj_juiced$Retained, robust = TRUE, method = c("chisq", "mc"),
               N = 0, na.rm = FALSE)

by(yj_juiced$Retained, yj_juiced$Schedule:yj_juiced$FRL, JarqueBeraTest)
```

Levenes Test

```
yj_juiced %>% levene_test(Retained ~ Schedule*FRL)
```

```
leveneTest(yj_juiced$Retained ~ yj_juiced$Schedule:yj_juiced$FRL, center=median)
leveneTest(yj_juiced$Retained ~ yj_juiced$Schedule*yj_juiced$FRL, center=mean)
```

Factorial ANOVA

```
aov(formula = Retained ~ Schedule + FRL + Schedule:FRL, data = yj_juiced, na.action =
na.exclude)

DP <- aov(Retained ~ Schedule + FRL+ Schedule:FRL , data= yj_juiced, na.action= na.exclude)
Anova(DP)
summary(DP)
```

TukeyHSD

```
model.tables(DP, type = "means")
TukeyHSD(DP)
plot(TukeyHSD(DP))
```

Non-Parametric ARTools ANOVA Code

```
if(!require(ARTool)){install.packages("ARTool")}
if(!require(emmeans)){install.packages("emmeans")}
if(!require(rcompanion)){install.packages("rcompanion ")}
if(!require(ggplot2)){install.packages("ggplot2")}
if(!require(psych)){install.packages("psych")}
library(ARTool)
model = art(Retained ~ Schedule + FRL + Schedule:FRL,
          data = yj_juiced)
model
anova(model)
Results = anova(model)
Result$part.eta.sq = with(Result, 'Sum Sq'/('Sum Sq.res'))
Result
model.lm = artlm(model, "FRL")

library(emmeans)
marginal = emmeans(model.lm,
                ~ Schedule:FRL)
pairs(marginal,
     adjust = "tukey")
cld(marginal,
   alpha=0.05,
   Letters=letters,
   adjust="tukey")
Result = anova(model)
Result$part.eta.sq = with(Result, `Sum Sq`/(`Sum Sq` + `Sum Sq.res`))
Result
```

```
library(emmeans)
marginal = emmeans(model.lm,
                   ~ Schedule)
pairs(marginal,
      adjust = "tukey")
cld(marginal,
    alpha=0.05,
    Letters=letters,
    adjust="tukey")
Result = anova(model)
Result$part.eta.sq = with(Result, `Sum Sq`/(`Sum Sq` + `Sum Sq.res`))
Result

library(emmeans)
marginal = emmeans(model.lm,
                   ~ FRL)
pairs(marginal,
      adjust = "tukey")
cld(marginal,
    alpha=0.05,
    Letters=letters,
    adjust="tukey")
Result = anova(model)
Result$part.eta.sq = with(Result, `Sum Sq`/(`Sum Sq` + `Sum Sq.res`))
Result
```