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Effects of Class Scheduling and Student Achievement on State Testing

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,

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2018

Abstract

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Elizabeth A. Childers

MA, University of West Georgia, 1998

BS, Brenau University, 1994

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The purpose of this research study was to determine the effectiveness of four different class schedules on students' academic achievement on end-of-course testing and whether a specific class schedule is more conducive to student academic achievement on state-mandated standardized tests. Georgia Department of Education provided archived public data for the 2009–2012 school years for a high school with an approximate population of 1,400 students. This high school implemented different class schedules; a 4x4 block schedule, A/B block schedule, a mixed block and traditional period day, or traditional period schedule. The main research question was focused on students' state standardized end-of-course test scores performance (N = 8,972) between students instructed using 4 different class schedules. Data were analyzed using an ANOVA to determine whether there was a significant difference attributable to a specific curricular schedule. Students' academic achievement on state standardized testing showed a significant increase in math for students instructed on the block and A/B block schedule. The results were viewed through the theory of constructivism, as it is used to advocate for forms of block scheduling to promote increased instructional techniques and student academic achievement. Although the schedules taken in totality not show an improved student academic performance based on the schedule under which instruction occurred, the individual course analysis reflected statistically significant differences in the content area of math. The findings of this research promote positive social change by adding to the understanding of the effectiveness of different schedules on student academic achievement.

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Chapter 1: Introduction to the Study

High school is a critical time for students, and upon graduation, they should be prepared to either enter the workforce or continue in higher education; however, too many students fail to make a successful transition (Bangser, 2008; Wagner, 2014). To address this issue, I conducted this quantitative study to explore the effect of multiple year changes in schedule on state-mandated end-of-course testing results. The study was designed to inform educators and other interested parties in scheduling practices that promote student academic achievement. I investigated the effectiveness of the 4x4 block schedule, the A/B block schedule, the mixed block and traditional period schedule, and the traditional period schedule on student academic achievement on end-of-course testing.

The United States' ability to function in a global economy can be affected by the country's ability to educate students (Klein, Rice, & Levy, 2012). For instance, despite more than a decade of policy and investment focused on closing academic achievement gaps and improving overall student achievement, students are graduating from both high school and college unprepared for the world of work (American College Test, 2015; Midkiff & Cohen-Vogel, 2015; Mitchell, Crowson, & Shipps, 2011; Wagner, 2014). This can affect the number of qualified people entering the workforce, which in turn affects the function of the economy.

Since 1994, when the National Education Commission on Time and Learning recommended the use of block scheduling in the nation's schools, the scheduling of courses during the school day has been a significant issue in high schools. The National

Education Commission on Time and Learning declared that the future of public education depended on the practical use of school time and by 1996, the National Association of Secondary School Principals advertised block scheduling as an exemplary model (Hackman & Waters, 1998). There has been a continued focus on and interest in school schedules since the push for block scheduling began in the 1990s (Patall, Cooper, & Allen, 2010; Rettig, & Canady, 2013).

The school that is the focus of this quantitative ex-post facto research study implemented a different curricular structure for each of the four years from 2009 through 2012. The graduating class of 2012 matriculated under a different schedule each year of their academic journey. The school employed a 4x4 block schedule from 1998 until 2009 when it changed from 4x4 block to A/B block schedule. The following year, 2010–2011, the school changed to a mixed block and period day, and the school changed once again in 2011–2012 to a traditional period class schedule composed of students participating in six, seven, or eight classes each day for a period of 40 and 60 minutes.

Although there is research relating to student achievement on block versus seven-period class schedules, there is a significant lack of research related to the impact of multiple year schedule changes on student academic performance. The findings of this research can add to the understanding of the effectiveness of different schedules, providing data that may assist educators when considering options available to promote student academic achievement, which can result in improved student academic achievement.

This chapter includes the background of the study on the issue of the implementation of instructional time over the last 30 years and the problem statement outlining the implementation of a different curricular structure for each of the 4 years from 2009 through 2012 at the school of focus in this study. The graduating class of 2012 matriculated under a different schedule each year of their academic journey. The purpose of the study was to explore students' end-of-course tests (EOCTs) to determine if there is any significance in the scores during the years of 2009 to 2012 associated to the different class scheduling for each of the 4 years. This study can add to the body of literature relating to curriculum schedules' impact on student academic achievement as well as contributing to the school of focus.

Background of the Study

One of the major school reform issues in the past 30 years has been the use of school time (Bonner, 2012; Comer, 2012; Darling-Hammond, 2007; Darling-Hammond, Wilhoit, & Pittenger, 2014). There are longitudinal studies in literature that show the association between class schedules and student academic performance (Anderson & Walker, 2015; Aud, et al., 2013; Baker, Joireman, Clay, & Abbott, 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, Bird, Newman, & Kalra, 2010; Jacobs, 2010; Kera, Aud, & Johnson, 2014); however, the literature did not reflect school schedule environments such as those experienced by the graduating class of 2012 at the high school in this study. The graduating class of 2012 experienced a different class schedule for each year of their high school career.

The literature review that provided a framework for this study includes information regarding the historical background of class scheduling (Baker, et al., 2009; Campbell, Brown, & Guy, 2009; Dance, 2015), scheduling implementation and use in schools, and student academic achievement under the reviewed schedules (Dickson, et al., 2010) along with a historical background on state-mandated end-of-course testing (Domaleski, 2004). The literature related directly to the research questions for this study. The review covered block scheduling history and its positive and negative effects (Kelchner, 2003; Walker, 2015; Wallace, 2013) and the relationship between block scheduling and student academic achievement (Comer, 2012; Thibodeaux, 2015). The review also included information on the traditional single-period scheduling history and its positive and negative aspects (Williams, 2011; Wright, 2010) and the relationship between traditional single-period format and student achievement. Finally, the review included an examination of the rationale for changing the class format in secondary schools from the traditional single-period schedule to block scheduling (Campbell et al., 2009; Rettig & Canady, 2013; Weinbaum, 2013).

High school is one of the most critical times for students, and a key component to a student's college and career readiness is the high school's scheduling practice. The schedule is an essential component of school success; the schedule design ensures that courses are in a format that supports and promotes learning (Campbell et al., 2009; Rettig & Canady, 2013), as there is a relationship between class schedules and students' academic achievement (Baker, et al., 2009; Sisson & Sisson, 2015). The time and frequency of instruction can affect student learning and there is an inseparable link

between instruction time and class schedules (Bonner, 2012); they are mutually dependent one on the other (Jacobs, 2010). Instruction time governs the implementation of disciplined-based courses and provides the means of facilitating a school's goals and objectives in time devoted to curriculum instruction (Jacobs, 2010). The schedule affects the pace of the student and teacher interactions and the schedule influence, whether block or traditional, cannot be undermined (Reller, 2010).

Researchers suggest that schools' improvement of standardized achievement tests are made primarily through avenues other than cognitive skills (Bozick, 2010; Bragg & Taylor, 2014; Finn et al., 2014). For example, time is an important factor in instruction that students receive. A report from The National Center on Time and Learning (2011) details the increase of focus in schools across the country to expand learning time for American students. Jansen & Merwe, (2015) also suggested that a 21st-century learning model is about a school year defined by hours of instruction rather than days per year. In addition, Carrington (2010) suggested that instruction in spaced out sessions rather than fewer more extended sessions allows for greater student learning. Finally, Finn et al. (2014) reported that a schedule can be an essential tool in creating a culture that promotes student achievement as there is a distinct interrelationship between teaching and learning.

Research has determined that the timing and frequency of instruction can affect student learning; therefore, time is a critical factor that affects how much students learn (Bonner, 2012; Carrington, 2010; Nichols, 2005). Focusing on time, or student schedules, can help address the Superintendents' Recommendations for a New Federal Framework for Educational Accountability (Dance, 2015), which state that schools must

have highly effective systems of teaching, curriculum, assessment, and support if 21st century learning is to be achieved (Dance, 2015; Cramer & Mokher, 2015; Griffin, McGaw, & Care, 2012; Gul et al., 2014). The issue of time has been regarded by advocates of block scheduling as one of overriding importance as the restructuring of school schedules is the foundation for improvement (A Nation At Risk: The Imperative for Educational Reform, 1983; Queen, 2009). At the school of focus in this study, the graduating class of 2012 matriculated under a different schedule each year of their academic journey. The EOCT data published by the state Governor's Office of Student Achievement shows the school in this study operated under a 4x4 block schedule, an A/B schedule, a mixed block schedule, and a traditional class period for the respective years of 2009 through 2012. These changes in schedule warrant a further investigation to determine if the mandated state testing scores are significantly different, indicating that class schedule had any impact on state testing achievement results.

There are few longitudinal studies in the literature aligning and associating curricular schedules and student academic performance, and there was no research on class schedules that mention school schedule environments such as those experienced by the students in the graduating classes of 2011 and 2012 at the high school in this study (Bonner, 2012; Comer, 2012; Wright, 2010). There is a lack of research related to the impact of multiple year schedules changes on student academic performance (Baker, et al., 2009; Comer, 2012; Dickson, et al., 2010; Martinez & Holland, 2011); therefore, the results of this research study can add to the understanding of the effectiveness of the single-period traditional schedule, 4x4 block schedule, a mixed block and traditional

schedule, and A/B block class schedules and their impact on student achievement at the secondary level. This study provided an opportunity to analyze students' academic achievement on a specific state standardized testing for a 4-year period through the lens of four different class schedules.

Problem Statement

The problem examined in this research study was the effectiveness of four different class schedules on students' academic achievement on end-of-course testing and whether a specific class schedule is more conducive to student academic achievement on state-mandated standardized tests. The school of focus operated on a different class schedule for each year from 2009 through 2012. Although there are longitudinal studies in the literature with comparisons of block and traditional period student academic achievement, there was nothing in my search that reflected the type of schedule the graduating seniors of 2012 experienced throughout their high school academic journey (Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dickson, et al., 2010; Wright, 2010). This study can reflect on a gap in the current practice by presenting a snapshot of student academic achievement as measured by mandated testing scores on each of the respective academic schedules, the 4x4 block, the A/B block, a mixed A/B and traditional schedule, and the seven-period traditional schedule. Additionally, this study can be helpful to the school of focus. The administration of the school recognized that the findings of this research can enhance teachers', administrators', and parents' awareness of instructional schedules as they relate to student achievement on state-mandated testing. For example, according to the principal, the research may lead to an identification of the aspects of the

particular class schedule that provides increased student achievement and may provide recommendations for the most effective schedule for optimum student achievement.

Research does not have conclusive evidence to support one schedule over another but does suggest there are benefits to both block schedules and the traditional schedule (Finn et al., 2014; Williams, 2011; Wright, 2010). The EOCT scores at this high school both support and counter previous research (Finn et al., 2014; Ford, 2015; Williams, 2011; Wright, 2010). For example, Ford (2015) reported that writing scores under the traditional schedule improve significantly over the scores under the block schedule; however, under both schedules the overall mean test scores slightly increased each year.

This research built upon previous research, as the literature review did not reveal research comparing students' academic performance over a consecutive 4-year period under a different class schedule for each of those years (Anderson & Walker, 2015; Dance, 2015; Ford, 2015). Regarding previous research, Comer (2012) conducted a study to determine if 4x4 block scheduling affected student achievement and school climate and found that SAT scores remained lower at the 4x4 block scheduling high school compared to the traditional high school. However, the completion rate of high school units was higher with block scheduling than the traditional high school scheduling method (Comer, 2012). Dorn (2015) also reported that there are mixed achievement results with the 4x4 block schedule and students often scored lower compared to those in traditional seven periods and other block configurations. Additionally, Freeman (2014) quantitatively analyzed class schedule effects on student academic achievement differences between traditional and block schedules with Algebra I End-of-Course

Assessment scores, English 10 End-of-Course Assessment scores, Biology I End-of-Course Assessment scores, along with attendance, graduation, and college and career readiness rates. But the results of this study suggested no significant differences in achievement between the two schedule types (Freeman, 2014). Williams (2011) compared high school data from 2005–2010 for a Florida school operating on both an A/B block and a traditional, concluding that students on the block schedule had higher reading scores than the traditional schedule whereas students on the traditional scheduled experienced higher mathematics scores than the A/B block schedule. This study builds upon previous research comparing students' academic performance to the curricular schedule under which their instruction occurred.

Purpose of the Study

The purpose of this ex-post facto quantitative research study was to compare the students' EOCTs to determine if there is any significance in the scores during the years of 2009 to 2012 that can be associated to the different class scheduling each of the four years. Previous research has been focused on student academic achievement on the 4x4 block versus the traditional hourly schedule, but there is an absence of research on the type of curricular schedules employed by the school of focus on this study (Anderson & Walker, 2015; Aud, et al., 2013; Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, et al., 2010; Jacobs, 2010; Kera et al., 2014). There is also a lack of evidence conclusively supporting one schedule over the other. Therefore, this study can provide additional evidence in a review of student academic achievement on the four different class schedules. Considering the current reliance on standardized tests to

measure a school's academic performance, the class schedule under which a school operates could prove to be a critical component in measuring students' academic success.

Research Questions and Hypotheses

The research questions developed to guide the study and provide the structure for data collection and analysis are stated in this section. The questions are derived from the problem statement and anchored in the purpose statement in the previous section. An ex-post-facto quantitative approach using current, as well as past research was used as a catalyst to answer the following research questions:

RQ1: How are the scores different on state standardized end-of-course tests for ninth-grade literature between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule?

$H_1$1: There is at least one statistically significant difference in end-of-course test ninth-grade literature scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$1: There is not a statistically significant difference in end-of-course test in ninth-grade literature scores between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

RQ2: How are the scores different on state standardized end-of-course tests for 11th-grade literature between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule?

$H_1$2: There is at least one statistically significant difference in end-of-course test 11th-grade literature scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$2: There is not a statistically significant difference in end-of-course test in 11th-grade literature scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ3: How are the scores different on state standardized end-of-course tests for mathematics I between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$3: There is at least one statistically significant difference in end-of-course test mathematics I scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$3: There is not a statistically significant difference in end-of-course test in mathematics I scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ4: How are the scores different on state standardized end-of-course tests for mathematics II between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$4: There is at least one statistically significant difference in end-of-course test mathematics II scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$4: There is not a statistically significant difference in end-of-course test in mathematics II scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ5: How are the scores different on state standardized end-of-course tests for physical science between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$5: There is at least one statistically significant difference in end-of-course test physical science scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$5: There is not a statistically significant difference in end-of-course test in physical science scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ6: How are the scores different on state standardized end-of-course tests for biology between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$6: There is at least one statistically significant difference in end-of-course test biology scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$6: There is not a statistically significant difference in end-of-course test in biology scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ7: How are the scores different on state standardized end-of-course tests for U.S. history between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$7: There is at least one statistically significant difference in end-of-course test U.S. history scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$7: There is not a statistically significant difference in end-of-course test in U.S. history scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ8: How are the scores different on state standardized end-of-course tests for economics between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$8: There is at least one statistically significant difference in end-of-course test economics scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$8: There is not a statistically significant difference in end-of-course test in U.S. economics scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

An ex-post-facto quantitative research design format was used to examine scores for a 4x4 block schedule, A/B block schedule, mixed block schedule, and a traditional seven-period schedule to determine if there is a discernable relationship between schedule format and student academic achievement on state-mandated EOCTs. This

quantitative study involved the comparison of the dependent variables of each year's EOCT results to determine if there is at least one statistically significant difference in EOCT scores that may be related to the independent variables of the curricular schedule under which the testing occurred. To determine if there were differences between the means of the groups, an ANOVA was used to determine if the independent variable of each of the scheduling formats had an impact on each year's dependent variables (mean scores of EOCTs). This type of analysis can be used to determine the differences between group means and their associated curricular schedules. Data included the EOCTs passage rates for all school years and all tested students in the block scheduling, A/B block scheduling, mixed block scheduling, and traditional scheduling. The research questions guiding the data collection and analysis of study were designed to determine if there was a relationship between students' academic achievement on state-mandated standardized tests and the curricular schedule under which their instruction occurred. This examination of data was conducted to determine whether a discernable pattern existed among scheduling formats and student academic achievement on state-mandated standardized testing, using a confidence level of $p < .05$.

Theoretical Foundation

The theory of constructivism emphasizes the role a student takes in their learning process and has been the focus of a growing body of research in the last two decades (Akyuz, Dixon, & Stephan, 2013; Alleman & Holly, 2013; Finn et al., 2014; Hackman & Waters, 1998; & Martin & Loomis, 2013). The term constructivism relates to the work of Vygotsky, whose work has provided the foundation of much research and theory in

cognitive development over the past several decades. Scientists promote constructivism as the model that best reflects the brain's natural way of making sense of the world (Costa & Kallick, 2009; Finn, et al., 2014; Murphy, 2013; Vygotsky, 1978). The theory of constructivism promotes a relationship between factual knowledge, conceptual frameworks, and an individual's ability to organize knowledge for it to be retrieved and applied. Constructivism advocates for cooperative learning, curriculum integration, problem-based learning, and interdisciplinary teaming (Akyuz et al., 2013; Alleman & Holly, 2013; Finn et al., 2014; Hackman & Waters, 1998; Martin & Loomis, 2013). The constructivist theory relates to this research because instructional techniques such as allowing teacher and student relationships to strengthen and creating learning communities are advocated by proponents of block scheduling (Costa & Kallick, 2009; Finn, et al., 2014). Block scheduling has been mentioned to provide more extended periods of time for student success and to involve students and their peers in discussions and positively engage learning possibilities.

Nature of the Study

In this study, a quantitative ex-post facto quantitative method approach was employed to investigate the effect of multiple class schedule changes on the standardized testing performance of secondary students. An ex-post facto research design is used to compare groups with qualities that already exist on some dependent variable. This research method approach can also be used in response to relational questions regarding variables within the study. The approach also involves the collection of data so that information can be quantified and subjected to statistical treatment to support or refute

alternative knowledge claims and the findings can be predictive, explanatory, and confirmative (Creswell, 2009, p. 66).

This method is appropriate for this study because it yielded results that can assist in providing information about the predictive value of students' achievement on state-mandated standardized testing from the curricular schedule under which their academic instruction occurred. An ex-post facto design is quasi-experimental because the subjects are not randomly assigned as they are grouped based on a characteristic or trait. In this study, these groupings were based on the characteristic of the independent variable of which class schedule the EOCT was administered: the 4x4 block, the A/B block, the mixed block and traditional period, or the traditional period. The ex-post facto design is a nonexperimental research technique that can be used to compare preexisting groups on some dependent variable, which in this study is the average of the EOCT scores. The assignment of participants to the levels of the independent variable is based on events that occurred in the past, which is from where the name is derived.

Ex-post facto designs can be quantitative and used to analyze variables and predictability under a control group. Quantitative research offers an opportunity to use strategies of inquiry such as experiments and surveys and collect data on predetermined instruments that yield statistical data (Creswell, 2009). I conducted this study to determine if class schedule makes a difference in students' academic performance on the EOCT. An ex-post facto design was most appropriate for this study as there is no control over the variables and a report on what has happened through an examination of the means for the scores for each year's schedule. A quantitative ex-post facto approach was

used in this study to study the mean differences in students' achievement on state testing over a period of four years, 2009 to 2012, when different class scheduling was used each of those academic years.

The study data were collected first for the use and timeframe of the scheduling formats (4x4 block, A/B Block, A/B Block and seven-period hybrid, and seven-period schedules) along with calculation of the scores of the EOCTs for each year of testing from 2009 through 2012. The data were obtained from the published data at the Georgia Department of Education website. The independent variable of the scheduling formats were compared to the dependent variable of the mean scores of the EOCTs to determine if there is a discernible impact on student academic achievement based on the schedule under which their instruction occurred.

Definitions

This quantitative study involved the comparison of the dependent variables of each year's EOCT results to determine if there is at least one statistically significant difference in EOCT scores that may be related to the independent variable of the curricular schedule under which the testing occurred (i.e., a 4x4 block, A/B block schedule, a mixed block and period schedule, or a traditional seven-period schedule). The following terms are defined as used throughout this document:

A/B block schedule: A teaching schedule where students and teachers meet their classes every other day for an extended block of time (Rettig & Canady, 2003).

Block scheduling: A teaching schedule that enrolls students in four courses with class schedules of approximately 90 minutes each school day for 90 calendar days.

Within this schedule, students can complete eight courses in 1 year (Rettig & Canady, 2003).

End-of-course test: Examination administered upon completion of gateway or benchmark courses. The examination scores are 20% of final grades within these courses, which include ninth and 11th-grade literature, biology, physical science, Mathematics I and II, U.S. History, and economics.

Every Student Succeeds Act (ESSA): Law signed by President Obama in December 2015 that replaced the No Child Left Behind (NCLB) law. NCLB was focused solely on student academic achievement and primarily used state reading and mathematics test scores to evaluate schools' academic performance. ESSA requires the consideration of more than just test scores when evaluating schools' performance. ESSA includes four academic factors each state must use. States can choose a fifth factor that impacts school quality.

No Child Left Behind (NCLB): Law preceding ESSA which focused solely on student academic achievement by using state reading and mathematics tests scores to evaluate schools' academic performance (NCLB).

Seven periods: A single period daily school schedule composed of students participating in six, seven, or eight classes each day and varying in duration between 40 and 60 minutes (Rettig & Canady, 2003).

Assumptions

Assumptions are premises accepted as being true for reasoning and required for statistical testing (Creswell, 2009). In this study, I assumed student achievement as

equivalent to student performance on the state EOCTs for ninth-grade literature, 11th - grade literature, mathematics I and II, biology, physical science, economics, and U.S. history. The research assumes that all student instruction was in an appropriate sequence and at an appropriate pace. The data gathered from state-provided accountability reports and school report cards assumes effective scoring of assessments and precise data entry of Public Information. The following list of assumptions was also considered for this study:

1. The results of the EOCTs accurately reflect the academic achievement and performance of each.
2. By testing procedures established by the State, all students experienced the appropriate administration procedures within an acceptable and appropriate environment.
3. The EOCT align with state-mandated content standards and include assessment of specific content knowledge and skills.
4. The data points are normally distributed for the ANOVA test.
5. Limitations also exist with the analysis of variance as an ANOVA assumes that all population means from each data group are loosely equal and that all variances from each data group must be loosely equal.

Scope and Delimitations

This research topic was chosen to examine if a difference exists in students' academic achievement on mandated testing based on the type of curricular schedule under which they received instruction. The problem investigated in this quantitative ex-

post facto research study was a school's scores on the EOCT from one school year to the next as curriculum schedules changed. An ex-post facto design was chosen for this study to determine if a specific class structure had any measurable effect on students' standardized testing results. This school was the only school in the district that implemented the class schedules that are the focus of this study. Therefore, the study is bounded by the ninth through 12-grade students attending this school during the yeas of 2009 and 2012.

Limitations

The findings of this study were limited to the state where the study took place. This study did not take into consideration such variables as teacher experience and the quality or quantity of educational materials nor were the learning philosophies of both teachers and administrators considered in this study. Potential bias was avoided by reducing random error by including the entire student population participating in the end-of-course testing for each of the years reviewed. I could not control all variables that could impact changes; however, the study was limited to the student scores on the EOCTs for students testing during the school years 2009–2012 because these scores are determinate for graduation. Only those students who took an EOCT during the years of 2009 through 2012 were included in the study. Generalizability of this research to the population at large is not absolute but is statistically probable as there are norm-referenced items in all content areas and courses to provide a national comparison.

The results obtained from this study may offer valuable insight and relevant information as it relates to the end-of-course standardized tests. However, other

standardized examinations may not produce similar results. Additionally, standardized examinations measure only a single point in time and do not factor in other factors which can have a negative impact on a student's score such as teacher preparedness, and teaching methods may have limited a student's ability to achieve academically. Additionally, this study did not include the socioeconomic background, the number of times a student had taken the test(s), and the type of student the child was academically. The study also did not include the educational background of the related parents.

Significance

The findings of this research can enhance teachers', administrators', and parents' awareness of and potential efficacy of specific instructional schedules. The results from this study can add to the body of literature relating to curriculum schedule's impact on student academic achievement as well as provide information for school of focus. This study will also add to the literature related to state-mandated testing achievement and multiple class schedules. One of the major school reform issues in the past 30 years has been the use of school time (Bonner, 2012; Comer, 2012; Darling-Hammond et al., 2014). There are longitudinal studies in the literature aligning and associating class schedules and student academic performance (Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dickson, et al., 2010), but there is a lack of research related to the impact of multiple year schedule changes on student academic performance. The data examined in this study may lead to an identification of the aspects of the particular class schedule that provides increased student achievement and may provide recommendations for the most effective schedule for optimum student achievement.

The implications for social change from this research are that results may assist educators when considering options available to promote student academic achievement. Because decisions, policies, and procedures should be made or developed with deference for all learners, this study may assist decision-makers in the choice and implementation of the most effective class structure to assure high academic achievement by students. The results of this study provides additional information to parents, teachers, and administrators on the effectiveness of each of the class schedules examined. This study can also provide additional understanding of the effectiveness of the 4x4 block schedule, mixed block and traditional schedule, A/B block class schedule, and single-period traditional schedules and their impact on student achievement at the secondary level.

Summary

Although there is research relating to student achievement on the block and seven-period class schedules, there is a significant lack of research related to the impact of multiple year schedule changes on student academic performance. I investigated if there is a connection between scheduling formats and student achievement as measured by achievement scores on state-mandated EOCTs. Chapter 1 outlines the problem and provides background for this study. Chapter 2 includes a review of the literature relative to student achievement under the reviewed schedule models. Chapter 3 presents the methodology for this study, including research design, assumptions, instrumentation, procedures, data processing, and analysis. Chapter 4 presents the research questions, an analysis of the quantitative data, test, and analysis of the hypotheses, and a summary of

research findings. Chapter 5 offers a summary and conclusions in this study, implications for practice, and recommendations for the future.

Chapter 2: Literature Review

The problem examined in this research study was the effectiveness of four different class schedules on students' academic achievement on end-of-course testing and whether a specific class schedule is more conducive to student academic achievement on state-mandated standardized tests. The purpose of this ex-post facto quantitative research study was to compare students' EOCTs to determine if there is any significance in the scores during the years of 2009 to 2012 that can be associated to the different class scheduling each of the 4 years. The school of focus operated on a different class schedule for each year from 2009 through 2012.

The goal of schools across the United States is to educate students, and the element of accountability in this regard is becoming more persistent. Schools have felt pressure from this element of accountability and have adjusted schedules to increase student academic achievement. This perception of change in class schedule as an element to increase student achievement has been a common denominator among school districts since 1994 when the National Education Commission on Time and Learning recommended the use of block scheduling in the nation's schools. The commission declared that the future of public education depended on the effective use of school time and by 1996, the National Association of Secondary School Principals supported block scheduling as an exemplary model (Hackman & Waters, 1998).

Although there is no research on the combination of the type of class schedules examined in this study, the literature review provides a perceived perception that the block schedule is more beneficial to students, faculty, and staff. The literature outlines

the benefits for teachers in the way of extended planning time, fewer students, and opportunities to create project-based activities. However, the lists of benefits are not directly related to the impact it may have on student achievement, and the literature indicated that there is no clear significant difference in student academic achievement on standardized tests. Research provides no conclusive evidence to support one schedule over another (Finn, et al., 2014; Loveland & Bland, 2012; Lovingood, 2010; Williams, 2011; & Wright, 2010). There are longitudinal studies in the literature on comparisons of block and traditional period student academic achievement but nothing that reflects the type of schedule the graduating seniors of 2012 experienced throughout their high school academic journey (Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dickson, et al., 2010; Wright, 2010).

The federal government's role in public education was expanded with the NCLB 2002 with the requirements of annual testing, annual academic progress, teacher qualifications, and changes in funding. Now in each state, schools are held accountable for student performance and are required to show student growth annually through statewide assessments (Areiza-Restrepo, 2013; Davidson, Reback, Rockoff, & Schwartz, 2013). The ESSA replaced NCLB and was signed by President Obama in December 2015. Although NCLB focused solely on student academic achievement and primarily used state reading and mathematics test scores when evaluating how schools were doing, ESSA requires that each state must use four academic factors that are included in the law. States can choose a fifth factor that impacts school quality such as school climate and

safety, student or educator engagement, access to advanced coursework, and postsecondary readiness.

Identifying characteristics of education that can have the most permanent beneficial impact on students is an increasingly crucial issue and has forced school districts to analyze all educational components that relate to student achievement (Aud, et al., 2013; Baker, 2014; Cobo, 2013; Jacobs, 2010; Nomme & Birol, 2014; Rubin, 2011). To maintain pace with contemporary American society, change is inevitable and schools must adequately align their curriculum and curricular structure in order to meet the demands of the 21st century (Aud, et al., 2013; Baker, 2014; Cobo, 2013; Jacobs, 2010; Nomme & Birol, 2014; Rubin, 2011). For instance, many experts say that since the 1970s, new technologies, combined with demographic, political, and economic trends, have altered Americans' work and social lives in ways that have significant consequences for today's young people (Jerald, 2009). In the computer age, the pace of technological change is rapid, and 62% of Americans said they use mobile technology to access digital data and tools "on the go" outside of their homes and workplaces (Jerald, 2009). Between 2002 and 2007, cell phones displaced landline telephones as the technology Americans say would be hardest to give up, and in just half a decade cell phones and the Internet both unseated the second most indispensable technology in 2002—the television (Jerald, 2009). When essential daily tools can change in just 5 years, the impact over longer stretches can be profound. These trends have prompted some education reformers to argue that the traditional curriculum is not enough: schools must provide students with

a broader set of skills to thrive in a rapidly evolving, technology-saturated world (Jerald, 2009).

Although there is research relating to student achievement on block and traditional period class schedules, there is a lack of research related to the impact of multiple year schedule changes on student academic performance (Anderson & Walker, 2015; Baker, et al., 2009; Dance, 2015; Dickson, et al., 2010). Standardized tests can have a significant impact on a student's academic journey and even their ability to graduate from high school. An examination that determines whether a curricular schedule allows greater academic performance on the tests can provide valuable information on an educational component that relates to student achievement. School districts are trying to analyze all educational components that can have the most permanent beneficial impact relative to student achievement and this study can provide information about whether a particular curricular class schedule has any significant bearing on student academic performance and achievement relating to standardized tests (Aud, et al., 2013; Jacobs, 2010; Kera, et al., 2014).

The time and frequency of instruction can affect student learning (Bonner, 2012). There is an inseparable link between instruction time and class schedules, and they are mutually dependent one on the other (Early, Rogge, & Deci, 2014; Jacobs, 2010). Instruction time governs the implementation of disciplined-based courses and provides the means of facilitating a school's goals and objectives in the area of time devoted to curriculum instruction (Jacobs, 2010). Over the last 30 years, education reforms have focused on ways to improve student academic achievement, and over the last 20 years,

school reform recommendations have advocated a more effective use of school time (Hanushek, Peterson, & Woessmann, 2013; Jacobs, 2010).

The literature review provides information about the literature search strategies, the theoretical framework and literature review relative to the fundamental concepts and variables examined, as well as encompasses the importance of instruction time and schedules along with the historical background of scheduling. The effects of block and seven-period scheduling on student achievement are explored along with comparisons of student academic achievement on the block and seven-period schedules (Anderson & Walker, 2015; Baker, et al., 2009; Dance, 2015; Dickson, et al., 2010).

Literature Search Strategy

The literature review was accomplished by searching for primary sources such as reports and findings on the topic of block scheduling and student achievement. Searches were made using the following terms to research the existing literature to support this research study, scheduling, master schedules, block scheduling, curricular scheduling, student achievement, mandated testing, comparison of schedules, history of scheduling, traditional scheduling. Dissertations, research studies, and journal articles used to direct the present study were obtained from Walden University electronic databases such as ERIC, EBSCO, and Education Research Complete. Other websites used were National Association of Secondary School Principals and Association for Curriculum and Development.

Theoretical Foundation

The results were viewed through the constructivist model of learning to provide a context for this research. The term constructivism relates to the work of Vygotsky whose work has become the foundation of much research and theory in cognitive development over the past several decades. Hackman & Waters (1998) described constructivism as a set of beliefs, norms, and practices, and these beliefs, norms, and practices help students construct meaning from the curriculum. The constructivist theory relates to this research since constructivism promotes instructional techniques such as strengthening teacher-student relationships and creating learning communities that are all practices education reformers promoted when advocating block schedule as noted in the literature review of this study (Costa & Kallick, 2009; Finn, et al., 2014; Gordon, 2008; Lambert, Zimmerman, Cooper, Lambert, & Gardner, 2002).

According to constructivism, people construct their understanding and knowledge of the world by experiencing new things and then reflecting on the new experience. This reflection promotes a greater comprehension and mastery. Constructivists emphasize depth of understanding rather than a superficial treatment of subject matter to promote greater comprehension and mastery of content (Martin & Loomis, 2013; Pelech & Pieper, 2010). Constructivism also maintains that learning is an active process. As people learn something new, all their previous knowledge is brought to the new learning experience. A newly learned fact or experience is blended into the understanding that already exists in that person's mind (Martin & Loomis, 2013; Costa & Kallick, 2009). Learning is not compulsory but is contextual, as it involves acquiring new knowledge or experiences, or

modifying and reinforcing existing knowledge (Costa & Kallick, 2009; Martin & Loomis, 2013). Learning is shaped by and builds upon what we already know (Costa & Kallick, 2009; Martin & Loomis, 2013). Rather than merely a collection of facts, experiences, and information, learning may be viewed as a process.

Scientists also promote constructivism as the model that best reflects the brain's natural way of making sense of the world (Costa & Kallick, 2009; Finn, et al., 2014). Constructivism is used to explain that there is a relationship between factual knowledge, a conceptual framework, and the ability to organize knowledge in such a way that it can be retrieved and applied. The structure of cognition and the structure of the environment codefine each other and therefore coemerge. As schools try to balance the need to improve student academic achievement with economic challenges, they must find the best scheduling format that maximizes instruction while also being cost-effective.

Literature Review Related to Key Concepts and Variables

The time a student spends in high school is one of the most critical and a key component to a student's college and career readiness is the high school's scheduling practice (Campbell et al., 2009). School systems have strived to increase student achievement for many years. One way they have attempted to do this is by adjusting the class schedule. In fact, school schedules have been manipulated to increase student achievement (Rettig & Canady, 1999). School administrators have manipulated the school day using various scheduling models to help increase student academic achievement. The 4x4 block and the traditional period day are the most widely used schedules (Dance, 2015). However, questions remain unanswered in the measurement of

students' performance on state-mandated testing after the implementation of the new Career and College Performance Index for Georgia (Georgia Department of Education, 2012). The state adopted a series of standardized tests known as the EOCTs as a measuring point of student achievement (Domaleski, 2004). The purposes of the EOCT are to improve student achievement through effective instruction and assessment of the standards in the EOC tested courses and to ensure that all students have access to a rigorous curriculum that meets high-performance standards. The results of the EOCT are used for diagnostic purposes to assess student achievement and to provide data in support of improved student instruction. The EOCTs were first introduced in 2001, and the scores count toward the student's final grade in the respective classes. The state administered the exams through the time frame examined in this study, and school systems of the state rely on the scores as a measure of student achievement and teacher accountability. Regardless of the type of schedule employed by a school, all the state public schools administer end-of-course exams.

Performance levels, scale scores, and grade conversion scores, along with raw scores (number correct) of items are converted to scale scores, which make it possible to standardize the reporting for all forms of the Georgia EOCTs for a given subject area. Each time a test is administered, a new form of that test has been equated with previously administered forms to adjust for differences in difficulty, and the scores on the different forms share the same reporting scale. The EOCT scores are reported on a scale that can range from 200 to 600 or above for performance standards-based tests. The minimum and maximum scale scores for the different subject areas differ because the subject area

tests vary in length and their relative difficulty. The cut score that indicates a student is meeting the EOCT standard is 400 for Georgia Performance Standards-based tests. The cut score that indicates a student is exceeding standard is 450 for Georgia Performance Standards-based tests. A statewide committee of Georgia educators, using a procedure approved by the state board of education, determined the cut scores for meeting the standard and exceeding the standard for each test. The performance level classification for each student is determined by the scale score associated with the total number of questions a student gets correct on an EOCT. In addition to a scale score for each test, a grade conversion scale, ranging from 0 to 100, also describes student performance on an EOCT. The grade conversion scale is helpful because it can be more readily incorporated into course grades than can scale scores (State Department of Education). Grade conversion scores were used to address this study's research questions and hypotheses.

Research has established that the timing and frequency of instruction can affect student learning; that instruction time and class schedules are mutually dependent one on the other and therefore, are inseparably linked (Anderson & Walker, 2015; Aud, et al., 2013; Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, et al., 2010; Jacobs, 2010; Kera, et al., 2014). Instruction time governs the implementation of disciplined-based courses and provides the means of facilitating a school's goals and objectives of time devoted to curriculum instruction; however, the class schedule structured the pace of the student and teacher interactions and the schedule's influence, whether block or traditional, cannot be undermined (Reller, 2010). Beginning in the 1990s schools began a shift from the traditional seven-period schedule to the 4x4 block

and in some cases, the mixed block. Although there are many types of schedules used in schools across the nation, research indicates that schedules are usually divided into the 4 main categories: a 4x4 block, an A/B block, a mixed block and seven periods, and a seven-period schedule.

Schedule Descriptions

Students under a 4x4 block complete four classes per semester and take an additional four classes the second semester totaling 180 days of school. Students in a 4x4 block schedule meet four times per day with each period lasting approximately 90 minutes per class for 90 days and approximately 90 students per day. At the end of 90 days, these students switch to four new classes. Students accumulate 8,100 minutes of instructional time under the 4x4 block and take two to three academic classes per semester with elective courses added into the schedule (Dance, 2015; Rettig & Canady, 1999).

Students in an A/B block schedule meet four times on alternating days totaling eight classes for the entire school year. Teachers have approximately 150-200 students for the entire year and students accumulate 8,100 minutes of instructional time under an A/B block schedule (Anderson & Walker, 2015; Comer, 2012; Dance, 2015; Ford, 2015;).

Students in a mixed block and seven-period schedule meet some classes for 90 minutes and some classes for 45-55 minutes. The blocked classes meet much like the A/B block schedule in that the classes last all year, as do the 45-55 minutes classes, which meet every day (Comer, 2012; Dance, 2015). Students receive approximately

8,100 minutes of instructional time and usually take four to five academic classes and two to three nonacademic classes depending on the student's class year and state requirements (Ford, 2015).

Students in a traditional schedule meet six, seven, or eight times a day with each period lasting 45-55 minutes per class and teachers meet approximately 120-150 students each day and keep those students for the entire school year. Students realize approximately 9,000 minutes of instructional time and are enrolled in four to five academic classes and two to three non-academic classes depending on the student's class year and state requirements (Comer, 2012; Dance, 2015; Ford, 2015).

While Dance (2015) reports that our students are inheriting a world that demands advanced knowledge and skills in an evolving global economy, Finn, et al. (2014) report findings that suggest that schools that improve standardized achievement tests do so primarily through channels other than cognitive skills. As reported by Finn, et al., (2014), the schedule can be a crucial, even critical, tool in promoting student achievement as research has determined that the timing and frequency of instruction can affect student learning. Therefore, time, as measured by the schedule, is a critical factor that affects how much students learn (Bonner, 2012; Carrington, 2010; Nichols, 2005). Dickson, et al., (2010) report on the effect of block scheduling on academic achievement through longitudinal studies aligning and associating class schedules and student academic performance. The National Center on Time and Learning (2011), reported that over the last several years, an impetus across the country to expand learning time for American students. Jansen & Merwe, (2015) suggests that a 21st-century learning model is about

education happening at any time and any place, and calls for the school year to be defined regarding hours of instructional time rather than a number of days per year.

Ford (2015), in an analysis of a test score comparison between the block and traditional scheduling of two schools and 12 subject areas, reported results of a significant difference in mean in two of the 12 subjects researched. Writing scores under the traditional scheduled improved significantly over the scores under the block schedule, however, at both schools in all 12 areas, the overall mean test scores slightly increased each year. Research indicated the possibility that the scores under the traditional schedule could be positive given more time (Ford, 2015). Gargis (2013) reported on quantitative research studies that compared grade point averages along with standardized test scores under both block and traditional schedules. The results are not consistent and do not actively support one schedule over the other.

Carrington (2010) suggests that students learn better when taking courses over a more extended period such as the traditional schedule. Carrington recommends that learning is enhanced when new subjects are presented in several sessions rather than compressed into fewer sessions and would advocate for the traditional schedule over the block as the most effective schedule for student achievement.

Finn, et al., (2014), reports that constructivist theory facilitates in understanding and recognizing connectedness of teaching and learning and how the schedule can be a crucial, even critical, tool in promoting student achievement. Finn, et al., (2014), integrate the two approaches of achievement tests and psychological science to ask how the enhancement of academic performance by schools relates to the types of cognitive

skills studied in psychological science. Cognitive abilities that develop from childhood through adulthood predict individual differences in performance on numerous measures. These maturing mental abilities underpin learning and cognitive skills and are associated with academic performance. Finn's research reported a strong relationship between cognitive ability and academic performance which suggests schools that are particularly effective in improving academic performance may also improve domain-independent cognitive skills. Additionally, the research reports evidence that there is evidence that targeted interventions may increase cognitive ability. The structure of cognition and the structure of the environment co-define each other and therefore co-emerge. Carrington (2010) suggests instruction in spaced out sessions rather than fewer longer sessions allows for greater student learning. Finn, et al., (2014) report that the schedule can be an essential tool in creating a culture that promotes student achievement as there is a distinct interrelationship between teaching and learning.

Importance of Instructional Time and Scheduling

Schools began a shift in the early 1990s from a traditional schedule to a 4x4 block schedule or a modified block schedule. The importance of instructional time and scheduling as a school structure has been discussed and examined by researchers and scholars (Rettig & Canady, 2013; Queen, 2009; Carrington, 2010; Dickson, et al., 2010). A well-designed schedule can provide a foundation for an exemplary curriculum program while a poorly designed schedule can negate progress while being unresponsive to students' need (Jacobs, 2004, 2010).

The National Education Commission was charged to examine the quality of education in the United States and report their conclusions. The Commission declared that the future of public education depended on the effective use of school time and one of the tools for improvement was the restructuring of school schedules (Queen, 2009; A Nation at Risk: The Imperative for Educational Reform, 1983). The next two decades saw a flurry of change as block scheduling was endorsed as an exemplary model (Dance, 2015). By 2006 about "fifty percent of all American secondary schools were in some form of block scheduling" (Dance, 2015; Dexter, Tai, & Sadler, 2006, p. 23).

With the recommendation of block scheduling by the National Education Commission on Time and Learning (1994), the use of time during the school day became a major issue in high schools and educators were encouraged to find better ways to utilize instructional time. The high school in this research study implemented a different class schedule for each of the years from 2009-2012. The graduating class of 2012 experienced a different schedule for each year of their high school journey: 4x4 block schedule for their freshman year, A/B block schedule their sophomore year, a mixed block and traditional period schedule their junior year, and a seven-period schedule their senior year.

Block scheduling has been broadly implemented since the 1990s, and as a result of the changes implemented relating to class scheduling, some studies concerning block scheduling achievement were conducted. A review of the literature on class schedule studies of student achievement on block schedules offers varied outcomes. As reflected in this literature review, some studies demonstrate academic improvement as a result of

block scheduling, some studies demonstrate negative results, and some studies demonstrate no change. Results from these studies have mixed results, but most researchers seem to favor block scheduling (Ford, 2015; Gargis, 2013). Some studies demonstrate academic improvement as a result of block scheduling, some studies demonstrate negative results, and some studies demonstrate no change. Results from these studies have mixed results, but most researchers seem to favor block scheduling (Ford, 2015; Gargis, 2013). While most research does not support significantly increased academic achievement on any specific schedule, most report a preference towards block scheduling for multiple reasons. Students have an opportunity to select more courses on block schedules. Block schedule behavior reports indicate fewer discipline referrals. Homework was another positive element related to block scheduling as students in a block schedule tend to have less at home homework. Additionally, students deemed at-risk benefit from having to concentrate on only two or three core classes each semester under a 4x4 block schedule.

According to the National Education Commission (1994), the primary reason many schools converted from traditional block schedules was to increase student achievement. However, typical measures of student achievement under block schedules, such as state standardized EOCTs and or graduation tests, state-mandated yearly performance tests as well as the SAT, and AP exams, have yielded mixed results (Bonner, 2012; Comer, 2012; Thibodeaux, 2015; Zepeda & Mayers, 2006). Numerous studies in many states have compared block and traditional schedule student scores on standardized tests. Some studies concluded that there were no significant differences in

the two schedule types (Arnold, 2002; Dexter, et al., 2006; Forman, 2009; Lawrence & McPherson, 2000; Queen, 2009; Zepeda & Mayers, 2006; Ford, 2015; Gargis, 2013), including the state department of education study (Domaleski, 2004). Other studies supported the opposite viewpoint such as Dorn (2015) who reported that there are mixed achievement results with the 4x4 block schedule. Students often scored lower compared to those in traditional seven periods and other block configurations. Conclusions were that traditional schedule students performed better at significant levels on standardized tests (Bonner, 2012; Comer, 2012; Dexter, et al., 2006; Domaleski, 2004; Ford, 2015; Gargis, 2013; Gruber & Onweugbuzie, 2001; Lawrence & McPherson, 2000; Lewis, Dugan, Winokur, & Cobb, 2005).

Research does not provide a majority of evidence to support one schedule over another; only suggestions there are benefits and hindrances to both block schedule and traditional schedule (Arnold, 2002; Dance, 2015; Dexter, et al., 2006; Ford, 2015; Forman, 2009; Gargis, 2013; Lawrence & McPherson, 2000; Queen, 2009; Zepeda & Mayers, 2006). Traditional block and A/B block offer benefits for teachers in the way of extended planning time, fewer students, and opportunities to create project-based activities. However, the lists of benefits are not directly related to the impact it may have on student achievement, and the literature indicated that there is no clear significant difference in student academic achievement on standardized tests. While the current research suggests that there are both benefits and negatives to the block schedule and the traditional period schedule, there is no evidence to support conclusively one schedule over the other. Some studies demonstrate academic improvement as a result of block

scheduling, some studies demonstrate negative results, and some studies demonstrate no change.

Class structure and scheduling is the process by which delivery of student instruction is accomplished. A schedule consists of the instructors, courses, time periods, and the time specified for each period and day.

Reller (2010) noted,

> The influence of the schedule, whether block or traditional, cannot be undermined. The schedule structures the pace of student and teacher interactions, the instructional strategies used by the teacher, and the cognitive level used by the students during the lesson. (p. 5)

The review of literature focuses on the implementation of curriculum scheduling in the high school setting and its effects on the academic achievement of students. Since the push for block scheduling beginning in the early 1990s, many school districts have looked at restructuring instructional time and have implemented or experimented with different methods of scheduling including a traditional block, A/B block, and mixed block and traditional periods (Rettig & Canady, 2013). The importance of instructional time and scheduling as a school structure has been discussed and examined by researchers and scholars (Queen, 2009; Rettig & Canady, 2003; Carrington, 2010; Dickson, et al., 2010). A well-designed schedule can provide a foundation for an exemplary curriculum program while a poorly designed schedule can negate progress while being unresponsive to students' need (Jacobs, 2004, 2010; Shapiro & Williams, 2014).

A schedule consists of the instructors, courses, period, and time specified for each period and day. As schools struggle to find ways to improve students' academic achievement, class scheduling has become the main topic (Thibodeaux, 2015; Zelkowski, 2010). Many school districts have looked at restructuring instructional time and have implemented or experimented with different methods of scheduling including a traditional block, A/B block, and mixed block and traditional periods (Zelkowski, 2010). The school of focus in this study provides a unique opportunity to examine each of the selected schedules chronologically as the high school implemented a different class schedule for each of the four years from 2009-2012. The graduating class of 2012 experienced a different schedule for each year of their high school journey: 4x4 block schedule for their freshman year, A/B block schedule their sophomore year, a mixed block and seven-period schedule their junior year, and a seven-period schedule their senior year.

Historical Background of School Class Scheduling

Public education in the United States dated to the early 19th century and began with Horace Mann's vision of public education (Bohan, 2003). In the early 1900s, The Carnegie Foundation suggested that high school study is measured by the amount of time spent in a course or subject area (Wallace, 2013). For most of the 20th century, school schedules remained unchanged. In 1983, the National Commission on Excellence in Education (NCEE) presented recommendations for school reform with one of the most prominent recommendations advocating a more effective use of school time. The Commission's analysis of student performance indicators concluded that educational

institutions seemed to have lost sight of the fundamental purposes of schooling, and of the high expectations and disciplined effort needed to attain them. Accordingly, the commission documented the educational dimensions of the risk:

> International comparisons of student achievement, completed a decade ago, reveal that on 19 academic tests American students were never first or second and, in comparison with other industrialized nations, were ranked last seven times. Some 23 million American adults are functionally illiterate by the simplest tests of everyday reading, writing, and comprehension. About 13% of all 17-year-olds in the United States can be considered functionally illiterate. Functional illiteracy among minority youth may run as high as 40%. Average achievement of high school students on most standardized tests is now lower than 26 years ago when Sputnik was launched. Over half of the populations of gifted students do not match their tested ability with comparable achievement in school. The College Board's Scholastic Aptitude Tests (SAT) demonstrate a virtually unbroken decline from 1963 to 1980 (The College Board, n.d.). Average verbal scores fell over 50 points, and average mathematics scores dropped nearly 40 points. College Board achievement tests also reveal consistent declines in recent years in such subjects as physics and English. Both the number and proportion of students demonstrating superior achievement on the SATs (i.e., those with scores of 650 or higher) have also dramatically declined. Many 17-year-olds do not possess the higher order intellectual skills we should expect of them. Nearly 40 % cannot draw inferences from written material, only one-fifth can write a persuasive essay,

> and only one-third can solve a mathematics problem requiring several steps. There was a steady decline in science achievement scores of U.S. 17-year-olds as measured by national assessments of science in 1969, 1973, and 1977. Between 1975 and 1980, remedial mathematics courses in public 4-year colleges increased by 72% and now constitute one-quarter of all mathematics courses taught in those institutions. (A Nation at Risk: The Imperative for Educational Reform, 1983, p. 11)

Based on the findings as outlined above, the Commission made recommendations for school reform, one of which was that schools redesign education so that time becomes a factor supporting learning, not a boundary marking its limits (A Nation at Risk: The Imperative for Educational Reform, 1983, p. 1). Block scheduling was proposed as a possible way to help time become a factor, rather than a boundary, for learning, and so began the focused attention on educational topics like the intensity of class time and the restructuring of school days.

Block scheduling was first suggested as Flexible Modular Scheduling (Trump, 1959) as a challenge to high school schedules. The flexible schedules could be arranged depending on the academic needs of the students. Trump advocated for flexibility in instructional strategies and how the school day was used (Dance, 2015; Ford, 2015; Gargis, 2013; Queen, 2009).

Carroll (1990) proposed that educators need to develop a schedule that would do away with the need for changing classes six to eight times a day. The alternative proposed was known as the Copernican plan. This schedule plan divided the school day

into longer blocks of time with each course ranging from 90 minutes to 4 hours in length and lasted for 30-90 school days. The Copernican plan was established to reflect the current needs of the educational system. It was a premise of The Copernican plan that because of the increased instructional time, teacher and student relationships would be nurtured and strengthened and would improve student achievement (Dance, 2015; Ford, 2015; Gargis, 2013; Zepeda & Mayers, 2006,).

In addition to reorganized school schedules, providing flexibility in the learning environments and creating smaller learning communities (Zepeda & Mayers, 2006), block scheduling had advantages that the traditional schedule did not. Classes that had labs were able to complete those labs without interruption and students saw a decrease in the number of tests, assignments, and projects they had on a given day. Teachers were afforded flexibility for more cooperative learning activities and were able to provide individualized instruction (Zepeda & Mayers, 2006).

There can be many advantages to a block format. Block schedule lessens the course load on students because even in an alternating-day schedule, students are only focusing on four classes a day, and those four classes typically meet every other day (Dance, 2015; Ford, 2015; Gargis, 2013; Rettig & Canady, 2003). However, one missed class can prove significant because of the amount of instruction missed by a student.

Economic needs rather than educational needs dictated the school year when students helped out on the family farm and were needed at home during the busiest times of the year. This traditional school calendar was developed for agricultural society and based on the Carnegie system as a means of measuring the number of hours a student has

studied a subject over the course of a year. After the publication of the National Commission on Excellence in Education report, educators began to evaluate ways to help students improve academically. Block scheduling became popular during the 1990s, and by the early 2000s, Rettig and Canady (2003) estimated that approximately 30% of high schools were on some form of block scheduling. By 2006 that number was reported that about 50% of all high schools were in some form of block scheduling (Dexter, et al., 2006, p. 23). Conversion to block scheduling became a relatively widespread trend in American schools in the 1990s with the report of the National Education Commission on Time and Learning (1994) declaring the crucial need for the effective use of school time (Dance, 2015; Dexter, et al., 2006; Ford, 2015; Gargis, 2013).

Block scheduling is viewed as the single best indication of change implemented since the early 1990s in public high schools in the United States due to the claims of longer class time allowing teachers to explore topics in greater depth, use various teaching strategies and plan creative lessons (Haney, 2015; Zelkowski, 2010). Block scheduling meant less administrative use of time and more instructional/classroom time for teachers. Block schedules accommodate a smaller number of classes and fewer students during the day than traditional schedules (Rettig & Canady, 2013). Block scheduling allowed students to take more courses during a high school career, earn more credits or have immediate remediation for a failed course as the course would be offered during the next semester. Block scheduling was touted as providing more focus on the academic needs of the students and thereby increasing student achievement (Queen, 2009).

Perceptions of Block Schedule Structure on Academic Achievement

Since the push by the National Education Commission on Time (1994) to restructure class schedules, there has been research to determine whether a relationship exists between block scheduling and improvement of teaching and learning (Anderson & Walker, 2015; Comer, 2012; Dance, 2015; Ford, 2015). Block scheduling presented as a means to improve school climate and working conditions for students and teachers, as well as academic achievement. After the NEC report, schools began adopting the concept of block scheduling, and by 2006 about 50% of all high schools were in some form of block scheduling (Dexter, et al., 2006, p. 23). Qualitative research has shown that the perception of many school officials and investigators is that academic achievement outcomes of changes to block scheduling are identifiable and may be consistent (Comer, 2012; Dance, 2015; Ford, 2015; Queen, 2009). These researchers report many studies that propose that preparing for and attending fewer classes per day has resulted in an improvement for both students and teachers. Teachers in a school with block scheduling have more preparation time per week to prepare, collaborate with colleagues, improve teaching, and develop curriculum for class instruction. These studies (Anderson & Walker, 2015; Comer, 2012; Dance, 2015; Ford, 2015) support the concept that the decrease in classes per day leads to less stress among teachers, students, and administrators.

Ford (2015) reports on data compiled from a study conducted consisting of three school districts where the 4x4 block schedule was used with a slight change for a particular subject matter such as band, vocational education, and advanced placement

courses. The study surveyed teachers, administrators, and parents seeking knowledge and data after the implementation of block scheduling in their schools. It was hoped that the results of the survey would inform as to what instructional strategies were being used and which strategies were working best. Additionally, the survey inquired about whether student behavior was impacted based on the change to block scheduling. The qualitative data reported that all stakeholders were satisfied with the scheduling model implemented (Ford, 2015). There was the perception that teachers were able to be more creative and use block extended time to expand student knowledge. Students were also afforded the opportunity to select more courses on the block schedule versus the six or seven courses available through a traditional schedule. Discipline incidents were reported to be fewer in number under a block schedule, and overall, teachers, administrators, and parents were satisfied with the change to block scheduling.

Ford (2015) also cites a causal-comparative study that evaluated North Carolina teachers' survey responses. Only block and traditional schools were included in the research surveys. The survey centered around (a) specific instructional practices, (b) appropriateness for using specific instructional strategies, and (c) training on specific instructional strategies. There was no difference in teacher views or instructional techniques between the block and traditional schedules.

A 4-year study in North Carolina reports on teacher and parent perceptions of block scheduling. The study reported that 70% to 80% of participants believed that block scheduling was worth continuing, and 84% of teachers perceived block scheduling to

have increased school safety. Student discipline was perceived to have improved by 40% (Ford, 2015; Jenkins, Queen, & Algozzine, 2002).

Comer (2012) conducted a comparative study to determine what the impact was of a 4x4 block and traditional schedule on school climate. The study obtained student data using the schools' student information system, and the data were analyzed using a one-way analysis of variance (ANOVA). In addition to SAT scores being lower on the block compared to the traditional schedule; the completion rate of high school units was higher with block scheduling.

Walker (2015) reports on a ten-year longitudinal study of six high schools, three that operated on a block schedule and three that operated on a traditional schedule. The study used qualitative data collected from face-to-face interviews, emails, and phone interviews with administrators, teachers, and students (Walker, 2015). The study reported that graduation rates of students improved more than 10% after the transition to block scheduling and there was a reported 42% positive impact increase in teacher-student relationships.

In addition to academic teachers, Ford's (2015) research also includes the perceptions of 15 high school physical education teachers regarding their experience teaching on a block schedule compared to the traditional schedule. The physical education teachers' perceptions consistently indicated reduced stress levels, a decrease in student absences, reduced behavior issues, and a stronger teacher-student relationship. Additionally, 66% of the physical education teachers also reported increased student academic achievement even though they could provide no documented evidence.

Overall, the qualitative research depicts 4x4 block schedule in a favorable light despite the lack of documented evidence to quantitatively support the favorable perspective. Regarding academics, students present as getting better grades, having more time for in-depth instruction, and developing a more satisfying relationship with their teachers. Teachers qualitatively describe the 4x4 block as an improvement over the traditional period day. Teachers report liking fewer students resulting in fewer papers to grade, having more planning time, fewer classes to prepare for, and a more relaxed schedule in general under the 4x4 block. The 4x4 block schedule fosters the perceptions of more class activities, more enrichment activities, and better relationships between teachers and students.

There is considerable research supporting block scheduling advantages. Teachers are reported as being able to improve instructional strategies while reducing their preparation time. Block schedule means teachers have fewer students each semester and can develop more in-depth relationships with those students, and along with the report of reducing discipline problems and students having fewer classes, these all lead to the perception of improved academic improvement when compared to traditional schedules. Rettig & Canady, 2013) compared traditional schedules as an assembly line that creates a depersonalizing nature within high schools. Research does not have conclusive evidence to support one schedule over another but does suggest there are benefits to both block schedules and the traditional schedule (Finn, et al., 2014; Wright, 2010; Williams, 2011). Qualitative research has shown that the perception of many school officials and investigators is that academic achievement outcomes of changes to block scheduling are

identifiable and may be consistent (Comer, 2012; Dance, 2015; Ford, 2015; Queen, 2009). However, there are contradictory and inconclusive results as reported in the next section.

Effects of Block Scheduling Structure on Academic Achievement

In studies from Virginia and California results supported the use of block scheduling especially in the first years of implementation, but there was a decline in scores after that (Arnold, 2002). Arnold reported that schools on a seven-period traditional schedule outperformed schools on an A/B block schedule for 3 or more years, but there was no meaningful difference in the mean scale scores (p. 47). Block scheduling research on a single high school reports a significant increase in ACT scores and state tests, a moderate increase on the SAT, and a small decrease in AP test scores (Snyder, 1997). Conversely, research involving three high schools demonstrated decreased scores on AP tests and standardized tests (Evans, Tokarczyk, Rice, & McCray, 2002). The effects of block scheduling on academic performance, as well as the dropout rate of high school students, was examined, and data showed a significant increase in the overall SAT scores as well as a decrease in the dropout rate (Wilson, 2008). A comparison of 51 Virginia high schools on the A/B block schedule with 104 high schools on the traditional period schedule found that schools on the traditional schedule outperformed schools on a block schedule. Significantly, however, in none of the cases was there a meaningful difference in mean scale scores (Arnold, 2002, p.47-48).

Research conducted at Montclair Kimberley Academy reports positive academic achievement from block scheduling (Flocco, 2012). The research reported there was

evidence of block schedules supporting more in-depth learning of the content leading to less stress on students. Additionally, Flocco reports that under a block schedule more students participated in Advanced Placement exams, more students took the SAT, and academic time did not suffer due to extra-curricular activities.

Nichols (2005) collected data from a large metropolitan Indiana school to measure block scheduling's impact block scheduling on language arts. The schools converted to block scheduling to influence student achievement and success. However, there was little evidence of improved students' academic achievement.

Empirical studies of block scheduling analyzed by Zepeda and Mayers (2006) presented information on the following: transition to block scheduling, implementation of block scheduling, scheduling effects on student learning, students and teachers' perception of block scheduling, and teachers' instructional practices. In their research, student grade point averages were increased under block scheduling, but standardized scores were inconsistent.

Dexter, et al., (2006) examined the association between scheduling and introductory college science grades. Their findings presented block scheduling as a disadvantage to students in preparation for college science. Wright (2010), in a longitudinal study, evaluated 20 years of student achievement data under a traditional schedule and a modified block schedule. The SAT mathematics scores increased 19 points under the modified block schedule, while both mathematics and reading scores of high school state tests showed significant improvement during the traditional schedule years.

Wright (2010) reports on a study based on schools in South Carolina which analyzed passage rates as measured by the English and mathematics high school exit exam. The study sought to determine if there was any significance in achievement on

exit exams based on the schedule employed, i.e., a semester block schedule, an alternate A/B block schedule, or a single-period traditional schedule. There were no significant differences between the means of passing rates on 131 schools employing a semester block schedule, an A/B block schedule, or a traditional period schedule.

Forman (2009) showed a 15% increase in student passing rates on the state assessment exam after a change to 4x4 block scheduling. Adrian (2009), in a quantitative study, examined the degree to which 4x4 block scheduling influenced student achievement. The results revealed block scheduled students experienced GPAs that were significantly higher compared to traditional school scheduled students. The same study also examined on-time graduation rates which showed no statistical difference between a traditional schedule and a block schedule.

Comer (2012) conducted a comparative study in Arizona to determine if 4x4 block scheduling affected student achievement and school climate. The study used the school district's student information system to obtain student data, including scholastic Aptitude Test (SAT) scores, grade point averages, completed credits, office referrals, detentions, truancies, tardies, and suspensions. The schools were similar regarding gender, ethnicity, and socioeconomic status and the number of participants from the traditional schedule high school included 1,955 students and 86 teachers and the 4x4 block schedule high school included 1,843 students and 95 teachers. The data were analyzed using a one-way analysis of variance (ANOVA). The findings of the study showed that SAT scores remained lower at the 4x4 block scheduling high school compared to the traditional high school. However, the completion rate of high school

units was higher with block scheduling than the traditional high school scheduling method.

Reames and Bradshaw (2009) conducted a longitudinal study of six high schools of similar population and demographics over a 10-year period. The study involved the collection of data from high schools transitioning from a traditional class schedule to a 4x4 block schedule. The findings of this study showed a significant increase in the mean values of student SAT scores from the baseline year of 1999 until 2009, and although SAT scores declined in a few specific years, the overall 10-year study showed an upward trend over time. The number of students passing the AP test with a score of 3 or higher showed marked improvement from 1999-2007. Over the course of 10 years, students' academic achievement in mathematics made the greatest gain while students' achievement in science was the lowest. Graduation rates improved from 60.2% to 70.6% since the conversion to 4x4 block scheduling.

Comparison of Block Scheduling to 7 Period Scheduling on Academic Achievement

While increased student achievement was a primary reason that block scheduling was proposed over traditional scheduling, measures of student achievement have yielded mixed results. While there have been numerous studies in many states comparing block and traditional schedule student scores on standardized tests, there was no significance difference found in scores between the two types of schedule (Arnold, 2002; Dance, 2015; Dexter, et al., 2006; Domaleski, 2004; Gargis, 2013; Ford, 2015; Forman, 2009; Haney, 2015; Lawrence & McPherson, 2000; Queen, 2009; Zepeda & Mayers, 2006).

The effectiveness of block scheduling varies from study to study and from subject to subject (Dance, 2015; Gallager, 2009; Gargis, 2013; Shapiro & Williams, 2014; Williams, 2011). Williams (2011) reported students experiencing higher standardized mathematics scores under a traditional schedule versus a 4x4 block schedule. However, students' standardized test reading scores were higher on the 4x4 block schedule. Gallager (2009) also supported higher English achievement on a block schedule over a daily period schedule. Wright (2010) conducted a longitudinal study on achievement data from 10 years on a traditional schedule compared to 10 years on a 4x4 block schedule. The research found that the standardized testing results showed statistically significant higher during the traditional schedule years. All students in the study consistently scored higher on standardized achievement tests under the traditional class schedule while the lowest performing schedules academically were the four block and the eight-block.

Summary: Comparison of Achievement on Block Scheduling to 7 Period Scheduling

Dexter, et al., (2006) found there were points to be made for both the 4x4 block as well as the traditional schedule in their study that was comprised of qualitative data and opinions through student surveys, but neither schedule was was proven to be noticeably more effective than the other. Lawrence and McPherson (2000) studied the topic by analyzing North Carolina high school end-of-year tests. Their study found evidence that students were more successful under the traditional schedule, and students in the core subjects that are used as benchmarks scored higher. A 1998 study conducted by The College Board Office of Research and Development compared advanced placement test

scores of students and found that students on the traditional schedule scored at a higher level than students on the block schedule (The College Board, n.d.). The study also noted performance differences between block students in the spring versus block students in the fall relating these performance differences to students either being more removed from the course at the time of the test, or have not yet completed the course when the test was administered. In both cases, the data favored those students on the traditional schedule. The College Board (The College Board, n.d.) indicates that while research supports benefits for both types of schedules, more data needs to be collected and analyzed to reach a conclusive answer.

Background on End-of-Course Testing

The A+ Educational Reform Act of 2000 (O.C.G.A. §20-2-281), mandates that the State Board of Education adopt end-of-course assessments in Grades 9 through 12 for core subjects to be determined by the State Board of Education. Currently, state high school students are tested in mathematics I and II, ninth grade language and composition, American literature, United States history, economics, biology and physical science. According to Domaleski (2004), EOCTs were used solely for determining what a student learned in a specific course. The testing director for the Georgia Department of Education published a study that was conducted in the state using EOCT scores to compare block schedule to the traditional schedule (Domaleski, 2004). The EOCT scores utilized in the study were scores reported to the state from students on both the traditional schedules and block schedules. At the time of the study, two years of scores were available as the tests had been implemented in the state in 2002. Domaleski (2004)

compared block schedule versus traditional schedule from eight of The state's EOCTs: algebra, geometry, ninth-grade literature, American literature, biology, physical science, United States history, and economics. The study results revealed little difference between EOCT scores from traditional schedules and block schedules. Domaleski summarized his research by stating that "no scheduling practice examined is consistently or meaningfully associated with higher EOCT performance" (p.13). Gargis (2013) reported on research studies conducted to determine if block scheduling improves student achievement. These studies are quantitative studies that compare grade point averages, standardized test scores, end-of-course grades, or ACT scores of students on block scheduling to students on traditional scheduling. The results are not consistent and do not actively support one schedule over the other (Dance, 2015; Ford, 2015; Gargis, 2013).

Summary and Conclusions

The literature review provided information about the literature search strategies, the theoretical framework and literature review relative to the fundamental concepts and variables examined, as well as encompass the importance of instruction time and schedules along with the historical background of scheduling. Since 1994, when the National Education Commission on Time and Learning recommended the use of block scheduling in the nation's schools, the scheduling of courses during the school day has been a significant issue in high schools (National Education Commission on Time and Learning, 1994). Accordingly, time has driven the schedule and encouraged teacher-directed lessons and discouraged highly interactive student learning. However, in a school following a block schedule, time is viewed as a resource permitting more

significant amounts of time for student learning, lab work, and interactive activities as a block scheduled class are twice as long as a traditional class schedule. However, the literature review does not conclusively report that one schedule over another allows for more significant student academic achievement, particularly on mandated testing and there are conflicting results. This literature examined in this review presents both advantages and disadvantages for the class schedules examined, and while this literature review provides some insight into class schedules, more study is needed as there is still no clear evidence that points to the best schedule for high schools. It is a prerequisite that we explore the daily class structure that provides the most beneficial setting to allow students to experience improved academic achievement. Therefore, this research study investigates the impact of the 4x4 block schedule, the A/B block schedule, the mixed A/B and seven-period schedule hybrid, and the seven-period schedule on high school student academic achievement by analyzing EOCTs as administered under each respective schedule.

Chapter 3: Research Method

The purpose of this quantitative ex-post facto research study was to examine the effectiveness of four different class schedules on students' academic achievement on state-mandated end-of-course testing and determine whether a specific class schedule was more conducive to student academic achievement on state-mandated standardized tests. This chapter outlines the research design and methodology employed to analyze effects of class schedules on student academic achievement on standardized testing, along with the methodology used in selecting the population and sampling. The data collection procedures and analysis, along with threats to validity and ethical considerations, are also outlined.

Research Design and Rationale

In this ex-post facto quantitative research study, the variables were based on the characteristic of which class schedule the EOCT was administered, the 4x4 block, the A/B block, the mixed block and traditional period, or the traditional period. To determine if there were differences between the test score achievement of the groups, an ANOVA was used to determine if the independent variable of the scheduling formats had an impact on the dependent variable (EOCT scores). An ex-post facto design was most appropriate for this study, as I had no control over the variables and can only report what happened through an examination of the means for the scores for each year's schedule. Additionally, as previously collected data is analyzed with a purpose other than that for which they were initially collected, this study is a secondary analysis, or a research study

employing archival data or records. The secondary analysis allowed for the examination of significant questions without the time-consuming task of generating the data.

A choice between research methods is based on a set of decisions about the questions to answer and the practicality of gathering the kind of data that will answer those questions. The ex-post facto research design allowed for examination as to whether a specific class schedule is more conducive to student academic achievement on state-mandated standardized tests. Rather than make before and after comparisons as in experimental design, an ex-post facto design allowed me to compare groups after the introduction of some condition and the groups as to the condition's possible effect.

Methodology

Population

The population of this study encompasses all students who completed an EOCT during the 4 years of 2009–2012 (n = 8972). The individual student scores were analyzed according to the EOCT and the schedule under which the test was administered. The following tables present a breakdown of the total students testing in each EOCT category as reported by the state Governor's Office of Student Achievement, the test years examined, and the type of schedule that each class used for that reported year. From 2009 through 2012, ninth-grade English tested 1,474 students with the following number of students testing in each of the respective types of schedules.

Table 1

Information for Ninth Grade Tested School Years

School year	Number of students testing	Type of schedule
2008–2009	374	4x4 block
2009–2010	361	A/B block
2010–2011	391	A/B block and seven period
2011–2012	348	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, 11th grade English tested 1,101 students with the following number of students testing in each of the respective types of schedules:

Table 2

Information for 11th Grade Tested School Years

School year	Number of students testing	Type of schedule
2008–2009	288	4x4 block
2009–2010	303	A/B block
2010–2011	239	A/B block and seven period
2011–2012	271	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, math I tested 1,283 students with the following number of students testing in each of the respective types of schedules:

Table 3

Math I Testing Data

School year	Number of students testing	Type of schedule
2008–2009	152	4x4 block
2009–2010	381	A/B block
2010–2011	384	A/B block and seven period
2011–2012	366	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, math II tested 1,126 students with the following number of students testing in each of the respective types of schedules:

Table 4

Math II Testing Data

School year	Number of students testing	Type of schedule
2008–2009	254	4x4 block
2009–2010	246	A/B block
2010–2011	321	A/B block and seven period
2011–2012	305	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, biology tested 1,270 students with the following number of students testing in each of the respective types of schedules:

Table 5

Biology Testing Data

School year	Number of students testing	Type of schedule
2008–2009	336	4x4 block
2009–2010	318	A/B block
2010–2011	321	A/B block and seven period
2011–2012	295	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, physical science tested 674 students with the following number of students testing in each of the respective types of schedules:

Table 6

Physical Science Testing Data

School year	Number of students testing	Type of schedule
2008–2009	39*	4x4 block
2009–2010	228	A/B block
2010–2011	188	A/B block and seven period
2011–2012	219	seven period

Note. From the Georgia Department of Education website. *Physical science was not a state-required course until 2009–2010.

From 2009 through 2012, U.S. History tested 1,088 students with the following number of students testing in each of the respective types of schedules.

Table 7

U.S. History Testing Data

School year	Number of students testing	Type of schedule
2008–2009	286	4x4 block
2009–2010	283	A/B block
2010–2011	235	A/B block and seven period
2011–2012	285	seven period

Note. From the Georgia Department of Education website.

From 2009 through 2012, economics tested 956 students with the following number of students testing in each of the respective types of schedules:

Table 8

Economics Testing Data

School year	Number of students testing	Type of schedule
2008–2009	287	4x4 block
2009–2010	272	A/B block
2010–2011	183	A/B block and seven period
2011–2012	214	seven period

Note. From the Georgia Department of Education website.

Sampling and Sampling Procedures

The site of study was a high school located in a district of approximately 14,000 students and is one of four high schools in the district. The school of focus is the only high school that implemented a different class schedule for each of the school years of 2009 through 2012. This research was conducted according to policies and procedures set forth by Walden University. Permission was requested from the principal at the research site to conduct the study in the high school and upon approval, reports of EOCT results for each student for each of the years from 2009 through 2012 were obtained. From the student scores collected, this study focused on the totality of each year's scores and individual student names and their associated scores were not disclosed. Neither the name of the school nor its test scores are disclosed.

Data Collection

The official published scores of EOCT results for each school year from 2009–2012 are provided to each school from the Georgia Department of Education's website. All data are provided electronically and are available for download into an excel format. Test year and test subject categorize student test scores for the 4x4-block schedule, A/B block schedule, mixed block, and traditional seven-period schedule. Published archival data of EOCT results for the school years of 2009–2012 were examined, compared, and analyzed by ANOVA to determine if the 4x4 block, A/B block, modified block, or traditional six- to eight-period classes had any measurable effect on state-mandated EOCT results in this high school.

Instrumentation and Operationalization of Constructs

Each year's scores of the state EOCTs in ninth-grade literature, 11th-grade literature, and biology, physical science, economics, mathematics I, mathematics II, and U.S. history provided the dependent variables for this study. State EOCTs are course content curriculum exams that measure a student's level of course comprehension and college and career readiness. The EOCTs have a high degree of validity because they serve the purpose for which they are intended, variables to measure student mastery of the state's content standards. The results of the EOCT are used for diagnostic purposes to assess student achievement and to provide data in support of improved student instruction. Validity was established via the process of test development. The Georgia Department of Education reports the Standard Error of Measurement Standard (SEM) is an estimate of the precision at various points along the score scale and is also known as the conditional standard error of measurement (Georgia Department of Education, 2017). This means that if a student takes a test repeatedly without additional instruction or memorization of the test, it would be expected that the student's observed score may vary from his or her true score within a range of observed score plus or minus the SEM (Georgia Department of Education, 2017). The SEM is calculated independently for each end-of-course assessment, and an error band (plus/minus one SEM unit) is reported together with the student's scale score. It is important to note that the SEM is a function of the number of points on which a score is based. The SEM is a way to measure this variation in achievement. If a student were to take this assessment multiple times, all of his or her scores would likely fall within the SEM range. The careful development from

inception of the EOCTs and all steps in between, including alignment with content standards, creation of test and item specifications, multiple reviews by educators, and careful form construction by content experts and psychometricians, provide evidence that EOCTs are valid instruments for the uses for which the state department has developed the test.

The reliability indices indicate that the tests provide consistent results and that the various generalizations of test results are justifiable. According to the Georgia Department of Education, Cronbach's alpha reliability coefficient (1951) is one reliability measure reported for the EOC Assessment System. A reliability coefficient expresses the consistency of test scores as the ratio of true score variance to observed total score variance (i.e., true score variance plus error variance). Cronbach's alpha measures the internal consistency over the responses to a set of items measuring an underlying unidimensional trait. Cronbach's alpha is computed using Crocker and Alina's formula (1986) where k = number of items, = the total score variance and = the variance of item i. The reliability coefficient is a unitless index, which can be compared from test to test and ranges from 0 to 1. The median reliability indices as well as the minimum and maximum values across forms and administrations for the Georgia Milestones assessments organized by subject area range from 0.85 to 0.94. The reliabilities are similar across grades/courses and subject areas and suggest that the EOC assessments are sufficiently reliable for their intended purpose. These strong indicators of reliability also support the tests' claim for validity. The state department of education oversees the development of the assessment and adheres to the Standards for Educational and Psychological Testing

(2014) as established by the American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME). The intent of these standards is "to promote the sound and ethical use of tests and to provide a basis for evaluating the quality of testing practices" (AERA, APA, NCME, 1). According to the Validity and Reliability report of the state department of education, the reliabilities are similar across grades/courses and subject areas and suggest that the end of course assessments are sufficiently and that scores reported to students are well estimated and provide a reliable picture of student performance (Georgia Department of Education, 2017).

Data Analysis Plan

To provide an answer to the research question relating to the effects of curricular scheduling on students' academic achievement, the dependent variable, students' achievement, will be compared to the independent variable, the type of schedule, a 4x4 block, A/B block, mixed A/B block and seven-period, and seven periods, under which instruction occurred. Academic achievement will be measured by student academic performance on EOCTs obtained from the official published scores of EOCTs results for each school year from 2009-2012. An individual ANOVA will be used to test for significance of the difference in the mean scores of students that received instruction via the different schedules in each of the end-of-course subjects (i.e., ninth-grade literature, 11th-grade literature, math I, math II, economics, U.S. History, physical science, and biology). SPSS will be used to create tables, charts, and graphs that will illustrate the findings of this quantitative study. According to SPSS, the ANOVA compares the means

of two or more independent groups to determine whether there is statistical evidence that the associated population means are significantly different. The level of significance is $p < .05$. If the observed significance is <.05, the assumption of no difference will be rejected, and the determination will be made that there is a difference in the mean of the compared populations, and the possibility exists that the treatment of scheduling made a difference in student academic achievement.

An ex-post-facto quantitative approach was used to answer the following research questions:

RQ1: How are the scores different on state standardized end-of-course tests for ninth-grade literature between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule?

$H_1$1: There is at least one statistically significant difference in end-of-course test ninth-grade literature scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$1: There is not a statistically significant difference in end-of-course test in ninth-grade literature scores between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

RQ2: How are the scores different on state standardized end-of-course tests for 11th-grade literature between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule?

$H_1$2: There is at least one statistically significant difference in end-of-course test 11th-grade literature scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$2: There is not a statistically significant difference in end-of-course test in 11th-grade literature scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ3: How are the scores different on state standardized end-of-course tests for mathematics I between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$3: There is at least one statistically significant difference in end-of-course test mathematics I scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$3: There is not a statistically significant difference in end-of-course test in mathematics I scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ4: How are the scores different on state standardized end-of-course tests for mathematics II between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$4: There is at least one statistically significant difference in end-of-course test mathematics II scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$4: There is not a statistically significant difference in end-of-course test in mathematics II scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ5: How are the scores different on state standardized end-of-course tests for physical science between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$5: There is at least one statistically significant difference in end-of-course test physical science scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$5: There is not a statistically significant difference in end-of-course test in physical science scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ6: How are the scores different on state standardized end-of-course tests for biology between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$6: There is at least one statistically significant difference in end-of-course test biology scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$6: There is not a statistically significant difference in end-of-course test in biology scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ_7 How are the scores different on state standardized end-of-course tests for U.S. history between students instructed on 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

H_1: There is at least one statistically significant difference in end-of-course test U.S. history scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

H_0: There is not a statistically significant difference in end-of-course test in U.S. history scores between students instructed on 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

RQ7: How are the scores different on state standardized end-of-course tests for U.S. history between students instructed on a 4x4 block, A/B block schedule, a mixed block and traditional period day, or traditional period schedule?

$H_1$7: There is at least one statistically significant difference in end-of-course test U.S. history scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

$H_0$7: There is not a statistically significant difference in end-of-course test in U.S. history scores between students instructed on a 4x4 block, A/B block schedule, mixed block and traditional period day, or traditional period schedule.

Using an ex-post facto quantitative approach, an ANOVA was used to analyze standardized EOCTs for ninth-grade literature, 11th-grade literature, and the subjects of math I, math II, physical science, biology, U.S. History, and economics between students instructed on 4x4 block in 2009, students instructed on an A/B block schedule in 2010,

students instructed on a mixed block and traditional period day in 2011, and students instructed on a traditional period schedule in 2012 to determine if students that received instruction via the different schedules in each of these end-of-course subjects showed any significant increase or decrease in their scores based on the schedule under which they received instruction.

Threats to Validity

This research will ensure validity and reliability by using quantitative data consisting of norm-referenced test results as reported by the state's department of education. The analysis relied upon the established validity and reliability of the EOCT as a measure of student learning. The A+ Educational Reform Act of 2000, O.C.G.A. §20-2-281, mandates that the State Board of Education adopt end-of-course assessments for core courses to be determined by the Board. The EOCTs serve as a student's final exam in the associated course. Internal validity of the exam has been established through standardization of the test; a secure test-taking environment; and a one-group, one-time administration of the test.

Ethical Procedures

Researchers must respect and protect the rights of the participants involved in research studies (Creswell, 2007). All policies and procedures outlined by Walden University were followed. Permission was requested from the principal at the research site to conduct the study in the high school. Since the research took place at the researcher's school of employment, no further approval or documentation was needed to conduct the study. All numerical data analyzed will be provided by the state's

department of education website. Data is available to the school through electronic means and permission was obtained by the school's administration. Also, the identities of individual students are not publicized, and no additional measures are needed or taken to protect the rights and identities of participants. The school's name was not given or reported to maintain complete confidentiality. The ethical concerns are minimal for this doctoral study because there was no contact with actual human subjects. However, the administration of the school of focus is aware of the research and look forward to an examination of the final data analysis. The principal has provided a letter confirming and acknowledging the school's intention to examine the final research data. This data may lead to an identification of the aspects of the class schedule that provides increased student achievement and may provide recommendations for the most effective schedule for optimum student achievement (Pendley, D., Personal Communication, November 29, 2016).

Summary

In this study, a quantitative ex-post facto method approach was employed to investigate the effect of multiple class schedule changes on the standardized testing performance of secondary students. Analyses were generated via SPSS to analyze and report descriptive data from the study. An ANOVA for each year of each class, i.e., 9th-grade literature, 11th-grade literature, mathematics I, mathematics II, physical science, biology, U.S. History, and economics was utilized to test the significance of the difference between the scores under each schedule. SPSS was used to analyze and compare the mean scores and failure rates of the EOCT scores of students utilizing

different scheduling types and create tables, charts, and graphs that will illustrate the findings of this quantitative study. This chapter explained the research design and methodology, the justification for selecting the quantitative approach, and the instrumentation used for data collection and data analysis. Chapter 4 will present and discuss the data analysis, and Chapter 5 will conclude with recommendations for future actions.

Chapter 4: Results

As educators have continued to search for ways to improve students' academic achievement, one of the major school reform issues in the past 30 years has been the use of school time (Bonner, 2012; Comer, 2012; Darling-Hammond, 2007; Darling-Hammond et al., 2014). Since the push for block scheduling beginning in the early 1990s, many school districts have looked at restructuring instructional time and have implemented or experimented with different methods of scheduling, which have included a traditional block, A/B block, and mixed block and traditional periods (Rettig & Canady, 2013). The school of focus in this study provided an opportunity to examine each of the selected schedules chronologically, as the high school implemented a different class schedule for each of the years from 2009–2012. The graduating class of 2012 experienced a different schedule for each year of their high school journey: 4x4 block schedule for their freshman year, A/B block schedule their sophomore year, a mixed block and seven-period schedule their junior year, and a seven-period schedule their senior year.

The purpose of this study was to compare students' EOCTs to determine if there is any significance in the scores during the from 2009 to 2012 that can be associated to the different class scheduling each of the 4 years. Previous research has been focused on student academic achievement on the 4x4 block versus the traditional hourly schedule. There is no significant review or research on the type of curricular schedules employed by the school of focus on this study (Anderson & Walker, 2015; Aud, et al., 2013; Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, et al., 2010; Jacobs,

2010; Kera et al., 2014). The research questions developed sought to determine whether students achievement was different based on the schedule under which instruction occurred (i.e., a 4x4 block schedule, an A/B block schedule, a mixed block and traditional period schedule, and a traditional period schedule). Students' EOCT scores for ninth-grade literature, 11th-grade literature, U.S. History, economics, physical science, biology, math I, and math II were examined to determine if there is a discernable relationship between schedule format and student academic achievement on state-mandated EOCTs. I compared the dependent variables of the EOCT results to determine if there was at least one statistically significant difference in EOCT scores that may be related to the independent variables of the curricular schedule under which the testing occurred. An ANOVA was used to determine if the independent variable of each of the scheduling formats had an impact on each year's dependent variables, which are mean scores of EOCTs' failures. A statistical examination then tested the difference between the two populations of each subject area in each of the schedules in each of the eight tested subjects.

Data Collection

The data were obtained for this study from the Georgia Department of Education. All official published scores of EOCT results are provided to each Georgia school from the state's department of education website. Data are provided electronically and available for download. Data were obtained for each of the EOCTs and each of the examined years, 2009 through 2012. The population (N = 8,972) in the study included all EOCTs administered during the years 2009 through 2012. From the individual student

scores collected, the means and ranges were determined for each set of scores, per year and by schedule under which the testing occurred. The data were analyzed by each subject category of test performance to determine if the 4x4 block, A/B block, mixed block, or seven-period schedule provided improved student academic performance that could be attributed to the schedule under which instruction occurred. Academic achievement was measured by student pass data on EOCTs obtained from the official published scores of EOCT results for each school year from 2009–2012.

Data Analysis

To provide an answer to the research question relating to the effects of curricular scheduling on students' academic achievement, the dependent variable (students' test scores) was compared to the independent variable (the type of schedule under which instruction occurred). An ANOVA was used to test for significance in the difference in the mean scores of students that received instruction via the different schedules in each of the EOCT subjects. The analysis was conducted for individual categories of each EOCT subject as well as comparison of overall end-of-course performance between each of the schedule types for each curricular year. To determine which schedules were significantly different from each other, each of the schedules were analyzed using a post-hoc test.

Summary of Results

The research questions developed to guide the study and provide the structure for data collection and analysis derived from the problem statement and anchor in the purpose statement in the previous section. The data analysis findings are presented in terms of answering the research questions.

The data obtained from the department of education were entered into SPSS software for analysis. The descriptives and analysis of each subject are in Tables 9 through 18. An analysis of data in its totality was done by schedule type. All content were analyzed for each schedule type as a whole to determine if any one schedule provided for greater student academic achievement. Table 9 provides a comparison of all schedules taken as a total of all students in all content areas and shows that the null hypothesis was rejected with a significance of .733 which is >.05. The determination can be made that the treatment of scheduling made no difference in student academic achievement when viewing the schedules and content areas as a whole.

Table 9

Overall Schedules ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Totals Tested	Between Groups	9696.500	3	3232.167	.534	.663
	Within Groups	169351.000	28	6048.250		
	Total	179047.500	31			
Totals Passed	Between Groups	6475.594	3	2158.531	.361	.782
	Within Groups	167510.625	28	5982.522		
	Total	173986.219	31			

After analysis and presentation of the schedules and content areas in totality, analysis was done for each content area under each schedule type to determine if there was any schedule type in each of the content areas that provided for increased student

academic achievement. The findings presented in the following tables include each content area and schedule type. Tables 10 through 18 outline the specifics of the comparisons between the schedules relating to student achievement under each of the respective schedules for each of the end of course categories (i.e., ninth-grade literature, 11th literature, math I, math II, biology, physical science, economics, and U.S. History).

Table 10 presents the ANOVA of ninth-grade literature. The ANOVA rejects the hypothesis as analysis of the individual schedules confirms that there is not a significant difference in EOCT in ninth-grade literature scores between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

Table 10

Ninth Grade Literature ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2193.375	3	731.125	.274	.842
Within Groups	10669.500	4	2667.375		
Total	12862.875	7			

Table 11 presents the ANOVA of 11th-grade literature. The ANOVA rejects the null hypothesis as analysis of these individual schedules confirms there is not a significant difference in EOCT scores in 11th-grade literature between students instructed on a particular schedule.

Table 11

11th Grade Literature ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3532.375	3	1177.458	.580	.658
Within Groups	8113.500	4	2028.375		
Total	11645.875	7			

Table 12 presents the ANOVA of math I and Table 13 presents the math I Tukey post hoc test. The ANOVA indicates there is a .006 significance in the overall scores and the Tukey post hoc test determines which specific group's means (compared with each other) are different. The test compares all possible pairs of means. The Tukey post hoc analysis indicates there is a significance in the mean differences between block and A/B schedule, block and mixed schedules, as well as block and 7 period traditional schedules. Block to A/B schedules shows a .007, block to mixed schedules reports a .011, and block to 7 period schedules reports a .013 significance. This analysis supports the hypothesis that a statistically significant difference in student achievement results on EOCT occurred based on the schedule under which student instruction occurred as students instructed under block scheduling showed the most significance in increased academic achievement.

Table 12

Math I ANOVA

	Sum of Squares	df	Mean Square	F	Sig.

Between Groups	66705.375	3	22235.125	21.775	.006
Within Groups	4084.500	4	1021.125		
Total	70789.875	7			

Table 13

Math I Tukey HSD Post Hoc Test

					95% Confidence Interval	
(I) Schedule Type	(J) Schedule Type	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Block	AB Block	-230.000*	31.955	.007	-360.08	-99.92
	Mixed	-203.000*	31.955	.011	-333.08	-72.92
	Seven Periods	-192.500*	31.955	.013	-322.58	-62.42
AB Block	Block	230.000*	31.955	.007	99.92	360.08
	Mixed	27.000	31.955	.832	-103.08	157.08
	Seven Periods	37.500	31.955	.671	-92.58	167.58
Mixed	Block	203.000*	31.955	.011	72.92	333.08
	AB Block	-27.000	31.955	.832	-157.08	103.08
	Seven Periods	10.500	31.955	.986	-119.58	140.58
Seven Periods	Block	192.500*	31.955	.013	62.42	322.58
	AB Block	-37.500	31.955	.671	-167.58	92.58
	Mixed	-10.500	31.955	.986	-140.58	119.58

Note. *The mean difference is significant at the 0.05 level

Table 14 presents the ANOVA of math II and Table 15 presents the math II Tukey post hoc analysis. The ANOVA indicates there is a .032 difference between groups in the math II schedules. The Tukey post hoc reports a significance between block and mixed block schedules of .047. The rejection of the null hypothesis indicates there is a difference relating to the schedule under which instruction occurred.

Table 14

Math II ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9692.500	3	3230.833	8.587	.032
Within Groups	1505.000	4	376.250		
Total	11197.500	7			

Table 15

Math II Tukey Post Hoc

Tukey HSD

(I) Schedule Type	(J) Schedule Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Block	AB Block	-2.000	19.397	1.000	-80.96	76.96
	Mixed	-80.500*	19.397	.047	-159.46	-1.54
	Seven Periods	-56.500	19.397	.135	-135.46	22.46
AB Block	Block	2.000	19.397	1.000	-76.96	80.96
	Mixed	-78.500	19.397	.051	-157.46	.46
	Seven Periods	-54.500	19.397	.148	-133.46	24.46
Mixed	Block	80.500*	19.397	.047	1.54	159.46
	AB Block	78.500	19.397	.051	-.46	157.46
	Seven Periods	24.000	19.397	.639	-54.96	102.96
Seven Periods	Block	56.500	19.397	.135	-22.46	135.46
	AB Block	54.500	19.397	.148	-24.46	133.46
	Mixed	-24.000	19.397	.639	-102.96	54.96

Note. *The mean difference is significant at the 0.05 level.

Table 16 show the analysis for biology. The schedule under which instruction occurred had no significant influence on students' EOCT scores.

Table 16

Biology ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2917.000	3	972.333	.764	.571
Within Groups	5093.000	4	1273.250		
Total	8010.000	7			

Table 17 displays the ANOVA for physical science and shows there is no a statistical variation among the population means in an overall comparison of the 4x4 schedule, A/B schedule, mixed schedule, and seven-period schedule data. The analysis of the individual schedules confirms the null hypothesis that there is not a statistically significant difference in EOCTs in physical science scores between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

Table 17

Physical Science ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28723.375	3	9574.458	3.733	.118
Within Groups	10258.500	4	2564.625		
Total	38981.875	7			

Table 18 reflects the ANOVA for economics and confirms the null hypothesis that there is not a statistically significant difference in EOCTs in economic scores

between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

Table 18

Economics ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13490.500	3	4496.833	2.016	.254
Within Groups	8921.000	4	2230.250		
Total	22411.500	7			

Table 19 reflects the ANOVA for U.S. History and confirms the null hypothesis that there is not a statistically significant difference in EOCTs in U.S. History scores between students instructed on a 4x4 block, A/B block, mixed block and traditional period day, or traditional period schedule.

Table 19

U.S. History ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2158.500	3	719.500	.229	.872
Within Groups	12565.000	4	3141.250		
Total	14723.500	7			

As reflected by the tables, an analysis of data in its totality was done by schedule type. All content was analyzed for each schedule type as a whole to determine if any one schedule provided for greater student academic achievement. While the schedules taken

in totality do not show an improved student academic performance based on the schedule under which instruction occurred, the individual course analysis does reflect statistically significant differences in the content area of math. Chapter 5 discusses the significant differences in the math scores and possible recommendations based on the analysis of data.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this ex-post facto quantitative research study was to compare the students' EOCTs to determine if there is any significance in the scores during the years of 2009 to 2012 that can be associated to the different class scheduling each of the 4 years. Previous research has been focused on student academic achievement on the 4x4 block versus the traditional hourly schedule. The literature review revealed an absence of significant review or research on the type of curricular schedules employed by the school of focus on this study (Anderson & Walker, 2015; Aud, et al., 2013; Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, et al., 2010; Jacobs, 2010; Kera, et al., 2014;). Although the current research suggests that there are both benefits and drawbacks to the block schedule and the traditional period schedule, there is no evidence to support one schedule over the other. Considering the current reliance on standardized tests to measure a school's academic performance, the class schedule under which a school operates could prove to be a critical component in measuring students' academic success.

Interpretation of the Findings

After reviewing the data and performing computations and analysis for each subject, the analysis of the data does not categorically support that one schedule is better than another for student academic performance in all subjects analyzed. Although the schedules taken in totality do not show an improved student academic performance based on the schedule under which instruction occurred, the individual course analysis does reflect statistically significant differences in the content area of math. Math I and math II

both reflect a significant difference in EOCT scores between students instructed on a block and AB schedule, block and mixed schedules, as well as block and seven-period schedules. In the content area of math I, block to A/B schedule shows a .007, block to mixed schedules reports a .011, and block to seven period traditional schedules reports a .013 significance. In the content area of math II, block to mixed block reflects a significance of .047. This finding supports the hypothesis that a statistically significant difference in student achievement results on EOCT occurred based on the schedule under which student instruction occurred. Students instructed on block, A/B block, and mixed block showed increased academic achievement on EOCTs. These significance levels show that the difference in the data is not likely to be due to chance.

It is important to restate that the theoretical foundation for this study was constructivism. When viewing these results through the theory of constructivism, it is of some significance that the differences in increased academic achievement can be found primarily in block or block variations of the schedule. The literature reviewed advocated for block schedule often because of the opportunities for cooperative learning, curriculum integration, problem-based learning and interdisciplinary teaming (Finn, et al., 2014; Martin & Loomis, 2013; Akyuz, et al., 2013; Alleman & Holly, 2013; Hackman & Waters, 1998). Constructivism maintains there is a relationship between factual knowledge, a conceptual framework, and the ability to organize knowledge so that it can be retrieved and applied. Scientists promote constructivism as the model that best reflects the brain's natural way of making sense of the world (Finn, et al., 2014; Costa & Kallick, 2009). Hackman & Waters, (1998) described constructivism as a set of beliefs,

norms, and practices, and these beliefs, norms, and practices help students construct meaning from the curriculum. According to constructivism, people construct their understanding and knowledge of the world by experiencing new things and then reflecting on the new experience. This reflection promotes a greater comprehension and mastery. Constructivists emphasize depth of understanding rather than a superficial treatment of subject matter to promote greater comprehension and mastery of content (Martin & Loomis, 2013; Pelech & Pieper, 2010). Constructivism maintains that learning is an active process. As a person learns something new, all their previous knowledge is brought to the new learning experience. A newly learned fact or experience is blended into the understanding that already exists in that person's mind (Martin & Loomis, 2013; Costa & Kallick, 2009). Block scheduling has been promoted as providing more extended periods of time for student success and to involve students and their peers in discussions and positively engage learning possibilities. The data from this study supports the block as the schedule for greater academic achievement on EOCTs in the content area of math.

Limitations of the Study

The findings of this study were limited to the state where the study took place. This study did not take into consideration such variables as teacher experience and the quality or quantity of educational materials nor were the learning philosophies of both teachers and administrators considered in this study. Additionally, this study did not examine the socioeconomic background, a number of times a student had taken the test(s)

and the type of student the child was academically. The study also did not examine the educational background of the related parents.

Recommendations, Implications, and Conclusion

All schools have the goal of increasing student learning. However, the impact of class time lengths on student achievement appears to be a complicated issue with no definitive answers. As reported in the literature review, there are studies that report there is a relationship between class schedules and students' academic achievement, that the schedule design ensures that courses are in a format that supports and promotes learning (Rettig & Canady, 2013; Campbell, et al., 2009; Sisson & Sisson, 2015; Baker, et al., 2009). Bonner (2012) reported that the time and frequency of instruction could affect student learning while Jacobs (2010) proposes there is an inseparable link between instruction time and class schedules as they are mutually dependent one on the other. The schedule affects the pace of the student and teacher interactions and the schedule influence; whether block or traditional, cannot be undermined (Reller, 2010), however, time alone does not appear to be a single variable by which student academic achievement can improve in all content areas.

The Superintendents' Recommendations for a New Federal Framework for Educational Accountability (Dance, 2015) stated that schools must have highly effective systems of teaching, curriculum, assessment, and support if 21st century learning is to be achieved (Cramer & Mokher, 2015; Dance, 2015; Gul, et al., 2014; Griffin, et al., 2012). Research has established that the timing and frequency of instruction can affect student learning; that instruction time and class schedules are mutually dependent one on the

other and therefore, are inseparably linked (Anderson & Walker, 2015; Aud, et al., 2013; Baker, et al., 2009; Bonner, 2012; Comer, 2012; Dance, 2015; Dickson, et al., 2010; Jacobs, 2010; Kera, et al., 2014). While there has been a significant discussion in literature around scheduling models, there has been no conclusive evidence demonstrating that one model is more effective than others are. In fact, one commonality found in the literature review is an agreement that success of a scheduling model is largely dependent on several factors, including school demographics, proper professional development targeting instructional strategies, and training for teachers. While the schedule is indeed of high importance, the results of this study do not provide irrefutable evidence that it is exclusively essential when promoting student academic achievement on state-mandated testing.

The purpose of this research study was to add to the educational research available and expand the information of this study in the area of school scheduling in high schools and the effects it has on student achievement on state-mandated testing. While this study did not categorically answer all the questions related to which schedule type is better, it does add to the knowledge base for administrators and other school personnel in understanding the implications of the curricular schedule on student academic performance.

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