COMPARISON OF THE EFFECTS BLOCK AND TRADITIONAL SCHEDULES HAVE ON THE NUMBER OF STUDENTS WHO ARE PROFICIENT ON THE BIOLOGY END-OF-COURSE TEST IN FORTY PUBLIC HIGH SCHOOLS IN THE STATE OF NORTH CAROLINA

by

Tonia Anita Bonner

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

Tonia Anita Bonner. COMPARISON OF THE EFFECTS BLOCK AND TRADITIONAL SCHEDULES HAVE ON THE NUMBER OF STUDENTS WHO ARE PROFICIENT ON THE BIOLOGY END-OF-COURSE TEST IN FORTY PUBLIC HIGH SCHOOLS IN THE STATE OF NORTH CAROLINA. (Under the direction of Dr. Constance Pearson) School of Education, April, 2012.

This study examined the difference between the number of overall students, African-American students, and students with disabilities on a semester 4 x 4 block schedule who were proficient on the North Carolina Biology End-of-Course Test and the number of the same group of students on a traditional 45-50 minute yearlong schedule who were proficient on the NC Biology End-of-Course Test in the state of North Carolina during the 2009-2010 school year. A causal-comparative design was used and three null hypotheses were tested using chi-square analysis. Archival data was used. The results showed that there was a significant association between the number of the overall students and African-American students who were proficient on the NC Biology EOC Test when taught biology on a 4 x 4 semester block versus a traditional schedule. However, no statistically significant relationship existed between the number of students with disabilities who were educated on 4 x 4 semester block schedule and those students with disabilities who were educated on a six or seven period traditional schedule in biology. Suggestions for further research are included.

Keywords: achievement, African-American students, block-scheduling, high schools, proficiency, students with disabilities

Dedication

First, I would like to thank the Lord for His grace and mercies that no doubt have been renewed every morning. "I can do all things through Christ which strengtheneth me." (Philippians 4:13 KJV)

To my husband, Darryl Sr., the one whom my soul found and I will never let go: Thank you for your understanding, patience, and love. Thank you for standing by me when I felt so alone on this journey. Thank you for playing mom and dad for our children and keeping the house clean, cooking dinner, attending ball games in my absence, and teaching Bible study. I love you so much and I don't know what I would have done if you were not in my life. Thank you, Honey, and I cannot wait to begin making up for the lost time.

To my daughters, Hope and Tanisha: Thank you for understanding when I could not babysit for you. Thank you for giving me the most beautiful grandsons ever! Thank you for being young ladies who fear and love the Lord! Stay strong and endure!

To my baby, Darryl II: Thank you for being unselfish, caring, and patient. You have made a lot of sacrifices during this time and I want you to know I appreciate it. Thank you for keeping your dad company and helping him to forget how busy I was.

To the Restoration Christian Church family: Thank you for bearing with me. You did not always know why you could not call, but out of respect you would give me my time and space.

To my parents who always had an encouraging word: I say thank you.

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Table of Contents

List of Tables

List of Abbreviations

Adequate Yearly Progress (AYP)

End of Course (EOC)

Grade Point Average (GPA)

No Child Left Behind (NCLB)

North Carolina (NC)

North Carolina Department Public Instruction (NCDPI)

North Carolina Standard Course of Study (NCSCOS)

School- Based Management and Accountability Program (ABC's)

Statistical Package for the Social Sciences (SPSS)

Student with Disabilities (SWD)

Chapter One: Introduction

Background

In an effort to improve instructional time use, about half of United States high schools adopted some type of block schedule by the year 2000 (Lamkin & Saleh, 2010). Today, in many states, block scheduling continues to be a preferred choice of school schedule. In North Carolina over 75% of the high schools are on some type of block schedule (North Carolina Department of Public Instruction, 2009). The block schedule provided an answer to the call made by school officials to make better use of school time, offering more learning opportunities to students within the school day (Wallinger, 2000).

The presence of international communications and global competition in the marketplace has revealed that American students are no longer in the number one academic position, and communities, teachers, and school leaders agree that change in educational policy related to instructional practices is needed (Wallinger, 2000). The achievement level varies amongst students worldwide, and as the world is continuing to flatten, American students are competing more with their international neighbors. As a result, U.S. policy makers are taking a closer look at the educational system (Wallinger, 2000). There are many educators, school boards, and school communities in favor of block scheduling. The proponents argue that block scheduling makes an attempt to meet the needs of gifted and at-risk children, increases test scores, lowers discipline issues, and supplements learning with longer class periods (Gruber & Onwuegbuzie, 2001). Students would also experience a reduction in the number of classes scheduled each day on a block schedule (Scheduling Policies, 2009). The block schedule encourages

teachers to break from traditional methods of teaching and to examine a variety of pedagogy, incorporating more hands-on and interactive activities (Wallinger, 2000). Finally, demands such as a need for smaller schools, the creation of a standard core curriculum, reexamination of the use of time, and changes to pedagogical practices and the curriculum call for schedules that are more flexible. Many secondary schools have begun to implement some form of block scheduling based on Trump's Flexible Modular Scheduling design (Lankin & Saleh, 2010). Research has been conducted to determine the effects of block scheduling on academic achievement, but it has not been conclusive (Lankin & Saleh, 2010)

Zepeda and Mayers (2006) did an analysis on 58 empirical studies of high school block scheduling. They found that across five groupings, data were inconsistent regarding whether teachers' styles were adjusted. The data revealed that block scheduling appeared to increase student grade point averages and improve the atmosphere of the school, but the data did not provide consistent effects on standardized test scores and attendance (Zepeda & Mayers, 2006).

Many studies viewed block scheduling only in terms of how it affected standardized test scores and subject matter (e.g., mathematics, English) (Zepeda & Mayers, 2006). Amongst the studies, researchers concluded that block schedule students outperformed traditionally scheduled students across the content areas, including English, biology, and geometry, while other studies indicated that math achievement was lowered for students on a block schedule versus those on a traditional schedule (Zepeda & Mayers, 2006). The conflicting results make room for additional studies to be conducted,

enabling school officials to make a more informed decision about how time is used during the school day.

The focus of time on task with school schedules has dated back as far as the 1940's. However, more noted time and schedule changes go back to the 1980's and 1990's with publications such as *A Nation at Risk* (Gullatt, 2006). The desire of some schools and communities was to allow students to focus on fewer academic courses at a time. Other leaders were concerned about the number of electives students could take, especially during their senior year. Still others were interested in changes to add to the vocational subjects and advanced placement course offerings, while some administrators saw the schedule change as a means of improving the safety of the school through implementing an alternate schedule. As the schools made changes, some allowed a great deal of input from as many sources as applicable, while some schools adopted change with little input from the community and staff (Gullat, 2006).

Positive factors associated with student learning, noted in the review of literature, as a result of block scheduling, included, but were not limited to: climate of the school, individuals' opinions, and the collection of data through questionnaires and surveys. The literature review also demonstrated that there were mixed conclusions drawn about block scheduling. For example, block scheduling provides the time during a class period for a variety of teaching methods to be explored and utilized by teachers. However, teachers have admitted that their practices and teaching methods did not change, going from 50-minute classes to 90-minute classes (Flannery, 2008). The studies indicated that no significance was gathered from observing data, as they related to grade point averages and results on test scores. A large urban school district in the southwestern United States

implemented block scheduling for the 2005-2006 school year in 13 of its 35 comprehensive high schools to enhance student learning (Biesinger, Crippen, & Muis, 2008). However, the study by Biesinger, Crippen, and Muis (2008) indicated that there was no significant increase in student performance. Though there were reported changes in student confidence, they could not be reported across differing ability levels.

Cahill (2009) suggested that time is an asset that needs to be organized and considered when schools desire to bring underprepared students to achievement of higher standards. No matter what the motivating factor to alternate the schedule, a variety of measurements have been used to determine the impact of the alternative schedules on student performance. Despite the method, the results on student achievement and school scheduling have been mixed (Gullat, 2006). Therefore, this study investigated student achievement on both schedules. Additionally, instead of looking at students' overall performances, the study examined two subgroups to investigate if one schedule yielded greater achievement than the other for African-American students and students with disabilities.

Block scheduling has become a popular and significant initiative in education. Though there is research on how students in general are achieving on a block schedule, very little research has been done to see how block scheduling has impacted the learning of African-American students and students with disabilities. Special education used to occur in a separate learning environment. Though there are still instances of this, more and more special education programs are being identified and placed in the regular classroom. The numbers of students with disabilities who are educated in general education classrooms have increased (Weller & McLeskey, 2000). Recognizing the

direction in which special education is headed today, it is observed that these students are being included in the regular education program with the offering of individualized instruction (Finkel, 2011). Congress passed the No Child Left Behind Act (NCLB) to address issues faced in American education (Nisbett, 2010). The federal initiative, NCLB, has called for a rigorous accountability system for states and has lessened the local control over educational matters and required states to develop or adopt tests to assess student performance. States are required to test at least 95% of all enrolled students, including subgroups such as African-Americans and students with special needs (Katsiyannis, Zhang, Ryan, & Jones, 2007). With the requirements of NCLB, although students with learning disabilities are being mainstreamed more and more and the use of block scheduling has increased, there is little research that has been conducted to evaluate the effects of the block schedule on the performance of these students (Bottge, Gugerty, Serlin, & Moon, 2003). One goal of this study was to add to the literature by evaluating the proficiencies of students with disabilities and one type of block schedule compared to a traditional schedule.

Another area of concern is the gap that exists between Caucasian students' achievements and African-American students' achievement. In the twenty-first century, knowing that the achievement gap still exists may be surprising to some. Providing equal opportunities to all students and that all students will achieve remains a goal within the schools (Robertson, 2008). The gap amongst African-American students and Caucasian students was a part of the NCLB initiative as well (Nisbett, 2010). With the NCLB initiative in place, concrete evidence is still lacking on how well this legislation is narrowing the gap (Robertson, 2008). Von Secker (2004) suggested that minority

students experienced improvement when the instructional practices by teachers emphasized greater access to laboratory experience in science, as students had more time in the class. Therefore, the teachers had the opportunity to include more hands-on laboratory activities for the students and an increase in achievement could be noted. Block scheduling is the schedule to support increased access to laboratory time and fostering the needed atmosphere for a minority student. According to Lamkin & Saleh (2010), the assumptions associated with block scheduling include the following: more time for exploration for students and teachers, the time to dig deeper into specific topics, and focus placed on tasks that are more project and problem-based and more conducive for teaching African-American students.

The goal of this study was to establish findings about the achievement in biology of African-American students and students with disabilities, as well as the general population, on a 4 x 4 block schedule versus those on a traditional schedule. Unfortunately, the research on this topic that has been done is outdated and limited. The use of block scheduling must be evaluated as a vehicle for greater achievement or merely a faddish approach (Chaika, 2005). Block scheduling must be reviewed to discuss its impact not only on the general population of students, but also on students who are considered to be at-risk. The literature provided very few studies geared towards the two identified subgroups; the need to add to this weakened area was established. Therefore, the two at-risk subgroups, African-American students and students with disabilities, were evaluated to note how they were being affected by the type of school schedule.

As school administrators began to adjust to the No Child Left Behind legislation, schools' schedules became a part of the conversation for improving student achievement.

School administrators were encouraged to give direct attention to changing the school day. Therefore, this study sought to review historical data on the performance of students on the North Carolina Biology End of Course test (NC Biology EOC) to see if the length of class periods during the school day was impacting student achievement. The study assessed the impact of block scheduling on the general population of students, African-American students, and students with disabilities. To date, there have been an equal number of research studies that report either negative results or positive results of block scheduling, which has led to mixed perceptions of the effects of block scheduling on student achievement (Maltese, Dexter, Tai, & Sadler, 2007).

Much of the current research discussed advantages of block scheduling that deals with the tone, feelings, and atmosphere of the classroom and/or school, neglecting to address the achievement of the subgroups. According to Canady and Rettig (1995), the single period traditional schedule was the cause of high schools being impersonal, that discipline problems were exacerbated, the time for teaching was cut thin, instructional practices were limited, teachers could not enjoy flexible planning, and the workplace was not friendly (Mistretta & Polansky, 1997). Thus, block scheduling became a school-wide reform, addressing the issues found within the traditional high school single period day (Deuel, 1999). Therefore, the block schedule is conducive for providing the time for more in-depth study.

Problem Statement

Emphasis has been placed on improving academic achievement for students across the country for more than 20 years (Katsiyannis et al., 2007). In 1983, the U.S. Secretary of Education announced that the United States was a nation at risk; as a result,

recommendations have caused teachers and administrators to attempt to improve education (Bottge et al., 2003).

Schools are now placing more students with disabilities in the least restrictive environment, allowing them to learn alongside their peers without disabilities. In addition, regulations have been put into place by the federal government that would focus on improving the performance of students with disabilities (Bottge et al., 2003). The NCLB legislation has placed emphasis on all children achieving (Nisbett, 2010).

Based on achievement levels, African-American students are in need of attention. Evaluating the achievement of African-American students learning on the block schedule versus a traditional schedule was necessary because literature does not provide much discussion on this topic. The nation cannot function competitively in a global market if a considerable number of students are left uneducated or undereducated; therefore, the education of African-American students is important (Li & Hasan, 2010). The nation continues to struggle with the achievement gap between Caucasian and African-American students (Li & Hasan, 2010). Very few studies have been conducted to evaluate block scheduling on African-American students (Weller & McLeskey, 2000). The literature lacks a detailed analysis of the achievement of students with disabilities and African-American students on a block schedule versus a traditional schedule. However, these are the students who experience higher dropout rates than students without disabilities and non-African-American students. Studies examined schools' restructured school days. The results suggested benefits such as increased student achievement, improved critical thinking skills, enhanced school climate, more collaborative learning and teaching practices, and more active, student-initiated learning

(Weller & McLeskey, 2000). However, the achievement of students with disabilities and African-American students has not been studied at any great depth. Therefore, this study sought to determine if there was an association between type of school schedule and the number of African-American students and students with disabilities who were proficient on the NC Biology EOC test. Additionally, the study will examine school scheduling effects on the overall test results of the general student population.

Purpose Statement

This study provides school administrators, educators, and stakeholders with a clearer picture of how the block schedule is affecting student proficiency on one NC EOC test compared to a traditional schedule. This study compared the number of students who were proficient when taught biology on a block schedule to the number of students who were proficient when taught biology on a traditional schedule. The students were represented by three groups: the general population of students, African-American students, and students with disabilities. All students took the end-of-course biology test in a North Carolina public high school. The goal was to provide empirical data that is lacking in the research community, related to the achievement of two sub-groups located in most high schools across the nation: African-American students and students with disabilities. This study examined how many of these students were proficient on the NC Biology EOC test. The study assessed how biology proficiency rates for these students in public schools of North Carolina on a semester 4 x 4 block schedule were compared to biology proficiency rates for students in public schools of North Carolina on a traditional schedule. The data was archival data, using the proficiency rates for 40 schools from the 2009-2010 school year.

Studies have supported both positive and negative effects of block scheduling on student achievement. In this study, data was analyzed to further evaluate the effects of block scheduling. In the state of North Carolina there were several end-of-course tests administered each year in the high schools. There were five core courses which were tested, and every student graduating from high school who completes each course was administered the corresponding test. The tests provided an indication of student mastery of the course concepts by providing a grade on a scale of 1 to 4. The purpose of this study was to use the number of students who were proficient on the biology test to compare the achievement of students on the two types of school schedule, 4 x 4 block and traditional schedule.

Research Questions

In an effort to examine the effects of school scheduling on achievement, proficiency rates of the students were retrieved from the North Carolina Department of Instruction website. Proficiency rates of the students for all high schools in the state of North Carolina on a semester 4 x 4 block schedule or a traditional schedule were used from school year 2009-2010. Three null hypotheses were created to answer the three research questions investigated in the study.

Research question 1. Are students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students who participate in a biology course on a traditional schedule?

$H_0 1_1$. There is no statistically significant difference among the number of students who were proficient on the NC Biology EOC and completed biology on a block schedule and the number of students who were proficient on the NC Biology EOC on the

North Carolina biology end-of-course test and completed biology on a traditional schedule.

Research question 2. Are African-American students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students who participate in a biology course on a traditional schedule?

$H_0 2_1$. There is no statistically significant difference among the number of African-American students who were proficient on the NC Biology EOC and completed biology on a block schedule and the number of African-American students who were proficient on the NC Biology EOC on the North Carolina biology end-of-course test and completed biology on a traditional schedule.

Research question 3. Are students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students who participate in a biology course on a traditional schedule?

$H_0 3_1$. There is no statistically significant relationship on the North Carolina biology end-of-course test among the number of students with disabilities who were proficient and who completed biology on a semester 4 x 4 block schedule and those who completed biology on a traditional yearlong schedule.

Identification of Variables

The key variables are isolated and identified. The independent variable is the school schedule. The two types of schedules that were compared are the semester 4 x4 block schedule and the traditional schedule which incorporates 6 or 7 periods of 45 to 50 minutes each. The dependent variable is the number of students who were proficient on the NC Biology EOC. The study examined the data for the general population of

students who were proficient for each type of school schedule. The study also examined the data for African-American students and students with disabilities who were proficient on the NC Biology EOC test for each type of school schedule.

Definitions

ABCs of Public Instruction is a searchable school level accountability model reporting results of the End of Grade and End of Course test results (North Carolina Department of Public Instruction, 2009).

Adequate Yearly Progress (AYP) measures a school's or school system's ability to meet required federal benchmarks with specific performance standards from year to year (United States Department of Education, 2008). Adequate yearly progress is the means by which schools are evaluated, according to the accountability provisions in the No Child Left Behind Act. AYP criteria are dependent on the following measures: Reading/language arts, mathematics, and either graduation rate (for high schools and districts) or attendance rate (for elementary and middle/junior high schools). However, the schools may vary in how they were graded for the North Carolina Accountability Program.

Block scheduling is comprised of classroom learning periods that lasts 85 to 100 minutes per day with students attending four block classes per semester (Jenkins, Queen, & Algozzine, 2002).

Collaborative learning is the grouping of various levels of learners to work together to achieve a particular goal (Srinivas, 2010).

Constructivism advocates learners participation in context-bound, real-world problem solving and student engagement in meta-cognition (Hackmann, 2004).

Cooperative learning is an instructional method that allows students to work in small groups within the classroom, often with a division of assignment of several specific tasks or roles. This group strategy allows students to practice working in a group and taking leadership roles (Castellano, 2011).

End-of-Course Test (EOC) is a test used to sample a student's knowledge of subject-related concepts as specified in the North Carolina Standard Course of Study. It also provides an estimate of the student's mastery of information within a particular content area (North Carolina Department of Public Instruction, 2010).

Individuals with Disabilities Education Act (IDEA), Public Law 105-17, fully supports the least restrictive mandate and stipulates further that students with learning disabilities have access to and make progress in the general education curriculum (Cawley, Hayden, & Baker-Kroczyniski, 2002).

North Carolina Report Card of Schools is a searchable site that provides for each school in North Carolina information about the school's student performance, class size, school safety, and teacher quality data (North Carolina Department of Public Instruction, 2010).

Proficiency rate refers to the number/percentage of students who were proficient, meaning they scored a level III or higher, on a North Carolina End of Course Test (Haynie, 2011).

Students with disabilities are students that may need specially designed instruction to meet their learning goals. A student with a disability will usually have an Individualized Education Plan (IEP), which guides his or her special education instruction. Students with disabilities are often referred to as special education students

and may be classified by their school as learning disabled (LD) or emotionally disturbed (ED) (National Center for Education Statistics, 2011).

Traditional Scheduling is comprised of classroom learning periods of 50 to 60 minutes per day (Jenkins et al., 2002).

Research Overview

This study sought to provide information on student proficiency levels within the general population of students, African-American students, and students with disabilities on the NC Biology EOC test. The goal was to provide school administrators, school boards, teachers, parents, legislature, and community stakeholders with a snapshot of how the North Carolina schools were doing with a vast majority of its schools now operating with some form of block scheduling, with the 4 x 4 semester block being the most popular.

The research presented limited the comparison of the number of students who were proficient to schools who operated on a 4 x 4 block semester schedule and schools who were traditional and operated on a six or seven period school day. The number of high schools who were blocked in the state of North Carolina during the 2009-2010 school year far exceeded the number of high schools who were on the traditional six or seven period schedule. The intent was to include all the schools in North Carolina; however, close to 90% of the schools in the state were block and only about 10% or less of the schools maintained a traditional schedule.

The study is organized into five chapters. The study begins with Chapter One, a detailed introduction of the problem. The problem is whether or not there was a statistically significant relationship between the number of students who were proficient

on the NC Biology EOC test among the general population of students, African-American students, and students with disabilities who were taught biology on a 4x 4 block schedule versus those who were taught on a traditional non-block schedule. The purpose of the study was to add to the literature on the topic of student achievement and school scheduling, more specifically examining two subgroups, African-American students and students with disabilities, who have been described as at risk students.

Chapter Two discusses the research and studies that have been completed by others in the field on block scheduling in comparison to traditional scheduling. Avowedly, the literature review indicated a deficiency of studies that addressed how African-American students and students with disabilities were achieving on the block schedule versus the same groups of students on the traditional schedule.

Chapter Three outlines the methodology. Chapter Three discusses how the information for the study was retrieved from archival data provided on the internet for each North Carolina high school and properly labeled it as categorical data so the appropriate statistical test was used to analyze and communicate its findings.

Chapter Four includes the data collected on the various schools and organizes the results of the chi square test that was used to analyze the number of students who were proficient based on the type of schedule the school was operating during the 2009-2010 school year.

Lastly, Chapter Five provides a summary of the results and data collected. In addition, Chapter Five explains the conclusions drawn and provides implications that would drive further investigation of the topic of student achievement and school scheduling.

The research concluded its summary with acknowledging that, with several limitations, the study indicated that for the general population of students and African-American students there was significant difference between the students who were proficient and completed biology on a 4 x 4 semester block schedule versus those who completed biology on a traditional schedule. However, no significance was found for the number of students with disabilities who were proficient on the NC Biology EOC test and completed biology on a 4 x 4 semester block schedule and those who completed biology on a traditional schedule.

Chapter Two: Review of the Literature

Introduction

There are many schools that are operating on a block schedule. School officials have adopted this type of schedule for various reasons. School officials are observing positive outcomes as a result of using a block schedule. However, there are still some school personnel who are not completely convinced that a block schedule is having any type of effect on the achievement of the students (Rikard & Banville, 2005). Though several studies have been done on this topic, there is still information lacking on how students of specific subgroups are being affected by the school schedule and how school time is used.

Theoretical Framework

Block scheduling was the result of conversations taking place among educators believing that more time in the classroom would provide an opportunity for more interaction to take place between the student and the teacher, which would lead to more learning. This concept is based on a learning theory developed by Vygotsky. The Vygotskian approach to learning is a method of developing students by engaging them in persistent and systematic inquiry (Zuckerman, Chudinova, & Khavkin, 1998). This approach implies that cognitive development comes only through the social interaction between or among people, leading to internalization of the information by the individual (Eun, 2008).

According to Vygotsky, in order to engage students, three factors must be present within a lesson: ideas are central and general to the discipline, cultural tools are adapted

for thinking about the ideas generated, and students must have the cooperation of their peers to solve problems in order to enable students to see each other's point of view (Zuckerman, et al., 1998). Four fundamental interrelated concepts must also be identified. The first fundamental concept is the explanation of how individual mental functions arise from purposeful interactions that are social in nature. Secondly, the understanding that psychological development is dependent on social interactions properly identified as the unity of behavior and consciousness. Thirdly, this concept called mediation discusses transition between social interaction and individual mental functioning as a result of certain mechanisms. Finally, to demonstrate development, there is the concept of psychological systems (Eun, 2008). The Vygotskian model endorses the use of student inquiry and holds the educator to the task of creating an environment for the student to learn by asking questions and making observations (Zuckerman et al., 1998).

Practitioners of education have enthusiastically turned their classrooms into creative workplaces as a result of teaching on a block schedule (Flannery, 2008). The Vygotskian learning model provides the foundation for block scheduling, and the longer class periods allow for more varied teaching strategies and time for in-depth study. Teachers boast of the ability to use the blocked classes as an opportunity to make connections with their students; writing teachers share that students have time to connect with their writings and with each other academically and socially (Flannery, 2008). The sharing of these types of events in the classroom clearly supports and run parallel with the ideas expressed in the Vygotskian approach to learning. The current research on Vygotskian thinking serves as a foundation for block classes because the theory supports

the need for collaboration within the classroom (John-Steiner & Mahn, 1996). One of the major arguments in favor of 90-100 minute class settings is that it allows the students to become familiar with the content being taught as a result of time being allotted for the implementation of hands-on and collaborative activities (Canady & Rettig, 1995). A modern interpretation of the work done by Vygotsky is the socio-cultural theoretical framework (John-Steiner & Mahn, 1996). Vygotsky's socio-cultural theoretical framework describes learning as taking place when learners are dependent on others with more experience (John-Steiner & Mahn, 1996).

Unlike the traditional model of the teacher transmitting information to the students, within the socio-cultural framework, the students play a more active role (Crawford, 1996). Coupling Vygotsky's socio-cultural theoretical framework with constructivism, the themes work together to support activities such as cooperative learning, role playing, large group discussions, and hands-on experiments. Constructivism emphasizes the active participation of the learners and it is considered to be a positive implication because it encourages students to participate in the classroom and engage in the subject content (Hyslop-Margison & Strobel, 2008). These theories follow the principle that social interaction precedes development. The traditional 50 to 55 minute class period does not hold enough time for students to become actively engaged with their learning before they must move to the next class. In response to this idea, the block schedule provides longer class periods for teachers to implement innovative approaches to instruction (Imbimbo & Gilkes, 2009). Categorically, the framework supports that learning is contingent upon interacting with others. The proponents of the block schedule endorse these schools of thought. The proponents

support the idea that students are given the opportunity to work in small groups and that teachers will make use of cooperative learning strategies, which allows students to interact in purposely-structured mixed ability groups to support the learning of all students involved (Jenkins et al., 2002).

The theories discussed have suggested that students are given the opportunity to learn the curriculum in an environment that is conducive for students to actively participate in content, not just having the knowledge passed on to them by a teacher. A class period that is extended can provide an atmosphere that will yield these types of interactions. For example, a study conducted by Biesinger et al. (2008) provided results of a mixed-method investigation into the effects of block scheduling on student self-efficacy instructional practices and student attitude in the subject of math. One of the key findings suggested that professional development is a critical need to ensure teachers' practices are reformed. The extended class time gave students an opportunity to become involved in the lesson being taught (Biesinger et al., 2008). Block scheduling advocates believe the increased time spent on learning provides an opportunity for more in-depth learning and produces higher teacher and student morale (Imbimbo & Gilkes, 2009).

Canady & Rettig (1995) argued that the only way that the strategies discussed in theory can be successful is to have adequate time for the interactions to occur. The block schedule allows teachers to capitalize on environments which provide individualized instructional plans for students, by providing an opportunity for students to interact with others one on one (Texas Education Agency, 1999). The longer class periods allow teachers and students to be active, creating creative learning situations resulting in flexible roles for both the teacher and the student. There has been positive feedback

provided as a result of the implementation of block scheduling. The required curriculum has been broadened and deepened by the teachers, and students found learning interesting, engaging, and challenging (Lamkin & Saleh, 2010).

The theory that supports the discussed benefits of blocked classes and mentioned previously is constructivism. Constructivism is a more contemporary theory that emphasizes the student's role in the learning process (Hackmann, 2004). In organizing the time utilization within a typical school day, supporters of constructivism would see block scheduling as the vehicle to encourage teachers to apply constructivist practices (Hackmann, 2004). The constructivist theory is built upon the works of both Jean Piaget and Lev Vygotsky, along with others (Hackmann, 2004). If schools are leaning towards a more "hands-on learning" environment, "active engagement of the learner," and "depth over breadth," then Hackmann (2004) argues a firm connection should be created between constructivism and block scheduling. He believes the school scheduling argument would be the means of a more comprehensive model that prevents block scheduling from being an event to being a "constructivist school culture" (Hackmann, 2004, p. 699).

History of Class Scheduling in U.S. High Schools

The traditional schedule is one that has been followed for most of school history in the United States. The implementation of 7 to 8, 50 to 60 minute classes per day is what is associated with a traditional schedule for secondary schools and began in the late 1800's. During the 1800's, the school planned its schedule around the life of the community. For example, many rural schools met during the summer months, undisturbed by the winters, road conditions, and away from the spring when the children

were needed to help out on the farm (Huyvaert, 1998). This planning did not involve the rigid notions of a school calendar that is experienced today. Prior to the 1900's, high schools were flexible in their schedules. Courses were offered based on the length of the day, within urban high schools, rather than being restricted to meet consistently each week for five days (Canady and Rettig, 1995). In an effort to make the educational schedule uniform, the National Education Association formed a committee identified as the Committee of Ten and the traditional schedule of schooling was birthed (Schott, 2008).

The Committee of Ten, in 1893, developed a plan that would provide a measurable set of standards for secondary schools and the orientation of the school day. The Committee of Ten recommended the subjects that should be taught, when they should be taught, and the allotted time for each of the subjects (Schott, 2008). This recommendation had not been changed very much since its implementation (Canady & Rettig, 1995). The units of time were calculated based on the Carnegie system and is traced back to the time in America when standards of industrialization in the workplace were being developed, during the turn of the twentieth century. The credits earned in each subject were based on the time spent in the related classrooms within the high school (Kruse & Kruse, 1995). In addition, the Carnegie system defined the unit standard as the time interval comprised of regular attendance in a course that met one class period per day, five days per week, and thirty six weeks per year (Huyvaert, 1998). It was during the 1930's that individual needs of students had become of educational interest. Combining this with trends beginning with World War II and into the 1960's, there was

pressure on schools to improve and provide more services to the citizens (Anderson, 1984).

Traditional, inflexible scheduling was based on meeting administrative and instructional needs instead of the needs of the learner, according to Watts and Castle (1993). In order to provide pedagogical practices that would meet the educational needs of students and the professional needs of teachers, a more flexible pattern was needed (Watts & Castle, 1993). In addition to not meeting the needs of the students, teachers were faced with more preparation on a traditional seven or eight period day. This type of thinking is not a new phenomenon, despite many individuals' perceptions of block scheduling.

Interestingly enough, block scheduling became part of the conversation for change early in educational history. In 1847, one educator, David P. Page, wrote a book titled *Theory and Practice of Teaching: The Motives and Methods of Good School-Keeping*. In this text, Page wrote and described what was properly identified as an alternating-day block schedule. His concern was that the teacher did not have enough time with her students when only seeing them every day for short periods. Instead, his recommendation was that the instructional time would be more profitable if more time was spent in the classes meeting only two or three days of the week (Holschen, 1999). A report made by the Committee of Ten, the Committee of Secondary School Studies, in 1893, furthered the evaluation of using blocked time for learning.

Another attempt at implementing an innovative schedule was made by J. Lloyd Trump in 1959. The length of time and frequency that classes met would vary under a flexible modular schedule. There was an elimination of a rigid class schedule and in its

place were classes that met with a time length of 20 minutes to 100 minutes, based on the needs of the students. Trump's goal was to meet the individual needs of the students in such a manner that their academic achievement improved. In this format, the evaluation was based on the total amount of class time (Schott, 2008). However, no real progress was made until the late twentieth century to rectify the time issue.

Reformers have theorized that the traditional scheduling of school is outdated and does not meet the needs of students entering school today. According to Rettig and Canady (2003), there are many disadvantages to the single period traditional schedule. In a response to the national report titled "A Nation at Risk" (Goldberg & Harvey, 1983), where the quality of schools in America was addressed, class time became a part of the discussion. In addition to this report, the National Education Commission published "Prisoners of Time" in 1994, which examined how time might be allotted to allow students to succeed to higher levels (Schott, 2008). Traditionally, the school's time had concentrated on the best interests of the community and not on how the students might be better served (Fallis, 2003). According to Fallis (2003), to improve student achievement, the time usage in school should be designed to address the needs of students. Prior to the concerns of the quality of the schools, as pointed out in the report, the most common scenario found had classes meeting for approximately 50 minutes per day.

Research began to focus on how the time in school was being spent. Sommerfeld (1996) reported in a 1984 study that had been done by researchers at Southwest Texas State University, that only 28 minutes of a 55-minute class were typically devoted to instruction. This study went on to suggest that this schedule provided inadequate time for probing ideas at a greater depth and limited the diversity of learning activities a teacher

could employ. The uncovering of this type of information began to change the attitudes of many educators about the traditional school schedule. The traditional six or seven period day was described as being hectic, impersonal, and an inefficient instructional environment by its critics, including that opportunities for individualizing instruction were not readily available within the traditional school schedule (Carroll, 1994). The focus of student achievement was being lost within this traditional way of doing school.

The need for a block schedule arose from the idea that the traditional single period schedule stressed teachers and pressed them for time, in juggling the large number of students passing through their classrooms on a daily basis (Jenkins et al., 2002). The teachers found themselves unable to use more effective and active learning models under the traditional schedule because a vast amount of time was fixed on surviving the day. Limits were placed on the type of instruction the students were receiving (Jenkins et al., 2002). Combining these concerns with the notion of collaborative learning in the classroom, Tschannen-Moran, Uline, Woolfolk Hoy, & Mackley (1999) suggested that having more time for instruction made sense. Additionally, a publication that came out in the 1980's is credited with initiating the pressures necessary to cause educators and educational leaders to think of ways for high school graduation requirements to be strengthened. With the input of more graduation requirements, the need for more opportunities for students to obtain more credits in core subjects evolved. To deal with this need, schools opted for a variety of practices that would increase class time. Some schools added more class periods to the school day (Canady & Rettig, 1995). While trying to find the best schedule, the class periods went through a variety of changes and the school day became more hectic for both teachers and students (Canady & Rettig,

1995). Some schools even attempted to lengthen the school day (Canady & Rettig, 1995).

As a result of the changes, many studies were done. The work of Fisher and Berliner (1985) provided the foundation for block scheduling in high schools. Their research supported the need for a change in school structure. The study of how time at school was spent became popular, in addition to how time was structured in schools. McCreary and Hausman (2001) stated that changing the school day was a means to increase student performance. Therefore, research on this topic has been ongoing for several decades. A variety of block schedule formats have been recommended by various educators and researchers in the field (Canady & Rettig, 1995).

Additional reports showed up in the twentieth century motivated by a decline in student achievement and the profound effects on the economy to include progressively: one in 1906 by the Carnegie Foundation; in 1983, the National Commission on Excellence in Education, discussed earlier; in 1994, the National Commission on Time and Learning in support of a reform that would address the utilization of school time (Zepeda & Mayers, 2006).

The movement to a block schedule for most high schools created controversy. Now, in the twenty-first century, critics of high schools continue to speak out. A 2005 report (as cited in Zepeda and Mayers, 2006) was presented during an educational summit sponsored by the National Governors Association and Achieve, Inc. sparked a continued call for higher standards, accountability, and restructuring efforts to guarantee that students graduate with the requisite skills to be successful in the workplace and college. Educators continue to look at time usage when facing the mandates of the

NCLB Act of 2001, which addresses test requirements and more demanding accountability standards for schools, districts and states (Linn, Baker, & Betebenner, 2002). Ted Sizer, a professor at Brown University, did a study that was funded by several private foundations. His study led to his authorship of the book *Horace's Compromise*. The book featured a school representative of the average school and a teacher representative of the average teacher. Sizer's recommendation in this book was to decrease teacher's student loads, the same recommendation that comes with a block schedule. He also wanted to encourage systems to provide an opportunity for teachers to build better relationships with their students and for students to have fewer classes. Sizer saw the changes as providing the teachers with an opportunity to provide individualized instruction and for students to be able to do a better job, having fewer teachers and fewer classes on which to focus their attention. The student-teacher relationship would improve, because the teacher with fewer students would get to know her students better (Holschen, 1999).

In British Columbia, Ontario, and Alberta, block scheduling has been in place since the 1970's (Holschen, 1999). Within the United States, block scheduling became increasingly popular during the 1990's. To begin the process, in the 1970's, a reform initiative was created to redistribute the allocation of time in secondary schools and it was at that time that block scheduling began to surface. Secondary school students had been attending 6 to 7 classes daily for 50 to 55 minutes for nearly a century when this initiative began (Rikard & Banville, 2005). This attempt, along with those made as early as the 1960's, were met with enthusiasm. However, by the 1980's, most flexible scheduling models had faded. The increase in student discipline and problems associated with

teachers' challenges in implementing and reforming their teaching methods to accommodate the longer periods caused block scheduling to lose ground (Nichols, 2005). To address these issues, time allocation remained a major factor. Therefore, educators began to view the restructuring of high schools as a design which would include fundamental changes to take place in expectations, content, and learning experiences (Jenkins et al., 2002). Block scheduling was chosen as a solution to the typical Carnegie-unit course schedule (Scheduling Policies, 2009). In certain locations, block scheduling was adopted in response to the issue of students being required to attend six to eight classes each day. There was a concern that learning this way was presenting a fragmentized view of the subjects they were learning (Scheduling Policies, 2011). Block scheduling was also adopted to address issues such as poverty, high student mobility, overcrowding, and the growing population of limited English-speaking students. These needs have extended into many areas of the United States. Today, block schedules have been adopted in many different high schools across the United States (Hughes, 2004).

In conclusion, in review of the history of school scheduling, the block schedule has become the norm for learning. In an effort to improve the use of instructional time, an estimated half of the U.S. high schools have tried some form of block scheduling. These changes were made based on Trump's Flexible modular scheduling design. Five basic scheduling models have been identified by Robert Lynn Canady and Michael D. Rettig, and have been used across the United States (Lamkin & Saleh, 2010).

To Block or Not to Block

The reasons school systems have employed block schedules vary from better preparation of students for college to the reduction in disruptions of the school day

(Rikard & Banville, 2005). In North Carolina, approximately 75% of the high schools are on block schedules (Jenkins et al., 2002). In Watauga County, North Carolina, prior to adopting the block schedule, the school system had many questions, wanting to make sure it made the best use of its time, and so decided to evaluate other school programs before making a choice of their own (Childers & Ireland, 2005). After a careful review process, Watauga High School had decided to adopt block scheduling just like many of its neighboring county high schools.

In Virginia, data had been collected over a period of time to show that 237 of the 303 high schools were on some type of block schedule. The schools had been operating on these block schedules for the past 18 years and, of those that had begun on the block schedule, only six of the schools have reverted back to the traditional 7 period day (Rettig & Canady, 2003). This type of data indicates positive results from the implementation of block scheduling.

Observing one state's or one system's ongoing success is not enough when considering block scheduling for the first time. In order to have smoothed transitions, and for the stakeholders, teachers, administrators, students, and parents to buy in, some suggestions should be followed. First, there must be a team approach; second, a core group should be established to set the groundwork for change; and, third, communication must be ongoing (Childers & Ireland, 2005). The way the schedule flows each day should be based on the type of block schedule the institution has decided to adopt.

Varieties of Traditional Scheduling Models

The traditional schedule consists of a variety of shorter class periods. The traditional schedule has its roots stemming from the industrial efficiency era of the

twentieth century, associated with the Carnegie-unit system. The idea was to move the largest number of students in a highly impersonal mass-production model through schools (Scheduling Policies, 2009). The common thread for the traditional schedule is the length of a class period, which ranges from 45 minutes to 55 minutes of class time per day. Teachers see more students on a traditional schedule and students are involved in more movement.

Five period traditional schedule. The school day is divided into 5, 65-minute classes that run for the duration of the school year. Teachers tend to have 110 to 130 students per day for the entire school year.

Six period traditional schedule. The six period a day is very similar to the five period day with the addition of one class. The additional class causes each class period to be shortened. Therefore, the periods are approximately 60 minutes long each day. Teachers see anywhere from 20 to 35 additional students, compared to the five period traditional schedule.

Seven period traditional schedule. Schools on the seven period traditional schedule have classes divided into 7, 50 to 55-minute per day classes. Each class meets each day of the 180 days of a school year.

Modified traditional schedules. There are modified forms of the traditional schedule which changes the school day depending on the day of the week. One such schedule is called a trimester system in which the schools do a seven period rotator schedule with seven courses being offered on a six period day schedule (Deuel, 1999). The seven period rotator is when one class meets 55-minutes each day, while the other classes (second through seventh periods) meet over a six day cycle rotating each day. On

day one, the seventh class does not meet; on day two, the sixth class does not meet; on day three, the fifth class does not meet; and it continues in this format. The class changes involve a five-minute break and each student averages 54 minutes of instructional time per day. The number of credits obtained remains at 28, the same amount received on the 7 period traditional schedule (Deuel, 1999).

Eight period traditional schedule. This schedule has students changing classes eight times during the typical school day, the most class changes of any schedule type in the course of one school day. The classes meet for 45 to 47 minutes per day. Students encounter eight different teachers and could meet in eight different locations. The traditional schedule has been known to extend beyond the eight period day, but it is very uncommon. Therefore, the varieties of traditional scheduling will stop with the discussion of an eight period day.

Varieties of Block Scheduling Models

Block scheduling comes in different forms and the forms used are dependent on the needs of the related schools. Schools are not committed to a particular pattern of block schedule. Therefore, there are a number of block schedule variations that schools can adopt based on their unique circumstances (Trenta & Newman, 2002). Double periods of 80 to 120 minutes have been the model for most block schedules (Scheduling Policies, 2009). Following is a description of each of the types of block scheduling found in the literature researched.

4 x 4 block. This schedule is one of the two most frequently adopted block schedule models. Within 4 x 4 block scheduling, each semester students are enrolled in four different courses that meet daily for 90 minutes (Lamkin & Saleh, 2010). This type

of schedule has been referred to as the accelerated, or Copernican, plan (Lewis, Dugan, Winokur, & Cob, 2005). This schedule allows students to take up to four more classes over their careers, compared to those on a traditional seven period day (Chion-Kenney, 2003). Each semester course on this type of schedule is equivalent to a full year course on a traditional period day (Trenta & Newman, 2002).

In an effort to educate all students, there must be some flexibility within the schedule. The 4 x 4 block was designed to reduce the total number of weekly course preparations for teachers and students. With this schedule, students have the option of retaking classes that were failed in the first semester in the second semester. Students on this schedule could play catch up in certain subjects by doubling up on a deficient subject within one school year (Scheduling Policies, 2009).

A/B alternating block. The A/B alternating block schedule is another means of blocking the school day. With this schedule, classes meet every other day for 90 minutes throughout the entire school year (Imbimbo & Gilkes, 2009). There are some A/B schedules that have the students in their classes for up to 95 minutes per day, every other day, throughout the entire year (Rikard & Banville, 2005). Basically, the A/B schedule is a 4 period day with A periods (1, 3, 5 & 7) meeting one day and B periods (2, 4, 6, 8) meeting on another day.

Modified block scheduling or hybrid block. A/B scheduling or traditional scheduling can be found within the 4 x 4 schedule to provide yearlong contact with courses such as band, orchestra, choir, AP classes, ROTC, and journalism. Providing a schedule like the modified block addresses some of the concerns expressed about learning gaps, since some classes will meet every day. A modified block or hybrid block

provides a blend of different models, where modules make up the school day (Imbimbo & Gilkes, 2009). Kenney (2003) related the hybrid block schedule to the combining of longer and shorter periods of time to accommodate particular challenges associated with some classes that work better with longer periods while others may not. Some courses can take full advantage of having the lengthier amounts of time and other courses may work better with the shorter time periods. The need of the campus must be evaluated and a hybrid schedule can be adjusted to fit that need. Boarman and Kirkpatric (1995) share the success of a large suburban high school in Maryland that has been successful in using a hybrid schedule. Since every class was not amendable to the same cure, the hybrid schedule became the solution to what this high school was facing. Another hybrid schedule was reported to have been successful by Shortt and Thayer (1995). The schedule mentioned here allowed students to meet each day for three blocked classes and one single period that met every day for the entire year.

Hillcrest model. The Hillcrest Model is an alternating day schedule very similar to A/B Alternate, but it has one day a week when all classes meet for shorter periods (Barnes, Straton, & Ukena, 1996). This method certainly has its advantages for a school employing it. This model has the odd/even classes meeting the same alternating days of the week throughout the year (Barnes et al., 1996).

Composite block. Another type of block schedule is referred to as a composite schedule. This schedule has only certain classes blocked and the other classes remain on a traditional year-long schedule. The year-long classes are called singles or skinnies. In order for this schedule to work, students must take a certain combination of classes. For example, if students have six singles, they must have two blocks to coincide with those

courses (Childers & Ireland, 2005). Classes within the English and social studies departments may offer both block and traditional scheduled classes on the composite schedule (Childers & Ireland, 2005). The composite is similar to the hybrid schedules except it allows for more than one period to meet every day as a class.

Trimester or quarter schedule. On a trimester or quarter schedule, the school year is broken into smaller segments and courses are on a more concentrated level of instruction. The trimester and the quarter-on/quarter-off block schedule follow this type of scheduling. The trimester schedule divides the school year into three equal sections, usually about 12 weeks in length for each trimester, with two trimesters equaling one year's worth of courses taught.

The school year can also be divided into four equal sections with the quarter-on/quarter-off block schedule. Each quarter has four nine-weeks in length segments and, when using this format, two full years of courses can be completed in two quarters. Students cover in one quarter what the traditional schedule student covers in one year.

Implementing a Traditional Schedule

As mentioned earlier, the traditional schedule has its roots in the industrial period of the early twentieth century. Learning took on the form of the factory concept where teachers were expected to create a quantifiable product in a given amount of time (Khazzaka, 1997). Students were awarded credit hours when they had successfully passed the course work and these hours accumulated and went toward graduation requirements (Kruse & Kruse, 1995). When implementing this type of schedule, the structure of the school day and the school year are dependent on the schedule for both the teachers and the students (Kruse & Kruse, 1995). During the implementation of the

traditional schedule, school staff members may spend their entire time in the same room teaching the same thing. The students rotate in and out and the teacher, as the instructional specialist, passes along content to the students on a daily basis. Rote learning tends to be the dominant form of teaching within this environment. There is little to no regrouping of students on this schedule (Kruse & Kruse, 1995).

Implementing a Block Schedule

If a block schedule is considered, there are various measures schools and school districts should take prior to making their final choice. It is recommended that the block schedule is well defined for the school that will be using it. As a result of reviewing the literature, certain suggestions stand out that will help any school or district implement a positive and smooth program. Block scheduling is a means of restructuring a school and when a school goes through restructuring, the National Education Commission on Time and Learning (1994) have a few standard guidelines that can be helpful. First, learning should be the focus of restructuring, not time; second, learning should not be marked by time; third, the school day should be deemed for academic instruction; and, four, professional time and opportunities should be provided to the teachers to enable them to do their jobs well (National Education Commission, 1994). The change process must be understood and, to avoid a negative experience, the use of principles of change management must be implemented (Scheduling Policies, 2009). According to Canady and Rettig (1995), the staff must be adequately prepared for a transition to a block schedule. Personalization needs to take place; on a block schedule, students should receive instruction that matches their learning needs (Texas Education Agency, 1999).

There are strategies that must accompany an implementation of block schedule within a school that has been on a traditional schedule.

The skills and strategies must be adopted first by the educators. Teacher training must be provided in cooperative learning, class building, and team foundation (Texas Education Agency, 1999). An article suggested that the pedagogic change required by teachers is substantial and time consuming. Included in the plan should be staff development, ongoing brainstorming, problem solving, and a variety of modification. If the commitment of systematic training and support structures cannot be made, then block scheduling should not be implemented (Scheduling Policies, 2009). Chaika (2005) suggested a scheduling model that is reflective of the student and program needs of the school. Marchant and Paulson (2001) demonstrated that individual schools should consider the varied learning needs of its own students to determine what type of services and professional development will be needed for its teachers. The goal is to maximize the positive outcomes of choosing a block schedule. Marchant and Paulson (2001) found that faculty professional development is a critical piece in the success of block scheduling. Teachers should have the ability to evaluate the wellbeing of a student on the new schedule in an effort to provide appropriate support. As a result of block scheduling, a new set of challenges may surface and schools must be prepared. Understanding that all students may not benefit from the block schedule, school psychologists and counselors must be able to assist those students who may not have an academic style that matches the plan (Marchant & Paulson, 2001). The key players for block scheduling are the teachers (Scheduling Policies, 2009). Student lessons should be developed to require active student participation. In addition, transitional activities requiring students to

physically move around the room should be included within each lesson. Unfortunately, there is still an overuse of lecturing on the block schedule. Queen, Algozzine, and Eaddy (1997) reported that at least 30% of the classes examined used lecture as the main instructional tool. Implementation of a new schedule is a change process and it should be treated in that manner.

Joseph M. Carroll (1994) advised the following when handling change: do not allow the change process to dominate too long; base the process of change on instructional research and research based evaluations; leaders must be clear in what they are executing; school within a school or pilot programs can be intimidating; and during the change process, make evaluation an integral part. Cromwell (2006) adds that schools need to beware of the gifted opposition, sequence change carefully, and limit the number of changes while ordering change strategically. As a restructuring endeavor, block scheduling involves a change and response from students and teachers up through the myriads of school bureaucracy. Money and time are necessary to prepare the teachers for the transition. Agreeing with research previously stated, Fitzpatrick and Mowers (1997) found that staff development was a crucial element in making the block schedule work. Holschen (1999) evaluated a school in Wisconsin and shared data that demonstrated a high cost for the school to host consultants and experts to share instructional strategies. They paid the teachers for additional hours of work to revise curriculum and syllabi and it was done because it was considered to be an important link to a successful transition (Holschen, 1999). Overall, schools providing the staff development have a more successful program. King (1978), in his study of Ontario schools, supported the idea that staff members were more pleased with a change to block scheduling when they were

involved in extensive staff development. Salvaterra and Adams (1995) provided a comparison between two schools: one received appropriate staff development in preparation to a switch to block scheduling while the other did not. Unsurprisingly, the school that did not receive the staff development did not have a successful block scheduling program (Holschen, 1999).

There were situations, however, where block schedules were implemented and there was no need for the extensive professional development for the teachers. For example, Donald Hackmann (1995), who implemented block scheduling at a middle school in Missouri, stated that though the teachers felt they needed the extensive staff development, they agreed that they were better prepared when they simply jumped right into it. Teachers were encouraged to rely upon their experience of expertise and collaborative lesson planning. A member of the board of education in Toronto, reported that teachers who were surveyed at four 4x4 block semester schools felt little in-service training was necessary (Kramer, 1997). These teachers did not have training; therefore, they could not compare jumping into block scheduling with another alternative.

Finally, Jenkins, Queen, and Algozzine (2002) suggested a list of tools that must be present in order for block scheduling to be successful, and the list included the following: continuous staff development must be provided to all teachers throughout the year; the educational leaders must develop a means of monitoring the implementation of instructional strategies and enforce time management; disciplinary action against the teachers must be utilized when teachers are unwilling to use basic principles and procedures to increase the effectiveness of the block scheduling; ineffective teachers must be helped and have administrative intervention; colleges of education should be

aware of the necessary tools teachers need upon graduating from college to teach effectively on block scheduling; and there should be effective training one to two years prior to a school switching to a block schedule. The list provides insight into how the block scheduling could be applied. The list indicates that in order for block scheduling to be successfully implemented, there are given steps that must be followed. Also, several types of instructional strategies should be utilized, such as cooperative learning, scaffolding, collaboration, and group discussions. The literature review does not indicate that all researchers are in agreement with the proposed list by Jenkins, Queen, and Algozzine.

Advantages of Traditional Scheduling

Schools have used the traditional schedule for many years and there are some aspects of the traditional schedule that makes this type of scheduling advantageous. For example, students have contact with their teachers daily; overall, more in class time is available to the students; and shorter periods are better suited for students who suffer from attention deficit disorder and other disabilities. Schools are competing with MTV, text messaging, and YouTube for students' attention. Therefore, the students of this era may have shorter attention spans and focus better during shorter periods. With the number of classes per day on the traditional schedule, students learn to balance their schedules, learn time management skills, and continuity is an important factor in traditional school scheduling (Cromwell, 2006). There are additional advantages that would reflect the traditional schedule to be a more suitable schedule.

Additional advantages to a traditional schedule include the fact that students do not fall too far behind when school is missed, teachers are less likely to water down the

curriculum because they have less daily time to teach, the schedule allows for longer lunch time, students believe the day goes faster, and, due to students not being bored, the drop-out rate decreases (Chaika, 2006). The pros for the traditional schedule are matched with a list of advantages for block scheduling.

Advantages of Block Scheduling

Positive results have occurred as a result of block scheduling. The advantages range from teacher satisfaction to school environment to student enjoyment. The advantages have been confirmed by ongoing research by a variety of researchers and institutions. As a grassroots movement, block scheduling appears to be the better choice, according to community and educational leaders. The schedule has built its momentum on its inherent logic and coherence (Chion-Kenney, 2003).

The goals of block scheduling can be viewed as advantages, especially when the goals are achieved. The goals for block scheduling are to decrease the number of class changes and transitions taking place during the course of the day, to reduce duplication and inefficiency, to lessen the number of students teachers deal with daily, to reduce the number of daily course preparations, to reduce fragmentation, to make learning environments more flexible, and to vary time based on content areas (Mistretta & Polasky, 1997). The goals of block scheduling are appealing and can induce the leaders of education to implement the schedule to receive its purported benefits.

The ability to cover material in-depth and with greater breadth on the block schedule is also an advantage. Block schedules support the tenets of learning that advocate active participation by the student. The brain can easily assimilate information that is exposed to a person over a period of time and is meaningful. Information can be

stored into long-term memory when more concrete information is added to the concepts to be learned and the learners are guided to associate it with something they already know. Teachers are able to organize the content for students on a block schedule; in addition, they are able to provide more individual attention to the students. Combining these efforts should enable the student to learn. It should provide the necessary times, and it should allow what is learned to enter long-term memory in an organized manner, making the block schedule attractive (Texas Education Agency, 1999).

As a result of the block schedule option, discipline issues have decreased and opportunity for enriching instruction has increased, providing a positive outlook for block scheduling. Deuel (1999) suggested that the school climate had improved because there was less unsupervised movement within the school. Hughes (2004) corroborated that the reduction in unsupervised movement was attributed to the students not changing as many classes during the school day. Schools running a block schedule documented a decline in referrals for discipline to the administrative offices (Shortt & Thayer, 1999). Queen and Isenhour (1998) concluded that there had to be a relationship between discipline and fewer class changes.

Queen and Isenhour (1998), along with the Texas Education Agency (1999), listed several advantages to the block schedule: proportionally, classroom administration time is reduced due to the lengthened class period; minimization of the effects of student transitions and less movement between classes or locations preventing loss of instructional time; greater continuity within the lessons; the students are able to focus on fewer courses; teachers have additional planning time; students have less make up work when absent from school; students who have needs such as remediation, or who fail

during the first semester, are given the opportunity to repeat the course the following semester; there is room for acceleration; and enrichment for advanced students. Many schools, using a block schedule, have the option to offer a diverse selection of classes. As these opportunities are experienced by individuals involved in block scheduling, the climate of the school is improved (Queen & Isenhour, 1998).

Marchant and Paulson (2001) found that block scheduling improved students' school functioning, relative to the school climate, management of class work, and discipline. Reid (1995) acknowledged that a school has a more relaxed but academic focused atmosphere with a block schedule. King (1978) mentioned that advocates of a block schedule noted that there was an improvement in attendance. Thus, the components of block scheduling can impact the climate of the school in a positive manner.

Block schedules provide an opportunity for schools to offer a variety of teaching strategies, course offerings, and practices to their students. Jenkins et al. (2002) explain this is an opportunity for teachers to change instructional practices by engaging students in more active classroom activities. Teachers have the opportunity to employ a variety of activities, such as audiovisual experiences, projects, discovery learning, peer coaching/peer tutoring, technology, simulations, role playing, and integrated/thematic teaching within a single class period to enhance the student's experience during a block class period (Jenkins et al., 2002). Winans (1997) found that motivation increased with the increased use of cooperative learning. Students were provided more time to apply problem solving skills, teamwork, time management, and consensus building. The

research has given positive feedback on the implementation of block scheduling and improvement of classroom instruction.

Queen (2001) concluded that the students could feel more relaxed in the school atmosphere, as the curriculum improves. More classes were offered to students, while their actual class load per day was lowered (Chion-Kenney, 2003). Through the use of block scheduling, more students completed advanced placement courses (Queen, 2001). Rettig and Canady (2003) demonstrated that the block schedule could be used to delay courses to allow students more time to mature or until their skills in reading, writing, and math are improved. The school could decide to place a student in an alternative course that would have him double dipped in a subject prior to taking the course firsthand, when it was a tested area according to the mandates (Rettig & Canady, 2003).

Queen (2001) acknowledged that in one scenario the block schedule was adopted with apprehension, but after the actual implementation there was an increase in its support from 33% to 80%. There was an increase from 52% to 87% in teacher satisfaction as a result of switching to the block schedule (Queen, 2001). The efforts of block scheduling became more popular and accepted not only in the class room, but there is data indicating that the schedule is advantageous to the media services found within the block schedule school.

Media centers have experienced an increase in support, especially with technology (Huffman, Thurman, & Thomas, 2005). Schools have increased the number of computer workstations as a result of the increase of student's visiting the media center. Huffman, Thurman, and Thomas (2005) reported that students who had a block schedule spent more time in the library for leisure reading and to check out material. Rettig and

Canady (2003) pointed out that teachers on a block schedule utilized technology more as an instructional tool. The longer class periods welcomed interactive learning (Queen & Isenhour, 1998).

The attitudes and feelings of teachers regarding how block scheduling has impacted them has been evaluated (Hughes, 2004). Teachers who were surveyed emphasized that the scheduling was successful, because it enabled them to implement a variety of new teaching techniques and provided room for evaluating students employing a variety of methods of learning, while allowing for students to receive more individualized attention (Deuel, 1999). The improvement in student attendance, classroom behavior, and motivation served as positive experiences for teachers who taught on a block schedule (Deuel, 1999). Teachers are only faced with three preparations and three classes per day, relieving them of stress and allowing them to be more energetic and better prepared (Hughes, 2004). Thus, the effect that block scheduling has on teachers has been positive for many. Physical education teachers commented on how physical fitness has improved and how much more emphasis can be placed on fitness, skill development, and practice opportunities with the longer class periods (Rikard & Banville, 2005).

Rettig and Canady (2003) found that teachers spent more time on preparing lessons and offering more excitement in the classroom with the extended class periods than with the shorter periods. They were able to improve the quality of instruction and learning with manageable workloads. Irmsher (1996) acknowledged that a manageable workload would result in less stress for the teacher. Schunk (1996) added that teachers were able to cover material in greater depth and breadth, and student long term memory

processes were improved with the greater amount of instructional time provided by the teachers. In addition to the improvements found within the classroom, Salvaterra and Adams (1995) reported that teachers were provided with the opportunity to collaborate and share ideas with their colleagues as the block schedule was mastered.

Students also experienced advantages that may not be of interest to school administrators and teachers. For example, with block scheduling, students are given the opportunity to graduate earlier than predicted and students have the option of enrolling in advanced and specialized courses of interest (Deuel, 1999). Nichols (2005) conducted a study that found that students on a block schedule did better academically in the language arts. In an extended class period it was suggested that students have the necessary time to dig deeper into details of the lessons taught each day (Hughes, 2004). The block schedule allows students to have to concentrate only on four classes nightly, reducing the amount of homework prescribed. The at-risk students' schedules can be adjusted so they have only two major academic blocks per semester and they can focus their attention on the two academic courses (Childers & Ireland, 2005).

The advantages that are mentioned and observed with the block schedule should have a connection with how well students are achieving. The literature has provided confirmation in this area as well. Deuel (1999) presented data showing students earning more A's and fewer C's, D's, and F's in advanced mathematics courses when they were on a block schedule. Delaney, Toburen, Hooton, and Dozier (1998) found that students' reading and math skills increased as a result of block scheduling. Trenta and Newman (2002) suggested that there was a positive trend in the four academic subject areas, but there was no significant relationship between block scheduling and cumulative GPA.

Patricia Wasley (1997) found some students who commented that they enjoyed the block schedule because the longer classes provided time to complete homework during class time. The block schedule enables teachers to accommodate students' different learning styles and facilitate individualized instruction (Texas Education Agency, 1999). This leads to students obtaining more information, having the ability to recall it, and using it more. Students are usually excited about seeing fewer teachers in one day and during any given term. The number of students on honor roll has improved as schools switched from the traditional schedule to a block schedule. Students find homework to be less of a stress factor when on an alternating day block schedule, because they have two nights to complete the longer homework assignments (Huff, 1995). The block schedule has had a positive effect on many students. However, everyone has not had the same encounter with block scheduling and there are those who find challenges associated with the longer class periods (Huff, 1995).

Disadvantages of Traditional Scheduling

There are arguments that suggest that the traditional schedule is the way to educate students. However, just like every story, there is another side. The disadvantages of the traditional schedule involves the more obvious situations, such as students have more classes to prepare for, resulting in more textbooks being taken home on any given night. Students can have five to eight different assignments. Students may change classes up to eight times, meeting with eight different teachers. One school night may require a student to have to study and prepare for multiple tests. Each day, the students could possibly face up to eight classroom environments, eight different classroom expectations, and eight classroom rules (Cromwell, 2006). The students'

schedules are crowded, leaving little room for electives. The schedule does not meet the criteria of offering higher amount of credits when on a six period day schedule. Throughout the school day more students are in the halls due to several class changes (Cromwell, 2006). As a result of the increased class changes, more fights occur and more students coming late to class are experienced. The class time for each individual subject is reduced on a daily basis. In-depth learning is lessened, resulting in more surface learning. Teacher and student workloads are increased. There is no resemblance to college-type schedules when classes are offered year round. Due to less class time, committed teachers are limited in their excitement and productivity. Finally, administrative duties are increased, as is the social time for students (Matthews, 2008).

Disadvantages of Block Scheduling

Though there are a number of advantages identified with block scheduling, there are perhaps equal numbers of disadvantages. The main challenge of block scheduling is the first year of implementation (Childers & Ireland, 2005). Time needs to be allotted for teachers to collaborate to discuss classroom management and instructional strategies (Delany, Toburen, Hooton, & Dozier, 1998). There is a need and time factor that must be available for teachers to implement a variety of teaching strategies; often, however, there is no incentive to encourage teachers to find new ways of teaching on the block schedule (Hughes, 2004). In block scheduling, the class period is longer and the school year or semester for instruction loses time when a school chooses block scheduling (Nichols, 2005). For example, the actual contact hours a student spends sitting in a class is lessened when comparing the block schedule to the traditional schedule. Consider the following math class: 90 minutes in a class for 90 days of a school year yields a total of

8100 contact minutes, whereas, 50 minutes in a class for 180 days (total number of school days in the state of North Carolina) of a school year equals 9000 contact minutes. On the block schedule, teachers lose approximately 900 minutes of instructional time per year.

There were noticeable negative impacts of the block schedule on teachers. Jenkins et al. (2002) examined teacher use of a variety of instructional practices. They looked at the frequency of lecture/direct instruction, use of small groups/structured pairs, and cooperative learning. The study compared the amount of use of each of these instructional methods between teachers on a block schedule and those on a traditional schedule. The conclusions showed that there was no significant difference found among the teachers' practices. Specifically, the conclusions indicated that the traditional-schedule teachers reported similar or slightly lower use of these strategies, showing that teacher practices are not influenced greatly by the schedule (Jenkins et al., 2002). To know that teachers are using the same lecturing techniques found on the traditional schedule is a practical disadvantage because it should be that teachers on the block schedule are including a variety of instructional methods in their classes (Texas Education Agency, 1999). One cause of teachers not taking advantage of the instructional practices that would complement the block schedule is that teachers are not always prepared to make a smooth transition to teach on block schedule (Mistretta & Polansky, 1997). If teachers are not using the time effectively, students are not going to stay focused and they will become bored or students will spend time in class doing homework (Chion-Kenney, 2003). The danger in teachers neglecting to use learning activities and teaching strategies is a waste of instructional time (Queen, 2001). The

scheduling issue and lack of teacher training has resulted in less time to cover state mandated curriculum needs and causing overcrowded vocational classes, both of which are viewed as disadvantages of block scheduling (Winans, 1997). Another disadvantage associated with the A/B block scheduling, which is not a part of this study, is that students tend to forget what they had learned from one class setting to the next (Chion-Kenney, 2003). As a result of the literature review, the pendulum for and against block scheduling continues to swing because there are disadvantages present with the block schedule in a variety of areas.

The disadvantages must be further explored and evaluated as they relate to student achievement in biology. Nichols (2005) conducted a study on pre- and post- block scheduling on student achievement. In his study, Nichols (2005) concluded that students who performed low before the block schedule was implemented continued to perform lower than their peers after the implementation of a block schedule. It was noted in the study that high-income students began to see improvement after time passed on blocked schedules (Nichols, 2005). Nichols' (2005) study provided the basis for further research because there could be different effects on different students from the implementation of a block schedule versus a traditional schedule in certain subject areas, such as biology.

In the sciences, Maltese, Dexter, Tai & Sadler (2007) conducted a study that revealed no significance in the percentage of students passing science courses in college between those on a block schedule or on a traditional schedule in high school. Often, when students are asked, they did not attribute success to the daily schedule of the school, but rather on the teacher's individual role with them (Maltese et al., 2007).

Harvard evaluators conducted a study of students on the Copernican Plan, which consisted of students completing three intensive trimesters in one year. The findings suggest that there were no significant differences in the test scores of students on schedules with such gaps in them and those who were on traditional schedules. In addition, the study noted that students do not put in double the amount of time on homework in classes that meet twice as long (Holschen, 1999).

Lack of attendance to class can be an issue when considering a block schedule. Student transfer can be a problem on block schedules, because a student can come from a traditional schedule and not be able to complete the class he or she began at the start of the school year (Hughes, 2004). Missing days of school add to the attendance challenge. When a student misses one day on block schedule they are missing the equivalent of two class periods (Mistretta & Polansky, 1997). This makes it more difficult, because one day equates to two missed days of instruction in that area on the traditional system. Other problems arise with teachers' absences, finding substitute teachers to work effectively with students for a 90-minute period of a course like physics is also challenging (Chion-Kenney, 2003). One of the greatest criticisms of block scheduling is teachers' lack of employing methodologies that encourage movement and active participation by the students during the extended class periods (Maltese et al., 2007). In a study, Maltese et al. (2007) supported this contention that teachers on block schedules did not differentiate instruction to match the extended time given by being on such a schedule.

Cromwell (2006) identified several potential problems of block scheduling. The creation or acceleration of certain educational problems will take place; for example,

teachers tend to continue lecturing within the extended class periods, rather than engaging the students in active learning; students' lack of attendance to class creates problems with making up missed work. Certain block schedules bring challenges to sequential courses, such as French I taken in the fall semester and French II taken the following year in the fall; in addition, some districts have ruled that teachers be paid more since they will be required to teach six different classes instead of five courses.

Hackmann (1995) shared that faculty during the first year working under the block schedule had lost morale. One possible reason was that teachers were working long hours rewriting lesson plans and analyzing how effectively they could implement the new teaching techniques (Holschen, 1999). Students had problems with organization and in maintaining attention for the extended class period. Low achievers tended to be those most displeased with the block schedule because the workload, to them, was a greater stressor; they mentioned the difficulty in keeping up with homework and the hard time catching up after being absent from school. These students felt teachers did not hold their attention very well, it was difficult to concentrate, it was overwhelming to freshmen, teachers assigned more homework, and they had a hard time budgeting their time (Marchant & Paulson, 2001).

Block Scheduling impact on Science Education

The literature review thus far has discussed the details of the pros and cons of school block scheduling versus traditional scheduling. The data presented looks at overall student achievement in a variety of subject matter, again with inconsistent data and revealing that certain subjects favor block scheduling over others (Elmore, 2002). Depending on the subject matter, teachers have responded differently to block

scheduling. If the attitudes of teachers can be affected differently, perhaps data and student achievement can be impacted differently.

The reasons schools choose an alternative schedule are evident. The concerns associated with a "Nation at Risk" have caused school officials to grapple with how instructional time is used in school (Gullatt, 2006). Even President Obama has suggested that in order for this generation of students to remain competitive, more time needs to be spent in school (Ramirez, 2009). The choice of many school leaders was one that involved increasing focus on fewer academic subjects at a time, to provide more electives for high school students, to provide more vocational subjects or more advanced (AP) courses, and to improve school safety (Gullatt, 2006). To satisfy this type of choice, schools have adopted schedules that lengthen the amount of time a student spends in a particular class. In a subject such as science, this seems ideal because it provides more time for the students to engage in extended investigations, including labs (Maltese et al., 2007).

The impact the schedule is having on the various subjects offered within the school varies. For courses such as science, seeking a means of involving more students in learning and allowing teachers to act as facilitators, the block schedule was favored (Gullatt, 2006). The longer class periods are seen as a vehicle to create an environment that is more student-centered. However, Veal (2000) found under the block schedule that teacher-led instruction continued to prevail in science education, though science teachers made use of more student-centered instruction. Bain and Bain (2010) did a study examining the effects of trimester block scheduling on the science curriculum and found that science teachers were concerned because the schedule did not leave room for

remediation. The science teachers, along with the math teachers, expressed that the schedule was too fast and they were dragging students along. Lecturing was found to be the pre-dominant mode of instruction; these studies suggested that teachers were trying to cover the content more than anything else.

Another study compared a traditional teaching sequence of four distinct lessons with a block schedule teaching sequence, introducing students to the ecological adaptation of the water lily (Randler, Kranich, & Eisele, 2008). As new curriculum in science education places more emphasis on methodological skills and experiments, the researchers sought to compare the effectiveness of the time allotted for covering the objective (Randler et al., 2008). Randler, Kranich, & Eisele (2008) came to the conclusion that the block schedule unit did not reveal superior effects in terms of retention of the information. Further, it was observed that there were significant differences in the performances of the traditionally scheduled students over the students who went through the lesson in blocked classes (Randler et al., 2008). The researchers also came to the conclusion that both educational approaches are capable of teaching the content of ecological adaptations. These findings add to the contrasting results of most studies conducted to determine the effects of block scheduling on learning. There are several authors who found traditional teaching to be favored over the block schedule and these authors include Lawrence, McPherson, and Terrazas. On the other hand, such authors as Deuel, Knight, and Deheon found that the block schedule produced better performing students. One study looked at how well students were doing during their first semester in college science depending on the type of high school schedule they had completed. This study reported that students who completed high school science on a

block schedule were not better prepared for science on the college level than students who completed science in high school on a traditional schedule (Dexter, 2006).

Some science teachers saw the blocked instructional time as an opportunity to use a more hands on approach to teaching science (Gullatt, 2006). Though there have been positive outcomes when a block schedule has been implemented, some schools have changed their minds concerning block scheduling and have moved back to a more traditional schedule (Gullatt, 2006). Again, the results and outcome of the school scheduling has shown an inconsistent ending.

Block Scheduling and Special Student Populations

The results of the studies reported concerning block scheduling tend to discuss student populations without any group distinctions among the students. Perception has been evaluated and teachers tend to agree that more in-depth coverage of material can be covered with block classes (Rikard & Banville, 2005). Block scheduling has been adopted as more of a grassroots movement without the support of federal government mandate and without solid evidence that it favors student achievement (Chion-Kenney, 2003). There are populations of students who may respond differently to block scheduling. The population of the average classroom is changing. By 2050, it has been predicted that 50% of the U.S. school population will consist of African-American, Hispanic, and Asian students (Li & Hasan, 2010). Additionally, on the secondary level, students with high incidence disabilities are becoming more common (Weller & McLeskey, 2000), adding another array of diverse students to be educated in the public school system. It has been suggested by a variety of authors that block scheduling is

promising in educating students with disabilities; however, extensive research has not been done on this topic (Weller & McLeskey, 2000).

Weller and McLeskey (2000) conducted a study to see how well the benefits of block scheduling were for students with disabilities. The study focused more on the teachers than the students. A review of the list of benefits and challenges that evolved from this study is similar to the pros and cons of block scheduling from almost any other study. For example, teachers in this study commented on how effective team teaching was for the transition; the ability for students to take two more classes per year; how more student centered activities were conducive to learning; changes in teaching strategies provided benefits unique to students with disabilities, which included resource classes being enhanced; and the idea that inclusion and block scheduling fit together well (Weller & McLesky, 2000). The challenges, again, are similar to those heard when block scheduling is discussed in general. The challenges reported included organizational techniques needed to be improved by teachers and students; there became a need for teachers to communicate more effectively and frequently; student absences became more of a hindrance; and the unique challenges identified for students with disabilities included the fact that adjustment for some students was more difficult due to the need for support from resource classes and all students did not have access to the support of resource classes (Weller & McLesky, 2000).

One study compared the effects of traditional schedules and block schedules on the academic achievement of students with and without disabilities. This study collected data on GPA, state-mandated tests in reading, language, math, science, and social studies, and college entrance ACT to measure achievement. The data revealed that students with

disabilities on a block schedule performed no differently than their counterparts on a traditional schedule. The authors had interviewed and analyzed the teachers' instructional methods and found that teachers on both types of schedules were satisfied with the job they performed as teachers and spent about the same amount of time utilizing various instructional methods. The collaboration between the regular education teacher and the special education teacher was about the same between both schedules, supporting the idea that moving from a traditional schedule to a block schedule does not guarantee a shift in instructional practices or in academic gain (Boetge et al., 2003).

There have been positive claims as a result of block scheduling implementation and students with disabilities programs. Boetge, Gugerty, Serlin, and Moon (2003) found that block scheduling increased academic achievement and helped engage students who were at risk of failing or dropping out in classroom activities. This benefit was extended to students with disabilities. The needs of students with disabilities could only be met in an atmosphere where student centered activities are supported. The length of block scheduled classes provided the necessary time to have an interactive classroom for the student. Combining the inclusion of students with block scheduling and facilitating learning will set a firm foundation for educating students with disabilities (Weller & McLesky, 2000).

In addition to students with disabilities, there is another population of students whose progress draws interest when discussing the effectiveness of a school's schedule on student achievement. This group includes the minority population of students found within schools. Prior to schedule changes and block scheduling, there have been achievement gaps in science between students of different ethnicities (Johnson, 2009).

There are numerous studies that have been completed to note how minority students are doing compared to their Caucasian counterparts. Many of the studies demonstrate that minorities' improvement can take place through teachers changing their instructional practices (Johnson, 2009). This type of information leads one to believe that the type of schedule adopted by a school can influence the achievement of these minority students.

Literature provides a large quantity of studies to suggest the existence of an academic achievement gap between African-American and Caucasian students (Bacharach, Baumeister, & Furr, 2003). The achievement gap is present; therefore, a study that examines test results of minority students on the two types of school schedules proves to be necessary. Oftentimes, data examining the effects that secondary education is having on the achievement of African-American students and Caucasian students deals with scenarios that have all schools from a particular district within a state, or data that is obtained after a federal initiative, or the practice of unique educational intervention programs have been implemented (Bacharach et al., 2003). Therefore, data independent of these specific circumstances can add to the literature, providing insight into how African-American students are progressing and how school scheduling is impacting this progress. The population of schools shows an increase in minority presence within schools over time. Educators must become committed to improving the education of minority students (Li & Hasan, 2010).

Literature reveals that minority students are not achieving on the same level in science as Caucasian students. When the school schedule is being examined, it would be important to evaluate its effects on the achievement of minority students to see if scheduling has a significant role. The anticipated data may provide evidence to evaluate

whether or not African-American students favor one schedule over another. This study was designed to add to the research data related to how class schedules effect the achievement of African-American students.

General Results and Summary

Though there are a few states, such as North Carolina and Virginia, that have schools that have been on block schedules for four or more years, there is very little data to show whether or not the block schedule is impacting testing results of schools in a more positive way than the traditional schedule. Unsurprisingly, Jenkins et al. (2002) found that block scheduling in itself does not promise that instructors will use alternative instructional methods, because teaching techniques are utilized differently by different teachers on block scheduling. Thus, teachers may not be taking advantage of the extended class time. As a result, the academic experience of students on a block schedule may not differ much from the experience of students who are educated on a traditional school schedule. The results of testing can lead to some conclusions about which type of schedule is having a more positive impact on student achievement. The climate of the school and teachers' perspectives has been the focus up to now, but with legislation like No Child Left Behind, it is necessary to evaluate the testing results and compare results based on the type of school scheduling, including students with disabilities and minority students.

Results of the literature review indicated that students, who were average or above average, were satisfied with their achievement, and these same students had the highest support for block scheduling (Marchant & Paulson, 2001). Lower achieving students believed school was important; however, they were displeased with their grades

when they encountered difficulty in managing the block schedule. It is important to differentiate which students may function positively within the block schedule and which may not. The lower performing students' progress may not mesh with the characteristics of block scheduling, and it is these students who require more attention by the school (Marchant & Paulson, 2001). Block scheduling is a good idea, but more research is needed to determine whether there may be some students who may not benefit from that type of structure (Marchant & Paulson, 2001). There are educators who argue that altering the use of time for teachers will result in teachers changing their programs and practices (Evan, Tokarczyk, Rice, & McCray, 2002). Though the changing of the school schedule and time usage has become a big issue for many schools, the changes do not suggest that it has changed the practices of the teachers (Elmore, 2002). The data released so far does not show that there is a positive relationship between block schedule adoption and student performance (Elmore, 2002).

Current research indicates that students with disabilities and minority students' benefits with block scheduling are comparable to the general student population. The major purpose of block scheduling is to increase student achievement, despite student background (Shortt & Thayer, 1999). When looking at or collecting data to evaluate the effects of school scheduling on student achievement, a small percentage of studies targeted more at risk populations. However, the result of surveys and questionnaires has been that block scheduling must be agreed upon by teachers and administrators in order to have a positive impact on at-risk students (Shortt & Thayer, 1999).

The impact of block scheduling on science classes has not reported any significant results. Using a survey, one study conducted looked for teaching variations and

surprisingly found that science teachers on a block schedule used similar teaching techniques as teachers on traditional plans (Maltese et al., 2007). The different scheduling formats did not produce significance in the data when students' achievements in introductory science college level courses were used as the instrument (Maltese et al., 2007). An important conclusion proposed by Maltese et al. (2007) was that block scheduling did not equally address the needs of students. In science college preparation, higher performing science students were advantaged while lower performing students were disadvantaged. This type of finding lays the foundation for what this study sought to evaluate. This study investigated how students with disabilities and African-American students were doing on standardized testing on a block schedule versus a traditional schedule.

Block scheduling has provided solutions to time allotment issues in education. This remedy for improving student achievement is still under review. The literature has provided an analysis of what effects block scheduling has on the atmosphere, climate, and discipline of the educational institution. Block scheduling has proponents for its ability to allow flexibility in the school day compared to the traditional schedule. The learning environment has improved with the implementation of block scheduling, because the flexibility allows for the use of varied teaching methods and a reduction in negative student issues (Hughes, 2004). Block scheduling has impacted education and it continues to be observed, analyzed, and discussed in educational research. The literature review demonstrated that there are still gaps within the data concerning the impact the school schedule is having on student achievement. Though there have been studies looking at African-American achievement in science and students with disabilities'

achievement, there was still a need to look at the achievement of these subgroup of students more narrowly in terms of school scheduling and how it is influencing the test results of students.

Chapter Three: Methodology

Introduction

This study was designed to determine if the type of school schedule used has any association with the student performance on the end-of-course biology assessment given in North Carolina high schools in the year 2009-2010. The number of students on a 4 x 4 block schedule that were proficient on the North Carolina Biology End-of-Course test was compared to the number of students on a traditional six or seven period day school schedule who were proficient on the same test. Statistical analysis was utilized to determine if there were any significant relationships present between the number of students who were proficient on the standardized NC Biology EOC test and the type of schedule, whether block or tradition. Data from the North Carolina Report Card for each school for the 2009-2010 school year were compiled to provide further implications of the study within the discussion section of Chapter Five (see appendix for school profiles). The researcher obtained the number of students who were proficient for all of the schools in the state of North Carolina that operated on a 4 x 4 block schedule or a traditional schedule on the Biology EOC test. The study was then limited to the results of forty schools, because of the limited number of schools that were identified as running a traditional six or seven period day schedule. The traditional scheduled schools were aligned with 4 x 4 semester block schools that were similar to them in student population and demographics. The quantitative nature of this study allowed the researcher to analyze for differences between the independent variables, traditional scheduling, and block scheduling. With the limitation of the inability to manipulate the experimental

conditions, a causal-comparative design was appropriate to provide the cause and effect between groups (Gall, Gall, & Borg, 2003). Finally, the number of proficient students from each subgroup was statistically compared from the schedule type, either block or traditional.

Design

This study utilized data obtained from archival testing databases linked to the NC DPI website entitled Reports of Disaggregated State, School System (LEA), and School Performance Data. The North Carolina Report Card site for each school was reviewed to identify each school. This website also confirmed each school was a public school and offered grades 9 through 12. The researcher did not use data for schools running other versions of block scheduling. The purpose of this study was to compare the number of students who were proficient on the NC Biology EOC test in 40 high schools in North Carolina on 4 x 4 semester block schedules to the number of students who were proficient on the same test in high school on traditional six-period or seven-period class schedules. The number of students who were proficient on the test for two subgroups were also included from each schedule type. The research attempted, using a causal-comparative study, to see if the type of scheduling had any impact on the number of students who were proficient for each school (Gay & Airasian, 2003). A causal-comparative study was utilized, because the study sought to test hypotheses concerning the relationship between the type of school schedule and the number of students who were proficient on the NC Biology EOC test. The type of schedule the school ran was not controlled and changes in the variables had already taken place (Ary, Jacobs, Razavieh, & Sorensen, 2006). The interest in this study stems from the number of

schools and school districts that have chosen a block schedule over the traditional six or seven period days. The decision to place schools on block scheduling was supported by research that suggested that block scheduling provided benefits to the school day not observed in the traditional schedule (Shortt &Thayer, 1999). The literature indicated a lack of research on certain sub-group of students' achievement; therefore, the study evaluated the effects of 4 x 4 block schedule and six or seven period traditional schedules on the proficiency rates of African-American students and students with disabilities, in addition to the general population. Again, the investigation is ex post facto and the schools were selected based on the following criteria: a NC public school offering grades 9-12 and offering the NC Biology Standard Course of Study curriculum and the school schedule reflected one of the schedules of interest in the study.

The data were categorical, meaning that the data were represented by the number of students who were proficient on the NC Biology EOC test, represented by counts in each group (Howell, 2008). The dependent variable for the first hypothesis was the number of students who were proficient on the NC Biology EOC test. The dependent variable for the second hypothesis was the number of African-American students who were proficient on the NC Biology EOC test and the dependent variable for the third hypothesis was the number of students with disabilities who were proficient on the NC Biology EOC test during the 2009-2010 school year. The independent variable for each hypothesis was the type of school schedule adopted by the school during the year 2009-2010. Factors such as school location and demographics were considered in order to match the schools on the two different types of schedules as much as possible. The percent of students who received free or reduced lunch was considered for the school, but

was not known for the number of students who were proficient on the test. Other variables that might have influenced the number of students who were proficient on the Biology EOC test and not considered were discussed earlier in the chapter. This study only sought to compare the number of students, African-American students, and students with disabilities who were proficient on the Biology EOC test on a traditional six period or seven period school schedule to those on a 4 x 4 semester block schedule, assuming all other factors were constant. To conclude, the results of this investigation compared the number of students who were proficient on the NC Biology EOC test who were educated on two different types of school schedules.

Questions and Hypotheses

Research question 1. Are students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students who participate in a biology course on a traditional schedule?

$H_0 1_1$. There is no statistically significant difference among the number of students who were proficient on the NC Biology EOC and completed biology on a block schedule and the number of students who were proficient on the NC Biology EOC on the North Carolina biology end-of-course test and completed biology on a traditional schedule.

Research question 2. Are African-American students who participate in a biology course on a block schedule, more likely to be proficient on the NC Biology EOC than students who participate in a biology course with a traditional schedule?

$H_0 2_1$. There is no statistically significant difference among the number of African-American students who were proficient on the NC Biology EOC and completed

biology on a block schedule and the number of African-American students who were proficient on the NC Biology EOC and completed biology on a traditional schedule.

Research question 3. Are students with disabilities who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students with disabilities who participate in a biology course on a traditional schedule?

$H_0 3_1$. There is no statistically significant difference among the number of students with disabilities who were proficient on the NC Biology EOC and who completed biology on a semester 4 x 4 block schedule and the number of students with disabilities who were proficient and completed biology on a traditional schedule.

Participants

The population for this study consisted of public high schools in North Carolina that tested students on the NC Biology EOC test during the 2009-2010 school year. The schools offered biology to students in grades 9 through 12 and ran either a 4 x 4 block schedule or a traditional six or seven period schedule. If the type of schedule the school ran was not readily available, the school was contacted by phone for verification. The number of 4 x 4 schools outnumbered the schools that ran a six or seven period day; therefore, to eliminate bias and have more counts for the number of students, African-American students, and students with disabilities from the block schedule than the tradition schedule, the sample was compiled by first stratifying the schools based on schedule types. Second, from the 6 or 7 period traditional schools found, twenty were randomly selected to be in the study. Third, matching was used to choose the 4 x 4 block schools that would be involved in the study to minimize selection threat. The twenty 4 x 4 block schedule schools were matched with the randomly selected traditional schools

based on schools' population sizes. The information to match the schools were retrieved from the NC Report Cards website http://www.ncreportcards.org/src/ (North Carolina Report Cards, n.d.) and Great Schools website http://www.greatschools.org/ (Great Schools, n.d.)

Of the over 200 high schools in North Carolina, only 24 of the schools ran a 6 or 7 period day during the 2009-2010 school year. Based on the availability of the six or seven period schools' data, 4 x 4 schools were paired with them based on school size and other similarities. The forty schools included were 20 traditional six or seven period day schools that were matched with 20, 4 x4 block schools based on school size, percentages of ethnic groups (particularly African-American students), and percentages of students who received free or reduced lunch (see Table 1). A limitation faced with the matching of the schools was that the schools were not matched in terms of the percentages of students with disabilities, as this information was not available.

Within Table 1, Schedule Type 1 is the six or seven period traditional schedule and Schedule Type 2 is representative of the 4 x 4 block schools. Cells within the tables that are left blank for a school meant that information for that particular school was not available via the internet websites that were used to gather data. The schools were grouped by school size, as pre-mentioned, then matched based on similarities.

Table 1

General Descriptions of the Schools Showing the Schedule Type, Percentages of Ethnic Groups, Percentage of Student Body Receiving Free and/or Reduced Lunch, and the Total Student Population.

Pseudo-School Names	**Schedule Type**	**Total School Population**	**%African American**	**%Caucasian**	**%Free/Reduced Lunch**
School 1	1	128	----	----	----

School 2	2	240	25	69	25

Pseudo-School Names	**Schedule Type**	**Total School Population**	**%African American**	**%Caucasian**	**%Free/Reduced Lunch**
School 3	2	525	48	44	56
School 4	1	607	48	49	52
School 5	1	645	16	70	34
School 6	2	666	12	87	----
School 7	2	800	85	13	----
School 8	1	819	74	24	68
School 9	1	895	21	74	----
School 10	2	898	60	35	56
School 11	1	1002	11	87	----
School 12	2	1009	39	50	53
School 13	2	1024	12	82	----
School 14	2	1049	45	44	9
School 15	2	1064	11	86	----
School 16	1	1074	2	93	----
School 17	2	1095	25	69	25
School 18	1	1151	5	92	----
School 19	2	1184	36	48	33
School 20	2	1219	2	90	35
School 21	2	1226	8	87	----
School 22	1	1329	41	47	35

School 23	1	1344	39	49	28

Pseudo-School Names	Schedule Type	Total School Population	%African American	%Caucasian	%Free/Reduced Lunch
School 24	1	1351	20	64	15
School 25	1	1382	38	49	23
School 26	1	1442	39	49	37
School 27	2	1455	32	59	43
School 28	1	1456	18	59	12
School 29	1	1510	37	40	----
School 30	2	1585	52	27	52
School 31	1	1586	41	47	37
School 32	2	1624	7	87	36
School 33	1	1683	40	51	26
School 34	1	1715	40	52	32
School 35	1	1764	49	39	38
School 36	2	1768	30	54	----
School 37	2	1774	37	56	39
School 38	2	1820	40	47	24
School 39	1	1909	10	82	8
School 40	2	1993	21	59	----

Fifteen traditional schedule schools were rural, while only two 4 x 4 semester block schedule schools were rural. Three traditional schedule schools were located in urban areas, while 15 block schedule schools were located in urban areas. Two

traditional schools were positioned in suburban areas and three block schedule schools were in the suburbs. The school sizes consisted of two schools having populations between 101 to 250 students, four schools were within 501 to 750 students, four schools had populations between 751 students to 1000 students, 18 schools had their number of students fall between 1001 and 1500, and 12 schools were grouped with populations ranging from 1501 students to 2000 students. None of the schools had a population that exceeded 2000 students (see Table 2).

Table 2

Matching Means and Standard Deviations by Type of Schedule

Type of Schedule	***M* (% African American)**	***M* (% Caucasian)**	***M* (% Free/Reduced Lunch)**	***M* (School Size)**
4x 4 Block	31.35	59.65	45.5	1200.9
Traditional	31	58.79	28.2	1239.6
SD	0.25	0.61	12.23	27.37

The students tested were in grades 9 through 12 who took the Biology End-of-Course test in North Carolina. There were no specifications provided by the schools on the exact number of students per grade level who were tested. Biology is a course that is not limited to a specific grade level in North Carolina. However, all students must complete the course prior to graduation and the grade in which this is done will vary from student to student. Considering this and the type of data that was utilized and the goal of the study, the matching process implemented for the study provided results to determine whether or not the type of schedule, six or seven period day versus the 4 x 4 semester

block day, had any relationship to the students' proficiencies on the NC Biology EOC test.

Setting

The data compiled for this research were secured from The Reports of Disaggregated State, School System (LEA), and School Performance Data for 2008-2010 website (North Carolina Department of Instruction, 2008-2010), which is linked to the NC DPI website. Once at the site, the user can input information for the school system, school, subject, grade (if applicable), and type of assessment that is of interest. The Division of Accountability Services, a unit of the NC DPI, under the leading of Dr. Tammy Howard, maintains the site. The information is collected from all LEA's submitted executive summaries through a secure site. Rules have been written and adopted on the management of the data. Once all the data is compiled for the school year it is submitted to the state board of education for approval; approval is granted in August.

The site indicated the number of students who were proficient on the test and the number of students that were tested. The site also provided the same information for African-American students and students with disabilities. Proficient indicates that the score is at or above a level III. The site provided the following information for any school searched in the database (see Table 3). The table is showing a condensed amount of the information provided in tabulated form on the site.

Table 3

Sample Data from the Reports of Disaggregated State, School System (LEA) and School Performance Data for 2008-2010

	2008-2009				2009-2010			
Student Subgroup	**# At or Above Level III**	**# Valid Scores**	**Percent At or Above Level III**	**Avg Scale Score**	**# At or Above Level III**	**# Valid Scores**	**Percent At or Above Level III**	**Avg Scale Score**
All Students	74	89	83.1%	154.7	91	99	91.9%	154.7
Female	36	42	85.7%	154.9	38	42	90.5%	154.6
Male	38	47	80.9%	154.4	53	57	93.0%	154.7
American Indian	*	*	*	-	*	*	*	-
Asian	*	*	*	-	*	*	*	-
Black	6	13	46.2%	147.9	18	22	81.8%	151.9
Hispanic	*	*	*	-	*	*	*	-
Multi-Racial	*	*	*	-	*	*	*	-
White	65	73	89.0%	156.0	70	74	94.6%	155.6

Note: * Indicates that the student population in the subgroup is too small to report the value. Adapted from website http://accrpt.ncpublicschools.org/app/2011/disag/.

Instrumentation

Instrument's description, purpose, and scoring. The NC Biology EOC annual testing program is a component of the NC EOC tests required by General Statute 115 C-174.10 of North Carolina. The purpose of the testing program is to ensure that the minimum skills and knowledge essential for an individual to function in society are possessed by the student; to improve the delivery of instruction, by having a way of identifying weaknesses and strengths in the education process; and as an accountability measure of the education system to the public (North Carolina Department of Public Instruction, 2009). The NC EOC biology test scores are used in the growth component

and the performance composite in the state's ABC's Accountability Program. To satisfy reporting requirements in science at the high school level for the NCLB Act of 2001 under the Title I requirements, Biology EOC scores are reported.

The biology goals and objectives of the 2004 NC SCOS for science are evaluated by the NC Biology EOC. It is expected that the students who take the biology EOC tests demonstrate knowledge of important principles and concepts, comprehend and apply laboratory activities, and relate scientific ideas to everyday living applications. The revised biology EOC tests have developed items on processing information, making connections between science and technology, and scientific concepts to align with inquiry instruction and higher order thinking skills. The biology EOC tests the content objectives based on the knowledge and skills that are to be taught in all biology courses in North Carolina. The items on the test access whether a student can move above memorization to application and synthesis of process skills.

The NC Biology EOC test was used as the instrument for this study because all students in the state of North Carolina must complete the high school biology course prior to graduation. When a student completes the course, he is required to take the NC Biology EOC test. This test is not limited to a particular grade level; therefore, it is testing a wide range of students in grades 9 through 12 with varying degrees of ability.

The number of students who were proficient on the test was collected for each participating school. In order for a student to be counted as proficient, his achievement level on the test must be a level III or IV. The achievement level ranges for the End-of Course test of biology (see Table 4).

Table 4

Achievement Levels on the EOC test of Biology with its correlating test range.

Test	**Level I**	**Level II**	**Level III**	**Level IV**
Biology	Less than or equal to 137	138-146	147-158	Greater than or equal to 159

At level I achievement, students do not have sufficient mastery of the skills and knowledge to be successful at a more advanced level in the course. At level II achievement, students' mastery of the content is inconsistent and students have limited understanding of biology concepts. Students at level III consistently demonstrate mastery of the content of biology and are well prepared for a more advanced course. Students at level IV perform in a superior manner and are clearly beyond the proficient level. A raw score is determined for each student based on the number of questions the child answered correctly. To equate scores across test forms within biology, the raw score is converted to a scale score. The student's achievement level is then determined by this score (NCDPI Division of Accountability Services, 2008).

The data used indicated the number of students, the number of African-American students, and the number of students with disabilities who were proficient, based on the previous guidelines discussed. The test does not indicate the number of students who were repeating the course or who had multiple attempts at taking the test. This does produce a threat to the validity of the interpretations and results of the study; however, it produces results that create a picture of how the North Carolina schools are doing on the NC Biology EOC test now that over 90% of the state's high schools have opted to use

some form of block scheduling, with the 4 x 4 semester block schedule being the most popular.

Validity. The instrument used in the study was the North Carolina End of Course Biology Test, which had been administered to all students enrolled in biology during the year of interest. The NC EOC Biology Test has been tested for its validity in the following areas: content, criterion-relatedness, and construct. The areas have been evaluated by the creators of the EOC tests as independent components of the test (North Carolina Department of Public Instruction, 2009). During the stages of developing the test, content validity was being built into the NC EOC tests. The North Carolina Standard Course of Study (SCOS) is the basis for all instruction in the educational system; therefore, the test items were aligned with the NC SCOS. The items were not only written, but were reviewed by NC teachers who interacted with students in the classroom, before they were finalized (North Carolina Department of Public Instruction, 2009).

The creators of the items of the test are trained NC teachers and educators. During the 2004-2005 and 2005-2006 school years, trained NC teachers and educators reviewed all items on the biology EOC. In the first and second semesters of the 2006-2007 school year, the questions were field-tested. Approximately 22,000 students from randomly selected schools across the state were involved. The test became operational in the 2007-2008 school year.

In the process, teachers were asked to predict the scoring of their students prior to administering the NC EOC in biology to assess the criterion-related validity, which validates the effectiveness of an assessment in predicting the behavior of an individual in

a specific area. Writers for the test went through extensive training on the nature of the test questions. Once items were chosen, two or more certified teachers in the content area were contracted to go through and review the test questions, after they had been trained on how to assess the validity of the questions. Teachers were instructed to use the NCSCOS when analyzing the questions. For the North Carolina EOC Tests of Science, evidence of content validity is provided through content relevance and the relationship of test scores to other external variables (North Carolina Department of Public Instruction, 2009). To provide a spectrum of information for curriculum evaluation and planning, multiple equivalent forms are administered. The test consists of 80 multiple choice questions given during an allotted amount of time, not to exceed four hours within the final week (block schedule) or the final two weeks (traditional schedule) of the course.

Reliability. In order to use the information from a test, it is necessary for the test outcome to be reliable. In many cases, a reliability coefficient of at least 0.85 is desirable in order to claim that the test is reliable. The tables below indicate that the reliability coefficient for the NC EOC in Biology is 0.910 and that there is a high degree of reliability across various characteristics such as gender, ethnicity, and students with disabilities (North Carolina Department of Public Instruction, 2009). The single basic concept that the instrument was used to measure was the internal-consistency reliability. The coefficient alpha, which sets an upper limit to the reliability, was used and the values are those examined in the table for NC EOC tests. The Spearman-Brown Prophecy Formula was implemented by the State Department to retrieve calculated coefficient alpha values (North Carolina Department of Public Instruction, 2009).

Table 5

Reliability Indices Averaged Across North Carolina EOC Tests of Biology Forms

Subject	N Operational Items on Test	Average Coefficient Alpha	Range of Coefficients Alpha
Biology	60	0.910	.905 - .922

Table 6

Reliability Indices Averaged Across North Carolina EOC Tests of Biology Forms (Ethnicity)

Subject	Asian	Black	Hispanic	Native American	Multi-Racial	White
Biology	0.927	0.874	0.899	0.881	0.908	0.904

Table 7

Reliability Indices Averaged Across North Carolina EOC Tests of Biology Forms (No Disability and Disability)

Subject	**No Disability**	**Disability**
Biology	0.908	0.892

Procedures

To initiate the study, the researcher submitted an IRB proposal to the Liberty University IRB Board. Upon approval by the IRB, the data gathering process began. The North Carolina Report Card website was used to identify the public high schools of North Carolina. Individual school sites were visited and reviewed to determine the type of schedule the school operated on during the 2009-2010 school year. If the type of schedule was not located online, a school representative was contacted by phone and asked about the type of schedule used for the year of interest. Using the Reports of

Disaggregated State, School System (LEA), and School Performance Data, an electronic public database (North Carolina Department of Public Instruction, 2008-2010) identified the number of students, the number of African-American students, and the students with disabilities who were proficient on the NC Biology EOC for each school was retrieved. Students enrolled in the biology course are mandated by the state to be taught the same goals and objectives, as outlined in the NC SCOS for biology, independent of the type of schedule the school is running. The number of students, African-American students, and students with disabilities who tested were also retrieved from the site. As the information was collected, it was organized and placed into a spreadsheet by schedule type and local education agency. The proficiencies were separated for general population of students, African-American students, and students with disabilities.

Data Analysis

Based on the research questions and hypotheses, three population groups were examined. Data retrieved reflected the number of students (in three categories: all students, African-American students, and students with disabilities) who were proficient on the NC Biology EOC test for each school and completed biology either on a traditional six or seven period day schedule or on a 4 x 4 block schedule. To accommodate addressing each research hypothesis, the data were analyzed as follows.

Three chi-square tests of independence were conducted to examine the three null hypotheses. The chi-square test of independence was conducted for this study. The chi-square test of independence was applied, because the data consisted of two categorical variables, the two types of schedules (Howell, 2008). This study sought to determine if a significant association existed between the two types of schedules, block or traditional,

and the number of students, African American students, and students with disabilities, who were proficient on the NC Biology EOC test. The null and alternative hypotheses are as follows:

$H_0 1_1$: There is no statistically significant difference among the number of students who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of students who were proficient and completed biology on a traditional schedule.

$H_1 1_1$: There is a significant difference among the number of students who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of students who were proficient and completed biology on a traditional schedule.

$H_0 2_1$: There is no statistically significant difference among the number of African-American students who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of African-American students who were proficient and completed biology on a traditional schedule.

$H_1 2_1$: There is a significant difference among the number of African-American students who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of African-American students who were proficient and completed biology on a traditional schedule.

$H_0 3_1$: There is no statistically significant difference among the number of students with disabilities who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of students with disabilities who were proficient and completed biology on a traditional schedule.

$H_1 3_1$: There is a significant difference among the number of students with disabilities who were proficient on the NC Biology EOC test and completed biology on a block schedule and the number of students with disabilities who were proficient and completed biology on a traditional schedule.

To refine the accuracy of the null-condition sampling distribution of chi-square, the Yates' correction for continuity was incorporated into the chi-square tests. The Yates' correction can be applied with a *df* of 1 (Preacher, 2001).

A $p < .05$ level of significance was used for all analyses in the study determining whether or not the null hypotheses were rejected and the alternative hypotheses retained. The assumptions associated with chi-square are that each subject contributes data to only one cell and the sample size is sufficient. The chi-square test is dependent on the set of observed and expected frequencies and degrees of freedom. The effect size was evaluated using the phi-coefficient of association to discuss the degree of the correlation that exists between the two variables, the type of school schedule, block or traditional, and the number of students proficient on the NC Biology EOC test. Chi-square will indicate whether or not there is a significance between the two variables, but the phi correlation is a post-test used to imply how significant and how important the relationship is between the two variables (Lowry, 2012). The phi correlation coefficient was used, because the chi-square data was a 2 x 2 contingency table and this statistic works best.

Chapter Four: Findings

Introduction

This chapter discusses the results of the findings from this research. The results are reported by each hypothesis tested. This causal comparative study sought to determine if there were any statistically significant relationships among the overall number of students, African-American students, and students with disabilities, who were proficient on the Biology EOC tests who were taught biology on a 4 x 4 schedule and those taught biology on a six or seven period schedule during the 2009-10 school year in the state of North Carolina.

In the data reported, no corrections were made for the proficiency rates that were used. As determined by NC DPI, the included data represents the number of students who had made proficiency (either on the first administration or on retake of the test) for each school. The results for each research hypothesis tested include the Chi-square value, degrees of freedom and the calculated alpha value.

The data for this study were collected using the North Carolina Report Cards of Schools website (North Carolina Report Cards, n.d.) and the Reports of Disaggregate State, School System (LEA) and School Performance Data website (North Carolina Department of Public Instruction, n.d.). The results are the number of students who were proficient scoring a level III or higher on the NC Biology EOC test during the 2009-10 school year and the assumption was made that all other factors for each student were equal.

The public high schools identified as having a six or seven period day schedule limited the number of schools in the study. Once the six or seven period day schools were identified, public high schools that ran a 4 x 4 block semester were aligned to those schools, based on student population, percent of ethnic groups, and percent of students receiving free/reduced lunch. All schools offered grades 9-12. Due to the small number of schools that were operating on a six or seven period day schedule during the 2009-10 school year, only 40 schools were used in this study.

Demographic and Descriptive Data

The study began by securing the proficiency numbers for all students, African American students and students with disabilities for all schools in the state of North Carolina. The Disaggregated Data found on the NC DPI website (North Carolina Department of Public Instruction) provided the number of students, African-American students, and students with disabilities, who had taken the NC Biology EOC test (see Table 8). The website also provided the total number of students, African-American students, and students with disabilities, who were proficient on the test (see Table 9). For the cells left blank, the assumption was made that the school did not have students to fall into the specified subgroup. Also, in tables 8 & 9, the schedule types are coded as following: type 1 schools are the traditional schedule schools and type 2 schools are the 4 x 4 schedule schools.

Table 8

Number of Students Tested: All students, African American Students, and Students with Disabilities by School

Pseudo-School Names	Schedule Type	All Students	African Americans students	Students with disabilities
School 1	1	33	19	----

Pseudo-School Names	Schedule Type	All Students	African Americans students	Students with disabilities
School 2	2	43	8	----
School 3	2	121	53	7
School 4	1	198	73	190
School 5	1	154	25	7
School 6	2	138	123	10
School 7	2	183	157	25
School 8	1	188	120	17
School 9	1	46	11	5
School 10	2	274	195	18
School 11	1	89	----	4
School 12	2	163	83	15
School 13	2	92	47	10
School 14	2	337	148	24
School 15	2	154	18	----
School 16	1	224	----	12
School 17	2	296	63	44
School 18	1	61	----	----
School 19	2	349	96	20
School 20	2	316	----	23
School 21	2	316	26	17

Pseudo-School Names	Schedule Type	All Students	African Americans students	Students with disabilities
School 22	1	333	124	22
School 23	1	376	131	25
School 24	1	365	49	23
School 25	1	202	118	10
School 26	1	398	148	28
School 27	2	351	106	40
School 28	1	371	62	13
School 29	1	311	113	25
School 30	2	273	138	27
School 31	1	437	212	39
School 32	2	436	24	39
School 33	1	422	180	28
School 34	1	372	151	28
School 35	1	398	143	25
School 36	2	464	99	56
School 37	2	406	144	16
School 38	2	398	141	17
School 39	1	567	38	48
School 40	2	600	98	71

As Tables 8 and 9 are observed together, the total number of students in Table 8 may differ from the total numbers in Table 9. Many of the schools had students to test who did not fit in the subgroups examined in the study; therefore, total number of students may appear to be higher than appropriated.

Table 9

Number of Students Proficient: All students, African American Students, and Students with Disabilities by School

Pseudo-School Names	Schedule Type	All Students	African-Americans students	Students with Disabilities
School 1	1	22	9	------
School 2	2	43	8	------
School 3	2	103	38	4
School 4	1	149	39	149
School 5	1	145	21	2
School 6	2	96	83	5
School 7	2	163	138	23
School 8	1	106	52	2
School 9	1	30	4	3
School 10	2	194	120	6
School 11	1	79	-----	4
School 12	2	118	51	9
School 13	2	73	25	7
School 14	2	202	77	10
School 15	2	113	14	------

Pseudo-School Names	Schedule Type	All Students	African-Americans students	Students with Disabilities
School 16	1	175	-----	6
School 17	2	238	41	19
School 18	1	61	----	------
School 19	2	294	65	6
School 20	2	245	----	10
School 21	2	316	23	14
School 22	1	291	90	9
School 23	1	307	88	17
School 24	1	335	33	16
School 25	1	202	118	9
School 26	1	271	82	10
School 27	2	290	75	26
School 28	1	336	42	7
School 29	1	238	76	15
School 30	2	238	115	15
School 31	1	279	95	14
School 32	2	354	20	20
School 33	1	338	116	11
School 34	1	300	93	12
School 35	1	353	120	18
School 36	2	409	69	39

Pseudo-School Names	Schedule Type	All Students	African-Americans students	Students with Disabilities
School 37	2	341	101	8
School 38	2	398	131	12
School 39	1	567	35	48
School 40	2	600	90	63

Analysis of Null Hypotheses

Following are the results of the research conducted. Each research question and hypothesis was tested using a Chi-square test of independence. The results are given by each hypothesis tested. The results were based on a significance level of an alpha level of 0.05.

Null Hypothesis One

Research Question 1: Are students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC test than students who participate in a biology course on a traditional schedule?

$H_0 1_1$: There is no statistically significant difference on the North Carolina biology end-of-course test among the number of students who were proficient and completed biology on semester 4 x 4 block schedule and those who completed biology on a six or seven period traditional yearlong schedule.

Based on the results for the Chi-square test and an alpha level of *0.05*, the null hypothesis 1 was rejected which states there is no significant difference among the number of students who were proficient on the NC Biology EOC test and completed biology on a 4 x 4 block semester schedule compared to the number of students who were

proficient and completed biology on a six or seven period traditional yearlong schedule (see table 10).

Table 10

Proportional Data for All Students who took the Biology EOC test on by schedule type

	Proficiency	
Schedule Type	**Number Proficient (%)**	**Number not Proficient (%)**
Traditional	4584 (82.4)	976 (17.6)
Block	4828 (84.6)	882 (15.4)

Using the above data, a chi-square test of the relationship between school schedule and the number of students who are proficient yielded $\chi^2(1) = 8.93$, which is statistically significant at $p = .003$. This is associated with a phi coefficient of 0.03. The measure of effect indicated by the level of phi is low, as the coefficient nears 0 means a weak relationship (Ary et al., 2006). The difference observed in the number of students, who were proficient is not attributed only to the type of schedule. However, the percentage of the number of students who were proficient was higher for the students of the general population who learned biology on the block schedule.

Null Hypothesis Two

Research Question 2: Are African-American students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC test than African-American students who participate in a biology course on a traditional schedule?

H_02_1: There is no significant difference between the number of African American students who are proficient on the North Carolina biology end-of-course test and completed biology on semester 4 x 4 block schedule and those who completed biology on

a six or seven period traditional yearlong schedule.

The second null hypothesis was rejected. Using the data collected as organized in table 11, a chi-square test was applied.

Table 11

Proportional Data for African-American Students who took the Biology EOC test by schedule types

	Proficiency	
Schedule	**Number Proficient (%)**	**Number not Proficient (%)**
Traditional	1113 (64.8)	604 (35.2)
Block	1284 (72.7)	483 (27.3)

In analyzing the data for the second hypothesis, there is a significant relationship among the number of African-American students who were proficient on the end-of-year test, depending on the type of school schedule followed. The chi-square tested whether or not a relationship was present and the results produced $\chi^2(1) = 24.59$, which is statistically significant at a $p < 0.001$. This is associated with a phi value of 0.08. Based on the criterion of the coefficient's value there is a weak relationship that existed between the type of schedule and the dependent variable, the number of students, who were proficient on the NC Biology EOC test. The research hypothesis failed to be rejected and the percentage of African-American students who were proficient on the block schedule was greater than the percentage of African-American students who were proficient on the traditional schedule.

Null Hypothesis Three

Research Question 3: Are students with disabilities who participate in a biology course on a 4 x 4 block schedule more likely to be proficient on the NC Biology EOC test

than students with disabilities who participate in a biology course on a traditional schedule?

$H_0 3_1$: There is no significant difference on the North Carolina biology end-of-course test between the number of students with disabilities who were proficient and completed biology on semester 4 x 4 block schedule and those who were proficient and completed biology on a six or seven period traditional yearlong schedule. To evaluate the significance of the third hypothesis the information was analyzed using a chi-square test (see Table 12).

Table 12

Proportional Data for Students with Disabilities who took the Biology EOC test by schedule type

	Proficiency	
Schedule	**Number Proficient (%)**	**Number not Proficient (%)**
Traditional	352 (64.1)	197 (35.9)
Block	296 (61.8)	183 (38.2)

There are a higher percentage of students with disabilities on the traditional schedule who were proficient on the test; however, the results were not statistically significant. The chi-square produced the following results. The $\chi^2 = 0.50$, which is not statistically significant at $p = .48$. This is associated with a phi value = 0.02. The value for the phi coefficient is approaching 0 indicating a weak relationship between the independent variables, type of schedule and the number of students with disabilities, who were proficient on the NC Biology EOC test.

After examining the results of the chi-square tests ran, the researcher reports for the three hypotheses tested, that the reported *p* values of the first two hypotheses is smaller than the stated alpha level of *.05* making it understood that the null hypotheses were rejected. However, the third null hypothesis failed to be rejected due to an alpha level greater than *.05*.

Summary

The chi-square test was applied to examine the nominal data of this study. When using chi-square, two assumptions were made. The assumptions include: the data entries were random and independently selected and the number of students who were proficient was measured as frequencies, greater than one. Basically the chi-square test allowed for the comparison of the observed frequencies of the number of students who were proficient on the biology EOC test with the expected frequencies. The nonparametric test allowed the data to be analyzed for significance. Chi-square was used to reject or fail to reject the three null hypotheses stated for the study. No preliminary statistical analyses were used to evaluate the data except the use of means and standard deviation to evaluate the matching selection process of the schools. The use of chi-square provided the results for this study, because it provided the relevant statistic to know whether or not the total number of students in the general population, the number of African American students, and the number of students with disabilities, who were proficient on the biology EOC test had a significant relationship with the type of schedule on which the students were taught biology. The phi correlation was used to provide the size of the effect of the chi-square on the data.

The chi-square determined from the number of students proficient that the general population of students tested there was a statistically significant relationship between the number of students who were proficient and the type of schedule the school ran. Likewise, for the first subgroup, African-American students, data revealed that there was a statistically significant relationship between the number of African-American students who were proficient and the school schedule. However, the chi-square results for the students with disabilities indicated that there was no statistically significant relationship between the number of students with disabilities who were proficient on the biology EOC test and the type of schedule that the school was on. Each of the hypotheses yielded a small phi value close to 0 which indicates little association between the variables. The effect size of the study was low suggesting that the dependent variable is not affected by the school schedule alone.

Chapter Five: Discussion

Summary of the Findings

High schools in the state of North Carolina have become settled on the type of schedule the schools will adopt, with a few changes occurring in various locations. Over 75% of the high schools are now running some type of block schedule in the state of North Carolina. Block scheduling has impacted North Carolina much of the same way it has impacted states across the U.S. (Gruber & Onwuegbuzie, 2001). Though many schools are on some type of blocked schedule, there was not enough evidence that students were learning or achieving higher on standardized tests because of the specific type of schedule. This ex post facto study revealed results that were consistent overall to what previous literature had revealed. This study sought to compare the achievement of students taught biology on 4 x 4 block schedule to the achievement of students taught on a six or seven period traditional schedule by examining the number of students who were proficient on the NC Biology EOC test. A variety of schools were considered for the study, varying in size, demographics, locations, and grade levels, but involved twenty schools that were on a six or seven period day matched to twenty schools that were on 4 x 4 schedules. They were matched based on school size, ethnic group percentages, grade levels, and percentage of free/reduced lunch. The study included public high schools, charter schools, and some year round schools.

In addition to the general population of students, two subgroups were included in the study: African-American students and students with learning disabilities. The interest was to note whether or not there were significant differences in the number of students

from these subgroups who were proficient on the NC Biology EOC test and were taught biology on a 4 x 4 block schedule and those who were taught on a six or seven period traditional schedule. A study by Weller and McLeskey (2000) indicated that students with disabilities require transformed learning settings to be successful and the school schedule can be a major factor.

The purpose of this study was to provide a current look at how course time scheduling impacts the performance of students on the NC Biology EOC test. The goal of the study was to add to the literature regarding how block scheduling was impacting the general population of students, African-American students, and students with disabilities. The study targeted these two subgroups because of a lack of research on these groups exists in the current literature.

The participants for the study were forty selected North Carolina high schools that had reported the number of students who were proficient on the NC Biology EOC test for the 2009-2010 school year. The study used archival data provided for the public high schools of North Carolina and their performance on the NC Biology EOC test. All information to categorize the schools was secured using the North Carolina Schools Report Cards website, Great Schools website, and reports located on the NC DPI website.

The research applied a chi-square test to the three hypotheses. A phi correlation was used to assess the correlation between the two variables. Summarized, the hypotheses stated that there was no significant difference in the overall number of students, the number of African-American students, and the number of students with disabilities who were proficient on the NC Biology EOC test and the type of school schedule in which they learned biology.

This study was designed to evaluate the performance of the general population of students, African-American students, and students with disabilities on the NC biology EOC test by using the number of students who were proficient in each school. The goal was to see if students who were taught on the 4 x 4 block schedule performed better on the NC biology EOC test than students who were taught biology on a six or seven period traditional schedule.

Summary of findings by research question. Research question one asked: Are students who participate in a biology course on a block schedule more likely to be proficient on the NC Biology EOC than students who participate in biology on a traditional schedule? The null hypothesis stated: There is no statistically significant difference between the number of students who were proficient on the NC Biology EOC and completed biology on a block schedule and the number of students who were proficient on the NC Biology EOC on the North Carolina biology end-of-course test and completed biology on a traditional schedule. An analysis of the data collected indicated that there was a statistically significant relationship between the number of students who were proficient on the NC Biology EOC test and completed biology on semester 4 x 4 block schedule and those who completed biology on a traditional yearlong schedule. The null hypothesis was rejected. The chi-square test states that there was a significant relationship between the variables, but the phi correlation indicated a weak correlation.

Research question two posed the question: Are African-American students who participate in biology on a block schedule more likely to be proficient on the NC Biology EOC than African-American students who participate in biology on a traditional schedule? The null hypothesis stated that there was no statistically significant

relationship between the number of African-American students who were proficient on the NC Biology EOC and completed biology on a block schedule and the number of African-American students who were proficient on the NC Biology EOC on the North Carolina biology end-of-course test and completed biology on a traditional schedule. The null hypothesis was rejected. The chi-square test provided the results of significance, but the phi correlation once again indicated a weak correlation.

Research question three posed the question: are students with disabilities who participate in biology on a block schedule more likely to be proficient on the NC Biology EOC test than students with disabilities who participate in biology on a traditional schedule? The null hypothesis stated: there is no statistically significant relationship between the number of students with disabilities who were proficient on the North Carolina Biology end-of course test and who completed biology on a semester 4 x 4 block schedule and those who were proficient and completed biology on a traditional yearlong schedule. For this research question, the null hypothesis failed to be rejected. The data, however, indicated that a greater proportion of students with disabilities on the traditional schedule were proficient than students with disabilities on a block schedule. A probable explanation for the lack of significance could be that for students with disabilities, modifications and individualized educational plans are utilized as appropriate, prohibiting the way they are educated to vary much from one type of schedule to another (Boettge et al., 2003). Needless to say, the small phi value indicated a weak correlation between the variables.

This study examined whether or not the amount of time spent in class on a daily basis would have any significance on the number of students who were proficient on the

NC Biology EOC. The study found that a statistically significant relationship existed between the overall number of students and the number of African-American students who were proficient on the NC Biology EOC test and the type of schedule being implemented by the school. However, the number of students with disabilities who were proficient on the NC Biology EOC test and the type of school schedule did not indicate a statistically significant relationship.

Discussion of the findings and the implications in light of the relevant literature. This study indicated that there is a significant relationship between how students perform on the NC Biology EOC test and the amount of time-spent daily in the biology classroom. This agrees with Gruber and Onwuegbuzie (2001) who investigated the effects of block scheduling on academic achievement among high school students. Although there was no statistical significance found when using GPA and the scores on the Georgia High School Graduation test, there was significance found for the science portion of the test and other content areas. The current study also supports another study done by Veal (2000), which found significance among students' and parents' perceptions of block scheduling versus those who were not in schools on a block schedule. Block-scheduled students felt that their grades improved above how the traditional students felt about their grades (Veal, 2000). Veal (2000) also chose science to be his subject of interest. Veal chose science because proponents of block scheduling suggested it to be more suitable for the science classroom (Veal, 2000). This study had the same desire and goal as Veal.

An interest in evaluating and analyzing the performance of African-American students on these two types of schedules came as a result of continued discussions among

school stakeholders and the federal government that African-American students do not achieve as well as their Caucasian counterparts (Johnson, 2009). This study wanted to investigate if one type of schedule favored African-American performance on a standardized test above the other. The study sought to draw conclusions about the performance of African-American students, while ignoring the impact of other factors on the performance of this group of students. The results indicated that the schedule type did impact the proficiency of African-American students on the NC Biology EOC test. This supports the research done by Bernstein, Millsap, Schimmenti, and Page (2008), which reported for the U.S. Department of Education that block scheduling was a strategy, when implemented with the smaller learning community structure, to increase the achievement of alienated students. African-American students were identified as part of those alienated students. The results of this study, however, differed from those of Spencer-Pugh in 2002. In that study, in an effort to further understand the achievement of African-American students, Spencer-Pugh (2002) examined the influence of block scheduling on that particular subgroup. Her study found no statistically significant relationship between African-American students and failing GPA rates and their years in a block schedule school. The current study indicated that there was a significant difference in proficiency of this subgroup on the given test and the type of schedule on which the students were taught biology. The data indicated that the block schedule produced a greater proportion of proficient African-American students than the traditional schedule.

Another study examined the effects of block scheduling on African-American students' perceptions on their own achievement. Slate and Jones (2000) found that

African-American students perceived the block schedule to be a means for their grades to improve. This was more of a qualitative study; however, it relates to this study because it also suggests that African-American students respond better to block schedules.

The only data that indicated no significant difference were the results of the students with disabilities. These results are consistent with outcomes of various studies that continue to be mixed, showing positive, negative, and neutral relationships to the two schedules (Queen, 2001).

Weller and McLeskey (2000) did a study on an inclusion school that decided to adopt a block schedule. The results identified the benefits and challenges associated with the switch for students with disabilities (SWD). Although the SWD proficiency means were found to be slightly higher for those taught on block schedule, there was no significant difference in this study. Weller and McLeskey (2000) speculated that the team teaching used in the block schedule was a greater asset than the schedule itself. This study did not perform any further investigations to indicate an explanation for the observed results.

The results of this study do agree, however, with the results of Bottge et al. (2003), who found no differences between students with disabilities who were in schools on block schedules and students with disabilities in schools on traditional schedules. They also found this true for students without disabilities. In addition, the study done by Bottge et al. (2003) investigated the instructional factors that could provide explanations for these findings. Just as suspected, teachers' perceptions of both schedules were similar, as were their instructional practices. Therefore, the data collected by Bottge et al.

(2003) can provide an explanation for why one group of students with disabilities had no advantage over the other group.

Outline of the Study Limitations

The limitations of this study include the limited number of schools in North Carolina that ran a six or seven period traditional school day. Another limitation was that some schools did not have records for the subgroups being studied. However, the sample did provide enough data to allow conclusions about the two schedules to be deduced and students' performances to be evaluated.

Another limitation was that the researcher made the assumption that every child was exposed to the North Carolina Standard Course of Study (SCOS) for biology (North Carolina Department of Public Instruction, 2010). Since the NC SCOS has been made available by the NCDPI, it was assumed that all biology teachers taught the same basic curriculum.

Another limitation was the lack of knowledge about the length of time that schools used a particular schedule type. The length of time schools had been on the types of schedule they had during the 2009-2010 school year was not factored into the study. Schools could have been in their first year of implementing their current schedules and other schools could have been using their current schedules for several years. Another limitation was that the number of biology classes offered was not known. There also was no information about administration, tutoring availability, number of students retaking the test, and teacher experience.

Only one form of block scheduling, another limitation, was included in the study and that was a 4 x 4, 90-minute block schedule. The dependent variable, the number of

students who were proficient on the NC Biology EOC test at each school, was a limitation as no individual student test scores were used. Also, assumptions about the students taking the tests and who had made proficiency were made and no differences were taken into account, such as socioeconomic background, number of times a student had taken biology, and the type of student the child was academically. The study also did not examine the educational background of the related parents. The data were all based on historical data that had been posted to NC DPI and was not gathered from the schools or school systems themselves.

Teaching pedagogy was not considered. The teachers' years of experience were not factored in as a variable. The varieties of instructional strategies were not considered. Although the turnover rate was provided for each school, it was not reported and was not considered in the study. The years of experience of the teachers who had actually taught the students were unknown and the teaching pedagogy for the teachers who were teaching during the year of interest were not researched and examined for relevancy or significance to the outcome of the study.

The NC DPI website stated that the data recorded were those provided after students were allowed to retest. There was no correction or any further study to see if there were more re-takers on one type of school schedule than on the other schedule. Another limitation to the study was that only one year of data was taken into consideration.

Another limitation was that only two subgroups were examined. The researcher opted to compare the number of African-American students who were proficient, even though there are other minority students present in the North Carolina public high

schools. Additionally, as mentioned earlier, one group of exceptional children was included: students with disabilities. Of the subjects representing the subgroups, no other demographic data was collected or reviewed. The population was based on group results and no individual test scores were used to allow for the correcting of other variables identified as having effects on student achievement.

To conclude, there were irregularities within the schools that were not accounted for and they include: the history of the instructional strategies of the teachers at each high school; the number of times the student encountered the content of the test; the biology teachers' licensure status; the teachers' educational experience and experience in teaching biology; remediation and tutoring opportunities; the teacher-to-student ratio within the classrooms; and the fact that student attendance records were not examined. These factors, along with the others discussed, may have had an impact on the study; however, the researcher used as much pertinent data as was available.

Implications for Practice

The study provides implications that may be useful to school boards and governmental officials as education is facing cutbacks in finances. The results indicate that the school schedule does have an effect on student performance. The school schedule does make a difference.

This study defined student achievement as proficiency on a state test at each school. This study focused on the area of science, indicating that more research can and should be done to evaluate how students are doing overall using block scheduling. Additionally, as more students with disabilities are being mainstreamed, this study serves

as a reminder and demonstrates the need for more data and studies on the differences and similarities of how these students respond to schedule types.

The implications of this study are student focused and aimed on student achievement, emphasizing the actual factors that affect achievement. As schools are being evaluated by the academic progress of their students, this study reminds practitioners of the areas that are being threatened and that are important.

Recommendations for Future Research

This study sets the groundwork for future studies. This study concluded, as other studies have, that block scheduling versus six or seven period traditional scheduling produces mixed data. Concluding, there is a significant relationship found between the number of students overall who are proficient on the NC biology end-of-course test and were taught on a 4 x 4 block schedule and proficient students who were taught on a six or seven period traditional schedule. Future studies should evaluate other factors, as well as science proficiency, that would add to the understanding of student achievement.

In the literature review, a school in Watauga County, North Carolina decided to adopt a hybrid schedule that involved block classes and a yearlong traditional schedule (Childers & Ireland, 2005). The results of this study suggested that student achievement is impacted by the type of schedule being implemented, so more studies could incorporate the examining of schools that have adopted a modified block schedule, where block schedule and traditional schedule are mixed, to see if modified block schedules have statistically significant impact on student achievement. The information gained from this type of study will help school officials and administrators to make more informed choices about the school day.

The trends seen in the pairing of certain schools used in the study indicates the percent of minority students within a school could have an impact on student achievement (see Appendix B). Therefore, a study that examines how minority students, not just African-American students, are doing on the different types of schedules would be beneficial. The study could involve a comparison of how minority students of one group compares to the achievement of another group. Discussion of educational gaps continues to exist among educators; therefore, this type of study could reveal more effective scheduling and practices depending on the ethnicity of the students in the school.

Because schools and school boards are usually data driven, another recommendation for research involves examining teaching strategies and methods. Teacher perception could also provide helpful information in terms of the morale of the school.

Recently, school districts have been faced with the challenge of doing more with less, as cutbacks in educational funds have taken place. A future study could focus on the cost of implementing each type of schedule in different schools. A study that focuses on the cost of implementation of each schedule type may provide data for school officials to use when making budget decisions.

This study focused on examining the significant relationships between the number of students who were proficient on the NC Biology EOC and were taught on a 4 x 4 block schedule and students who were proficient on the NC Biology EOC and were taught on a six or seven period traditional yearlong schedule. After the data were collected, a chi-square test was used to analyze the number of students who were

proficient from both types of schedules. The chi-square indicated that the number of general population students and African-American students who were proficient on the NC Biology EOC test was significantly related to the type of schedule employed by the school. The study indicated that there was no significant relationship between students with disabilities who were proficient on the test and the related schedule type. Other areas should be examined to expand the related knowledge base.

Block scheduling has become popular over the past twenty years. Many schools and school districts have made the choice to switch to some form of block schedule. Little current research, however, has been conducted to determine whether or not the use of block scheduling was actually improving academic performance. This study added to the related scholarly literature by comparing the performance of students who were taught on a traditional schedule with those taught on a block schedule. The conclusion was that there was a positive relationship between the type of schedule on which they were taught and the achievement in biology of the general population of students and African-American students, but there was no relationship between the achievement of students with disabilities and the schedule on which they were taught biology. This information may be valuable as school officials continue to make decisions regarding the scheduling of classes for their students.

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Appendix A: IRB Approval

IRB Approval 1033.111910: A Comparison of the Effects Block and Traditional Schedules have on the Scores of the Biology EOC Test in Four Public High Schools in the state of North Carolina

Hartin, Tiffany Erin

Sent: Friday, November 19, 2010 9:13 AM

To: Bonner, Tonia Anita

Cc: Garzon, Fernando; IRB, IRB; Pearson, Constance L

Attachments: Annual Review Form.doc (31 KB) ; Change in Protocol.doc (29 KB)

Good Morning Tonia,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. Attached you'll find the forms for those cases.

Thank you for your cooperation with the IRB and we wish you well with your research project. We will be glad to send you a written memo from the Liberty IRB, as needed, upon request.

Sincerely,

Fernando Garzon, Psy.D.
IRB Chair
Associate Professor
Liberty University
1971 University Blvd.
Lynchburg, VA 24502
(434) 592-4054

Appendix B: Matching of the Schools by Size

The schools in the table below have been paired together because there appears to be a population effect taking place among certain schools.

Pseudo-School Names	Urban/Sub/Rural	Schedule Type	% Prof.	African Am.	Students with Disabilities	Total # of Students
School 1	Rural	1	0.67	0.47		128
School 2	Rural	2	0.95	0.95		240
School 11	Rural	1	0.89			1002
School 12	Rural	2	0.72	0.61	0.60	1009
School 15	Rural	2	0.73	0.80	0.50	1064
School 16	Rural	1	0.78		0.50	1074
School 18	Rural	1	0.80		0.67	1151
School 19	Suburban	2	0.84	0.68	0.30	1184
School 26	Urban	1	0.68	0.55	0.36	1442
School 27	Urban	2	0.83	0.71	0.65	1455
School 29	Suburban	1	0.77	0.67	0.60	1510
School 30	Suburban	2	0.87	0.83	0.56	1585
School 34	Urban	1	0.81	0.62	0.43	1715
School 35	Urban	1	0.89	0.84	0.72	1764
School 36	Urban	2	0.88	0.70	0.70	1768
School 37	Suburban	2	0.84	0.71	0.50	1774
School 38	Urban	2	0.95	0.93	0.71	1820
School 39	Urban	1	0.95	0.92	0.95	1909
School 40	Urban	2	0.95	0.92	0.89	1993