

A Matter of Time: The Effects of Block Scheduling on the Academic Achievement of Secondary  
School Students in the District of Columbia

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Submitted in Partial Fulfillment of the Requirements for the

Degree of Master of Education

May 2013

Graduate Programs in Education

Goucher College

## Table of Contents

List of Tables	i
Abstract	ii
I. Introduction	1
Statement of the Problem	2
Hypothesis	2
Operational Definitions	3
II. Review of the Literature	4
Fragmented instruction and Poor Time Utilization	4
Schedule-Based Strategies for Improving Student Achievement	7
Impacts of Schedule-Based Strategies for Improving Student Achievement	11
III. Methods	16
Design	16
Participants	17
Instrument	19
Procedure	20
IV. Results	21
V. Discussion	28
Threats to Validity	28
Comparison of the Results of this Study to Previous Research	31
Conclusions and Suggestions for Future Research	33
References	35

## List of Tables

1. Analysis of SAT Total Scores	22
2. Analysis of SAT Math Scores	23
3. Analysis of SAT Reading Scores	23
4. Analysis of SAT Writing Scores	24
5. Analysis of Advanced Placement Test Scores	24
6. Analysis of DC CAS Reading Scores	25
7. Analysis of DC CAS Math Scores	26
8. Comparative Analysis of DC CAS Math Score Gains	26
9. Comparative Analysis of DC CAS Reading Score Gains	27

## **ABSTRACT**

This historical study analyzes the relative effectiveness of traditional scheduling, 4X4 block scheduling (4X4), and alternate day block (A/B) scheduling in three different schools governed by District of Columbia Public Schools (DCPS) system as measured by SAT, AP Exam, and DC CAS performances. A random sample of 1,389 from three different DCPS schools representing three scheduling types from 2007-2012 was drawn. ANOVA was run to determine mean performance levels for student performance at each school for each metric. An additional test was run to compare means from 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS data for the 2011 cohorts at each of the three schools. Analysis of overall performance means distinctly favors the A/B scheduling model. However, comparative analysis of 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS data for the 2011 cohort favors the 4X4 model. The results of this study are nebulous at best. A larger sample size and consideration of additional factors would likely allow researchers to better analyze the implications of this research.

## CHAPTER I

### INTRODUCTION

In the current era of accountability, school policy makers in urban schools are taking creative measures to increase student achievement on standardized tests. Nichols (2005) cites the work of researchers from the National Commission on Excellence in Education who suggest that more effective use of allocated classroom time may be a key component in increasing the effectiveness of classroom instruction in the United States. In response to such prescriptive guidance, urban schools have implemented a number of different strategies. As early as the 1960s and 1970s, school administrators began to use flexible modular scheduling, a sort of alternating instructional block in which students received lengthy instruction in certain subjects for established intervals of one to two months. Schools eventually began to shy away from these practices, though, because of increased discipline problems.

A new wave of scheduling reforms began in the 1980s and 1990s, a time in which schools began to implement more modern forms of *block scheduling*. Lewis, Dugan, Winokur, and Cobb (2005) describe two distinct forms of block scheduling: In the most common form, 4 X 4 block scheduling, students receive instruction in four courses that meet for ninety minute blocks of time for an entire semester. In the second form, alternate day block scheduling (A/B), students are enrolled in seven to eight courses, three to four of which meet on day A and three to four of which meet on day B in alternating fashion.

In theory, block scheduling helps students accomplish more meaningful work than traditional scheduling. They are given more time to delve into subject matter. However, the results of many studies suggest that block scheduling may not be a panacea for increasing the efficiency of classroom time or the effectiveness of instruction.

Nichols (2005) claims that “only limited empirical research explores the impact of block scheduling structures on potential student academic achievement” (p. 300). Lewis et al. (2005) suggest a number of potential shortcomings of block scheduling. An overall reduction of total time in the classroom poses difficulty for teachers’ pacing, sometimes resulting in an overreliance on lecture as an instructional method. Some teachers report higher frequencies of student fatigue or boredom during ninety minute instructional blocks. Other teachers complain that students are expected to do too much work independently during these lengthy periods and that classroom management is subsequently made more difficult. The scheduling of electives can also be problematic given the constrictions of the four-period day.

District of Columbia Public Schools has instituted block scheduling models at many of its high schools and educational campuses. Given the doubts surrounding the effectiveness of block scheduling, it is important to evaluate the efficacy of established programs.

### **Statement of the Problem**

The purpose of this study is to determine whether block scheduling by District of Columbia Public Schools (DCPS) improves student performance on such traditional measures of achievement as the SAT, Advanced Placement (AP) Examination, and the District’s benchmark assessment (District of Columbia Comprehensive Assessment of Schools—or DC CAS).

### **Hypothesis**

A careful analysis of SAT, AP, and DC CAS data drawn from a sizable sample of students in traditionally scheduled schools and block scheduled schools will yield no significant relationship between the use of block scheduling and the performance of students.

## **Operational Definitions**

### *Block scheduling*

For the purposes of this study, block scheduling is defined as the implementation of class periods that exceed eighty minutes daily. This definition includes 4 X 4 block scheduling in which students attend the same four classes for ninety minutes per day over the course of the semester, alternate day block scheduling (A/B) in which students are enrolled in seven to eight classes simultaneously and alternate between two sets of four classes on A days and B days.

## **Dependent Variable(s)**

### *Student Achievement*

As a broad measure of the effectiveness of block scheduling, student achievement is defined as a combination of SAT scores, AP Exam scores, and performance on the DC-CAS.

## **CHAPTER II**

### **REVIEW OF LITERATURE**

The following literature review explores an often overlooked problem in American education: proper utilization of time in U.S. classrooms. This snapshot also discusses a number of scheduling innovations that are designed, in theory, to make the time American children spend in school as productive as possible. Section one discusses several shortfalls associated with what has come to be known as the *traditional scheduling* model as well as the ways in which these shortfalls could potentially impact student performance. Section two describes several innovative scheduling techniques and their theoretical impact on various performance indicators. The third section of this literature review discusses a number of past studies that have evaluated the effectiveness of various scheduling techniques in regards to their impact on student performance. Many of the methods used to conduct the research discussed in section three will be replicated in this study.

#### **Fragmented Instruction and Poor Time Utilization in U.S. Public Schools**

Through the traditional scheduling model, students are typically enrolled in one credit courses that meet once per day for approximately 50 to 55 minutes at a time (Zelkowski, 2005). Zelkowski explains that the number of periods and time spent in individual classes can vary from district to district, depending on the size of the student body. For the most part, seven unique periods per day constitute the norm. On each day in a traditional school year, students cycle through each of these periods, sometimes changing elective courses every quarter or semester.

The modern era in the U.S. education system, though, is defined by the word *reform*—change, then, is inevitable. Most notably in the topic of reforms, The No *Child Left Behind Act* of 2001 has worked to change the face of educational policy today (Dexter, Tai, & Sadler, 2006).



While the national conversation regarding educational reform for the last decade has centered on the topic of teacher efficacy—issues such as merit pay and evaluation reigning supreme—more quiet aspects of reform have gone relatively unnoticed. According to Dexter et al. one of the primary initiatives of the No Child Left Behind movement has focused an introspective lens on the process by which students move from place to place in the building—that is, their schedules. Long before the passing of the landmark 2001 act, though, some educational researchers and theorists had grown critical of traditional scheduling models, citing various inefficiencies and inadequacies.

Gruber and Onwuegbuzie (2001) expound on the first of many shortfalls of the traditional scheduling model. Of the many deleterious effects of short instructional periods, the most destructive to student achievement may be the tendency of this scheduling model to overwhelm students with disjointed curricular expectations, constantly changing classroom norms, and high workloads. The traditional schedule with its tightly regimented sets of short class periods can create the impression that different subjects are separate, that lessons learned in one class cannot be generalized into other settings. Students find themselves in a state of nearly constant transition as they move from subject to subject. While still processing one lesson, they sometimes fail to adjust to the demands of a new academic task until their next lesson is nearly over.

Moreover, Gruber and Onwuegbuzie (2001) add that the amount of homework assigned under the traditional scheduling model is overwhelming for students not in its volume but in its variance. The effect of traditional schedules and their subsequent homework demands has a logical, if not obvious, impact on student performance. Students who are highly anxious, who are asked to transition between activities before the point when deep analysis is possible cannot be

expected to perform well on primary measures of student achievement (Biesinger, Crippen, & Muis, 2008). For example, a typical high school student may find him or herself reading Shakespeare for thirty minutes only to jump into applied physics a few minutes later. By the time the student adequately transitions from analyzing characterization in *Macbeth* to calculating angular velocity, it may be time to go to bed without his or her reaping the academic benefits of having completed either assignment.

The fragmentation of instruction described by Gruber and Onwuegbuzie (2001) as well as Biesinger et al. (2008) kick-starts the litany of negative characterizations ascribed to traditional scheduling in modern educational research. Citing information compiled by researchers associated with the Association for Supervision and Curriculum Development, Nichols (2005) contends that among the major drawbacks associated with the traditional model is a limited opportunity to increase graduation requirements that may heighten student preparedness for post-secondary educational pursuits. Specifically, Nichols argues that in-depth courses in writing and mathematics are critical for high school students who hope to succeed at the college level, as collegiate work generally entails little in the way of worksheets and much in the way of analysis and application. The traditional conception of scheduling, with 50 to 55 minute class periods, may not provide time for students to do the type of work that is necessary to succeed in a post-secondary environment. Students educated under a traditional model are left to complete the majority of content analysis activities and application projects on their own time, without the guidance of experts (Dexter et al., 2006).

Traditional scheduling models can also curtail the efforts of instructors and other educational professionals to improve classroom practice. Such models often limit instructional opportunities, providing little to no time for flexible teaching and learning (Nichols, 2005).

Bound to a 50 to 55 minute block of time each day and struggling to follow curricular guidelines, classroom teachers are often left with a difficult conundrum. They must balance the delivery of massive amounts of content with the individual needs of their students.

New research into cognitive processes suggests that different students learn in different ways and that collaborative methods of instruction in which the teacher acts more as a facilitator of knowledge than a dispenser of it are effective if employed properly (Dexter et al., 2006). The problem is that differentiating instruction effectively and using experimental approaches to introduce content are time-consuming endeavors. The difficulty of delivering such effective instruction in a typical 50 to 55 minute block of time is immense. The logical toll of adhering to traditional scheduling models is that the practice proliferates environments in which students do not learn.

### **Schedule-Based Strategies for Improving Student Achievement**

Though No Child Left Behind (NCLB) was instrumental in refocusing the dialogue of school achievement and turning the lens of examination inward at our very system of education, theorists and researchers have actually been maligning traditional scheduling methods for decades. Zapeda and Mayers (2006) describe one of the earliest efforts to address the inadequacies of traditional scheduling: the flexible module scheduling model designed by J. Lloyd Trump in the 1960s. Decades before the passing of NCLB, Trump perceived that academic success in different subject areas may require varied amounts of time. Accordingly, he proposed an alternative to the lock-step nature of traditional scheduling by proposing flexible scheduling according to the needed time allotments for different subjects. Under Trump's model, classes varied in length from 20 to over 100 minutes. Information available through the Oregon

Department of Education (1996) asserts that flexible module scheduling eventually fell to the wayside, amid concerns over student discipline and classroom management.

Though decidedly a failure, Trump's plan played the role of progenitor to a whole host of schedule based reforms that would take flight in the early 1990s—reforms aimed at eliminating the fragmentation, stress, and disjointedness associated with traditional scheduling models. Collectively, these schedule-based reforms are known by the blanket term *block scheduling*. Nichols (2005) discusses the burgeoning, mid-90s popularity of block-scheduling among high school principals. Replying to a survey question, 11 to 15 percent of secondary principals at that time claimed that their schools had already implemented block scheduling, aspects of block scheduling, or were planning to do one or the other in the next year. Dexter et al. (2006) suggest that about 50 percent of today's high schools use block scheduling in some form.

The term block scheduling generally equates with the concept of longer class periods. At the most basic level, this is true. Typically, the umbrella term *block scheduling* refers to any schedule modification that provides for larger amounts of time (typically 80 to 100 minutes) per class period (Trenta & Newman, 2002). Students enrolled in courses through block scheduling take less courses in a given day than traditionally scheduled students but receive instruction in their classes for considerably lengthier periods of time.

However, a simplistic conception of this technique as meaning longer periods fails to account for the variation between different plans categorized under the larger umbrella term *block scheduling*. In reality there are many different types of block scheduling, the two most popular being 4 X 4 block scheduling and alternate day (A/B) block scheduling (Trenta & Newman, 2002). In 4 X 4 block scheduling, by far the most widely used block scheduling plan, students take four courses each semester for a total of eight total courses during the academic

year. Each course in a given semester equates roughly to a year-long course in a traditionally scheduled plan.

The A/B block scheduling plan operates similarly but with a slight variation. The student still attends four 80 to 100-minute courses a day, but he or she is actually enrolled in a total of eight courses that meet year round on alternating days labeled A and B (Trenta & Newman, 2002). One week, the student will follow the A schedule on Monday and Wednesday while following the B schedule Tuesday, Thursday, and Friday. The next week, the schedule will shift. The student will then follow the B schedule on Monday and Wednesday while following the A schedule on Tuesday, Thursday, and Friday (Zelkowski, 2005).

Theoretically, the benefits of block scheduling are immense. Nichols (2005) explains that block scheduling may offer instructors increased flexibility while delivering instruction. Specifically, 4 X 4 and A/B block models may provide time needed for in-depth, hands-on learning. They may also encourage teachers to design more high-quality learning experiences for students. The extended daily time afforded instructors by 4 X 4 and A/B scheduled course structures may allow them to differentiate instruction more effectively. Teachers may also find that they are able to use more cooperative learning structures, and strategies that challenge them to re-envision their roles in the classroom. In using more methods of instruction, teachers may be able to cast a wider net, more effectively capitalizing on the current skills and interests of their students while providing them with more authentic activities (Dexter et al., 2006). For example, students in an Advanced Placement (AP) history classes may spend time organizing a Lincoln-Douglas debate and engaging in sustained dialogue with peers. Such engaged students may invest more effort in their own academic growth and eventually achieve higher marks on AP tests.

The implementation of 4 X 4 and A/B block scheduling plans may also reduce instructional fragmentation. Hackman (2004) and Hurley (1997) assert that students enrolled in classes under these types of plans deal with significantly less stress associated with transitions and homework loads (Biesinger et al., 2008). Instead of transitioning between seven or even eight classes, block-scheduled students only move through four instructional periods per day. That means far less distraction and more time actually spent learning. Furthermore, students enrolled in block-scheduled classes only have to adjust to four sets of rules and four different teaching styles per day. This patent fact can provide for more positive working relationships between instructors and students. The reduction of distractions in the classroom and the formation of positive student-teacher relationships produce an environment that is more conducive to learning. Furthermore, the reduction of homework—in terms of variety, not volume—allows students to make more meaningful connections between the work they do in the classroom and the work they do at home. Overall, the general sense of continuity associated with block scheduling should logically produce measurable results in student achievement. The intended environment is one of heightened and sustained student engagement.

Some recent research, however, indicates that not all projected impacts are positive. Zelkowski (2005) asserts that continuous enrollment in mathematics courses may be the largest factor that determines whether a student is “college ready” rather than simply “college eligible.” While students registered for classes through A/B block scheduling are enrolled in core classes continuously, 4 X 4 scheduling plans may allow some students to schedule gaps in their semester-to-semester course loads. For example, a student may take a course such as trigonometry during the first semester of his or her junior year but may not enroll in calculus until the next academic year, perhaps as late as the second semester. While technically fulfilling

requirements for graduation, the student is essentially at a loss for information he or she would have retained more easily by moving more sequentially without any gaps in instruction. Zelkowski suggests that traditional scheduling may have one advantage over block scheduling in its year to year structure. That is, a student cannot intentionally or accidentally schedule academic gaps because he or she is required to take mathematics or English courses in sequential order across successive instructional years.

Other critics of block scheduling point out the patent fact that students who receive instruction via A/B or 4X4 models usually spend less time in the classroom per subject, per year than their traditionally-scheduled peers. Bernard (2005) points out that that two 50- minute classes are often replaced with one 90-minute class, a trend quite typical in A/B and 4X4 block-scheduled courses (Dexter et al., 2006). A simple mental calculation reveals that students spend ten minutes less in each class for every two days of instruction and nine-hundred minutes less in each class during the course of the academic year. That block-scheduled students spend less time in class is a fact. Whether or not the time they do spend in class is utilized effectively is debatable.

### **Impacts of Schedule-Based Strategies for Improving Student Achievement**

Educational research regarding the effects of block scheduling yields an unclear picture. For as many studies as have been conducted on this topic there exist as many opinions as to whether block scheduling is an effective method of raising student achievement. In addition, the sheer number of confounding variables that can potentially compromise the validity of these studies casts a looming shadow over most causal or correlative relationships that appear to have been found.

Regarding student attitudes towards the implementation of block scheduling, Biesinger, et al. (2008) cite survey data suggesting that instances of student satisfaction and positive student-teacher relationships are encouraged by block scheduling in cases when a teacher has employed new and innovative pedagogical practices. That is, a teacher who is able to nimbly operate in the block scheduling model, using practices such as cooperative learning and reciprocal teaching, enjoys the benefits of increased positivity in the classroom. Theoretically, students with higher senses of self satisfaction and more engagement in class will be more invested in their studies, achieving higher grades and attaining more impressive grade point averages. However, the belief that positive student attitudes will yield positive results on all indicators of performance is a hasty presumption.

This survey data compiled by Biesinger et al. (2008) also suggest that students' attitudes about block scheduling may have more to do with motivators external to the class—motivators such as having the opportunity to spend more daily time in electives and decreased homework loads. Observations in this study also suggest that many classroom instructors have done little to change the type of instruction they use on a daily basis after converting to block scheduling. What is sometimes touted as a remarkable way to increase the efficiency and productiveness of classroom time then becomes an over-glorified extended period. Teachers who are unwilling to use cooperative learning methods or experiment with project-based learning outcomes fall back on less effective teaching methods such as direct lecture. Gruber and Onwuegbuzie (2001) assert that teachers, many of whom have taught for long periods of time using methods more suited to traditional scheduling, should attend professional development activities that teach them how to use instructional time effectively after the implementation of block scheduling. Administrators and school districts must provide these opportunities accordingly. Only then will the “extra time”



provided by block scheduling models be used for more enriching instructional practices such as cooperative learning, sustained dialogues, and application.

In terms of actual performance—proven indicators of student achievement—the results that block scheduling has produced thus far are quite nebulous. In a multiyear study of student performance in five urban school districts both before and after conversions to block scheduling, Nichols (2005) noted only a slight positive impact on student performance as measured by grade point average in his study of five large schools. Furthermore, the pace of improvement in each school was dramatically different. Some schools boasted significant student achievement levels in the first year or two only to see improvement plateau in following academic years. Other schools slowly built toward marked progress after initially displaying little indication of growth. Such inconsistencies in success of implementation between schools and programs suggest that other factors may be at play, that increases or decreases in performance may be more attributable to other factors than they are to scheduling methods.

Nichols (2005) also notes a disturbing trend in the success of block schedule implementation. While all ethnic groups and socioeconomic statuses represented in the five schools showed slight improvements after the transition to block scheduling, the success of ethnic minority students and students of low socioeconomic status were less significant than were the improvements made by ethnic majority students and students of high socioeconomic status. These results suggest that a conversion to block scheduling may not be effective in of itself and that other interventions may also be necessary to produce meaningful improvements for students of low socioeconomic status and ethnic minority students.

Trenta and Newman (2005) note inconclusive links between enrollment in block-scheduled classes and student achievement. In their study of the institution of a single block

scheduling program in a small mid-western city, the researchers observed that students enrolled in block classes did not show any significant improvement in overall grade point average but did show some significant improvements in achievement in individual core academic classes. These results suggest that longer class periods may be an effective intervention for some subject areas but not for others. Regarding achievement on the Ohio Proficiency Test (OPT), a state benchmark, Trenta and Newman discovered a tenuous and perhaps indirect relationship between high scores and improved grade point averages linked to enrollment in block scheduling classes. Again, the interplay of many variables calls into question the validity of these results. Links between performance on the ACT, a college entrance exam sometimes taken in place of the SAT, and enrollment in block-scheduled classes were also insignificant. However, students who take the ACT often self-select, another confounding variable that may delegitimize aspects of the study.

Evans, Tokarczyk, and Rice (2002) did note some significant positive relationships between a student's enrollment in block-scheduled classes and student achievement. In their study, which examined pre- and post-block transition performances on a variety of indicators across a number of schools in a single district, the researchers observed a 25 percent increase in enrollment in Advanced Placement courses and a 30 percent increase in the number of students achieving scores of 3, 4, or 5 on the AP tests. A strongly emphasized component of the college admissions process, the AP test requires intense concentration over a number of hours. Students are often expected to read massive amounts of historical or literary text and react with unique written responses. Theoretically enrollment in block-scheduled classes could provide students with the time necessary to practice the construction of such thorough analysis (Dexter et al., 2006).

Evans et al. (2002) also noted significant improvements related to student performance on the SAT, the primary college entrance examination accepted by most four year institutions of higher learning. Between the 1996-1997 and 1998-1999 school years, average SAT scores rose 14 points within the district in their study from 975 to 989, results perhaps attributable to increased practice with test taking strategies in elective test-prep courses.

While some studies produce inconclusive results, other studies actually suggest that block scheduling may harm student performance. Gruber and Onwuegbuzie's 2001 study comparing the achievement of 115 Georgia students who received instruction through 4 X 4 block scheduling and the achievement of 146 Georgia students who received instruction via traditional scheduling, yielded a number of interesting results. While the block-scheduled and traditionally scheduled students performed essentially the same in the writing portion of the Georgia High School Graduation Test (GHS GT), traditionally scheduled students outperformed their block-scheduled peers in the math and social studies sections of the test. These results suggest that—at least in the State of Georgia—there may be some disconnect between the skills valued on high-stakes, benchmark tests and the skills explicitly taught in the block-scheduled classroom.

## CHAPTER III

### METHODS

#### Design

Historical data describing the academic achievement, college readiness, and high school completion of students will be gathered, analyzed, and compared for students who experienced block scheduling versus students who experienced traditional scheduling. Three metrics of student achievement will be considered:

##### *SAT*

Published by the *College Board*, the SAT measures skills in reading comprehension, mathematics, and writing which could be acquired across courses. The SAT is scored on a scale of 200 to 800 with a mean of 500 and standard deviation of 100. The highest total score (across all three tests) is 2400. Though only arguably a good measure of college readiness, college and university admissions boards rely heavily on SAT scores during the admissions and financial aid processes.

##### *Advanced Placement (AP) Testing*

Another *College Board* product, Advanced Placement tests are designed to be a rigorous assessment of a high school student's early acquisition of college-level material. The format of the test varies depending on the subject matter, but English, science, and history sections typically feature difficult writing and multiple-choice problems. The tests scorers award marks of one through five, five meaning that a student is recommended for early college credit for outstanding performance.

### *District of Columbia Comprehensive Assessment of Schools*

Each state uses its own benchmark assessment to determine Adequate Yearly Progress (AYP), an individualized report card for each school that determines where monetary resources should be allocated in order to best serve its students. District of Columbia Public Schools uses the District of Columbia Comprehensive Assessment System (DC-CAS) to determine Adequate Yearly Progress. Administered to third, eighth, and tenth grade students, the DC-CAS measures students' acquisition of specific skills aligned to grade-level reading and math standards. The test's scorers label students as below basic, basic, proficient, and advanced depending on scores. While not the only evaluation of a school's effectiveness, the DC-CAS does play a significant role in faculty retention and curricular design.

### **Participants**

Three Washington, DC high schools were selected to participate in this study, mostly on the basis scheduling type. One school employs a 4X4 block schedule, one uses an alternating day block schedule, and the last relies on the traditional seven-period schedule.

School A serves students mostly from the district's first ward but is a magnet program that draws students from each of the city's eight wards. Currently, School A uses 4 X 4 Block Scheduling. However, unlike many schools that use this format, School A does require consecutive blocks of English and mathematics instruction in order to curb instances of scheduling gaps. School A's multicultural focus is reflected in its ambitious goal that students develop intellectual curiosity and fluency in at least two languages. As of 2010, 34% and 31% of students attending School A scored proficient or advanced in mathematics and reading respectively. These numbers are down from 2009, and the school is currently in year one of its restructuring plan. School A must accordingly offer its students the choice to transfer to a better-

performing district school. It must also provide its staff with targeted professional development opportunities. In terms of its demographics, School A is quite diverse. 66% of students are Hispanic, 30% are black/African-American, 3% are Asian or Pacific Islander, and 1% identify as other. 37% of students at School A are ELLs, receive special education services. Poverty is endemic at School A with 90% of students qualifying for free or reduced-price lunch (DCPS Catalog, 2011).

School B is the district's largest comprehensive high school and is situated in the comparatively affluent third ward. The school employs an alternating day block scheduling model, in which students are enrolled in eight courses simultaneously over the course of the school year. As of 2010, 68% and 65% of School B's students scored advanced or proficient on the mathematics and reading portions of the DC-CAS respectively. These numbers reflect a slight improvement in mathematics and a slight regression in reading when compared to the previous year's scores. The school is in the second year of a restructuring plan; it must offer school choice and supplemental academic services to its students. Demographically, School B may be the most ethnically and racially diverse comprehensive high school in Washington, DC. 51% of students are black/African-American, 24% are white, 17% are Hispanic, and 8% are Asian or Pacific Islander. 10% of students at School B are ELLs and 10% receive special education services. Poverty is not as wide-spread at School B, as only 43% of students qualify for free or reduced-price lunches (DCPS Catalog, 2011).

School C serves students in the district's first ward in the northwest portion of the city. The school offers academy programs in transportation and technology as well as construction and design. 24% and 20% of students scored proficient or advanced in mathematics and reading respectively on the DC-CAS—both of these numbers are down from 2009 levels. The school is

currently in the second year of a restructuring plan after failing to meet AYP. Accordingly, it must offer school choice and academic support to its students. Demographically, School C serves a diverse population: 73% black or African-American, 24% Hispanic, 2% Asian or Pacific Islander, and 1% other. English Language Learners (ELLs) constitute 20% of the population, and 20% of the school's population receives special education services. Poverty is a significant factor at School C as 77% of students qualify for free or reduced-price lunches (DCPS Catalog, 2011).

The Office of the State Superintendent of Education (OSSE) in Washington, DC furnished a robust sample for each of the schools chosen for this study. For School A, OSSE provided 2007-2012 SAT, AP, and DC CAS data for five cohorts of students. The total number of students sampled from School A was 413. OSSE provided 2008-2012 data on four cohorts for School B. The total number of students sampled from School B was 484. For school C, OSSE provided 2008-2012 data pertaining to the performance of four cohorts of students. The total number of students sampled from School C was 491. In total, 1,389 students from three DCPS schools were selected for the purposes of this study.

### **Instrument**

As this study relies exclusively on historical data, the design of a new instrument was unnecessary. Researchers evaluated 2007-2012 data available from three DCPS schools. These data include SAT scores (reading, mathematics, and writing), AP Examination scores, and DC-CAS scores in both reading and mathematics. This data was furnished by the District of Columbia Office of the State Superintendant of Education (OSSE) for the exclusive purpose of educational research. These instruments were not selected because they are the most valid measures of student performance available; rather, they were chosen because they are the

standard by which schools, students, and college admissions committees alike measure academic success.

### **Procedure**

After the delivery of 2007-2012 data for each of the four schools, SPSS was used to examine the relationship between student enrollment by scheduling type and student performance on the SAT, AP Exam, and the DC CAS. For each cohort overall means for each metric were computed.

For the 2011 cohorts at each school, SPSS was used to compare “growth” between 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS scores. The comparison of these scores allowed for some examination of student performances before and after enrollment in block-scheduled classes. Student reading and mathematics scores of below basic, basic, proficient, and advanced were coded numerically 1-4 for purposes of the comparison. The student data base was filtered by unique ID so that each student’s 8<sup>th</sup> and 10<sup>th</sup> grade scores appeared once in separate sheets. Improvement or lack thereof, from 8<sup>th</sup> to 10<sup>th</sup> grade (pre- and post-block schedule enrollment) was calculated in this way.



## **CHAPTER IV**

### **RESULTS**

This study examines the impacts of types of high school schedules on SAT total score, SAT scores for reading, math, and writing; AP scores; and District of Columbia Comprehensive Assessment of Schools (DC-CAS) scores in reading and math. In addition, a comparison of 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS data was used to measure student growth after enrollment in each of the schedule arrangements. Data were analyzed in SPSS using the compare means with Analysis of Variance (ANOVA). Statistically significant differences were found for each analysis in favor of the School B (A/B) with the exception of the district math scores which favored the School A (4x4). This exception was disregarded, however, due to the insufficiently small sample size (N = 2) available at School B. Data were also analyzed in SPSS to compare mean rates of growth on the DC CAS reading and mathematics batteries for the 2011 cohort. Statistically significant differences were noted in the comparison of these means, favoring the 4X4 Block Schedule configuration at School A over both the traditional schedule model at School C and the alternate day block arrangement at School B.

SAT total score means (listed in Table 1) for School A (4X4 Block), School B (A/B), and School C (7-Period) decidedly favor the alternate day block schedule configuration. Analysis of total scores of School B's sample group (N=1260) yielded a mean of 1722.13/2400, a score that bettered School A's sample group (N=816) by 551.21 points and School C's sample group (N=192) by 649.09 points. Analysis of School B scores also yielded the largest standard deviation by far: 356.61 versus 263.59 at School A and 223.36 at School C.

**Table 1**  
**Analysis of SAT Totals**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	1170.92	816	263.59
School B Using Alternating Block (AB)	1722.13	1260	356.61
School C Using Traditional 7 Period Model	1076.04	192	223.36
Total	1469.12	2268	424.83

Differences between means significant at  $p < .001$

Similar trends were observed when SAT data was disaggregated into its three constituent tests of math, reading, and writing (See tables 5-7). Considering mathematics scores, students enrolled in classes configured with the A/B model at School B outperformed their peers at School A and School C by significant margins. The mean SAT Math score at School B was 565.15. At School A and School C the mean scores were 399.68 and 362.45 respectively. Again, the standard deviation for mathematics scores at School B (135.53) was far greater than the range at either of the other schools (School A: 106.80 and School C: 114.26). The mean SAT Reading score at was 580.78 at School B with a standard deviation of 131.07 points, 385.43 at School A with a standard deviation of 98.06 points, and 369.69 at School C with a standard deviation of 89.90 points. Considering SAT Reading scores, School B students again outperformed their peers at School A and School C by statistically significant margins. The mean SAT Writing score at School B was 577.58 with a standard deviation of 127.70. In comparison, the mean score at School A was 385.81 with a standard deviation of 94.50, and the mean at School C was 343.91 with a standard deviation of 83.90.

**Table 2**  
**Analysis of SAT Math Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	399.68	816	106.80
School B Using Alternating Block (AB)	565.15	1260	135.53
School C Using Traditional 7 Period Model	362.45	192	114.26
Total	488.46	2268	151.17

Differences between means significant at  $p < .001$

**Table 3**  
**Analysis of SAT Verbal Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	385.43	816	98.05
School B Using Alternating Block (AB)	580.78	1260	131.07
School C Using Traditional 7 Period Model	369.69	192	89.90
Total	49.26	2268	153.01

Differences between means significant at  $p < .001$

**Table 4**  
**Analysis of SAT Writing Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	385.81	816	92.50
School B Using Alternating Block (AB)	577.58	1257	127.70
School C Using Traditional 7 Period Model	343.91	192	83.90
Total	488.68	2265	150.67

Differences between means significant at  $p < .001$

Analysis of Advanced Placement (AP) means (see Table 2) also favors the alternate day block configuration in use at School B. Considering all AP scores taken between 2007 and 2012, School B's population (N=1537) enjoyed the highest mean at 2.63 with School A (N=924) and School C (N=165) trailing at 1.50 and 1.25 respectively. As was the case while considering total SAT scores, the standard deviation for AP test scores at School B was decidedly the largest at 1.41 versus .91 at School A and .64 at School C.

**Table 5**  
**Analysis of AP Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	1.50	924	.98
School B Using Alternating Block (AB)	2.63	1537	1.41
School C Using Traditional 7 Period Model	1.25	165	.64
Total	2.15	2626	1.36

Differences between means significant at  $p < .001$

Analysis of District of Columbia Comprehensive Assessment of Schools (DC CAS) scores also indicates that School B students enrolled in the AB configuration outperform their School A and School C peers. Considering reading scores (illustrated in table 6) the mean for School B students was 3.18, a school-wide rating of proficient. Meanwhile mean reading scores at School A and School C were 2.50 and 2.01 respectively, indications of basic performance levels. As with the aforementioned tests, School B scores had the highest standard deviation at .86, compared with .77 at School A and .71 at School C.

Mean mathematics scores (illustrated in table 7) favor the 4X4 model at School A over the traditional scheduling model at School C. However, an insufficient sample size (N=1) available for School B makes comparison with the AB model unreliable. Mean student performance on the mathematics examination at School A was actually quite close to the proficient level at 2.94 while the mean score at School C was at the low end of basic at 2.00. The standard deviations at School A and School C were .82 and .88 respectively.

**Table 6**  
**Analysis of DC CAS Reading Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	2.50	569	.77
School B Using Alternating Block (AB)	3.18	796	.86
School C Using Traditional 7 Period Model	2.01	302	.71
Total	2.74	1667	.93

Differences between means significant at  $p < .001$

**Table 7**  
**Analysis of DC CAS Math Scores**

Schedule Type	Mean	N	Std. Deviation
School A Using 4x4 Block	2.94	240	.82
School B Using Alternating Block (AB)	1.00	1	-----
School C Using Traditional 7 Period Model	2.00	307	.88
Total	2.41	548	.97

Differences between means significant at  $p < .001$

Analysis of mean gains on the DC CAS mathematics exam for the 2011 cohort clearly favored School A's 4X4 Block configuration over School C's Traditional Scheduling Model (see table 8). However, DC CAS mathematics data from School B was missing, making a three-way comparison impossible. A comparison of School A's students' 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS math scores revealed a mean gain of .38 points. School C students showed no gain (mean = .00) when their 8<sup>th</sup> and 10<sup>th</sup> grade math scores were compared in the same fashion.

**Table 8**  
**Comparative Analysis of DC CAS Math Score Gains (2011 Cohort)**

Schedule Type	Mean Gain	N	Std. Deviation
School A Using 4x4 Block	.38	58	.72
School B Using Alternating Block (AB)	-----	-----	-----
School C Using Traditional 7 Period Model	.00	31	.68
Total	.25	89	.73

Differences between means significant at  $p < .001$

When 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS reading test scores were compared (see table 9), School A's students posted a strong mean gain of .40. Unlike the case with mathematics scores, School C students actually displayed modest mean gain of .13 when reading scores were considered. Surprisingly, though, student performance in the 2011 School B cohort actually declined. These students posted a mean loss of .20—the first data point favoring School A's 4X4 schedule type outright over all other models.

**Table 9**  
**Comparative Analysis of DC CAS Reading Score Gains**

ScheduleType	Mean Gain	N	Std. Deviation
School A Using 4x4 Block	.40	57	.70
School B Using Alternating Block (AB)	-.20	69	.63
School C Using Traditional 7 Period Model	.13	31	.56
Total	.08	157	.70

Differences between means significant at  $p < .001$

## **CHAPTER V**

### **DISCUSSION**

This study examines the impacts of types of high school schedules on SAT total score, AP scores, and District of Columbia Comprehensive System of Schools Assessment (DC CAS) math and reading proficiency scores. Statistically significant differences were found and are presented in tables in Chapter IV. Overall, significant relationships were noted between student performance on each of the aforementioned indicators and schedule type. Considering overall scores from the entire sample, students enrolled in School B (A/B) outperformed their peers at School A (4X4) and School C (traditional schedule), with students from School C scoring lowest on all measures. However, when 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS scores for the 2011 cohort were analyzed and compared for growth, students at School A (4X4) posted the most gains in both reading and math. Students at School C (traditional scheduling) posted no gains in math and a small gain in reading. Meanwhile, students at School B (A/B)—the highest overall performers—actually posted losses on the DC CAS reading test. Math scores for this cohort were missing entirely. The null hypothesis was rejected. However, exactly what the relationship is between scheduling type and student performance nevertheless remains quite nebulous.

#### **Threats to Validity**

The original intention of the researcher was to gather historical student performance data from around the time that School A and School B instituted block scheduling and to compare this data to that available from School C High School which did not make the switch. OSSE was unable to provide data from this time period (the mid 1990s). Instead, OSSE provided the researcher with more current student performance data (ranging from 2007-2012). Prior to the initial use of DC CAS in 2007, District of Columbia Public Schools relied on the Stanford



Achievement Test-9<sup>th</sup> Edition (SAT 9) as its benchmark assessment. OSSE was unable to provide access to information to student performance data pertaining to this exam or any benchmarks prior to 2007. While this data set was not ideal given the original intent of the study, it did provide the researcher with some means to analyze the effectiveness of scheduling type.

All experiments contain threats to external and internal validity. External validity refers to the ability to generalize from the sample selected for the experiment to a larger population. The participants in this study were chosen from only three of the District of Columbia's seventeen large comprehensive high schools because of the availability of knowledge regarding schedule type. Over 400 unique individuals were chosen at random to form each of the five cohorts at each of the three schools. Though the total sample size is relatively large (N=1,389), it is problematic to extrapolate the findings from this study to the entire school-going population in the District of Columbia (N=43,866) (DCPS Catalog, 2011). The comparison between 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS mean scores across the three schools is especially problematic in terms of the sample. The researcher was only able to compare the results of the 2011 cohorts from each school—an especially small number of students (N= 548 for math and N=157 for reading).

Difficulties with the sample also threaten internal validity in terms of differential selection of participants. Each of the sample schools is a markedly different environment in of itself. School A, School B, and School C each serve markedly different populations when race, English-language proficiency rates, special education status, and socioeconomic status are considered. Given the segmentation of the District, the three schools selected for this study likely differ from other DCPS schools at even deeper levels than they differ from each other—both in their populations and practices. For example, it is difficult to extrapolate findings from School A that the 4X4 block schedule model is an effective means of increasing student performance on

the DC CAS because School A institutes 4X4 in such a way as to mitigate the deleterious effects of discontinuous enrollment. While School A requires that students take math and English classes in logical sequence, other schools might not require the same. The challenges faced by educators at each of the testing sites and at other schools in the district differ in such profound ways, in fact, that any number of factors could impact student performance on such traditional measures of student achievement as SAT, AP, and state benchmarks (DC CAS).

Other threats to internal validity are selection-maturation interaction, mortality, and history. For SAT and AP tests, students can “self-select.” That is, different numbers of students at different schools may opt to take these tests or may approach these tests with markedly different attitudes. Events such as student mobility, extended absences, pregnancy, incarceration, temporary changes of placement, and lengthy illnesses may also skew results. In the case of the AP exam, students at one school might opt to take multiple tests while other students opt to take none. For example, the number of SATs taken at School B (N=1260) is much greater than the number of SATs taken at School A (N=816) or School C (N=192). For the SAT, students may opt to test multiple times, distorting means further in favor of more traditionally high-performing schools such as School B. At other schools, such as School C, students may opt not to test at all. The same is true when considering AP tests taken at School B (N=1537) versus at School C (N=924) and School C (N=165).

The last in this string of threats to internal validity pertains to testing and instrumentation. Regarding the validity of the measures themselves, the researcher selected the SAT, AP Examination, and state benchmarks (DC CAS) not because they are necessarily reliable indicators of learning—not to mention reliable indicators of the effectiveness of scheduling type—but because they are the commonly accepted standard of measure in today’s schools. No

form of block scheduling is necessarily configured to yield enhanced results on any of these tests; however, some research suggests that block scheduling provides the kind of in depth focus on content needed for high performance on the AP Exam (Biesinger et al., 2008). While the students in this study could have self-selected out of SAT or AP Exam, all students in the study were required to take the DC CAS.

Even this study's most robust comparison between 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS scores in the reading and mathematics scores for the 2011 cohorts in each school is flawed in terms of instrumentation. That is, the 10<sup>th</sup> grade DC CAS tests in math and reading are more difficult than the 8<sup>th</sup> grade versions of the test. Essentially this fact constitutes a change in instrumentation. The mean gain at School C (.00) in the DC CAS mathematics test likely would have been more impressive if the students had taken an 8<sup>th</sup> grade version of the test again. The mean loss at School B (-.20) on the DC CAS reading assessment would likely have presented as mere stagnation had students there taken an 8<sup>th</sup> grade assessment. Of course, this logic also suggests that the math (.38) and reading (.40) gains at School A are all the more impressive.

### **Comparison of the Results of this Study to Previous Research**

Like the general body of research relating to the effectiveness of block scheduling, this study yielded mixed results. However, many of the researcher's findings corroborate previously published findings. Regarding overall student performance measures such as school-wide means on the SAT, AP, and DC CAS, School C High School (traditional scheduling) underperformed both School A (4X4) and School B (A/B)—sometimes by very significant margins. These results support previous research by Nichols (2005) that suggests that traditional scheduling limits the amount of time that students spend doing in-depth work and curtails teacher's efforts to employ research-proven instructional methods.

The results of this study refute the assertions of Bernard (2005) that traditional scheduling is more advantageous than block scheduling because students spend more time in class through traditional models. The researchers' findings also contrast sharply with those of Zelkowski (2005), who points towards the continuous and sequential enrollment characteristic of traditional scheduling as a strength.

On the same token, the relative overall successes of both School B and School A on the SAT, AP, and DC CAS could be attributable to the schools' uses of block scheduling. Nichols (2005) and Dexter et al. (2006) assert that block scheduling provides for more instructional flexibility. That is, classroom teachers are able to differentiate subject matter more effectively and design lessons to include more authentic activities, thereby increasing the chances of academic success. Meanwhile, Hackman (2004) and Hurley (2007) cite the patent fact that block scheduling reduces transitions, enabling teachers and students to use time more effectively as they explore content. It is quite possible that the strengths and weaknesses the aforementioned researchers ascribe to block scheduling and traditional scheduling respectively could account for differences noted in this study. The researcher's findings corroborate those of Evans et al. (2002), who noted significant relationships between student enrollment through block scheduling and student performance on the AP Examination and the SAT.

These findings contrast with those of Nichols (2005), whose study of the effectiveness of block scheduling in or around the time of its implementation suggested that block scheduling only accounts for slight improvements that usually plateau over time. Trenta and Newman (2005) also attributed only the slightest of improvements to block scheduling with grade point average and performance on state benchmark assessments were evaluated—findings not consistent with those of this study.

Overall means of student performance on the SAT, AP Exam, and the DC CAS yield the following rankings: (1) School B—A/B scheduling, (2) School A—4X4 scheduling, and (3) School C—traditional scheduling. School B students outperformed their counterparts at both School A and School C by significant margins on all of these assessments. However, regarding the researcher's comparison of 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS math and reading scores, the 4X4 schedule at School A seemed to produce the best results. Unlike overall means which favored School B, the results of this test showed that School B's A/B schedule actually resulted in net losses in student performance. The researcher's findings regarding the effectiveness of 4X4 block scheduling in this test clash sharply with those of Gruber et al. (2001). While the researcher determined that 4X4 block schedule at School B was the most advantageous configuration for both math and reading benchmark improvements, Gruber et al. (2001) found that Georgia students in traditionally scheduled schools outperformed their 4X4-scheduled counterparts on both the mathematics and social studies sections of the state benchmark assessment.

### **Conclusions and Suggestions for Future Research**

As is the case of previously conducted research, the findings of this study produce conflicting results. While longitudinal analysis of overall mean performance on the AP Examination, SAT, and DC CAS favor alternating block scheduling, close analysis comparing the 8<sup>th</sup> and 10<sup>th</sup> grade DC CAS results of the 2011 cohort favor the 4X4 arrangement. In the last analysis, School B's A/B schedule appeared inferior even to School C's use of the traditional schedule.

The interesting yet inconsistent findings of this study could more effectively tested if the sample size were expanded. District of Columbia Public Schools (DCPS) governs seventeen

large comprehensive high schools, each with its own unique environment, population dynamics, and chosen scheduling arrangement. Limiting the study to only three of the seventeen schools in the District inherently limits the researcher's ability to make generalizations with the data. The comparison of 8<sup>th</sup> and 10<sup>th</sup> grade means on the DC CAS is especially problematic given that the only viable sample came from the 2011 cohort.

The study would have benefitted not only from expansion but also from data disaggregation. Nichols (2005) conducted a comprehensive study of several large high schools, disaggregating GPA data by considering ethnicity and socioeconomic status. He found that slight improvements associated with block scheduling were not uniform when ethnicity and socioeconomic status were considered—a trend not investigated in this study. As No Child Left Behind stipulates that a school's AYP status is determined by its ability to foster growth for all students—especially those who typically underperform—it behooves future researchers to disaggregate growth data in as many ways as possible (i.e., special education students, students receiving free or reduced-price lunches, and students who are limited English-proficient).

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