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Middle School A/B Block and Traditional Scheduling: An Analysis of Math and Reading Performance by Race

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Abstract

The purpose of this quantitative study was to examine whether a difference existed in the percentage performance of students earning a pass/advanced score on the Standards of Learning (SOL) Test in math and reading in Virginia's Region IV for schools using an A/B block schedule and those using a traditional schedule. The research also examined if the percentage performance by race—Black, Hispanic, and White—differed on the math and reading SOL Test for Region IV in Virginia. Forty-three schools were included in the study—23 block and 20 traditional schools. The percentage performance in math and reading of each school and the percentage performance by race for each school were studied. Analyses of variance and *t* tests were used to examine differences. The *t*-test results do not show significant differences in the percentage performance of students earning pass/advanced scores in reading and math in block and traditional schools. Significant differences were shown in the percentage of Black and Hispanic students earning pass/advanced scores on the math and reading SOL Test for Region IV in Virginia. A larger percentage of Black and Hispanic students earned pass/advanced scores in the A/B block-scheduled schools than in the traditional schools.

Keywords

middle school, scheduling, block scheduling, traditional scheduling, A/B block scheduling

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The social fabric of the nation is tied to the education of its citizenry because the solutions to complex issues of the society are dependent on a well-informed populace that can read, compute, and think critically. Thomas Jefferson wrote that the ultimate power of society is controlled by the people and that an enlightened people are necessary for the classes to flourish (National Commission on Excellence in Education [NCEE], 1983).

Twenty-five years after the release of "A Nation at Risk," the U.S. Department of Education (USDOE) published a report (2008) analyzing what had been accomplished. The challenges remain exacerbated by changing demographics and increased student needs. For example, in 1988 of 20 children starting kindergarten, 6 did not graduate from high school, 10 of the 14 high school graduates went on to college, and 5 (50%) of them graduated from college in 2007. In 1983, 6 out of 20 students could read proficiently; in 2007, 7 out of 20 could read proficiently. Teaching children to read continues to challenge many American school districts. When compared with teaching children math, the results are more encouraging. In 1983, 4 out of 20 students demonstrated proficiency in math; in 2007, 8 out of 20 were proficient (USDOE, 2008).

Many districts continue to struggle with student achievement, most notably achievement gaps that stubbornly exist between majority and minority populations. In many urban areas of the country, student literacy remains a national disgrace. High school dropout rates remain high, 50% in some of the urban areas of the country. Students are leaving high school unable to read and complete basic computations (USDOE, 2008).

Daily newspapers, news magazines, and other media report the sad state of affairs in urban public schools. The Washington, D.C., public school system is an example of a district in which the school board and local school officials report directly to the mayor as strategies are implemented to save a very sick school system, perhaps one of the worst in the nation (Nakamura, 2007).

The encouraging news is that the release of "A Nation at Risk" resulted in transparency and discussions about our declining educational system by parents, teachers, school administrators, and government officials. In 1989, George H. W. Bush convened a governor's summit in Charlottesville, Virginia, to focus on education issues facing the nation. Adoption of the National Goals 2000 resulted. President Clinton's administration sponsored and passed the Improving America's Schools Act in 1994, which required states to develop academic content standards. Goals 2000 and the Educate America Act provided funding to the states to develop accountability standards. In 2000, G. W. Bush's administration secured bipartisan support for the No Child Left Behind (NCLB) Act that required each school district in the nation to measure and report results in math and reading based on standardized tests. School districts that fail to meet established benchmarks or fail to make adequate yearly progress face stiff penalties, including implementation of provisions to tutor failing students and to allow students from failing schools to attend healthy schools. The NCLB Act also requires districts to report disaggregated data for minority, special education, English as second language learners, and economically poor students (socioeconomic status). Districts could no longer hide the poor performance of at-risk populations because scores were buried in averages of

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higher performing groups, thus presenting the school as an academically healthy one (USDOE, 2008).

Accountability and standards-based education have been implemented in each of the 50 states. Virginia's reform efforts, mainly standards-based educational practices, have been in place since 1997. All Virginia school districts are required to demonstrate student success based on performance on math, reading, writing, science, and history/social science Standards of Learning (SOL) tests. Virginia schools in each district are granted accreditation when testing benchmarks are met. Additionally, high school students earn a diploma based on successful performance on SOL end of course test in English, social studies, mathematics, and science (Virginia Department of Education [VDOE], 2009).

In November 2000, the Virginia State Department of Accountability and the Governor's Best Practice Centers identified 16 best practices that when implemented support student success as measured by the SOL test. Scheduling and use of time were among the 16 best practices identified (VDOE, 2009).

One of the recommendations made by the Commission on Excellence in Education and its report, "A Nation at Risk," was an increased use of time either by lengthening the school day or school year or by restructuring time spent during the school day (NCEE, 1983).

Statement of the Problem

The problem in this study is to examine an identified recommendation for reform, efficient use of time, and to determine whether the implemented reform has made a difference in student performance in math and reading.

The purpose of this study is to evaluate middle school performance in mathematics and reading, in Virginia's Region IV, which follow either a traditional or a block schedule. Specifically, the following question will be explored: Is there a difference in school performance, as measured by SOL tests in mathematics and reading in schools that use a block schedule and schools that follow a traditional schedule?

The NCLB Legislation requires districts to disaggregate data for racial and other subgroups because of continued disparities in these groups' school performances (USDOE, 2008). Considering the scheduling reforms that have been implemented, the following question also arises: "Is there a difference in SOL scores by race—White, Black, and Hispanic—between schools using a block schedule and those using a traditional schedule?"

Hypotheses

Hypothesis 1: There is no significant difference in middle school SOL math performance as measured by the percentage of students earning a pass/advanced

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score in selected Virginia Region IV middle schools following a traditional schedule and schools following an A/B block schedule.

Hypothesis 2: There is a significant difference in middle school SOL math performance as measured by the percentage of students earning a pass/advanced score in selected Virginia Region IV middle schools following a traditional schedule and schools following an A/B block schedule.

Hypothesis 3: There is no significant difference in middle school SOL reading performance as measured by the percentage of students earning a pass/advanced score in selected Virginia Region IV middle schools following a traditional schedule and schools following an A/B block schedule.

Hypothesis 4: There is a significant difference in middle school SOL reading performance as measured by the percentage of students earning a pass/advanced score in selected Virginia Region IV middle schools following a traditional schedule and schools following an A/B block schedule.

Hypothesis 5: There is no significant difference in middle school SOL math performance as measured by the percentage of students earning a pass/advanced score by race—White, Black, and Hispanic—in selected Virginia Region IV middle schools following the A/B block and traditional schedules.

Hypothesis 6: There is a significant difference in middle school SOL math performance as measured by the percentage of students earning a pass/advanced score by race—White, Black, and Hispanic—in selected Virginia Region IV middle schools following the A/B block and traditional schedules.

Hypothesis 7: There is no significant difference in middle school SOL reading performance as measured by the percentage of students earning pass/advanced score by race—White, Black, and Hispanic—in selected Virginia Region IV middle schools following a traditional schedule and an A/B block schedule.

Hypothesis 8: There is a significant difference in middle school SOL reading—White, Black, and Hispanic—in selected Virginia Region IV middle schools following a traditional schedule and an A/B block schedule.

Significance of Study

The effective use of time and the structuring of the school schedule, recommended by the National Education Commission on Time and Learning, from 1994, have been used by many school districts as reform strategies. Yet the effectiveness of the practice has not been clearly established in high school programs (Eineder & Bishop, 1997; W. Evans, Tokarczyk, Rice, & McCray, 2002; Khazzaka, 1997; Kramer, 1997a, 1997b; Wilson & Stokes, 1999; Wronkovich, Hess, & Robinson, 1997; Zapeda & Mayers, 2006).

A handful of studies have addressed block scheduling at the middle school level (Canady & Rettig, 1995; DeRouen, 1998; DiBiase & Queen, 1999; Mattox, Hancock, & Queen, 1995; Schroth & Dixon, 1995). When the keywords "block scheduling in

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Virginia schools" were entered in a search engine, only one of nine results addressed the subject. Cobb, Abate, and Baker (1999) assert that a limited amount of research is available that addresses middle school block scheduling. Instead of using information gained about high school programs and applying those findings to the middle school group, the study will look specifically at middle school scheduling.

Inexperienced teachers, high school cast-offs who are waiting to return to high school programs, and teachers lacking preparation for teaching in a middle school negatively affect achievement (National Middle School Association, 2003; Schroth & Dixon, 1995; Woodside, 1989). Handy and Urich (1998, as reported in Zapeda & Mayers, 2006) found that changing the schedule would make little difference unless teachers received training and participated in programs that modeled successful instructional strategies and implemented student-centered methods and management techniques.

Definition of Terms

A/B or Alternating Block: Students attend three or four 90-minute classes every other day. Some schools use a seven-period day and embed a daily 45-minute class into the schedule.

Advanced: Successfully completing 39 of 45 SOL items in reading and 43 of 50 in mathematics. The scaled score is 500 to 600.

Allocated time: The amount of time that students are assigned to a particular class/course during the school day.

4 × 4 Block schedule: Students are assigned four classes of about 90 minutes each day for a semester, which typically lasts for 90 days. Schools organized in this way enable students to complete eight courses per school year.

Block schedule: A schedule that extends the allocated time from a 45/50-minute class period to a 90- to 240-minute class period.

Pass proficient: Successfully completing 28 of 45 SOL Test items in reading and 32 of 50 items in mathematics. The scaled score is 400 to 499.

Standards of Learning Test (SOL): Standards-based test administered in language arts/reading and mathematics.

Traditional schedule: The allocated time for a class/course is 45/50 minutes.

Literature Review

Theoretical Perspective

This study is based on Joseph Carroll's Copernican Plan. The Copernican Plan restructures the way time is used in school and posits that using blocks of time increase student achievement as measured by grades and standardized testing scores (J. M. Carroll, 1989). Blocks of time can vary from 90 to 240 minutes for a particular discipline. J. M. Carroll (1989) began to consider the relationship of time and learning after working

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with a group of troubled students in the District of Columbia public schools. Troubled students studied English and math for 4 hours in a summer school program and made more progress in that setting than they had made in 2 years in a traditional program. Similar results were observed in both the Los Alamos public schools and the Masconomet Regional School District in Massachusetts. In theory, when teachers spend longer periods of time with students and quality instruction is provided, student achievement is improved. The longer periods of time spent in a classroom also improves the student-teacher relationship and contributes to improved achievement (J. M. Carroll, 1994). J. B. Carroll (1989) in his model for student learning also defines five variables necessary for student achievement. Opportunity to learn—the amount of time allocated for learning—is significant in this study. Time, per se, is not as important as what happens with the given time. Yet active engagement in learning is related to student achievement. Given that active engagement is important in learning, structuring the lessons so that projects, cooperative learning, and student-centered activities can occur in blocks of times, 90 minutes or more can facilitate this kind of instructional delivery. This study will examine school performance in mathematics and reading in Virginia's Region IV schools.

Time and Achievement

A successful middle school environment provides a curriculum that is relevant, challenging, integrative, and exploratory and offers multiple learning and teaching approaches that respond to the diversity of this group Keys to educating young adolescents. Westerville, OH. Strong middle schools are characterized by assessment and evaluation programs that promote quality learning, organizational structures that support meaningful relationships and learning, and school-wide efforts and policies that foster health, wellness, safety, and multifaceted guidance and support services (NMSA, 2003). Clearly defining expectations and identifying what students should know and be able to do are also present in the curriculum of successful middle school programs. Interactive learning and engaging assignments are important. Content mastery and ample time to allow for a variety of instructional practices are recommended by Woodside (1989). Use of cooperative and active learning experiences, independent study, small group interactions, and use of technology complement the needs of middle school students (NMSA, 2003; Woodside, 1989).

The Turning Points report also recommended flexible schedules and extended time to support interdisciplinary teaming and helping students connect with a caring adult (Woodside, 1989). Elementary students enter middle school having lived their school day with one or two teachers. The norm in middle school is learning to interact with seven or eight teachers. Meeting the expectations of so many adults during the school day is often chaotic, fragmented, and challenging for the early adolescent. Feeling lost in middle school is common, and the 45- to 50-minute departmentalized schedule does not afford opportunities for students to form strong relationships with teachers (DeRouen, 1998; Hackman & Valentine 1998). Nor does this form of organization encourage student-centered learning (Hackmann & Valentine, 1998; Woodside, 1989).

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Baker (1999) suggests that students who feel alienated from school are also likely to fail. Students who are successful in school experience caring and supportive relationships with teachers. Relationship aspects are often ignored because middle schools/junior high schools become more content focused as the time restraints increase in the schedule.

In summary, caring and supportive teachers, small family-like groupings of students, and recognition that middle school students are self-conscious and self-absorbed are important in helping students transition to the middle school environment successfully. Ability-grouping and comparisons, as well as failure to recognize and respond to differences, negatively influence school success. A schedule that enables the teacher to spend more uninterrupted time with students, to have the time to develop stronger relationships, to offer guidance and direction to offset the sometimes negative advice from peers, and to provide accommodations for academic differences may be superior to the traditional schedule. The fragmentation of the traditional schedule and the limited time often prevents implementation of the foregoing strategies.

Achievement Gaps Among Black, Hispanic, and White Students

Lee (2004) using data from the National Assessment of Educational Progress reports that the achievement gap of Black and Hispanic students ranges from 0.7 to 1.1 standard deviations. These data are from the National Assessment of Educational Progress long-term trends, which measure basic computation skills. Black and Hispanic performance continue to lag behind White students on this assessment measure.

The debate and discussion in the 1990s and early part of the 21st century about American education led to the enactment of the NCLB Act. Section 1001 of the NCLB legislation enacted in 2002 requires state governments to ensure that all children receive high-quality education and that the prevailing achievement gaps between racial and ethnic minorities be closed (NCLB, 2002). The states were tasked to use specific academic assessments to measure performance and to close the gaps between minority and majority populations. Appropriation of federal education dollars was linked to districts meeting the expectations that all children reach identified benchmarks or make adequate yearly progress (NCLB, 2002).

Closing the achievement gap that exists between Black and Hispanic and White students' performance continues to challenge all American school districts (R. Evans, 2005). Promising practices, such as differentiation, creating smaller units or teams, using extended blocks of instructional time, and promoting strong student-teacher relationships, have contributed to improved performance. Evans also believes that real progress toward eradicating the achievement gaps will occur when the cultural and economic challenges faced by many students in these groups are addressed. Strong early childhood education programs, parenting support for the single-parent family structures that is the reality for many minority students, and after school programs have helped (R. Evans, 2005; NCEE, 1983).

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Block and Traditional Scheduling

Unfortunately, the predominant type of instruction in many middle schools is listening to the teacher (Hackmann & Valentine, 1998). Very few active learning and critical thinking types of assignments are evident or interdisciplinary teaming. Interdisciplinary teaming capitalizes on individual teacher strengths and skills, while allowing for teacher creativity, empowerment, and leadership. In-depth learning occurs when longer blocks of time are used to teach the lessons. The early adolescent functions better when the classroom provides varied learning activities. Longer blocks of time enable teachers to more effectively implement varied learning assignments (Canady & Rettig, 1995; Hackmann &Valentine, 1998).

Stability and structure are important. Changing classes often, and trying to become responsive to the many teachers, sometimes seven during the school day, does not complement the early adolescent's needs (Woodside, 1989). Small classes that result from a block schedule can promote a community environment and enable students to develop personal relationships with teachers and peers (DeRouen, 1998; Fisher & Frey, 2007; Hackmann & Valentine, 1998).

The traditional schedule, with its frequency of starting and stopping, is highly likely to cause teachers to use more passive classroom instruction and to provide little or no multiple assignment experiences during the class (Hackman & Valentine, 1998; Mattox et al., 2005). The alternating block schedule provides all teachers with the opportunity to offer the exploratory or elective classes and to use longer periods of time to provide richness in the curriculum (Hackmann & Valentine, 1998; National Education Commission on Time and Learning, 1994).

Fisher and Frey (2007) found that traditional schedules do not promote child-centered instruction, nor is the academic success of students in the 45/55-minute schedule as good as those in the interdisciplinary block. Critics might say that meeting daily offers the advantage of seeing students more frequently and offering a small dose of instruction and thus is preferable to the alternating day schedule. The research does not affirm this thinking (Canady & Rettig, 1995; Fisher & Frey, 2007; Hackmann & Valentine, 1998; Mattox et al., 2005).

A Texas study looked at the effects on block scheduling and seventh-grade mathematics. The researcher hypothesized that student achievement, as measured by the Texas Assessment of Academic Skills, would show gains for lower achieving students scheduled 90 minutes daily compared with students scheduled 50 minutes each day. The second hypothesis looked at the idea that uninterrupted time, 50 minutes daily, positively affects achievement when compared with the interrupted schedule of 90 minutes every other day as measured by achievement on the Texas Assessment of Academic Skills test. An analysis of variance (ANOVA) was used to look for differences in achievement. No significant differences were shown between the block and traditional scheduled schools. The researcher noted as additional factors mediating variables such as length of time the schedule had been in use (1 year) and the level of staff development offered

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to teachers using the new schedule, as well as teacher skill and experience. A 5-year difference existed between the average years of experience of teachers in the school using a block schedule; teacher experience was 5.4 years compared with 10 years in the traditional school (Schroth & Dixon, 1995). However, in a study similar to this research, Mattox et al. (2005) reported that sixth-grade mathematics students showed significant increases in performance after transitioning to a block schedule from a traditional schedule. The study, in the Northeastern United States, involved five middle schools of about 8,700 students. The study was an experimental design; the schools followed a traditional schedule for the first three years of the research and then transitioned to a block schedule of either a 4 × 4 or an alternating day schedule. The assessment was a state mandated standards-based test. Four schools showed significant performance increases after the second year of implementation. One school showed significant increases in performance at all 3 years of implantation of the block.

In summary, the block schedule, when compared with the traditional schedule, may offer more opportunities for schools to respond to the wide variance that characterizes the early adolescents' differences in learning, their need for belongingness, and the development of strong positive relationships with teachers. Extended blocks of time more closely resemble the elementary program where children are assigned to fewer adults and are offered more structure. These extended time blocks made available for middle school students are important at a potentially turbulent time in their lives. The one factor on which researchers are in agreement is that time is the variable that influences increased success for low achievers. Yet the debate continues about block and traditional schedules and whether this organization of time contributes to improved student achievement and school performance. Research on middle school scheduling is limited; this study will address middle school scheduling and its impact on test performance of Black and Hispanic students in Northern Virginia.

Descriptions of Different Block Schedules

Block scheduling takes many forms (Canady & Rettig, 1995). The most commonly used form is either the 4 × 4 or the alternating day schedule, sometimes called the A/B schedule. The 4 × 4 schedule is similar to the university schedule because students complete a course each semester, which is typically 18 weeks. Students enroll in four courses, 90 minutes each, and the courses meet daily. Districts with high mobility and transfer rates find that catching students up who enroll in mid semester coming from schools using a traditional or full-year schedule can be more challenging than using a traditional 45/50-minute schedule that meets daily. This schedule also hinders interdisciplinary teaming because students complete the courses in a semester (Hackmann & Valentine, 1998; Zapeda & Mayers, 2006).

The A/B alternating schedule meets year long, and students take seven or eight classes that are attended every other day. If the school follows a seven-period day, one class meets daily or is embedded. Three classes meet daily for 90 minutes each, and students see teachers every other day during the year. In schools with an eight-period

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day, students take four classes, 90 minutes each, and meet their teachers every other day for the year (Zapeda & Mayers, 2006).

The most common variation of the Copernican Plan is the A/B alternating day schedule or the 4 × 4 schedule. Other features of the Copernican Plan encompass classes being scheduled for 120 minutes, or 240 minutes for 30, 45, 60, or 90 days. For example, a student might complete a core subject—math, science, or language arts—in 30 days, attending the class daily for four hours using the remaining two hours of the school day for electives. Another arrangement might allow the student to enroll in two core classes for two hours each, for 60 days, finishing the day with elective classes (Carroll, 1994).

The traditional system for scheduling secondary schools is based on the Carnegie unit structure, which has dominated educations for over 100 years. Teachers teach five classes for about 45 minutes each throughout the school year. At the completion of the course, high school students are granted a unit of credit necessary for graduation (Carroll, 1994).

In summary, middle schools have typically used a 45- to 60-minute, six- to seven-period day schedule. The reform movement has challenged the use of time in schools and many districts have turned to some form of the Copernican schedule, which organizes the school day into longer blocks of time ranging from 90 to 240 minutes. Most high schools follow the A/B schedule, a 90-minute class period that meets on alternating days, or a 4 × 4 schedule. The 4 × 4 schedule organizes instruction into 90-minute blocks of time that meet for 90 days. Students typcially take four classes during the school day. Middle schools follow similar schedules, either the traditional 45-minute schedule or an A/B/4 × 4 block schedule.

Method

Introduction

Much of the research on block scheduling has addressed the reform strategy at the high school level. This research study looked specifically at middle school block and traditional (non block) scheduling and achievement as measured by the percentage of students in a school earning a pass/proficient or pass/advanced score in mathematics and reading on the SOL Tests. This research study looked specifically at block and traditional (nonblock) scheduling and achievement as measured by the percentage of students in a school earning a pass/proficient or pass advanced score in mathematics and reading on the SOL Tests.

The study will also examine if differences in performance exists as measured by school percentage performance in math and reading SOL scores by race—Black, Hispanic, and White—in block and nonblock schools.

Population

The population for this study included middle schools in Region IV in the state of Virginia. The VDOE webpage reports 89,454 middle school students (78 middle schools) in this

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region. The following counties and cities comprise Region IV: Alexandria, Arlington, Clarke, Culpeper, Fairfax, Falls Church City Public Schools, Fauquier, Frederick, Loudoun, Madison, Manassas City, Manassas City Public Schools, Orange, Page, Prince William, Rappahannock, Shenandoah, Warren, and Winchester City Public Schools (Digital-Topo-Maps.com, n.d.; http://www.digital-topo-maps.com/virginia.shtml). Locale descriptions of the 19 districts are 6 large suburban, 9 rural, 2 middle sized cities, 1 small city, and 1 town (VDOE). The large suburban districts are Fairfax, Loudoun, Prince William, Falls Church, Manassas City, and Manassas Park. Rural districts are Clarke, Culpeper, Fauquier, Frederick, Madison, Orange, Page, Rappahannock, and Warren. Alexandria and Arlington are described as middle size cities; Winchester has a small city designation, and Warren is described as a town.

The Study Group

This study specifically evaluated middle schools in Virginia's Region IV, which encompasses the northern tip of the state from east to west. Middles schools included in the study followed an alternating block schedule having 80 to 90 minutes per block. Block schools' classes met every other day; students attended 3 or 4 blocks daily. The traditional schools followed a schedule of 45- to 60-minute classes that met daily. Specific criteria were used to establish the study groups and represent the population of Region IV. Virginia middle schools in Region IV using an alternating block schedule, 80 to 90 minutes per block, or nonblock middle schools following a daily 45- to 60-minute class period, and a middle school organization of 6 to 8 minutes were the criteria used to select schools for the study. Performance data from the SOL reading and mathematics tests for the 2008/2009 school year were used.

A total of 43 middle schools in Region IV, comprising 33,834 students—58% White (19,672), 18% Black (5,995), and 22% Latino (7,443)—were used for the research. Schools in the study group using a block schedule were 53.4% (23), and schools using a traditional schedule were 46.5% (20) (VDOE, 2009).

Two Fairfax schools, Glasgow and Holmes, were used for the study; the remaining schools in Fairfax were omitted because of the grade organization, seven through eight. Rappahannock, Warren, Falls City Public Schools, and Manassas City were also eliminated from the study because these districts did not follow the middle school organization, grades 5 to 8 or 6 to 8, configurations defined by Clark and Clark (1993). Madison and Orange County used a 4 × 4 block schedule and were eliminated. Shenandoah County schools were eliminated because of low or no racial diversity in the population. Low numbers for racial diversity is defined as being able to identify students in a school population; no racial diversity means that no Black or Hispanic students comprised the school population. In some instances, schools from a county were included while others were not because the schools did not meet certain study criteria. For example, some of the Prince William County Middle Schools were eliminated because they used hybrid or mixed block schedules. Page County had newly implemented the middle school concept and had constructed two new schools to house its middle school population. No

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SOL data were available for this jurisdiction for the 2008-2009 school year and these schools were, therefore, eliminated from the study. All the middle schools in Alexandria, Arlington, Culpeper, Fauquier, Manassas Park City, and Loudoun were included in this study (VDOE, 2009).

In this study, data were evaluated using statistical tests, an independent measures *t* test, and ANOVA. An independent-measures *t* test allows the researcher to compare mean differences of two groups for significance (Gravetter & Wallnau, 2007). The independent *t* test will help the researcher decide if there are significant differences in the percentage performance of students' math and reading scores, in block and non-block schools.

An independent-measures *t* test is unsuitable when comparing more than two means for significance because a Type 1 error can occur (Gravetter & Wallnau, 2007). A Type 1 error can lead the researcher to conclude that a treatment is effective when there is no effect. An ANOVA allows the researcher to determine significance when more than two means are being compared, reducing the concern for Type 1 error.

Data Source and Collection

The VDOE webpage offers a rich source of data on SOL Tests by jurisdiction. The NCLB legislation requires states to report student performance by race/ethnicity. The data for math and reading by school will be a percentage of all students earning pass proficient or advanced on the SOL Tests. Additionally, data by school on the performance by race—Black, White, and Hispanic—will be gathered and evaluated in terms of school schedule, block or nonblock. The data will be the percentage by race of students earning pass proficient/advanced on SOLs in mathematics and reading. A pass/proficient performance in reading is based on students successfully completing 28 of 45 items correctly; advanced status is granted if the student completes 39 of 45 items correctly. Raw scores for mathematics are based on correctly completing an average of 32 correct items of 50 for pass-proficient and 43 of 50 for pass-advanced status.

Percentages of all students earning a pass proficient/advanced were entered into an Excel spreadsheet and later transferred to SPSS. Likewise, the data, percentage of students by race—White, Black, and Hispanic—and schedule type by school was recorded into an Excel spreadsheet and later transferred to SPSS.

The link, educational directory, was first used to locate the region, division, and the schools within that division. A list of schools following a block schedule and those using a traditional schedule was generated from this source. The data and reports link, assessment data and school report card, were also used to provide results for each school's math and reading and were recorded in an Excel spreadsheet (VDOE, 2009).

A telephone contact was made to each of the schools in the study to verify the schedule information found on the VDOE's website.

Research Design

The research design was based on the use of secondary data, information on SOL performance, and discipline reports by school, block and nonblock, in Region IV of Virginia.

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The research design was nonexperimental because the researcher has no control over the independent variables. Independent variables included schedule types, ethnicity, and school, and the treatment conditions were block or nonblock schedule. Dependent variables were school performance in math and reading and No causality can be assigned between the independent and dependent variables. The research at best showed relationships between the variables (Mertler & Vannatta, 2005).

Data Analysis

Data were analyzed using descriptive statistics to provide information about the sample size, means, and standard deviation. An independent-sample *t* test was used to answer the question, "Is there a difference in the block and nonblock schools and the percentage of students earning pass proficient/advanced on math and reading SOL scores?" An independent-sample *t* test is a statistical procedure that allows the researcher to compare means from two separate samples or groups (Gravetter & Wallnau, 2007). In this study, mean comparisons of math in block and nonblock schools were completed. The same procedure was used for mean reading scores based on the schedule type. An α level of .05, acceptable in educational studies, was used in this study.

Univariate ANOVA is used to study differences of two or more groups or factors on the dependent variable. The relationship between schedule types, block or nonblock, the school, and ethnicity—Black, White, and Hispanic—and the percentage performance of the school on math and reading was evaluated using univariate ANOVA (Mertler & Vannatta, 2005).

Data analysis of Region IV middle schools' math and reading SOL Test scores was computed using SPSS, Statistical Package for Social Sciences. Statistical analyses, *t* tests, and univariate ANOVA were used to answer questions about mean performance of block schools and traditional schools and performance by race.

An independent-sample *t* test was used to determine if there were significant differences in the means of math and reading school scores from block and nonblock schools.

An independent-sample *t* test comparing Region IV middle schools' mean math scores as measured by the percentage of students earning pass/advanced scores using a block and traditional schedule was calculated. No significant difference was found, $t(41) = 1.81$, $p > .05$. The mean math score of the block schools ($M = 82.61$, $s = 7.81$) was not significantly different from the nonblock schools ($M = 78.65$, $s = 6.32$).

An independent-sample *t* test comparing Region IV middle schools' mean reading scores as measured by the percentage of students earning pass/advanced scores using a block and traditional schedule was calculated.

No significant difference was found, $t(41) = 1.15$, $p > .05$. The mean reading scores of the block schools ($M = 89.65$, $s = 5.71$) were not significantly different from the nonblock school ($M = 87.80$, $s = 4.63$).

Tables 1 and 2 provide summaries of the *t* test results for middle school math and reading school scores.

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Table 1. *T* Tests for Math Block and Nonblock Schools

Type of Schedule	*N*	*df*	*M*	*s*	*t*	*p*
Block	23	22	82.61	7.81	1.81	.078
Nonblock	20	19	78.65	6.32		

Table 2. *T* Tests for Reading Block and Nonblock Schools

Type of Schedule	*N*	*df*	*M*	*s*	*t*	*p*
Block	23	22	89.65	5.78	1.15	.26
Nonblock	20	19	87.80	4.63		

Table 3. Tests of Between-Subject Effects for Math

Source	*df*	*s*	*M*	*F*	*p*
Schedtype	1	787.74	787.74	14.04	.000
Race	2	6931.40	3465.70	61.75	.000
Schedtype × Race	2	161.85	80.93	1.44	.240
Error	123	6903.34	56.13		
Total	129	766335.00			

Univariate ANOVA Results for Math

Univariate ANOVA allows the researcher to study variables with more than one factor (Gravetter & Wallnau, 2007). In this study, the dependent variables math and reading scores were categorized by race—Black, White, and Hispanic. The independent variable, schedule type, also had two factors, block and nonblock.

The univariate ANOVA compared mean variances of schedule type and math performance of Black, Hispanic, and White students. Significant main effects for schedule type and race were found. Schedule type, $F(1, 123) = 14.04$ $p < .05$; race, $F(2, 123) = 61.75$, $p < .05$. There was no significant interaction between race and schedule type. Interaction, a relationship between the factors, can affect the treatment effects (Gravetter & Wallnau, 2007). Interactions between race and the schedule types results were the following: $F(2, 123) = 1.442$, $p > .05$. A post hoc test, Tukey, was run to determine which groups were different. The percentages of Black and Hispanic math students earning pass/advance were significantly lower in non block schools. Black and Hispanic mean pass rates in block schools were: Black = 73.96, s = 8.62; Hispanic = 74.39, s = 9.11. Black and Hispanic mean pass rates in non block schools were: Black = 66.35, s = 6.64; Hispanic = 69.25, s = 8.07. Tables 3 and 4 summarize

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Table 4. Tukey Post Hoc Test for Math

(I) Race	(J) Race	(I – J)	Standard Error	*p*
Black	Hispanic	−1.58	1.62	.59
	White	−16.16	1.62	.00
Hispanic	Black	1.58	1.62	.59
	White	−14.58	1.62	.00
White	Black	16.16	1.62	.00
	Hispanic	14.58	1.62	.00

Table 5. Tests of Between-Subject Effects for Reading

Source	*df*	*s*	*M*	*F*	*p*
Schedtype	1	216.95	216.95	4.75	.031
Race	2	4430.01	2215.01	48.45	.000
Schedtype × Race	2	34.60	17.30	.38	.69
Error	123	5622.73	45.17		
Total	129	952356.00			

the above information. Black and Hispanic mean pass rates in nonblock schools were the following: Black = 66.35, $s = 6.64$; Hispanic = 69.25, $s = 8.07$. Tables 3 and 4 summarize the above information.

Univariate ANOVA Results for Reading

A univariate ANOVA compared mean variances of schedule type and reading performance of Black, Hispanic, and White students by school. Significant effects for schedule type and race were found. Schedule type, $F(1, 123) = 4.76$, $p < .05$; race, $F(2, 123) = 48.45$, $p < .05$. There was no significant interaction between race and schedule type for reading, $F(2, 123) = .378$, $p > .05$.

A post hoc test, Tukey, was run to determine which groups were different. The percentages of Black and Hispanic students earning pass/advanced in reading were significantly lower in nonblock middle schools. Black and Hispanic reading mean pass rates in block middle schools were the following: Black = 82.39, $s = 8.39$; Hispanic = 83.35, $s = 8.73$. Black and Hispanic reading mean pass rates in nonblock middle schools were the following: Black = 78.60, $s = 7.16$; Hispanic 80.60, $s = 6.75$. Tables 5 and 6 summarize the above information.

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Table 6. Tukey Post Hoc Test for Reading

(I) Race	(J) Race	(I – J)	Standard Error	*p*
Black	Hispanic	1.44	1.46	.58
	White	–13.05	1.46	.00
Hispanic	Black	1.44	1.46	.58
	White	–11.60	1.46	.00
White	Black	13.05	1.46	.00
	Hispanic	11.60	1.46	.00

Discussion and Conclusion

The purpose of this research was to examine reading and math SOL Test scores for mean differences in block and nonblock schools in Virginia's Region IV. The research also sought to determine if race made a difference in test performance with relation to schedule type. Many schools have implemented block scheduling as a school reform method. This research sought to gather data to evaluate if A/B block scheduling is a promising practice and add to the body of information about middle school scheduling.

Comparison of Means for Block and Nonblock Schools

The *t* test that evaluated the difference in school means for reading and math showed no significant differences between the block and nonblock schools. However, when race was partitioned out, significant differences in the mean variance of block and nonblock schools were shown. Black and Hispanic percentages of students scoring pass/advanced were significantly lower in the nonblock schools than in the block schools. The inconsistent results of this study align with the research (Carroll, 1989; DiBiase & Queen, 199; Fisher & Frey, 2007; Mattox et al., 2005; Schroth & Dixon, 1995; Woodside, 1989; Zapeda & Mayers, 2006).

Disaggregation of the data provided valuable information and supports the importance of requiring jurisdictions to examine subgroup data stringently. The NCLB Act (2002) mandated school districts to disaggregate data to better evaluate the performance of subgroups. The data on school performance, drawn from VDOE's website, was based on the percentage performance of 19,672 Whites, 5,995 Blacks, and 7,443 Hispanics. The *t* test results for reading and math in block and nonblock schools were influenced by the smaller numbers of subgroups being subdued by the majority group whose performance surpassed the subgroups in block and nonblock formats. After completing the univariate ANOVA, which provided different results with regard to race, a *t* test was completed on the performance of White students in block and nonblock schools. The *t* test confirmed no difference for Whites.

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Implications and Future Research

A significant difference was found in schedule types for reading and math when considering race with no significant interaction between schedule type and race. The Tukey post hoc test was significant for differences in Black and Hispanic means in block and nonblock schools when compared with Whites. The block schools were significantly higher in math and reading than nonblock schools (see Tables 5 and 6). Schedule type and performance on the SOL Test in Virginia's Region IV appear to be related and should be given consideration when working with student subgroups whose performance has consistently lagged behind the majority population. Reform efforts have targeted children who continually experience failure and large numbers of children in the Black and Hispanic subgroups perform poorly in school (R. Evans, 2005; NCLB, 2002). Concentrated periods of time appear to hold promise; the percentages of Black and Hispanic students earning pass/advanced were significantly larger in the A/B block schedule. The results, students performing better in block school than traditional ones, mirror the findings of Canady and Rettig (1995); Carroll, J.M, 1989; Fisher and Frey (2007); and National Education Commission on Time (1994).

The math results from this study seem to mirror some of the findings of Mattox et al. (2005). The researchers in this study evaluated suburban and semirural schools in the southeastern part of the United States. The experience level of teacher and administrators varied widely, which was true in this study. The student population, similar to this study, included Black, White, and Hispanic groups. *T* tests were used to evaluate the mean differences of standards-based test scores in mathematics. Unlike this study, data were examined for 3 years. In schools with significant Black and Hispanic populations, increases in sixth-grade math scores occurred. White students' math scores also improved, and these differences may be attributed to the length of the study (3 years).

Gaps in achievement of Black and Hispanic students and Whites are no surprise (R. Evans, 2005; Lee, 2004; NCEE, 1983; USDOE, 2008). Many White students are performing successfully when using standards-based testing as a measure (VDOE). However, White students whose performance does not meet the standards-based measures may be subsumed by the larger numbers of Whites who are performing well. Further research on schedule type and performance may provide directions for addressing school success, particularly with children, regardless of race, who fail on standards-based measures such as SOL Tests and other indicators of successful school experiences.

Though this study adds to the body of information about scheduling and particularly middle school scheduling, the study is narrow and has limitations. The small sample size, 43 schools, and lack of random selection inhibit generalizing about this research. The results are limited to Virginia Region IV middle schools using an A/B block schedule. The test data were for 1 year and is also a limitation. Evaluating testing over a 3-year period or longer would also support broader application of the results. A major limitation of the study is the lack of consideration of teacher

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practices, skills, and classroom experiences. How teachers use extended classroom time and the quality of their instructional delivery are significant in student achievement and test performance. Teachers' experience, skill, and attitude are also significant factors in student achievement. The results from this study offer a starting point for further research on how teachers use classroom time, whether in a block or traditional schedule. The Mattox et al. (2005) study on middle school math achievement informs the design of this study; teacher experiences and skills were not controlled for in the study.

However, all Virginia schools are held accountable for student success on the SOL Tests and thus must teach a standards-based curriculum (VDOE, 2008). This expectation of teachers provides a commonality whether teaching in a block or traditional schedule.

Many questions remain about scheduling, and future research on a national scale is recommended. Collection of data, grading, attendance, and testing results in middle schools following a block format, and those middle schools using a more traditional schedule may be beneficial to school leaders and policy makers in addressing student achievement and performance. This study evaluated the performance of Black and Hispanic students in the A/B block format compared with those in a traditional schedule in the northern region of Virginia and falls short of representing the makeup of a state or national group. A larger study about middle school scheduling including other subgroups—special education, economically disadvantaged, English second language learners, and all children who are not performing well in school regardless of racial ethnic designation—would contribute to the literature and may support schools in their quest to improve schooling for all.

Testing is a very small component of a student's education. Grades; social, emotional, and psychological development; and teacher influence are also components of the schooling process (NMSA, 2003; Tomlinson, 1999; Van Ryzin, Gravely, & Roseth, 2009; Woodside, 1989). An evaluation of students' performance and school success is incomplete without considering the teacher variable. The teacher's skill, expertise, and experiences are very critical factors that influence student success or lack of success.

What are teachers' perspectives about traditional and block schedules and student achievement and standards-based testing? How do teachers' skills and abilities influence attitudes and ideas about the use of block and traditional scheduling? Are the lessons taught significantly different in block formats and nonblock schedules? What do teachers say about students' grades and other nontesting performance measures in the A/B block or other block scheduling formats when compared with the traditional schedule? Do the differences in lesson presentations matter in the overall school performance of students? Answers to these questions are also important when making decisions about scheduling types.

The structure of the school day, an important aspect of instructional delivery, and reform practices are intertwined. The results from this study appear to show that longer blocks of time in the A/B format enabled a larger percentage of Black and Hispanic students to earn a pass/advanced on math and reading SOL Test when compared with Black and Hispanic students in a traditional 45- to 50-minute schedule.

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