Dedication

This research study is dedicated to my wife, Stephanie Perkins Rayfield, to my mother, Barbara Banish Rayfield, and in the memory of my father, James Denard Rayfield, Jr.
Acknowledgements

Many people have contributed to my success in completing this dissertation. I was fortunate to have an outstanding committee. Dr. Parson was a wonderful chair and mentor, and I want to thank him for all of his help from the first time we talked about a dissertation topic on block scheduling (at ASCD in Boston) to my final defense where he provided the leadership for success. Dr. Twiford was instrumental in keeping me focused on the topic and on the dissertation. His leadership during professional seminar was a key-contributing factor to my success as well. I dedicate Chapter IV to Dr. Mary Yakimowski, a true teacher and friend. It was a great accomplishment for her to teach an English major to prepare and to interpret the statistics necessary to complete this research study. Dr. Krill was an encouraging force for my dissertation. From the first time I met her during the preliminary defense, I knew she was someone of great magnitude for my study. Thank you, Dr. Krill, for staying with me to the end. My friend and colleague, Dr. Roberts, was another contributor to my success. I sincerely appreciate his encouragement and willingness to listen to numerous updates on my progress.

I also must acknowledge Dr. Samuel Leary. Sam was instrumental in encouraging me to apply to the Virginia Tech program. He remained constant throughout the process and listened during numerous lunchtime updates as I completed the dissertation process. I also must acknowledge and thank all of the professors in the Department of Educational Leadership and Policy Studies who helped me complete the requirements for the Doctor of Education degree. I want to thank my secretary, Karen Vasconcellos, and Dr. Twiford’s secretary, Linda Jones, for their encouragement and support. And finally, to my family, my wife and my mother, thank you for listening and understanding when I responded to your many requests with “I need to be working on my paper.”
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CHAPTER I

THE PROBLEM

Learning in America is a prisoner of time. For the past 150 years, American public schools have held time constant and let learning vary. The rule, only rarely voiced, is simple: learn what you can in the time we make available. (National Education Commission on Time and Learning, 1994, p. 7)

The traditional high school schedule has remained unchanged for most of the twentieth century. One reason for the reluctance to change is that teachers have been protective of the schedule. Teachers have prepared to teach in a schedule in which they were familiar and have been trained. They had a calling to teach in a school that was reminiscent of the high school that they attended. For this reason, the high school schedule was largely based on tradition rather than on research and educational best practices. As we enter a new century, the traditional high school schedule is very much a part of today’s culture, since generations of Americans have graduated from a high school that required the Carnegie unit, and they have been successful.

However, educators across the nation must rethink the organization of the school day in relation to time as they face the challenges of a new century (Shortt & Thayer, 1997). As knowledge and information become more prolific and accessible, educators are finding that the old ways of doing things just do not work. Longer periods of time are now needed for teachers to teach, for the emphasis of teaching has changed its focus from tasks demanding skill and drill to tasks requiring critical thinking, problem solving, and student involvement (McCullough & Tanner, 2001). The high school schedule is now receiving renewed attention.

The traditional high school schedule had its beginning in the 1920s and was based on a factory model of compartmentalization and specialization, training students for farm and
industrial work (National Association of Secondary School Principals, 1996; Shortt & Thayer, 1997). Decision-making, creativity, judgment, and technological knowledge were neither taught nor expected (Edwards, 1993). Shortt and Thayer assert that the workplace that today’s students will enter emphasizes values, rewards, and skills that have been ignored by many traditional schools. For example, today’s work settings use teams to create products and to solve problems and design new processes. However, few schools have taken the initiative to restructure the classroom to foster cooperation and collaboration (Shortt & Thayer, 1997). Learning together in student teams, exploring new ideas, and conducting research can be valuable for students who will pursue a career that will require them to work together with others. If teachers are to implement teaming concepts that encourage students to jointly pursue research projects and real world problems, there must be time in the instructional period for them to work together. Schools of the new century must abandon the factory model and encourage teachers to cross disciplines, work in teams, and focus on contextual learning – all of which will be strengthened by using time effectively and maintaining high academic standards (Shortt & Thayer, 1997).

During the last decade, two organizations have focused specifically on the use of time and learning at the high school level. The National Education Commission on Time and Learning (1994) proposed that the number of academic days be doubled, that the school day emphasize instruction, and that schools emphasize student learning, not the scheduling of time. Solutions intended to create more time for learning included lengthening the school day and year and utilizing the school day more efficiently. Further, in 1996, the National Association of Secondary School Principals (NASSP) in Breaking Ranks: Changing an American Institution argued that the high school day must be restructured. Time required learning a new concept or skill varies from individual to individual, and the school day should accommodate the learning
needs of all students. “Teaching and learning need more room for flexibility. High schools must abandon the Carnegie unit so that they no longer equate seat time with learning” (NASSP, 1996, p. 5).

Recently, the National Commission on the High School Senior Year (2001) described the final year of high school students as wasted opportunities that need to be reclaimed. The report stated that while statistics show that student achievement is improving in elementary schools, test scores are continuing to lag in middle and senior high schools. The report concluded that one way to address the problem might be to make the time requirements in the high school more flexible. “Educators should work to provide the widest possible array of demanding educational alternatives for all students” (National Commission on the High School Senior Year, 2001, p. 31). Proponents of the restructuring of the high school argue that with the manipulation of time periods in the school day, it is possible to deliver an educational product that more closely meets the changing instructional needs of both students and teachers (NASSP, 1996).

Block scheduling, the use of extended periods of time for learning, is one response to the restructuring of the high school. The National Education Commission on Time and Learning (1994) stated that “new uses of time should ensure that schools rely much less on the 51-minute period, after which teachers and students drop everything and run off to the next class. Block scheduling... should be more common” (p. 31). In a traditional schedule utilizing 51-minute periods, students generally attend six or seven different classes. “Assuming a seven-period day, a homeroom, and lunch, a typical student will be in nine locations pursuing nine different activities in a 6-½ hour school day” (Carroll, 1994, p. 27). Carroll explained that this schedule is unlike any experienced by the student before or after high school or in the work place. It produces a hectic, impersonal, and inefficient environment (Carroll, 1994). By reconfiguring the school day
into longer periods of time with fewer class changes per day, students have more time to study material in depth while concentrating on fewer subjects at any one time. Additionally, the block schedule affords students and teachers the time to interact more regularly and to develop better personal relationships (Guskey & Kifer, 1995).

**Statement of the Problem**

Educators must continue to conduct research in the area of scheduling in an attempt to develop more effective scheduling models that meet the needs of the students and the teachers especially in terms of time and learning (Lawrence & McPherson, 2000). Much of the decision making as whether to implement one form of block scheduling or another has occurred without the understanding of the implications this type of reform has on instructional practices within the classroom and on student academic achievement (Veal & Flinders, 2001). There is agreement that block scheduling can have a positive impact on school climate, provide teachers the opportunity to improve and to expand their instructional strategies, reduce discipline referrals, and improve student attendance (Deuel, 1999; Mutter, Chase & Nichols, 1997). There is also evidence that grade point averages and the number of students on the honor roll increases with block scheduling (Brown & Schatten, 2000; Guskey & Kifer, 1995). Furthermore, it is most common to encounter research on student effects and opinions of block scheduling, teacher effects and opinions of block scheduling, and parent opinions of block scheduling (Cobb, Abate & Baker, 1999). However, there is limited scientific evidence supporting the effect of block scheduling on student academic achievement. Therefore, by comparing the 7-period alternating day schedule, the 4 x 4 block schedule, and the traditional single-period schedule, this study provides important data to be used by school administrators when considering options for a high school schedule.
**Purpose of the Study**

The purpose of this study was to compare the effects of the 7-period alternating day schedule, the 4 x 4 block schedule, and the traditional single-period schedule on student academic achievement. Student academic achievement was measured by using the mean scaled scores for the Virginia Standards of Learning end-of-course tests for high schools. This study also attempted to determine if length of time on the schedule was a factor by comparing only schools that had used the schedule (7-period alternating day, 4 x 4, traditional) for three or more years. The intent of this study was to determine if one particular block schedule was more desirable than the other, and to determine if block scheduling provided administrators and teachers the mechanism to improve student achievement.

**Research Questions**

The study examined the following research questions:

1. Is there a significant difference among high schools using a 7-period alternating day schedule, a 4 x 4 block schedule, or a traditional single-period schedule for three or more years with respect to the mean scaled scores on the Virginia Standards of Learning (SOL) end-of-course tests?

2. Is there a significant difference among high schools in an urban, suburban, or rural location with respect to the mean scaled scores on the Virginia SOL end-of-course tests?

3. Is there a significant interaction between schedule type (7-period alternating day, 4 x 4, traditional) and school location (urban, suburban, rural) with respect to the mean scaled scores on the Virginia SOL end-of-course tests?
4. Are there any content areas (English, history and the social sciences, mathematics, or science) that appear to be positively or negatively affected by one block schedule as compared to the other?

**Significance of the Study**

In a response to the concerns and the recommendations of the national commissions as well as the business, industry, and government leaders, the Commonwealth of Virginia began a statewide reform movement to ensure that the students in the public schools can compete in the international economy of the twenty first century as well as be informed and responsible citizens of a democracy (Commonwealth of Virginia, 1995). The reform effort consists of four major elements: (a) rigorous academic standards, (b) assessments that measure student achievement, (c) measures to ensure accountability for student achievement, and (d) a performance report card. In 1995, rigorous academic standards were set forth in the Standards of Learning (SOL) by the Commonwealth of Virginia and outlined the minimum acceptable academic standards for every student from kindergarten through twelfth grade in the four core subject areas of English, mathematics, science, and history and the social science. Following the adoption of the SOL, the Virginia Department of Education (VDOE) developed assessment programs designed to assess the extent to which the students have learned the contents and skills specified in the SOL. At the high school level, the tests are administered at the end of certain courses in the core subjects of English, mathematics, science, and history and the social sciences. The tests are connected to graduation requirements for students, and to ensure accountability, to accreditation status for the schools.

Mutter, Chase and Nichols (1997) explained that the move to rigorous academic standards is one reason that many schools are changing to the block schedule. By 1995,
approximately 40% of secondary schools in the United States had changed their school schedules to one that involved longer class periods (Mutter, Chase, & Nichols). It had been predicted that over 75% of the high schools nationwide would use some form of block scheduling in the next few years (Queen, Algozzine, & Eaddy, 1997). This level of participation has been achieved in two states, North Carolina and Virginia. As the trend continues throughout the United States, administrators will seek evidence for the impact of block scheduling on student achievement. The question of time used for instruction will become a major focus.

Definitions

Achievement: The extent to which the student has acquired certain skills as measured by the Virginia Standards of Learning high school end-of-course assessments.

Alternating Day Block Schedule: Classes meet every other day for 90 minutes for the entire 180-day school year. For example, periods 1, 3, 7, meet on day 1, and periods 2, 4, 6 meet on day 2. Period 5 is a constant and meets every day for 50 minutes. (This schedule type is also referred to as an A-B schedule.)

Block Schedule: A schedule that is designed to increase the length of a class period beyond the traditional 50 minutes used in schools offering six or seven periods.

4 x 4 Schedule: Students take four classes that meet every day for 90 minutes. Students take four classes each semester for a total of eight classes for the school year. (This schedule type is also referred to as a semester or intensive schedule.)

Mean Scaled Score: The sum of all scores’ distributions divided by the number of scores. The score takes into account scale scores’ slight variations in the difficulty of different forms of the same test.
Schedule: A resource that facilitates effective utilization of people, space, and time in an organization (Canady & Rettig, 1995).

Standards of Learning (SOL): The minimum acceptable academic standards in Virginia for every student from kindergarten through twelfth grade in the four core subject areas of English, mathematics, science, and history and the social sciences.

Traditional Schedule: Students take seven classes every day in periods of approximately 50 minutes. This has been the predominant form of high school scheduling for approximately 75 years (Marshak, 1997).

Limitations of the Study

There are several factors and variables that are beyond the control of the researcher and may affect the results or the interpretation of the results of this study.

1. Teachers use different teaching strategies in all scheduling models. The study did not control for individual teacher differences.

2. The amount and quality of staff development and other training used to prepare teachers to implement longer class periods varies from school to school.

3. There was no control for initial student differences in the abilities, socio-economic status, or family background in the schools used in this study.

4. For the 2001 spring administration of the Standards of Learning tests, the Virginia Board of Education adopted a resolution giving local school divisions more flexibility in establishing a testing window. Some high school utilized the original testing window of May 7-18, 2001; others extended the window to end June 1, 2001.

5. The study did not control for the fact that the strongest mathematics students frequently take Algebra I while in middle school thus making the group of students
taking Algebra I at the high school level more homogenous than those taking the other SOL end-of-course tests used in this study.

6. The study did not control for the varying amounts of time found within each schedule. For example, the 7-period alternating day schedule is comprised of six extended blocks of time of approximately 100 minutes and one single period of approximately 50 minutes. Under this scheduling configuration, some students were instructed in a course for 50 minutes everyday while others were instructed in the same course for 100 minutes every other day.

7. School location – urban, suburban, rural – was defined and identified by the high school principals responding to the survey.

Delimitations of the Study

The researcher delimited the study by comparing student performance on the Virginia Standards of Learning end-of-course tests in only Virginia high schools utilizing a 7-period alternating day schedule, a 4 x 4 block schedule, or a traditional single-period schedule for three or more years. Furthermore, only those high schools in Virginia that incorporated a grade structure of 9 through 12 were included in this study.

Theoretical Framework

For a theoretical framework concerning time and learning, Carroll (1963) provided a succinct “model of school learning.” Carroll’s model stated, “that the learner will succeed in learning a given task to the extent that he spends the amount of time that he needs to learn the task” (p. 725). Furthermore, Carroll defined time in the context of learning by stating time is the extent to which “the person is oriented to the learning task and actively engaged in learning” (p. 725). Carroll focused on five elements important to student achievement within the realm of
time: (a) aptitude – the amount of time needed to learn the task; (b) ability to understand 
instruction; (c) quality of instruction; (d) perseverance – the amount of time the learner is willing 
to spend in the learning; and (e) opportunity – the time allowed for learning. Of these five 
elements, three are directly related to the use of time – aptitude, perseverance, and opportunity. 
Carroll concluded that it may come as a surprise to some that schools in general allow less time 
than is adequate for students to learn a given task. Block scheduling seeks to correct this 
inadequacy (McCullough & Tanner, 2001).

Bloom (1974) further explored the relationship of time and learning by building on 
Carroll’s model of time as being a variable in school learning. By setting time as a central 
variable in school learning, “Carroll produced a major shift in our thinking about education and 
education research” (Bloom, 1974, p. 683). According to Bloom, “all learning, whether it is done 
in school or elsewhere, requires time” (p. 682). Bloom further stated that time is especially 
important in instances where the learner must be exposed to sequential experiences over many 
years to attain mastery of a given concept or body of knowledge. “Time for school learning is 
even more limited by the resources available” (p. 682). Schools and individuals must concentrate 
on merging time and resources for the benefit of the learner. “A thorough understanding of time 
and its use in school learning may help us turn this great potential toward the improvement of 
schools and the improvement of the human condition” (p. 688).

The Bloom et al. (1956) Taxonomy of Educational Objectives is often cited as a 
framework for providing teachers with the connection between instruction and assessment. 
Bloom’s Taxonomy acts as a guide for classifying the verbs found in most state and national 
standards. Utilizing this language is the starting point in the critical process of articulating what 
students are expected to learn and to do. For example, if a series of Bloom objectives call for
students to define, describe, and identify a concept, then the activities should be hands-on involvement where students have the time to perform the tasks. Table 1, Bloom’s Taxonomy of Educational Objectives, provides a definition of each of the levels of Bloom’s Taxonomy, a hierarchy that is used to order skills from the simple to the more complex. Bloom identified six different levels of using and understanding information within the cognitive domain. The extended periods of time offered by a block scheduling model would allow students the opportunity to master several levels of the Bloom hierarchy, thereby acquiring more thinking and reacting skills. The time made available for teacher and student interaction with the block schedule allows an opportunity for students to make the transition from the basic recall (knowledge) to the higher cognitive levels of instruction and learning (analysis, synthesis, and evaluation) (McCullough & Tanner, 2001). Teachers can stay with a topic long enough to help students turn new knowledge into meaning. In longer classes, teachers can help students connect their new learning with prior knowledge.

Table 1

Bloom’s Taxonomy of Educational Objectives

<table>
<thead>
<tr>
<th>Domain</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Rote memorization; recall</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Translate information into one’s own words; paraphrase</td>
</tr>
<tr>
<td>Application</td>
<td>Use information in a new situation; experiment, demonstrate</td>
</tr>
<tr>
<td>Analysis</td>
<td>Divide information into parts; differentiate</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Construct something new by integrating several pieces; compose, create</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Place a value judgment on data; debate, critique</td>
</tr>
</tbody>
</table>
Figure 1, High School Block Scheduling and Student Academic Achievement, provides a visual that seeks to make the connection between time and learning with the use of block scheduling. Although block scheduling is not a novel concept, alternative scheduling models are receiving renewed interest to support the delivery of teaching and learning methods associated with improved student achievement (Deuel, 1999). Merely adding time to a schedule by itself will not automatically improve student achievement. There must be a scheduling format matched with the proper instructional practices working together to promote student success.
Figure 1. High school block scheduling and student academic achievement
CHAPTER II
REVIEW OF LITERATURE

In order to understand the relationship of time and learning, block scheduling, and student achievement, it is necessary to review a number of related factors such as the current status of block scheduling, block scheduling models, perceived benefits of block scheduling, perceived limitations of block scheduling, instructional practices promoted by the move to the block scheduling, and related student achievement research.

Status of Block Scheduling

Rettig and Canady (1999) organized their research on block scheduling into three common threads: the effects of block scheduling on school climate, the effects of block scheduling on academics, and factors affecting the change to block scheduling. Based on their review of current research and their experiences working with schools nationwide, they offer the following statements as factors describing the status of block scheduling. These factors serve as the platform for this study that compares two models of block scheduling.

1. The two major types of block scheduling that have developed in high schools throughout the United States are the alternate-day schedule (A-B schedule) and the 4 x 4 semester model.

2. Ample data support the fact that schools experiencing the most success with block scheduling involved teachers, students, and parents in the decision to change the schedule.

3. The majority of administrators, teachers, parents, and students support block scheduling after at least two years of implementation.
4. The A-B schedule is much easier to implement than the 4 x 4 schedule because the A-B schedule has fewer political and administrative problems.

5. Few schools have successfully implemented a pure 4 x 4 block schedule in which students take four classes, running for about 1 ½ hours, per semester. In most cases, schools using a 4 x 4 schedule have made modifications to accommodate year-long classes in band and Advanced Placement courses.

6. The 4 x 4 schedule provides greater instructional flexibility than the A-B format.

7. Whether block scheduling helps or hinders student achievement on standardized tests remains an open question. Many individual schools have reported gains. Studies in both Canada and the United States have reported conflicting results.

8. Few schools have returned to the single-period schedule after adopting the A-B or 4 x 4 block.

9. Evidence suggests that schools are more likely to move from an A-B schedule to the 4 x 4 model than they are to move from the 4 x 4 to an A-B schedule. (Rettig & Canady, 1999, p. 18.)

Block Scheduling Models

Block scheduling has received considerable attention in the past 10 years. In Florida, North Carolina, and Virginia, block scheduling has become a very popular alternative to the traditional six- or seven-class period day (Brown & Schatten, 2000; North Carolina Department of Public Instruction, 1999; Rettig, 2000). One reason for the rapid change in Virginia has been due to the efforts of R. L. Canady from the University of Virginia. R.L Canady, professor emeritus at the Curry School of Education at the University of Virginia, is known for his work on school scheduling and grading practices. Much of his work is based on experiences and research
in Virginia’s public schools. His area of study focuses on ways to make learning constant and time the variable so that all students have the opportunity to achieve (R. L. Canady, personal communication, February 2002).

In 1992, 96% percent of the high schools in the nation and 98% percent of the high schools in Virginia were scheduled in a traditional six-period day (Mutter, Chase, & Nichols, 1997). By 1995, however, over 40% of the high schools in the nation and 46% of the high schools in Virginia used some form of block scheduling. In the 2000 – 2001 school year, the number of high schools in Virginia utilizing some form of block scheduling had increased to 74% (Rettig, 2000). Moreover, of the 300 high schools in Virginia, 222 were using some form of block scheduling. Table 2 shows the number of high schools in Virginia using a traditional, single period schedule or a block schedule over a 5-year period.

Table 2

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>96-97</td>
</tr>
<tr>
<td>Traditional</td>
</tr>
<tr>
<td>Block</td>
</tr>
</tbody>
</table>

*Note. Table 2 is from the Directory of High School Scheduling Models in Virginia, 2000-2001, Rettig, 2000.*

In reviewing the literature on block scheduling, two distinct models are frequently described: the alternating day or A-B block schedule and the 4 x 4 block schedule. Although there are many variations on these block-scheduling models, this study focused on the 7- period alternating day and the 4 x 4 block schedules. Any schools using a form of block scheduling other than the 7- period alternating day block schedule and the 4 x 4 block schedule were
excluded from this study. Table 3 is a summary of the 222 block scheduled schools in Virginia for the 2000-2001 school year.

Table 3

*Summary of High School Block Scheduling Models in Virginia*

<table>
<thead>
<tr>
<th>Scheduling Model</th>
<th>Number of Schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 A/B Block</td>
<td>6</td>
<td>2.0%</td>
</tr>
<tr>
<td>7 A/B Block</td>
<td>89</td>
<td>29.5%</td>
</tr>
<tr>
<td>8 A/B Block</td>
<td>27</td>
<td>8.9%</td>
</tr>
<tr>
<td>4 x 4 Block</td>
<td>94</td>
<td>31.1%</td>
</tr>
<tr>
<td>Other Block</td>
<td>6</td>
<td>2.0%</td>
</tr>
<tr>
<td>Total</td>
<td>222</td>
<td>73.5%</td>
</tr>
</tbody>
</table>

*Note.* Table 3 is from the *Directory of High School Scheduling Models in Virginia, 2000-2001*, Rettig, 2000.

*7 – Period Alternating Day Block Schedule*

The alternating day or A-B block schedule alternates periods within the day or week. The classes usually meet every other day for extended blocks of time (Queen & Isenhour, 1998). Therefore, in a school using the 7-period alternating day schedule, a student would take his A-day schedule on Monday, Wednesday, and Friday, and his B-day schedule on Tuesday and Thursday. The following week the A-day classes would meet on Tuesday and Thursday, and the B-day classes would meet on Monday, Wednesday, and Friday. Each class meets five times during a two-week period. There is one period that remains constant and meets every day, five days a week, for approximately 50 minutes. Students are enrolled in seven courses throughout the academic school year.
4 x 4 Block Schedule

The 4 x 4 block schedule refers to the use of four periods in the school day (as opposed to six or seven) with each period ninety minutes in length (Mutter, Chase & Nichols, 1997). Students are enrolled in four courses that meet every day of the week, allowing completion of four year-long equivalent courses in one semester or term (Cobb, Abate, & Baker, 1999). In this scheduling arrangement it is possible for students to earn thirty-two credits in four years without attending summer school (Mutter, Chase, & Nichols, 1997). Students concentrate on only four classes for an entire semester or term; teachers teach three classes containing a total of between 60 and 90 students each term (Queen & Isenhour, 1998).

Benefits of Block Scheduling

Literature on the potential benefits as well as the limitations of block scheduling is voluminous. However, most of the claims are not based on empirical data. Even when empirical data are examined, casual comparisons of school outcomes between different schedules must be interpreted with caution due to the number of confounding variables that interact with the outcome measures such as school size, school location, and the number of years the school has been on the block schedule (McCreary, & Hausman, 2001). However, scheduling formats do enable teachers to focus on individual student needs for we do not all learn in the same way or at the same pace. Block scheduling utilizes longer classes that promote increased individualized instruction allowing teachers to concentrate on specific groups of students for longer periods of time (Deuel, 1999; Shortt & Thayer, 1997). Teachers gain additional time increasing the potential to implement creative and diverse student-centered instructional practices and flexible assessment and evaluation strategies that could otherwise not be utilized under traditional schedules (Deuel, 1999; Guskey & Kifer, 1995, Wilson & Stokes, 1999). Eineder and Bishop
(1997) assert two advantages of block scheduling. Teachers receive significantly smaller student loads, and students have fewer teachers to satisfy. Moreover, block scheduling increases opportunities for students to complete teacher-supervised group activities and projects in class. Furthermore, Deuel concluded that teachers on block schedules describe their instructional practices as more effective compared to their instruction under the traditional schedules.

To better understand the benefits of block scheduling, it is important to review the benefits in terms of the two types of schedules, 7-period alternating day and the 4 x 4 block. Figure 2 and Figure 3 summarize the benefits gained by using the alternate-day block schedule and the 4 x 4 block schedule, respectively (Canady and Rettig, 1996).

*Limitations of Block Scheduling*

For every benefit of a block schedule, educators and researchers alike cite potential problems and pitfalls. Queen (2000) cites maturity level of students, retention, course sequencing, and the overuse of lectures as potential problems. Furthermore, instructional time will be lost if the teacher utilizes the same instructional strategies as in a traditional period or tries to fill the extra time with homework (Queen & Isenhour, 1998). Whenever a school moves from a traditional schedule to any form of a block schedule, and does not extend the school day, the teachers must be given time to adjust to fewer minutes overall in the classroom (Veal & Flinders, 2001). Thus what might be perceived as an advantage of block scheduling becomes a limitation because the pace of instruction has increased while the total time annually per course has decreased. Moreover, block scheduling has been reported successful only when lucid and measurable goals were established, meaningful staff development was linked to those goals, and expectations that teachers would change their instructional practices were articulated (Shortt & Thayer, 1997).
Alternate-Day Schedule

- Teachers benefit from increased instructional time.
- Teachers are able to plan lessons for extended periods of time.
- The number of class changes is reduced.
- Compared to the traditional-period schedule, students have fewer classes, quizzes, tests, and homework assignments on any one day.

*Figure 2. Benefits of the alternate-day or A-B schedule*


4 x 4 Block Schedule

- Teachers benefit from increased instructional time (as in the A-B schedule).
- Teachers work with fewer students and prepare for fewer courses each semester.
- Teachers and students have two “fresh-starts” each year.
- Compared to the traditional and the alternate day schedule, students concentrate on only four classes per semester resulting in fewer quizzes, tests, and homework assignments.
- Students may retake failed courses during the second semester.
- Flexibility in course structure provides administrators the opportunity to offer students courses over an extended period of time (e.g., Algebra I).
- Students may earn eight credits without the stress of taking eight courses at the same time.

*Figure 3. Benefits of the 4 x 4 block schedule*

*Note.* Benefits of the 4 x 4 schedule are from Canady & Rettig, 1996, *Teaching in the block: Strategies for engaging active learners.*
In contrast to advocates such as Canady and Rettig who claim restructuring the school day into longer blocks of time will improve student performance, there are those critics that claim that structural changes alone will not lead to changes in student outcomes. Elmore (1995) found that structural change does not necessarily lead to improved student performance. By observing teaching practices in classrooms that had been restructured, Elmore concluded that what teachers said they were doing and what they were actually doing were contradictory. In fact, student outcomes in these classrooms did not improve due to observable characteristics such as teachers answering their own questions, classrooms arranged in teacher-centered designs, and activities focused on rote learning. As Elmore (1995) states, educators believe structures constrain or enable their ability to serve students. Therefore, they are motivated to change them. However, precisely how these changes will result in student outcomes is much less clear. Elmore concluded “that the relationship between structural change in schools and changes in teaching and learning are mediated by relatively powerful factors, such as shared norms, knowledge, and skills of teachers” (p. 26).

In summary, these researchers (e.g., Elmore, 1995) attest that while implementing alternative schedules will alter the structure of time, there must be a concerted effort to change the instructional practices within the span of that time in order to improve student achievement. Time alone is not the only concern educators have in developing a new schedule; a continued search for the best instructional practices that meet the individual student needs is a primary focus in this era of reform that emphasizes increased graduation requirements and high-stakes testing (Queen, 2000).
Instructional Practices

Marshak (1997) studied alternating day and 4 x 4 block scheduling in 10 Seattle area high schools and identified 9 key elements of instructional practice that exemplified teaching and learning in a block scheduled classroom: (a) Lecture is just one tool among many modes of teaching; (b) change, variety, and novelty are common characteristics of the teaching and learning process; (c) students direct their learning with guidance from the teacher; (d) cooperative learning is implemented in its entirety; (e) teachers forsake coverage of the curriculum as the ultimate goal and focus on the breadth and depth of the learning; (f) technology is utilized for research, communication, and creativity; (g) student involvement is at a high level within the learning process; (h) teachers and students are encouraged to explore and experiment; and (i) individuality and personalization shape the learning process.

Shortt and Thayer (1997) described an increased emphasis on technology and a work environment that requires cooperation and collaboration as two reasons for schools changing to a block schedule. The block schedule supports the instructional program that prepares students for the complex and competitive work environment they will enter. It offers schools the opportunity to implement practices that have been excluded in the traditional 50-minute period. Block scheduling offers the time students need in order to develop the skills – teaming, collaborating, working to standards – that will allow them to be successful and productive in the future (Shortt & Thayer, 1997).

Veal and Flinders (2001) emphasized that at best researchers have only begun to identify the types of changes in teaching practices with block scheduling. The changes included a greater variety in the use of individualized instruction (Eineder & Bishop, 1997), smaller group activities (Queen, Algonizine, & Eaddy, 1998), and curriculum and content adjustments related to pacing.
Since these changes in practice are complex, Veal and Flinders studied three contiguous schedules (6 period day, 4 x 4, and a hybrid of the two) at one high school during the first year of implementation. They asked the question “how does block scheduling change classroom practice, and how do teachers understand these changes within the context of their work?” (p. 22). They found four areas of specific changes with respect to how block schedules had changed the work of teaching practices: (a) methods of teaching, (b) opportunities for reflection, (c) student-teacher rapport, and (d) levels of anxiety. According to responses from surveys, teachers had changed their teaching methods, which were more varied and differed from previous years. Teachers also reported an increase in the pace of their teaching describing the block classes as “yearlong classes squeezed into a single semester” (p. 26). Teachers in all subject areas reported that it was difficult to eliminate course content. Moreover, anxiety was related to the need for additional planning and an increased pace of instruction. In regard to relationships with students, the significant difference was between the hybrid schedule and traditional teachers. Positive changes were attributed to an increase in daily contact as well as seeing fewer students per day. Negative changes in student relationships were most often attributed to large class size, an increased pace in instruction, and the semester-length as opposed to the full-year length of time to get to know the students. Lack of time to reflect during the course of the implementation was also a concern. In summary, the teachers in this study reported two noticeable changes. There was an increase in the variety of teaching methods, and there was an improved student-teacher relationship. Veal and Flinders’s results provide new opportunities for teachers and administrators to address new teaching methods such as those that involve hands-on learning and simulations. Traditionally, these methods may have been viewed as impractical simply because there was not enough time.
As addressed above, educators (e.g., Deuel, 1999; Veal & Flinders, 2001) state that one influence affecting the success of teaching within the block schedule is how instructional time is utilized. Instructional decisions will ultimately affect the pace of instruction, the rate of content coverage, student time on task, the motivation of teachers and students, and most importantly, student learning and achievement (Robbins, Gregory, & Herndon, 2000; Wilson & Stokes, 1999). Many teachers have used block scheduling as a resource to integrate the curriculum and to provide enriched student learning experiences. Others have used the additional minutes to afford students the chance to delve deeper into subject areas, creating enhanced student understanding. Students report that block scheduling has prepared them for college and is less stressful than a traditional schedule (Robbins, Gregory, & Herndon, 2000). Block scheduling does match learning time to the learner (Rettig & Canady, 1999; Queen, 2000). For example, in the 4 x 4 model more advanced students have the option to take higher-level courses especially in mathematics and science. These courses may be at the Advanced Placement or International Baccalaureate level, or courses offering dual credit at the college level (Rettig & Canady, 1999).

Teachers do adopt more participatory teaching methods under the alternate day as well as the 4 x 4 block schedule (Eineder & Bishop, 1997; Wilson & Stokes, 1999). Reid (1995) examined the effect of block scheduling on English and reported improvements in writing ability and an increase in the use of peer-review workshops. Other studies pointed to more specific instructional improvements, including individualization of instructional methods to meet student needs (Guskey & Kifer, 1995; Wilson & Stokes, 1999) and improved interpersonal communication between teachers and students (Eineder & Bishop, 1997). An additional advantage of the 4 x 4 block schedule is to increase the likelihood of students who are at-risk of dropping out of school to remain in school (Queen & Isenhour, 1998). One reason may be the
availability of repeat classes without attending summer school. Another reason may be the instructional flexibility offered by the 4 x 4 block schedule. Many schools in Virginia have begun to offer Algebra I and geometry as yearlong courses to enhance students’ chances of passing the Standards of Learning end-of-course assessments. Various strategies that meet individual learning styles, alternative assessment, and integration of content may now be planned for the students (Guskey & Kifer, 1995; Mutter, Chase & Nichols, 1997).

**Student Academic Achievement**

Educators who are considering block scheduling need to understand the effects of the schedule on student academic achievement. Evaluations completed at various high schools (Angola High School, 1997; Eineder & Bishop, 1997; Guskey & Kifer, 1995; Mutter, Chase & Nichols, 1997) confirm the majority of students parents, teachers, and administrators prefer the block schedule because students earn more credits, grades and attendance improve, and discipline cases decrease. There is also evidence that teachers and students who have participated in the block schedule longer have an even stronger preference for the block (Deuel, 1999; Eineder & Bishop, 1997).

A study conducted by Eineder and Bishop (1997) at one Ohio high school implementing the 4 x 4 block model supported that students earn high grade point averages, more students attain the honor roll, student-teacher relations are improved, and teachers and students prefer block scheduling. After one year of block scheduling, students attained a 24 percent increase in the number of A’s and a 15 percent decrease in the number of F’s. Application of statistical measures found significant improvement in the grade point average (correlated t test, p < .001) and in the frequency of honor roll attainment (chi square, p < .001). Data analysis of a 4 x 4 block model at Angola High School (1997) in Indiana compared data for two years. The study
found significant improvements (p < .01) in grade point averages and percent of students
attaining the honor roll. Similar improvement was found on the Scholastic Aptitude Tests, the
American College Testing assessments, and Advanced Placement scores. The Indiana State
Proficiency Exams improved to some of the highest in their region (p < .05). Students, parents,
and faculty were satisfied with the schedule as well. Furthermore, analysis of data (surveys and
interviews) suggested that extensive planning for the block and intensive staff training were
instrumental in making the significant improvements.

In the most recent evaluations of block scheduling within Broward County Public
Schools (Deuel, 1999; Brown & Schatten, 2000), results showed higher grades and grade point
averages among block scheduled students compared to students on a traditional schedule. On
measures of school attendance, suspensions, number of Advanced Placement (AP) candidates,
and percent of AP candidates passing with a score of three or higher, students at the block-
scheduled schools did as well as students at the traditional schedule school. Mutter, Chase, and
Nichols (1997) found that block scheduling had positive effects on school-based student
achievement as well. They reported 60 percent of one high school’s departments experienced
reduced failure rates. Thirty-four percent of the students who failed courses were able to repeat
the courses immediately during the second semester. These three evaluations found that the
majority of students, counselors, teachers, and administrators indicated a preference for block
scheduling.

However, when one measures student improvement using criterion-referenced tests, the
results are less clear. There are inconsistent data regarding the improvement of standardized test
scores under block scheduling (Center for Applied Research and Educational Improvement,
1995; Lawrence & McPherson, 2000; McCreary & Hausman, 2001; Veal & Flinders, 2001; Veal
& Schreiber, 1999). In an evaluation of the 4 x 4 block scheduling model in North Carolina, results indicated that block scheduling had little effect on end-of-course test scores (North Carolina Department of Public Instruction, 1996). An evaluative study conducted at Governor Thomas Johnson High School (Maryland) indicated that fluctuations in pass rates in all subject areas were small and insignificant when compared to the school’s scores on the tests prior to implementing the block schedule (Guskey & Kifer, 1995). The Center for Applied Research and Educational Improvement (CAREI, 1995) at the University of Minnesota reported that high schools using block schedules showed improvement in such areas as student behavior and discipline, but evidence does not exist to support block scheduling results in improved student achievement. The study showed that block scheduling allows teachers and students to cover more curriculum content and master more objectives, but the study does not show significance in measures such as the IOWA Test of Basic Skills. The only claim the study made was that block scheduling does not adversely affect student achievement. It is important to note that merely changing the amount of time students spend in class through block scheduling does not guarantee school-wide success (Schroth & Dixon, 1996). Schroth and Dixon studied math achievement scores in block-scheduled schools, alternating day and 4 x 4, as well as traditional-scheduled schools and found no significant difference between the traditional and blocked schedules on the Texas Assessment of Academic Skills (TASS). They did find that changes in instructional practices and the effective use of class time were essential to the success of block scheduling.

Queen, Algonzine and Eaddy (1998) evaluated the implementation of a 4 x 4 block schedule in three high schools in one school district during the first two years of implementation. As in previous studies, they found that teachers, students, and parents supported the new schedule and felt that it was effective. They also compared the mean scores of statewide end-of-
course assessments in math, science, and social science beginning with the year prior to implementation of the 4 x 4 block and concluding with the second year of implementation. Significant improvement was found in the social science area. Queen, et. al., attributed the increase as a result of the block schedule as well as the improved pacing of instruction, and the use of a variety of instructional strategies. They also noted that a definite pattern in student achievement appeared when comparing the test scores of students for the year before the block to the first and second years of the program. Scores improved for the first semester and then tended to decrease in the second semester. “Although the yearly averages showed improvement for the two years since the beginning the use of the model, there would be greater increases if students and teachers could sustain the same amount of achievement for the second semester as in the first semester” (Queen, et. al., 1998, p. 112-113). This study is in sharp contrast to the Bateson (1990) study that is cited frequently as a case against block scheduling. Bateson studied 30,000 tenth-grade students who took science courses either in the yearlong or semester-long blocks. The students in the yearlong courses outperformed both those students taking science in the first semester and those taking science in the second semester. Furthermore, Bateson’s finding that second-semester students outperformed the first-semester students suggested that first semester students had forgotten a significant amount of the class material by the time they were administered the examinations at the end of the year, contrary to the belief that retention is not a problem associated with the block schedules (Bateson, 1990).

Indeed, many studies evaluating block scheduling have resulted in inconsistent results. Some have found that students in block scheduling have significant higher academic achievement as reported by grades and norm-referenced standardized tests (Deuel, 1999; Guskey & Kifer, 1995). However, some research has been less than positive, finding negative or no
effects of block scheduling on student achievement particularly in subjects that require repeated instruction like math, science and music (Bateson, 1990; Lawrence & McPherson, 2000).

Gruber and Onwuegbuzie (2001) studied the effects of block scheduling on academic achievement by comparing 115 high school students who received instruction following a 4 x 4 block schedule and 146 students who received instruction with a traditional schedule. The casual-comparative research design utilized a series of independent t-tests to compare grade point averages and scores on the Georgia High School Graduation Test (GHSGT) between the two groups. Findings revealed no statistically significant difference in grade point averages or in scores on the writing portion of the GHSGT between the two groups. However, statistically significant differences were found for language arts (d = .34, moderate), mathematics (d = .52, large), social studies (d = .46, large), and science (d = .46 large). For each of the significant differences, students who received instruction with the traditional schedule received the higher GHSHT scores.

Similarly, Lawrence and McPherson (2000) compared end-of-course test scores in Algebra I, Biology I, English I, and U.S. History I for students in one high school using a traditional schedule with students in another high school using a 4 x 4 block schedule. An independent samples t test was used to determine if a statistical significance existed between the traditional mean scores of students using the traditional schedule and the mean scores of students using the block schedule for each of the four subjects. Lawrence and McPherson found that in each case the mean score for the students on the traditional schedule was higher than the mean scores for the block schedule: Algebra I (t = 3.23, p < .05); Biology I (t = 2.73, p < .05); English I (t = 5.32, p < .05); U.S. History I (t = 4.42, p < .05). One reason for the findings of Lawrence and McPherson as well as Queen, Algonzine, and Eaddy (1998) may be the length of time on the
block schedule. Shortt and Thayer (1997) indicated that the first year on the block schedule is very demanding and many teachers do not cover as much as they did on the traditional schedule. Furthermore, the teachers are still adjusting to the new pacing of the curriculum and have not fully incorporated the idea of utilizing the pacing guide. Shortt and Thayer stated that during the first two years, the teachers might not be prepared to consolidate the curriculum, make choices about content and learning activities, and match the curriculum to the performance standards.

McCreary and Hausman (2001) investigated the differences in student outcomes between the alternating day, 4 x 4 block, and trimester schedules in one urban school district. Students in the semester schedule maintained a higher annual grade point average than students in the A-B schedule. Students within the 4 x 4 schedule earned significantly higher Stanford 9 total math scores than students on the A-B and trimester schedules while students on the A-B and trimester schedules had significantly higher Stanford 9 total science. McCreary and Hausman noted that an explanation may be that students benefit from math courses that are sequential and meet daily while students in science courses may profit from the longer annual periods that allow for more hands-on, in-depth laboratory experiences. McCreary and Hausman concluded that administrators must consider the alignment of pacing, curriculum, instructional policy, and professional development when implementing a block schedule. Since different schedules interact differently as apparent in this one study, educators will do well to study the impact of different schedules on student achievement before deciding on the schedule that is right for their school (McCreary & Hausman).

When trying to determine scheduling options based on student achievement and standardized tests, it is apparent that the research provides limited reliable data on which to base a decision. The model that appears to have the greatest potential for improving student
performance is the 4 x 4 model (Rettig & Canady, 1999; Queen & Isenhour, 1998). This conclusion is based on the studies presented in the review of literature (e.g., Angola High School, 1997; Deuel, 1999; Mutter, Chase, & Nichols, 1997) that showed the potential for this schedule to positively impact student grades, depth and mastery of learning, and nationally-normed tests such as the Advanced Placement and American College Testing programs. What works best for one school or one school district may not work best for another (Gruber & Onwuegbuzie, 2001; Lawrence & McPherson, 2000; McCreary & Hausman, 2001). Only by continuing to research utilizing both quantitative and qualitative data will educators be certain to ascertain whether to retain, modify, or discard a block scheduling method (Gruber & Onwuegbuzie, 2001; Veal & Schreiber, 1999).

Summary

In reviewing the research about block scheduling, there is overwhelming evidence that supports the view that a high school environment can be affected positively by either an A-B or 4 x 4 block schedule. Appendix A provides a literature review matrix of the most pertinent studies for these two types of block scheduling. An analysis of these studies indicates that while the literature on block scheduling is optimistic about the benefits for students, there is a lack of data which show evidence that the benefits are being achieved. Most of the studies have focused upon teacher and student perceptions about the block schedule, and student achievement has been measured by teacher assessments. Consistent evidence shows that students’ grades and the number of students on the honor roll increases. Some evidence suggests that both improvements are greater in the 4 x 4 block schools than in the A-B block schools (Rettig & Canady, 1999). While this information is valuable, it does not inform educators and public school administrators on the potential of the scheduling models (A-B or 4 x 4) to impact student academic achievement
on criterion-referenced end-of-course assessments. There is a need to expand the research by addressing differences in student achievement on the Virginia Standards of Learning high school end-of-course assessments between the two most popular block scheduling models, the 7-period alternating day and the 4 x 4 block schedules.