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The Impact of High School Schedule Type on Instructional Effectiveness and Student Achievement in Mathematics

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THE IMPACT OF HIGH SCHOOL SCHEDULE TYPE ON INSTRUCTIONAL
EFFECTIVENESS AND STUDENT ACHIEVEMENT IN
MATHEMATICS

A Dissertation

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by

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ABSTRACT

The purpose of this quantitative study was to determine the impact of high school schedule type on instructional effectiveness and student achievement in mathematics. An analysis was prepared to determine the schedule types currently used in math classes, whether significant differences exist between schedule types on the percent of students meeting or exceeding on the 2011 PSAE math test, how teachers rate the effectiveness of a schedule they currently use versus how others that use a different schedule rate the same schedule for various student outcomes in mathematics, and whether significant differences exist in the effectiveness ratings between schedule types on various student outcomes in mathematics. The research design involved a population of 350 lead math teachers or math department chairs currently teaching at a 9–12 high school in Illinois. Teachers' beliefs on the effectiveness of the different schedule types on various student outcomes were collected using a 23-item survey. Statistical analysis of the data included descriptive analysis for selected items, means, and standard deviations. A one-way ANOVA was used to test whether significant differences existed between schedule types on the percentage of students meeting or exceeding standards on the 2011 PSAE math test, and a comparison of the mean ratings for each schedule type was used to determine how teachers rated the effectiveness of a schedule type they currently use versus how others who use a different schedule type rated the same schedule. Repeated measures one-way ANOVAs were used to determine whether significant differences existed in the effectiveness ratings between schedule types on various student outcomes in mathematics. Significance was identified at the .05 level.

In all, 91 lead math teachers or math department chairs of high schools in Illinois responded to the survey instrument, which questioned the perceived level of effectiveness of the traditional schedule, AB block schedule, 4 x 4 block schedule, and trimester schedule for 11 different student outcomes in mathematics. As a result of the analysis, there were no significant differences found in the percent of students meeting or exceeding standards on the 2011 PSAE between schools on a block schedule versus those on a traditional schedule. The analysis showed that teachers currently on a traditional schedule rated the traditional schedule higher than those currently teaching on a block schedule. Teachers currently teaching on a block schedule rated the block schedule more favorably than teachers currently teaching on a traditional schedule. However, teachers currently teaching on a block schedule rated the traditional schedule as the most effective overall for most of the student outcomes. When analyzing the responses of all of the respondents, the traditional schedule was perceived to be more effective than all other schedule types for eight of the 11 student outcomes while the AB block schedule was rated most effective for only one outcome.

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CHAPTER 1

INTRODUCTION

The structure and schedule of the traditional high school remained essentially the same for most of the 20th century. Rather than being based on educational merit, current student schedules are often based on tradition. Even with the awareness of some of the problems with traditional schedules, some educators still resist any change in the schedule and choose to return to an unblocked format. Despite its roots in history, the traditional schedule was called into question in 1983 when *A Nation at Risk* reported that American students were lagging behind their counterparts in other nations (Queen, 2001). This report suggested that a restructuring of the traditional schedule for more effective use of school time and increased concentration on core academic subjects was needed (Evans, Tokarczyk, Rice, & McCray, 2002). Donahoe (1993) argued that the rearranging of the traditional schedule and use of time in schools would promote an active culture that would improve student learning. One year later the National Commission on Time and Learning (1994) published its report, *Prisoners of Time*, warning that schools should be focused on learning, not on time, and encouraged the use of block scheduling to engage students in active instruction. Cawelti (1994) argued that a change could occur in the expectations, content, and learning experiences provided in the curriculum simply by restructuring the high school schedule. He conducted a national survey that found 40% of schools in the United States were using some form of block scheduling.

With the gaining popularity of block scheduling came many promised benefits to the overall education of the students. Canady and Rettig (1995) suggested that alternative schedules would allow students to complete more courses and therefore promote improvements in academic achievement. Block scheduling also purported to lead to fewer disciplinary referrals, improved class attendance, increased numbers of students taking advanced placement classes, advanced mastery of subject content, and improved grades. Additionally, students reported more individual attention from teachers in a block schedule, and teachers reported a better ability to engage students in activities during class (Queen, 2001).

Despite the benefits that resulted from the restructuring of the traditional schedule, potential drawbacks purportedly occurred. Issues of retention of learning, loss of instructional minutes, the sequencing of advanced placement and foreign language classes, dealing with student absences and student transfers, and implementation costs were concerns that needed to be addressed when moving to an alternative or block schedule (Canady & Rettig, 1995). Math teachers had concerns specific to instruction on the block. They feared that under a block schedule, student attentiveness might be reduced, gaps in sequential instruction might harm student learning, and students would complete less homework (Kramer, 1997a).

Statement of the Problem

A wide array of research exists outlining the proposed benefits and limitations of both a traditional schedule and a non-traditional block schedule. Although there is little debate on the impact block scheduling has on many aspects of education, its effectiveness in increasing student achievement and providing a forum for effective math instruction is still an issue yet to be resolved. According to Evans et al. (2002), more students make the honor roll when the school uses a block schedule rather than a traditional schedule. Additionally, students complete more

advanced placement classes (Edwards, 1995) and have higher grade point averages when instruction has occurred using a block schedule (Pisapia & Westfall, 1997). Although students' overall grade point average have shown to be higher when instructed with a block schedule, Cobb, Abate, and Baker (1999) found that the grade point average of students in mathematics tended to be lower with the block schedule.

While local indicators of student achievement, such as grades, honor roll, and advanced placement course completion, have been shown to improve with the use of a block schedule, the results are mixed on the effect of block scheduling on students' performance on standardized achievement tests such as the ACT or SAT. Evans et al. (2002), Lawrence and McPherson (2000), and Harmston, Pliska, Ziomek, and Hackman (2003) all found an upward trend in students' ACT or SAT scores when a school went to the block scheduling format. However, Raphael, Wahlstrom, and McLean (1986) found that the scores decreased in the block, while other studies have shown that there is not a significant difference in scores regardless of the schedule type (Arnold, 2002; Lockwood, 1995; Lyons & Terry, 2003; Pederson, 2001; Salvaterra & Adams, 1995). While the overall impact of alternative or block scheduling on student achievement is uncertain, the effect on math achievement is an even greater debate due to recent trends in accountability that focus on math performance. Despite the varying research on the impact of schedule type on student achievement, many schools have either moved to a block schedule or away from a block schedule with the hopes that the change of schedule type alone will result in higher student achievement.

In general, students and teachers on a block schedule perceive the alternate format as more effective than the traditional format (Eineder & Bishop, 1997). However, this opinion is not shared by all teachers (Kramer, 1997a). Both Stevens (1976) and Usiskin (1995) found that

math teachers have mixed feelings about the block schedule. The lack of support shown by math teachers often stems from a fear that the curriculum will not fit into the larger time blocks and a concern about covering two lessons worth of material during the double block of time.

Additionally, math teachers feel that the possible gaps in the sequencing of math instruction could also be an issue. These concerns have led to a focus on the effectiveness of a block schedule for mathematics.

Purpose of the Study

The purpose of this quantitative study was to examine the various schedule types used by Grades 9 through 12 in schools in Illinois. Data from the 2011 Prairie State Achievement Exam (PSAE) obtained on the Illinois Interactive Report Card (IIRC) website was used to determine if significant differences exist in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types. Additionally, survey data was used to determine if significant differences exist in the effectiveness rating given by lead math teachers or math department chairs to a schedule type between those who currently used that schedule type and those that used a different schedule type. Finally, survey data were used to determine if significant differences existed in the perceived effectiveness by lead math teachers and math department chairs between schedule types on various student outcomes in mathematics. The types of schedules that were compared are six-, seven-, or eight-period traditional schedules, 4 x 4 block schedules, A/B alternating block schedules, and trimester schedules.

Research Questions

This quantitative study addressed four research questions:

1. What schedule types are currently used in ninth through 12th grade high school mathematic classes in Illinois?

2. Is there a significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types?
3. How does the mean effectiveness rating given to a schedule type by lead math teachers or department chairs who currently use that schedule compare to the mean effectiveness rating given by those who use a different schedule type?
4. Are there significant differences in the effectiveness ratings given by math department chairs or lead teachers between schedule types on various student outcomes in mathematics? The following student outcomes in mathematics were studied.
 - Covering the appropriate amount of material (Kramer, 1997a).
 - Keeping the students focused and attentive the entire class period (Canady & Rettig, 1997).
 - Preparing the students for future math classes (Kramer, 1997a).
 - Assessing students' understanding and mastery of a math lesson/concept (Wronkovich, Hess, & Robinson, 1997).
 - Improving students' grades in math classes (Kramer, 1997a).
 - Students' performance on standardized tests (Kramer, 1997a; Wronkovich et al., 1997).
 - Retention of concepts from one math class to the next (Canady & Rettig, 1997).
 - Retention of math concepts from one school year to the next (Kramer, 1997a; Kramer, 1997b).
 - Promoting student engagement during instruction (Canady & Rettig, 1997).

- Assisting students struggling with material (Kramer, 1997a, 1997b).
- Allowing for varied instructional strategies (Canady & Rettig, 1997).

Null Hypotheses

H₀1: There is no significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types.

H₀2: There is no significant difference in the perceived effectiveness between schedule types on the ability to cover the appropriate amount of material.

H₀3: There is no significant difference in the perceived effectiveness between schedule types on keeping students focused and attentive the entire class period.

H₀4: There is no significant difference in the perceived effectiveness between schedule types on preparing students for future math classes.

H₀5: There is no significant difference in the perceived effectiveness between schedule types on assessing students' understanding and mastery of a math lesson/concept.

H₀6: There is no significant difference in the perceived effectiveness between schedule types on improving students' grades in math classes.

H₀7: There is no significant difference in the perceived effectiveness between schedule types on students' performance on standardized tests.

H₀8: There is no significant difference in the perceived effectiveness between schedule types on students' retention of concepts from one class to the next.

H₀9: There is no significant difference in the perceived effectiveness between schedule types on students' retention of concepts from one year to the next.

H₀10: There is no significant difference in the perceived effectiveness between schedule types on promoting student engagement during instruction.

H₀11: There is no significant difference in the perceived effectiveness between schedule types on assisting students struggling with the material.

H₀12: There is no significant difference in the perceived effectiveness between schedule types on allowing for varied instructional strategies.

Definition of Terms

Several terms used in this investigation are defined in the interest of consistency.

A *traditional schedule* refers to a schedule type usually consisting of a six-, seven-, or eight-period day with classes meeting every day. Six-period classes are typically 50 to 60 minutes in length, seven-period classes are typically 45 to 52 minutes in length, and eight-period classes are typically 40 to 48 minutes in length (Canady & Rettig, 1995).

A *4 x 4 block schedule* refers to a schedule type in which students take four 90-minute classes per day. In this format, a course that normally covers the entire school year is covered in an intense, half-year course (Canady & Rettig, 1997).

An *alternating A/B schedule* refers to a schedule type consisting of 80- to 120-minute class periods in which students take eight courses a semester. Four classes meet one day on an A day and the other four meet the next day on a B day. This alternating pattern is repeated throughout the semester (Canady & Rettig, 1997).

A *trimester schedule* refers to a schedule type that offers students the opportunity to focus on two related core classes for an intensive period of instruction. In this model, students enroll in two classes every 60 days with one class meeting in the morning and the other in the afternoon (Canady & Rettig, 1995).

A *traditional/block hybrid schedule* refers to a schedule type that combines the two types of schedules with some classes meeting 40 to 50 minutes every day while others meet every other day for 80 to 90 minutes (Childers & Ireland, 2005).

The *Prairie State Achievement Exam (PSAE)* is a state exam given to all 11th grade students in Illinois that consists of the ACT test and the WorkKeys exam. This exam is used to determine if a school is meeting adequate yearly progress. Students are tested on reading, math, and science as a part of the PSAE exam.

Limitations of the Study

Since any significant differences between schedule types on math achievement were based solely on the percent of students meeting or exceeding on the math section of the 2011 PSAE, there was a limited ability to control variables that vary in the schools selected. The schools selected varied in demographics such as size, ethnicity, and percentage of low-income students. Any differences in student achievement observed between schools could be the result of these factors as opposed to the schedule type.

Besides the variance in demographics between schools, this study also did not account for other initiatives taking place that could have had an impact on student achievement scores on the PSAE mathematics exam. Some of the initiatives included adding additional math instruction during the day, changing the math instructional strategies, and the overall variance in the quality of math instructors in schools.

The PSAE was chosen as the basis for comparison because it is taken by all 11th grade students in Illinois and its content is based on national curriculum surveys. A main component of the PSAE exam is the ACT, which does not assess components of achievement not related to

college readiness. Therefore, the assessment used for comparison in this study was only give a portion of the student achievement picture.

When gauging math department chair and lead math teacher perceptions of the effectiveness of various schedule types, this study did not account for the exposure of the participants to various schedule types. Differences in the effectiveness ratings given to the various outcomes could be due to the familiarity of the participants with the various schedule types rather than the actual effectiveness of the schedule type.

Delimitations

1. The survey was confined to math department chairs or lead math teachers in the state of Illinois.
2. The study only looked at Grades 9 through 12 in public high schools in Illinois.
3. The survey only consisted of 11 student outcomes in mathematics.

Significance of Study

Many studies have been conducted on the impact of block scheduling on student achievement in general as well as specifically in the area of math (Deuel, 1999; Evans et al., 2002; Griffin & Nicholson, 2002; Khazzaka, 1997/1998; Knight & DeLeon, 1999). Teachers' perceptions in general have been supportive of block scheduling however, math instructors have expressed specific concerns (Kramer, 1997a; Stevens, 1976; Usiskin, 1995). Despite the varying research, many schools have looked to block scheduling as a means to improve student achievement.

This study presents the prevalence of the various schedule types in high schools in Illinois as well as whether significant differences exist in the percentage of students meeting or exceeding standards on the mathematics section of the PSAE based on the schedule type used by

the school. The results can assist schools in determining if schedule type should be considered as one factor to examine in an attempt to raise student achievement. Additionally, by examining whether significant differences exist in the effectiveness ratings given by math department chairs or lead teachers between schedule types on various student outcomes in mathematics, this study can be used by schools to determine if schedule type should be one of the factors examined for the student outcomes in mathematics being addressed within the school.

CHAPTER 2

REVIEW OF THE LITERATURE

History of the Traditional Schedule

Remaining virtually unchanged for most of the 20th century, the traditional style schedule is deeply rooted in history. While serving as the primary structure, the use of a traditional schedule was based primarily on tradition rather than on its educational merit (Queen, 2001). According to Kruse and Kruse (1995), traditional schedules in secondary school buildings are constructed and used similarly to factories. Work stations are isolated for specific purposes by specific specialists at specific times during the day. With this schedule, it is common for a teacher to spend an entire career isolated in the same classroom assigned to rotating groups of students on a daily basis. This system has its roots in the industrial reforms of the early 20th century where teachers were expected to create a quantifiable product in a given amount of time (Carroll, 1994).

Although it was the primary schedule being used in almost all schools, the traditional schedule's effectiveness was called in to question in 1983 with the release of *A Nation at Risk* (National Commission on Excellence in Education, 1983). This report indicated that American students were lagging behind academically when compared to their counterparts in other industrialized nations and suggested the restructuring of time and increased concentration on core academic subjects (Evans et al., 2002). One year later, *Prisoners of Time* (National

Commission on Time and Learning, 1994), was released, which urged schools to focus on learning not time and suggested block scheduling as a way to give more time to actively engage students in instruction. During this same time, Cawelti (1994) suggested that by restructuring high schools, educators could change the expectations, content, and learning experiences in the curriculum. The increased focus on restructuring the time and therefore the schedule led to unprecedented questioning of the use of time in a traditional schedule. According to Gilman and Knoll (1994), 16% of each school day was lost to administrative duties and organizational disruptions and interruptions on a traditional schedule. Further, research findings indicated that only 60% of the school day was available for actual instruction (Rossmiller, 1983) and only 38% of the average school day involved actual academic activities (Karweit, 1995).

Due to its reliance on a rigid schedule and its constraints with time, the traditional schedule was found to have many instructional disadvantages. Shortt and Thayer (1997) believed traditional schedules were based on a factory model and, therefore, promoted compartmentalization and specialization rather than cross-curricular disciplines, team-teaching, and contextual teaching. According to Canady and Rettig (1995), it is doubtful that most adults could survive the typical impersonal and hectic pace that students subjected to a traditional schedule face every day. Many teachers in a traditional schedule contend they cannot adequately prepare for and interact with large numbers of students being assigned to them on a daily basis. This schedule promotes impersonal student-teacher relationships in an unproductive and frenetic environment (Carroll, 1990).

Besides relationships with teachers, the traditional schedule often leads to more discipline issues and altercations among students due to the increased number of class transitions and the large number of students in the hallways (Furlong & Morrison, 1994). Discipline problems may

also arise within the classroom due to the shortened class periods (Canady & Rettig, 1995). Since teachers often feel pressured to cover the curriculum and get the lesson taught with shorter time periods, when discipline situations arise and students do not respond immediately to the correction by the instructor, the typical reaction is to send the student to the office. Additionally, the traditional schedule also stifles teacher creativity. Although evidence has shown that lectures are probably not the best way for students to learn materials, the short instructional time in a traditional schedule often forces the overuse of this method by teachers and does not lend to more creative and innovative methods of instruction (Boyer, 1983). The shorter class periods seem to offer insufficient time to learn subjects in depth using a variety of instructional methods and therefore result in truancy, discipline problems, and lower academic performance (Khazzaka, 1997/1998). According to Canady and Rettig (1995), when teachers are faced with only 45 minutes, they often feel pressed to expose children to the curriculum, and the best way to accomplish this is through lecture. Even when teachers desire to vary from the lecture format, they often find it difficult due to the shorter time periods. A 45-minute class period makes it nearly impossible for lab work in science classes or other creative teaching techniques in other classes.

To alleviate some of the problems with the traditional schedule, a possible solution would be to add minutes to the school day. However, there has been tremendous opposition to any change in the school day from parents because of afterschool activities, from teacher unions because of the need to increase pay due to increased time, and from athletic schedules. As a result, the focus instead has been on how to more effectively use the time during the day. Sizer (1984) asserted that in a traditional schedule, students rush from one class to another to collect knowledge which leads to a frenetic and restless school day. Boyer (1983) stated, "Just as the

arrangement of space is standardized in the American classroom, so is the use of time. If ideas are to be thoughtfully examined, time must be used wisely. Time is the student's treasure" (p. 141). Watts and Castle (1993) summarized the need for reform in the way students are taught when arguing the following:

The schedule is God. You can implement any innovation you want in your classroom as long as you don't mess with the schedule. Traditional, inflexible scheduling is based on administrative and institutional needs. New, more flexible scheduling patterns are based on pedagogical practices, the educational needs of students, and the professional needs of teachers. (pp. 306-307)

Types of Schedules

Prior to the search for new ways to restructure the time in a school day, the traditional schedule was dominant. This type of schedule consisted of either a six-, seven-, or eight-period day with each period 45 to 55 minutes in length (Hackman, Hecht, Harmston, Pliska, & Ziomek, 2001). According to Canady and Rettig (1995), six-period classes were typically 50 to 60 minutes in length, seven-period classes were 45 to 52 minutes, eight-period classes were 40 to 48 minutes, and the few nine-period classes were 42 minutes or less. With the attempt to create a schedule that allowed longer class periods, schools began to develop many forms of alternative scheduling.

One of the most common schedules is the 4 x 4 block schedule. In this format, a course that normally covers the entire school year is covered in an intense, half-year course. Students attend four 90-minute classes per day. This schedule type provides increased quality instructional time to teachers; allows teachers to plan extended lessons; reduces the number of classes teachers have each semester allowing better interpersonal relationships between teachers

and students; encourages the use of a wider variety of instructional methods; reduces the number of classes, quizzes, tests, and homework assignments students receive in one day; allows students who fail a class an early opportunity to retake the class; increases the opportunities for acceleration; and enables students to enroll in a greater number and variety of elective courses in comparison to a six- or seven-period traditional schedule. Despite the benefits the 4 x 4 model brings to a school, disadvantages can also materialize. Curriculum must be adjusted to accommodate the pacing of instruction, teachers require additional training in effectively teaching in longer blocks of time, advanced placement classes and band are offered in one semester, graduation requirements must be reevaluated, student absences can be problematic, class sizes increase or staff must be added, and more course offerings may be required as students take more classes per year (Canady & Rettig, 1995).

Besides the 4 x 4 plan, the alternating A/B schedule is also common. This plan typically consists of 80- to 120-minute class periods and the students take eight classes a semester. Four classes will meet one day on an A day and the other four will meet the next day on a B day. This alternating pattern is repeated throughout the semester (Canady & Rettig, 1997). Like the 4 x 4 block schedule, the amount of useable instruction time for teachers increases; the planning of extended lessons is possible; the number of class changes is reduced; the use of a variety of instructional methods is encouraged; and students have fewer classes, quizzes, tests, and assignments on a given day. Additionally, the alternating schedule permits more concentrated work in specialized programs and simplifies itinerant teacher schedules. Although the alternating day schedule offers many benefits, some of the drawbacks of a traditional schedule still exist. Teachers still must work with 100 to 180 different students the entire school year; as many as five or six preparations may still be assigned to teachers each semester; students are still

responsible for six, seven, or eight subjects all year; no opportunities for acceleration are available; and the alternating day format could disrupt the continuity of instruction, particularly in subjects such as foreign languages, music classes, and mathematics (Canady & Rettig, 1995).

Although not as common, some schools have implemented trimester schedules. This model offers students the opportunity to focus on two related core classes for an intensive period of instruction. Students enroll in two classes and switch to two different classes every 60 days. One class meets in the morning while the other class meets in the afternoon. Some schools have used this model as a way to facilitate academic–technical programs. In the trimester schedule, students focus on related academic and technical classes during each 60-day period. The core courses are therefore supported by a reduced credit exploratory course, which reinforces and enriches the concepts covered in the core course (Canady & Rettig, 1995).

Because many schools' schedules would be classified as either traditional or block style, some have combined the two types and schedule some classes to meet every day for 40 to 50 minutes, and others meet every other day for 80 to 90 minutes (Childers & Ireland, 2005). One way to accomplish this is to have some select courses last two class periods creating a class of approximately 90 minutes within the existing schedule. Students in the 90-minute class would remain in class at the passing period and continue until the end of the next period. Classes selected for the 90-minute block might include upper-level science classes that would benefit from the extended time for lab activities or classes in which an interdisciplinary team teaching module is being implemented. Although this model is advantageous in accomplishing longer class periods for a few courses, it would probably not result in many of the advantages claimed by schools that are on a block schedule for all courses (Lybbert, 1998).

Advantage of Block Scheduling

With the increased popularity of block scheduling came many reported advantages. One proposed benefit of the increased class time afforded in the block scheduling is more effective and personalized instruction. According to Deuel (1999), block scheduling leads to more innovative hands-on instruction, more time on task, and more personalized instruction. Additionally, the extended class periods allows students to move from being passive participants in teacher-dominated classrooms to active learners where the teachers serve as facilitators. This structure encourages more student engagement, emphasizes depth over surface treatment of content, builds real-world connections, and helps students develop problem solving skills (Buckman, King, & Ryan, 1995).

Besides promoting student engagement, the block schedule is also better suited to meet the needs of all learners. In a typical block schedule, students can take more classes, and the longer class periods give the potential to alter curriculum delivery to adequately meet the needs of all students in the regular classroom (Mattox, Hancock, & Queen, 2005). According to Hackman (1999), in a block schedule the learning is socially constructed, which also allows students to interact with one another. When surveying guidance counselors, Deuel (1999) found that they believed students did a better job concentrating on fewer subjects at a time, had time to do more in-depth study, were able to enroll in classes needed to graduate on time, and were able to pursue electives that interested them. At-risk students seemed to really benefit from the ability to concentrate on fewer subjects at one time as well as the opportunity to retake a failed class either in the same year or at the beginning of the next year (Kramer, 1997b). The extended time also leads to a smoother transition from the homelike atmosphere of the elementary school to the departmentalized environment of the high school (Mowen & Mowen, 2004), allows for more

thought-provoking essays on exams rather than simply fast multiple-choice questions (Cooper, 1996), and places fewer daily homework demands on students (Wilson, 1995).

Besides the direct effect on the types of instruction within the classroom, the block schedule also places fewer demands on teachers. According to Carroll (1990), teachers were able to more effectively plan for their classes since they were only preparing for four courses a day as opposed to the six, seven, or eight periods that were typical in a traditional schedule. The increased planning time and decreased number of classes to prepare for daily leads to the ability of teachers to work more frequently in teams, control time more effectively, group children for learning, and make the curriculum more meaningful for the students. The additional time allows the teacher to develop lessons that more fully develop key concepts, ask probing questions, and help students master the material (Khazzaka, 1997/1998).

Arguably one of the most important advantages of a block schedule is the impact on the overall atmosphere of the school. According to O'Neil (1995), in a block schedule, the students and teachers get to know each other better, which leads to a more personalized instructional process. These relationships result in the potential to quell explosive behavioral situations, which leads to fewer discipline problems in a classroom (Canady & Rettig, 1995). Using surveys in Tennessee secondary schools, Smith and McNelis (1995) found that implementing block scheduling created a learning climate that was "quieter, less stressful, less harried, and more relaxed" (p. 3). Teachers and students were more relaxed and relationships were improved due to a more moderately paced day. Hundley (1996) also studied the effects of block scheduling on the school atmosphere and also found a much more relaxed, positive environment than was typically observed in schools with traditional schedules.

Queen (2001) summarized that the main advantages of block scheduling are reduced instructional time spent on classroom administration, extended lessons with greater continuity, fewer discipline incidents due to the reduced number of class changes, a less-fragmented schedule allowing students to focus on fewer classes at one time, lengthened planning time for teachers, fewer courses to make up when a student is absent, an increased ability to provide remedial assistance to students who need assistance or fail a course, the ability for acceleration and enrichment for advanced students, a wider variety of elective course offerings, and more engagement and interactive learning due to longer class periods. Fewer class changes also lead to a cleaner school environment, fewer tardies, and fewer discipline problems (Canady & Rettig, 1997).

Disadvantages of Block Scheduling

Because the supporters of block scheduling focus on the advantages, critics are quick to point out the drawbacks. According to Canady and Rettig (1997), the longer class periods can make it more difficult to maintain students' attention and to create a schedule where the workload is balanced each semester on a 4 x 4 block schedule or on alternating days in an A/B rotating schedule. Students often need additional review time and have a hard time retaining what is taught since classes don't meet daily. Teachers are also unable to cover the same amount of material since the block usually leads to a loss in instructional time and converting transfer credits and creating a schedule for transfer students is also problematic. Although the longer class periods and alternating day schedules have many advantages, some teachers believe that students need daily instruction in subjects like foreign languages, math, and band. The block schedule, however, does not offer this option (Khazzaka, 1997/1998). According to block scheduling supporters, the ability to cover subjects in more depth is one of the many advantages.

Dougherty (1998) argued that content coverage may decrease when depth is emphasized over breadth. Additionally, student absences with a block schedule are problematic. Students have a difficult time catching up and mastering material that was missed since they miss a larger chunk of time when absent (Hackman et al., 2001). Some teachers have expressed concerns that they were unable to cover all of the material in a semester and not all students could keep up with the pace (Wronkovich et al., 1997). Studies have shown that with the quickened pace and less content coverage, some students feel they were not adequately prepared for advance placement tests, and fewer students took the exams as a result (Knight & DeLeon, 1999).

The effectiveness of the block schedule depends on the instructional strategies used by the teacher and seems to vary from classroom to classroom. According to Griffin and Nicholson (2002), some teachers presented brief lectures or mini-lessons followed by student inquiry; others were bound to more traditional teaching strategies consisting of lecture followed by seatwork. Although some classes were engaging atmospheres for learning, others had students working individually on textbook problems. When lecturing is the sole methodology for an 80- or 90-minute class, learning suffers (Gerking, 1995). The overreliance on more traditional teaching methods can lead to students reporting being more tired, less attentive, and more bored in the longer class periods compared with the shorter classes in traditional schedules (Lapkin, Harley, & Hart, 1997). Although surveys of parents have garnered general support for block scheduling, some parents fear that 80-minute classes are too long for students to devote to a subject in which they struggle; children are more isolated, which limits the opportunities for them to interact with one another; and the students are not adequately challenged in their classes (Evans et al., 2002).

Impact of Schedule Type on Student Achievement

Although research supports an improvement in school climate and atmosphere when switching to block schedule, the results on the impact on student achievement vary widely. One indicator of student achievement that has been explored is the impact block scheduling has on grades and the number of students on the honor roll. A study conducted by Evans et al. (2002) compiled data from three districts that had switched to a 4 x 4 block schedule at the beginning of the 1997-1998 school year. Baseline data were collected from the 1996-1997 school year and then compared to data from the 1997-1998 and 1998-1999 school years. From the study it was found that the percent of students on the honor roll at the three sites increased by 9%, and the number of students experiencing multiple fails decreased. Additionally, the number of students who received a single D or F for a final course grade decreased by 7%.

In a similar study, Khazzaka (1997/1998) focused on six high schools in the same geographic area that had all switched from a seven-period day to a four-period day in the early 1990s. School records under the seven-period schedule were compared with those under the four-period schedule to determine whether a change in students' grade point averages had occurred. Based on the data, students earned higher grades under the block schedule than they had under the traditional schedule and also completed 20% more classes than under the traditional schedule. A study of a piloted block scheduling program in a district garnered similar results. Students were randomly selected to participate in the block style schedule, while the remaining students were instructed under the traditional schedule. After adjusting for differences in prior academic performance, students on the block schedule scored higher than those on the traditional schedule on semester exams and earned better grades (Knight & DeLeon, 1999).

Griffin and Nicholson (2002) found that grade distribution did not vary significantly under the block schedule when compared to those representing a traditional seven-period schedule. The schools studied had switched to a 4 x 4 block schedule during the 1997-1998 school year, and data were collected three years prior to the switch and three years after the switch. Although little variance was found in grade distribution, more students made the honor roll and fewer students received two or more Fs. Deuel (1999) compared 10 large urban schools utilizing a block schedule to 13 schools of similar size that were on a traditional schedule. Results indicated that students in block scheduling schools earned more As and fewer Cs, Ds, and Fs. In comparison, Trenta and Newman (2002) also found a positive significant relationship between block scheduling and grades when at a small, mid-western school district.

When looking specifically at the impact on the various high school grade levels, results have shown that the block schedule is extremely beneficial to incoming ninth graders. In a study by Eineder and Bishop (1997), the number of ninth graders making the honor roll doubled for the first grading period after switching from a traditional schedule to a block schedule. This same impact on academic achievement was found when investigating data of 11th and 12th grade students who attended the high school under both the traditional and block schedules. After just one year of the block schedule, the students achieved a 24% increase in the number of As and a 15% decrease in the number of Fs.

When looking at the grades of students after switching from a traditional schedule to a 4 x 4 block schedule, Edwards (1995) also found a positive impact for students on the block schedule. Orange County High School in California had been on a 4 x 4 block schedule for two years, and a comparison was made of the students' grades on the block schedule to when the

high school utilized a traditional schedule. Over the two-year period since the implementation of the 4 x 4 schedule, the percentage of A grades earned by students went from 21% to 32%.

Studying the hybrid schedule in Pocono Mountain School District in Pennsylvania, McGorry and McGorry (1998) saw academic benefits to the block. The hybrid schedule used modified the schedule in order to block the core classes so students would receive 90 minutes of instruction in English and science classes one day and 90 minutes of math and social studies the next day. Students in the pilot group with blocked core classes went from 30% on the honor roll the previous year to over 40% with a block schedule. Additionally, 26% of students in the pilot study received As in math and science compared to only 9% of the rest of the student body. The failure rate of students in the pilot group also decreased with only 5% of the students failing math and science compared to 16% in the overall student body.

Positive effects of a block schedule at the middle school level have been shown as well. Lewisburg Area Middle School in Pennsylvania moved from a traditional schedule to an alternating block schedule for the 1994-1995 school year (DiRocco, 1999). When analyzing student achievement, researchers found that students earned a higher grade point average and achieved higher standardized test scores on the alternating block schedule than they had previously when on a traditional schedule (DiRocco, 1999). An overall increase in grades earned and larger numbers of students on the honor roll has been supported by numerous other studies (Buckman et al., 1995; Pisapia & Westfall, 1997; Salvaterra & Adams, 1995; Stanley & Gifford, 1998).

Although many studies have pointed to an increase in grades earned and number of students on the honor roll, this is not always the case. Nichols (2000) collected and analyzed data generated by six high schools from a large urban corporation in the Midwest. Two of the

high schools currently use a 4 x 4 block schedule, three have been on a rotating A/B block schedule for many years, and one remains on a traditional schedule. Student data prior to the switch to the block were compared to data after the transition to an alternative schedule. Based on the results, no significant or consistent change in the students' grade point averages occurred and no quantitative data were present to support the proposed benefits of the block schedule on student achievement. Williams (1999) compared the grade point averages of one group of students during their ninth-grade year while under the traditional seven-period day to the grade point averages of their 10th grade year under the 4 x 4 block schedule. The participants included 198 students out of an enrollment of 650 students in a rural high school in West Virginia. For the study, grade point averages in English, math, science, and social studies were used for the comparison, and the results showed no significant differences in grade point averages from the students' freshman year on the traditional schedule to their sophomore year on the block schedule. Wronkovich et al. (1997) also found no differences in student achievement when studying the various schedule types in high schools.

In addition to studies that have shown improved grades and student achievement as well as no change regardless of schedule type, studies have also shown a negative effect on student achievement based on the schedule type. Lawrence and McPherson (2000) found that block scheduling was detrimental to student achievement. In the study, secondary students from two high schools in the same school district in the Southeastern region of North Carolina were compared. According to the results, the grades and the scores on the end-of-the-course assessments were significantly higher for those students who received instruction in a traditional schedule than for those who were on a block schedule.

Because there is some uncertainty as to the effect of block scheduling on local measures of student achievement such as grades and number of students on the honor roll, the effect of block scheduling on standardized test performance is even more unclear. Many studies have shown that block scheduling leads to an increase in student scores on achievement tests. One such study, conducted by Lewis, Dugan, Winokur, and Cobb (2005) compared the standardized testing results for ninth-grade students and ACT test results for 11th-grade students of three high schools—one on a traditional schedule, one on an A/B rotating block schedule, and one on a 4 x 4 block schedule. The results showed that students on a 4 x 4 block schedule had greater gains in scores in reading and mathematics than did students in both traditional scheduling and A/B block scheduling. Evans et al. (2002) also found an increase in SAT scores and in the number of students completing advanced placement tests. Other studies have shown that under a block schedule, ACT scores increase (Khazzaka, 1997/1998; Snyder, 1997), the percentage gain in reading and mathematics is higher on state-standardized tests (Bateson, 1990; Shortt & Thayer, 1998; Veal & Schreiber, 1999), and students score higher on the SAT-II exam (Hess, Wronkovich, & Robinson, 1999).

As was the case with grades and honor roll attainment, not all studies point to higher standardized test achievement for students on a block schedule. When comparing 38,089 high school seniors in 568 public high schools in Iowa and Illinois that were either on a traditional eight-period schedule, an eight-block alternating day schedule, or a 4 x 4 semester block schedule, Pliska, Harmston, and Hackman (2001) found no significant difference among student ACT scores. After controlling for lifestyle factors, gender, school enrollment levels, number of examinees, and years under the scheduling model, the results indicated that the scheduling type used at a school was not a predictor of the ACT composite scores obtained by students. The

mean scores of students on the ACT based on schedule type was 21.28 in schools with an eight-period schedule, 21.13 in schools with an eight-block alternating model, and 21.36 in schools with a 4 x 4 semester plan. From a descriptive perspective, the mean composite score differences between schedule types were negligible. In a similar study, Arnold (2002) studied the scores of 11th-grade students in Virginia on the Test of Achievement and Proficiency (TAP). The schedule types compared were a traditional seven-period schedule and a seven-period A/B block schedule model, and student data were collected from the 1990-1991 school year through the 1995-1996 school year. According to the results of the study, no significant difference was found in students' test scores associated with the type of schedule. When investigating a controversial block-scheduling program in a small, Midwestern city, Trenta and Newman (2002) compared 500 students and found no significant impact on the ACT scores of students based on the switch to a block schedule. Numerous other studies have shown that the schedule type has little to no impact on students' achievement on standardized tests such as the SAT, ACT, or advanced placement exams (Salvaterra & Adams, 1995; Trenta & Newman, 2002; Whitla, Bempechat, Perrone, & Carroll, 1992).

In some instances, a switch to a block scheduling format from a traditional schedule has been shown to be detrimental to achievement on standardized tests. Harmston et al. (2003) compared data from 450 public high schools in Illinois and Iowa that employed either a traditional schedule, a 4 x 4 semester schedule, or an eight-block alternating day block schedule. Seven years of data were available for blocked schools, which represented two years prior to implementation through four years after implementation. The eight-period traditional schools demonstrated a slight upward trend in mean ACT scores, the eight-block schools varied in their performance but increased very little over time, and the 4 x 4 semester block schools

demonstrated a declining trend in scores. Comparing students' performance on the Georgia High School Graduation Test (GHS GT), Gruber and Onwuegbuzie (2001) compared scores from students who graduated from a specific high school in the 1996-1997 school year to those who graduated in 1999-2000. The high school chosen for the study moved from a traditional schedule to a block schedule in the 1997-1998 school year. Although no statistically significant differences were found in student scores on the writing portion of the GHS GT, significant differences were found for language arts, mathematics, social studies, and science. In all of the areas where significant differences were found, students who received instruction on a traditional schedule received higher GHS GT scores. The negative impact of block scheduling on student achievement standards was also supported by Brake (2000) when comparing ACT and SAT scores of students on a traditional eight-period schedule versus those on an A/B block schedule and a 4 x 4 semester schedule. Advanced placement (AP) test results have also been found to vary based on the schedule type. Although some studies have found an increase in AP test scores, Knight and DeLeon (1999) found that a greater percentage of students took AP classes on a traditional schedule, more students attempted the AP exam, and the scores of students on a traditional schedule were better than their peers on a block schedule. Wronkovich (1998) found similar decreases in AP test scores for students on a block schedule compared to those on a traditional schedule.

Teacher Perceptions of Block Scheduling

One of the main purported advantages of block scheduling was the increased use of varied instructional strategies and cooperative learning due to the longer class periods. When interviewing teachers at Philo High School in Southeastern Ohio, Eineder and Bishop (1997) found that teachers overwhelmingly believed this to be true. The results of the survey revealed

that 97% of the teachers felt that a wider variety of projects were completed in class, and 91% felt that more extensive use of cooperative learning was used with block scheduling. According to many administrators, the longer class periods and ability to design more in-depth activities and projects under the block encourage teachers to work harder to plan activities and lessons with increased variety (Nichols, 2000). In general, after teaching on a block schedule, many teachers supported the alternate schedule over a traditional schedule. When surveying teachers in two high schools in the Cleveland, Mississippi School District, Griffin and Nicholson (2002) found that the majority of teachers and all administrators preferred the block schedule to the traditional seven-period day that was used prior to the switch. Among teachers in 10 high schools in the Broward County School District in Southeast Florida, 93% reported implementing a variety of new teaching techniques, 86% increased the number of learning activities, 84% experimented with different evaluation techniques, and 75% provided more individualized attention (Deuel, 1999). When asked if they would rather stay on the block schedule or switch back to a traditional style schedule, 80% indicated they would choose to remain on the block schedule. Evans et al. (2002) also found positive attitudes towards block scheduling when interviewing teachers from three school districts on a 4 x 4 block schedule. The teachers felt that the block schedule allowed them to spend more than half of each class on activities other than lecture, the extended time allowed them to do more activities and expand on lessons, students could do more independent projects and present the information to teachers and classmates, more time working with individual students was possible, teaching was more interesting and challenging, and the amount of papers to grade at one time was less due to the lighter student load.

Other studies have found decreased student and teacher stress due to the fewer number of classes per day or semester on a block schedule (Veal & Flinders, 2001). The teachers'

perceptions of the advantages of a block schedule are even more significant with teachers that are teaching on the block for the first year. According to Wilson and Stokes (1999), teachers in their initial year of block scheduling perceived the advantages of block scheduling as more beneficial than teachers who had taught on a block schedule for numerous years.

Staunton (1997) also found favorable teacher attitudes toward the block schedule when surveying teachers at four block-scheduled high schools in the Huntington School District. Many of the teachers stated that they preferred the chance to explore topics in detail and extend classroom discussions. Additionally, they reported that they were more relaxed with the block schedule, as were the students. The disruptions, delays, and interruptions that were detrimental with shorter class periods were reduced in the block schedule class with fewer transitions and a more relaxed class environment. Although the teachers noted several positive changes with the block, they were quick to point out that the move to a block schedule must be carefully initiated as part of a thoughtful plan to institute desired changes in instruction and curriculum. Simply moving to a block does not necessarily force change in instruction. True, positive change only occurs with meaningful training; clear educational goals for the students; and teachers, administrators, parents, and students working together.

Although teachers believe that they incorporate more activities when teaching on a block schedule, Jenkins, Queen, and Algozzine (2002) found this was not always the case. Their study of 2,167 North Carolina teachers indicated little difference between the instructional strategies used by block teachers and those used by non-block teachers. Additionally, the perception a teacher has about the effectiveness of a block schedule seems to be linked to the amount of training received prior to the switch. According to Kramer (1997a), teachers from schools that provided training prior to moving to a block schedule were very positive about the block

schedule while teachers from schools that did not provide training were very negative. They also noted that switching to a block schedule made them feel like a first-year teacher again, and therefore, believed when switching to a block schedule, the teachers needed more planning time to appropriately adjust to the new format.

Student Perceptions of Block Scheduling

As was the case with the teachers, the students who were on a block schedule preferred its format to that of a traditional schedule. According to Eineder and Bishop (1997), 77% of the students surveyed felt a wider variety of projects were completed in class and more extensive use of cooperative learning was used with the block schedule. When surveyed, students in a block schedule viewed block classes more favorably due to a faster pace, the compression of content, more time to do homework in class, more individual help from their teacher, and the ability to know their classmates better (Knight & DeLeon, 1999). O'Neil (1995) found that students on a block schedule had more positive attitudes toward school as well as increased levels of cognitive engagement. The longer class periods can lead to a less-rushed feeling and, as a result, less stress (Skrobarcek et al., 1997). Additionally, students reported that the block schedule led to more interesting classes (Wilson & Stokes, 1999) as well as adequately preparing them for college courses in math, science, and foreign language (Salvaterra, Lare, Gnall, & Adams, 1999). Evans et al. (2002) reported that students felt that in a block schedule they had greater opportunities to take a variety of courses, academic electives, and advanced placement classes; fewer classes to focus on; more class time available for teachers to answer homework questions; and more time to address difficult assignments. Students also reported that with a block schedule the day goes faster, more material can be covered in one class period, labs can be completed and expanded, and more in-depth conversation is possible (Marchant & Paulson, 2001). According

to Hurley (1997), students reported liking the block schedule because they were getting better grades, had more time for in-depth study, received more individual attention from teachers, experienced less hectic lives, and had the ability to start fresh after the semester.

Although the students generally supported the block schedule, they did report that its effectiveness was dependent on the teacher. Some students reported an overuse of lecture and a difficulty paying attention with the longer class periods (Hurley, 1997). Another disadvantage mentioned by students was that they did not like uneven schedules that were too easy one semester and too difficult the other semester. They also felt that absences created difficulties, since one absence was equivalent to two absences under the old schedule. Marchant and Paulson (2001) reported that some students felt the block schedule did not hold their attention as well as the traditional schedule, it was hard to concentrate for the entire class period, sometimes too much material was covered, the adjustment to the new schedule type was overwhelming as a freshman, teachers assign too much homework because of the extra time between classes, they had to learn to budget their time to not overload on one day and not the others, and some teachers did not use a variety of instructional methods during class but relied solely on lecture.

Effectiveness of Block Schedule in Mathematics

Because many teachers and students feel that the block schedule is much more conducive to learning, its effectiveness for math continues to be a question for many math teachers. In a study of three high schools with different scheduling formats in Northern Colorado, Lewis et al. (2005) examined the effect of schedule type on math ACT scores by comparing a 4 x 4 block schedule school, an A/B block schedule school, and a traditional schedule school. The results showed that students on the 4 x 4 block schedule had a higher improvement in math achievement on the Levels test from their ninth-grade year to the 11th-grade year and also outperformed the

other two schedules on the ACT test. Additionally, Veal and Schreiber (1999) found that block schedule students scored higher on math computation tests than students on a traditional schedule. A major advantage of the block schedule for mathematics is the ability of students to take more math classes during their high school careers. The format of the block schedule assists students unlikely to succeed within existing time constraints, allows for honors programs offering two semesters of challenging math each year, and makes it possible to offer courses in statistics and data analysis (Harter, 1994).

Despite the benefits of the block schedule in math, many math teachers have expressed concerns with its effectiveness in math instruction. The lack of support shown by math teachers often stems from a fear that the curriculum will not fit into the longer time blocks and a concern about covering two lessons' worth of material during a double block of time. An additional concern is the possible gaps in the sequencing of math instruction (Kramer, 1997a). Both Stevens (1976) and Usiskin (1995) found that math teachers had mixed feelings about the block schedule. Although many of the teachers in other subjects preferred the block schedule, math teachers showed less support. One reason for this is that in general math teachers appear to have a more difficult time adjusting instructional strategies to accommodate the block schedule (Reid, 1995). Dickey (1997) believed that it is naïve to think that the traditional sequencing of courses in math will be effective on the block. He advocated for the creation of additional courses or topics that address data analysis and integrate other topics such as science into the curriculum. Gullat (2006) reiterated that a successful math program on a block schedule involves new teaching modes and an overhaul of the curriculum. These initiatives are needed to address the primary concerns of how students will keep up with the material when they are forced to learn two skills in one class period and how they retain math skills for more than a year when they are

not practicing them. Students actively involved in block math classes expressed a greater enjoyment of class time (Wronkovich et al., 1997). Kramer (1996) noted that teaching mathematics through lecture alone on the block schedule does not work well. Students find it difficult to sit through a class that essentially consists of two lectures conducted in sequence. Instead, teachers should include a large percentage of participatory activities into the period. Although the block schedule made math classes more interesting and enjoyable and allowed the possibility to take more math classes, concerns arose over the speed of the classes in order to cover the required material as well as whether the students learned as much or mastered the material as well as in a traditional schedule. The evidence collected through surveys seem to indicate that under a block schedule, math teachers will teach less breadth of content but will cover topics in more depth.

Because the effect of the block schedule on the math achievement of students is still in question, many math teachers point to studies to show the drawbacks of moving to a block. Skrobareck et al. (1997) studied the effects of a pilot block schedule for Algebra I in a large Central Texas high school. The results showed that during the first year on the block, students made better grades and went on to take more advanced math classes. In subsequent years, however, failure rates in the block classes have increased while the failure rates in the traditional classes have decreased. Similar findings have been reported when looking at math achievement scores on standardized tests. Gruber and Onwuegbuzie (2001) reported that traditional schedule students had significantly higher scores on the mathematics segment of the GHSCT than did block schedule students. Similarly, Wronkovich et al. (1997) found the traditional schedule model preferable for students' performance on a test of college-level math skills. Although Kramer (1997b) also found that students' achievement and retention was affected with an extra

semester gap, he did notice that students quickly recovered during the subsequent math course and showed no long-term negative effects.

Implementation of a Block Schedule

According to Lybbert (1998), there are several key steps that should be taken prior to implementing a block schedule that will greatly maximize the potential for success. First, a school should develop a plan of action. Since there are many questions that will have to be answered when considering a schedule change, as well as many decisions to be made, a school must identify which essential stakeholders will be involved in the planning and decision-making process. This group will need to decide what it will take to actually adopt a block scheduling plan. They must determine whether the decision will be subject to board approval, what financial resources will be required for staff development, if additional teachers or staff will need to be added, and whether the faculty will vote on the decision to change to a block schedule.

After developing a plan of action, the committee should look to see if there are valid reasons for making a change. Unless an educational reason for changing to a block schedule is apparent, it is unlikely that enough enthusiasm will be generated to bring about the switch. The committee should focus on district and campus strategic planning goals and decide whether a block schedule will be more effective in the achievement of the goals (Lybbert, 1998).

In order to be fully informed and in a position to answer the many questions that will be asked, the committee must undertake an extensive research effort when contemplating a change to a block schedule. Fortunately, there is a great deal of information that exists on block scheduling. Many schools that have had success on the block have already compiled materials into handbooks that outline their process of adopting block scheduling. In-person visits to

schools that have made the switch is something the committee may also want to consider in order to gain a better understanding of the block scheduling process (Lybbert, 1998).

Once the leadership committee reaches a point where they feel they are competent and have gathered enough information to be informed enough to make a decision, the focus should then be on communicating with and persuading, if necessary, the faculty and critical interest groups (Lybbert, 1998). Since the faculty represents the key players who will determine the ultimate success or failure of the reform, they should be the focal point. The presentations should be made at staff meetings and provide several alternatives such as the alternating block schedule, the accelerated block schedule, modified blocks, and trimester. Committee members need to be prepared to take the lead in recommending a plan and clearly explaining why it is superior to the other options for the school. Through this process, the opinions of others should be considered and adequate time should be allowed for questions, discussions, and review of all of the options (Lybbert, 1998).

Hackman (1995) provided implementation guidelines a faculty should consider before considering a switch to a block schedule. First, a district should employ a systems thinking approach. A block schedule should not be implemented because it is the latest trend but rather because it empowers teachers to rethink and restructure their systems. Next, the faculty should secure the support of their superiors. Many aspects of implementing the block schedule will be beyond the faculty's jurisdiction, such as adding or reducing staff, bus schedules, and revisions to the negotiated contract agreements. Additionally, moving to a block schedule will possibly clash with long-standing district norms or traditions. As a result, frequent communication with the central office will eliminate any surprises and encourage feedback. A clear understanding of the change process is also crucial when considering a move to block scheduling. Just because

teachers can agree that the change is best for students does not ensure they will support the change and feel it is good for them personally. Adequate time for the faculty to assess how they feel about the possibility of a new schedule, as well as a process to address any concerns, is vital to success (Hackman, 1995).

Besides involvement of the superiors, faculty should also involve all stakeholders. Since this change will have an impact at all levels, there needs to be involvement and support from various stakeholders. Principals need to support the initiative to help ensure involvement, to explain the rationale, and to support teachers through the change process. Students and parents should also be involved and their input and suggestions should be solicited through conferences, meetings, and newsletters (Hackman, 1995).

Although the faculty will have ideas about what is best for their district, outside sources can also be a valuable resource when considering a change. Teachers should look at journal articles, attend national and state conferences, invite educators who have implemented block schedules to speak, and visit other schools that are on the block to gain ideas of the best approach for the district (Hackman, 1995).

Because outside sources can provide great resources, the faculty will ultimately need to think creatively. The block schedule allows for the opportunity to break away from the restraints of the traditional schedule. A school should not simply adopt another school's model but instead should think outside of the box to develop a system that fits the individual needs of the district. Depending on the design of the new schedule, the budgetary implications may need to be examined. Thinking creatively about cost saving solutions can allow for a faculty to propose the implementation of a block schedule at no additional cost (Hackman, 1995).

The success of a block scheduling also depends on the training that occurs prior to the implementation. As a result, a plan should be developed for faculty in-services. Since the alternative schedule will create the need for teachers to teach differently than they have in the past, professional development that focuses on engaging the students through cooperative learning, student efficacy, and student use of technology is helpful (Hackman, 1995).

Because the implementation of a block schedule is perhaps the most difficult and time-consuming part of the process, there also need to be steps in place to evaluate its effectiveness. The components that will be used for evaluation of the schedule should be established prior to implementation. With the extra hours rewriting lesson plans and analyzing new teaching approaches, it is not uncommon for teacher morale to decline the first year in a block schedule. Therefore, it is critical to celebrate tangible successes by reserving time at faculty meetings to share positive classroom experiences, to meet in large groups to brainstorm creative teaching approaches and share effective lessons, and for administrators to take every opportunity to publicly praise the faculty for their hard work (Hackman, 1995).

Teaching on the Block

Regardless of which alternative schedule type is implemented, the effectiveness of the schedule is determined by the effectiveness of the instructional strategies used by the teachers. According to Canady and Rettig (1995), a major need which must be addressed with the implementation of block scheduling is helping teachers gain the necessary strategies and skills to teach successfully with larger block of time. To be successful in the transition to a block schedule, teachers need at least five to 10 days of professional development. During the workshops, strategies must be modeled for teachers, and then teachers should be allowed to participate in activities with a high degree of engagement where they practice designing

instruction for large blocks of time (Canady & Rettig, 1997). The lesson design for a block schedule should incorporate three key elements. First, teachers should provide a 25-to-40 minute explanation, which focuses on what is to be learned, constructed, dissected, prepared, developed, located, written, or performed. During this step, the objectives are identified, tasks to be completed are specified, and how the students will successfully meet the learning outcomes is demonstrated. Next a teacher should move to application. This phase, also called hands-on time, transitions the students into active learners as they apply what the teacher has been explaining. Typically 40 to 60 minutes in length, this phase significantly enhances the retention of the content by students. The final phase of a successful block lesson is synthesis. This part of the lesson usually consumes 15 to 30 minutes depending on the content of the lesson and the length of the block period. During this phase, the teacher involves the student in connecting the explanation phase with the application phase. It provides a time for reflection, review, and re-teaching if necessary. Ultimately, this phase provides the relevance of the lesson and helps answer the proverbial questions of why the students are learning the material and when they will ever use the skills covered (Canady & Rettig, 1997).

In an effort to help teachers maximize the effectiveness of instruction in a block schedule, Hackman and Schmitt (1997) offered several creative instructional approaches for teachers. First, they suggested that teachers continuously engage students in active learning. The block schedule allows teachers to embrace the teacher as coach philosophy. In this concept teachers would facilitate learning rather than always using the direct delivery method of instruction. Even when lecture is necessary, teachers should use activities such as think-pair-share, learning journals, and active questioning (Hackman & Schmitt, 1997). Additionally, group activities to encourage student participation is also a good strategy to use in a block schedule and can be done

through cooperative learning, writing groups, case studies, role playing, and stimulations. These activities can aid in the long-term memory of concepts since the students are able to state them orally or to physically engage in the activities. With the longer periods on a block schedule, teachers have more of an opportunity to utilize outside resources. The use of these resources can help teachers and students focus on real-life applications of their classes. Teachers can use guest speakers, community artifacts, integrated field trips, and community scavenger hunts to tie the community and school together (Hackman & Schmitt, 1997). Not only does the longer time allow for varied activities and resources but it can also allow for alternative assessments. The use of cooperative problem analysis and resolution with a classroom partner or the use of technology to assess manipulate and present information are more typical of what students will encounter outside of the classroom and are more telling of the students' mastery and knowledge of the concepts. Besides its use in assessments, technology should also be incorporated as an instructional resource. The use of teacher- or student-developed multimedia presentations and internet research activities can be beneficial in enhancing the instruction within a class or a unit (Hackman & Schmitt, 1997). Finally, since the block schedule can often mean teachers moving away from their comfort zones and the ways they have taught for years, it is imperative to share resources and ideas with colleagues. The longer periods of time and the flexibility in the scheduling will hopefully allow teachers to plan and work together in ways that were not previously available (Hackman & Schmitt, 1997).

Summary

Although the traditional schedule was the dominant schedule for much of the 20th century, many schools looked to alternative methods of structuring the school day based on the perception that American students were lagging behind (Queen, 2001). The switch to alternative

schedules such as a 4 x 4 block, A/B block, and trimester schedule produced many benefits. This structure led to more innovative, hands-on, and personalized instruction that encouraged more student engagement, emphasized depth over surface treatment of content, and helped students develop problem-solving skills (Deuel, 1999). Besides the benefits to students, the block schedule also placed fewer demands on teachers due to the reduced number of preps daily. This resulted in more collaboration among teachers and a more effective use of instructional time (Carroll, 1990). The benefits to the students and teachers ultimately led to an overall improvement in the atmosphere of the school. Teachers and students reported being more relaxed and felt they had better relationships due to the moderately paced day (O'Neil, 1995).

Despite the many purported benefits of a block schedule, disadvantages have also materialized. The longer class periods in the block format make it more difficult to maintain students' attention and some students have difficulties retaining material from previous class periods since the classes don't meet daily (Canady & Rettig, 1997). Absences are also problematic due to the increased amount of material covered in a day and the difficulties of students to catch up with what was missed while also trying to keep up with the current material (Hackman et al., 2001).

Although many teachers and students have perceptions about the impact of schedule type on achievement, the results are varied. Some studies have shown positive effects based on the schedule type (Evans et al., 2002; Griffin & Nicholson, 2002; Khazzaka, 1997/1998; Knight & DeLeon, 1999), some have shown negative effects (Brake, 2000; Harmston et al., 2003; Lawrence & McPherson, 2000), and some have shown that the schedule type has no impact on achievement (Nichols, 2000; Williams, 1999; Wronkovich et al., 1997). Despite the varying findings, teachers and students are generally supportive of block schedules and prefer this

structure over that of the traditional schedule (Eineder & Bishop, 1997). This same level of support is not shown, however, by many math teachers. The lack of support shown by math teachers often stems from a fear that the curriculum will not fit into longer time blocks and a concern about covering two lessons' worth of material during a double block of time. An additional concern is the possible gaps in the sequencing of math instruction (Kramer, 1997a). Although the research on the impact of schedule type on achievement varies, many schools are either moving from the block schedule to a traditional schedule or from a traditional schedule to a block schedule with the hope that the schedule change alone will result in improved math achievement.

CHAPTER 3

METHODOLOGY

This chapter discusses research methodology including the null hypotheses, data sources, population of the study, the data collection process, and the instrument used. The purpose of this quantitative study was to examine various schedule types used by Grades 9 through 12 in high schools in Illinois. Data from the 2011 PSAE was used to determine if there were significant differences in the percentage of students meeting or exceeding on the PSAE math test between high school schedule types (Illinois State Board of Education, 2012). Additionally, survey data were used to determine if there were significant differences in the effectiveness rating given by lead math teachers or math department chairs to a schedule type between those who currently use that schedule type and those that use a different schedule type. For each student outcome and schedule type addressed on the survey, responses were sorted by those who currently use the schedule type in one group and those that currently use a different schedule type in a second group. Survey data were also used to determine if there were significant differences in the perceived effectiveness by lead math teachers or math department chairs between schedule types on various student outcomes in mathematics. Overall, the design involved the following procedures:

1. Illinois public high schools encompassing Grades 9 through 12 were included in the population.

2. The type of schedule currently being used for mathematics was collected from each school that responded to the survey.
3. The percentage of students meeting or exceeding standards on the 2011 PSAE mathematics test from each school that responds to the survey was determined using the IIRC website.
4. A comparison of the effectiveness rating given by math department chairs or lead math teachers to the schedule they currently used was compared to the effectiveness rating given to that schedule type by math department chairs or lead math teachers currently using a different schedule type was conducted.
5. Math department chairs and lead teachers' perceptions of the best schedule type for various aspects of student outcomes in mathematics was collected from schools that respond to the survey.

Research Questions

This quantitative study sought answers to four research questions:

1. What schedule types are currently used in ninth- through 12th-grade high school mathematic classes in Illinois?
2. Is there a significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types?
3. How does the mean effectiveness rating given to a schedule type by lead math teachers or department chairs that currently use that schedule compare to the mean effectiveness rating given by those that use a different schedule type?

4. Are there significant differences in the effectiveness ratings given by math department chairs or lead teachers between schedule types on various student outcomes in mathematics?

Research Question Analysis and Null Hypotheses

Research Question 1 was addressed through descriptive analysis. Research Question 2 and H_{01} —There is no significant difference in the percentage of students meeting or exceeding on the PSAE math test between high school schedule types—was addressed using an ANOVA. For this analysis, schedule type was the independent variable and the dependent variable was math achievement scores, which were measured by the percentage of students meeting or exceeding standards on the PSAE math test for each school that responded to the survey. Research Question 3 was addressed through descriptive analysis and a comparison of means. For each schedule type and student outcome addressed on the survey, the responses were sorted by those who currently used the schedule type in one group and those that currently used a different schedule type in a second group. The effectiveness rating mean was then calculated for the group that currently used the schedule type and compared to the effectiveness rating mean for the group that currently used a different schedule type. Research Question 4 and the following null hypotheses was addressed using repeated measure one-way ANOVAs. Those are H_{02} —There is no significant difference in the perceived effectiveness between schedule types on the ability to cover the appropriate amount of material; H_{03} —There is no significant difference in the perceived effectiveness between schedule types on keeping students focused and attentive the entire class period; H_{04} —There is no significant difference in the perceived effectiveness between schedule types on preparing students for future math classes; H_{05} —There is no significant difference in the perceived effectiveness between schedule types on assessing

students' understanding and mastery of a math lesson/concept; H₀6—There is no significant difference in the perceived effectiveness between schedule types on improving students' grades in math classes; H₀7—There is no significant difference in the perceived effectiveness between schedule types on students' performance on standardized tests; H₀8—There is no significant difference in the perceived effectiveness between schedule types on students' retention of concepts from one class to the next; H₀9—There is no significant difference in the perceived effectiveness between schedule types on students' retention of concepts from one year to the next; H₀10—There is no significant difference in the perceived effectiveness between schedule types on promoting student engagement during instruction; H₀11—There is no significant difference in the perceived effectiveness between schedule types on assisting students struggling with the material; and H₀12—There is no significant difference in the perceived effectiveness between schedule types on allowing for varied instructional strategies. For Research Question 4, the independent variable was again the schedule type and the dependent variable was the effectiveness rating, measured on a scale from 1 to 5, given to each schedule type for the student outcomes from the survey.

Design

According to Creswell (1994), a quantitative design utilizes a survey or experimental instrument to gather information whereas a qualitative design looks at reality more subjectively and wants a close interaction with informants. For quantitative designs, the researcher is independent of what is being studied and reality is looked at as objective, singular, and apart from the researcher (Creswell, 1994). In qualitative designs, on the other hand, the researcher interacts with that being researched and defines reality as seen by participants in the study (Creswell, 1994). In this study, the information on the effectiveness of schedule types on various

student outcomes in math was collected extensively through the use of a survey with no interaction with the individuals in the study. As a result, a quantitative design was chosen for this study.

Participants

For the purpose of this study, a high school was defined as a Grades 9 through 12 facility. There were a total of 793 public high schools selected with this grade configuration from the information provided from the Illinois High School Association. An email was sent to the principal of each of the high schools selected requesting the email address for his or her lead math teacher or math department chair. Each math department chair or lead math teacher then received a direct email asking him or her to participate in the study by responding to the survey provided.

Data Collection

1. Seven hundred ninety three high schools in Illinois were selected.
2. A list of participants was developed using information provided by the Illinois High School Association. A spreadsheet was provided that listed principals' email addresses, phone numbers, and school addresses for all schools that were members of the Illinois High School Association.
3. Principals were contacted by email and asked to provide the email address for their lead math teacher or math department chair. Once the contact information had been obtained, each lead math teacher or math department chair was emailed directly and asked to participate in the study by completing the survey (Appendix A). The body of the email consisted of a cover letter explaining the study and a link to the on-line survey. The first two pages of the survey explained the consent to participate and

- required participants to click that they agreed prior to accessing the remainder of the survey.
4. The percentage of students meeting or exceeding standards on the 2011 PSAE math test for each school that responded to the survey was obtained using the IIRC website. The schedule type used in math classes for each school was obtained from the survey.
 5. The math department chairs or lead math teachers were surveyed on their perceptions of the effectiveness of schedule types for various student outcomes in mathematics.
 6. Three weeks after the initial email to the principals, a follow-up email was sent thanking the principals for providing the contact information or encouraging them to provide the email address of their lead math teachers or math department chairs. Three weeks after the initial email of the survey to lead math teachers or math department chairs, a follow-up email was sent to the math teachers thanking them for completing the survey or encouraging them to participate in the study by completing the survey.
 7. Survey results were used to examine the schedule types currently used in Grades 9 through 12 high school mathematics classes in Illinois whether there was a significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types whether there was a significant difference in the effectiveness ratings given by math department chairs or lead teachers between those who currently used that schedule type and those that used a different schedule type, and whether there were significant differences in the effectiveness ratings given by math department chairs or lead math teachers between schedule types on various student outcomes in mathematics.

Instrumentation

The Scheduling for Math Instruction Survey was used with math department chairs or lead math teachers to determine their perception of the effectiveness of various schedule types on different student outcomes in mathematics (Appendix A). The Scheduling for Math Instruction Survey was developed after reviewing the current literature to determine the student outcomes in mathematics to be addressed. Based on the review of the literature, the survey asked lead math teachers or math department chairs to rate the effectiveness of each schedule type in covering the appropriate amount of material (Kramer, 1997a), keeping students focused and attentive the entire class period (Canady & Rettig, 1997), preparing students for future math classes (Kramer, 1997a), assessing students' understanding and mastery of a math lesson/concept (Wronkovich et al., 1997), improving students' grades in math classes (Kramer, 1997a), students' performance on standardized tests (Kramer, 1997a; Wronkovich et al., 1997), retention of concepts from one class to the next (Canady & Rettig, 1997), retention of concepts from one year to the next (Kramer, 1997a; Kramer, 1997b), promoting student engagement during instruction (Canady & Rettig, 1997), assisting students struggling with the material (Kramer, 1997a; Kramer, 1997b), and allowing for varied instructional strategies (Canady & Rettig, 1997). Math department chairs or lead teachers were asked to indicate the current schedule type they used, the number of years they had been on their current schedule, and the schedule types they had used in the past. Additionally, each lead math teacher or math department chair was asked to rate each schedule type on a scale of 1 to 5 for each schedule type and each student outcome with 1 representing *not effective*, 2 representing *somewhat effective*, 3 representing *neutral*, 4 representing *effective*, and 5 representing *very effective*. Besides the information on current and past schedule use and the rating of effectiveness for each schedule type for the various student outcomes, it was also

helpful to know demographic information about the individuals and the schools represented. As a result, the survey also asked for the name of the school, school enrollment, and school locale as well as the gender, age, and years of teaching experience of the respondent. To ensure content clarity and validity of the survey, a small number of non-lead math teachers not involved in the study were selected to take the survey and provide feedback on possible improvements.

Survey Reliability

The reliability of the survey was tested via Cronbach's alpha coefficient. The reliability analysis for the scale was reported statistically by determining the scale mean, the scale variance for each item if deleted, the corrected item correlation, and the alpha when the item was deleted.

Face Validity

The degree to which this survey accurately assessed the concept of math department chair or lead math teachers' perceptions of the effectiveness of schedule types was validated by sampling 10 ninth- through 12th-grade math teachers in regards to the survey instrument clarity and organization.

Content Validity

The student outcomes on the Scheduling for Math Instruction survey were developed through the research presented in the literature review. Outcomes shown to be critical to effective math instruction according to the research were included in the survey. After the survey was piloted by 10 ninth- through 12th-grade math teachers, two additional student outcomes were added to the survey.

Data Analysis

This study of the differences in math achievement between schedule types and the perception of Illinois math department chairs or lead math teachers of the effectiveness of schedule types on various student outcomes drew on analysis relying extensively on a survey instrument (Appendix A) developed by me. This survey was conducted during the 2012-2013 academic year.

Research Question 1 was explored through descriptive analysis. Based on the responses on the surveys, the number of schools using a certain schedule type was determined and compared to the number of schools using other schedule types.

Research Question 2 (H_{01}) was tested using a one-way ANOVA using the factor of schedule type with regards to math scores on the PSAE math test.

Research Question 3 was tested by using descriptive analysis. Individuals were grouped by their current schedule type and the mean score of the rating given to their schedule type was compared to the mean score given to that same schedule type by individuals that were currently using a different schedule. This comparison was done for each schedule type and each student outcome.

Research Question 4 (H_{02} – H_{012}) was tested using a repeated measures one-way ANOVA for each of the hypotheses. The factor of schedule type in regards to the perceived level of effectiveness for the various student outcomes in mathematics was used to conduct this analysis.

Summary

In this chapter, the design components consisting of the hypotheses, the data source including the population, and the instrument used were presented and described. The purpose of this study was to examine the various schedule types used by Grades 9 through 12 high schools in Illinois, whether significant differences exist in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types whether significant differences exist in the effectiveness rating given by math department chairs or lead math teachers to a schedule type between those who currently use that schedule type and those that use a different schedule type and whether significant differences exist in the perceived

effectiveness by lead math teachers and math department chairs between schedule types on various student outcomes in mathematics.

CHAPTER 4

FINDINGS

The purpose of this quantitative study was to examine the various schedule types used by ninth- through 12th-grade high schools in Illinois. This chapter provides a description of the data and presents the results of the study. It is organized into the following sections: respondent characteristics, reliability of scheduling for math instruction survey, descriptive data, inferential analysis, and summary of findings.

Respondent Characteristics

The population of lead math teachers or math department chairs that participated in this survey represented a cross section of Illinois high schools encompassing Grades 9 through 12. Lead math teachers or math department chairs in 91 high schools in Illinois responded to this survey.

Respondents by Gender

Of the 91 math department chairs or lead math teachers that responded to the survey, 36 were men and 55 were women. Men made up 39.56% of the pool, and 60.44% of the respondents were women.

Respondents by Age

Respondents were asked to provide their age. The respondents represented five possible age categories: (a) 22–30; (b) 31–40; (c) 41–50; (d) 51–60; and (e) 61 and . Eleven teachers aged 22–30 responded accounting for 12.22% of the sample; 21 teachers aged 31–40 responded

accounting for 23.33% of the sample; 32 teachers aged 41–50 responded accounting for 35.56% of the sample; 18 teachers aged 51–60 responded accounting for 20.00% of the sample; and eight teachers 61 or older responded accounting for 8.89% of the sample. The mean age of the 91 respondents was 44.3 years. The youngest respondent was 24 years of age and the oldest respondent was 73 years of age.

Respondents by Years of Experience

Respondents were asked to provide their years of teaching experience. The respondents represented four possible categories: (a) Less than 5; (b) 5–15; (c) 16–25; (d) More than 25. Four teachers had less than five years of teaching experience, accounting for 4.40% of the sample; 32 teachers had 5–15 years of experience, accounting for 35.16% of the sample; 26 teachers had 16–25 years of experience, accounting for 28.57% of the sample; and 29 teachers had more than 25 years of experience, accounting for 31.87% of the sample. The mean experience of the 91 respondents was 19.33 years. The least amount of experience of any respondent was two years and the most experience was 50 years.

Respondents by School Enrollment

Teachers responding to the survey reported serving in schools ranging in size from less than 500 students to 2001 or more students as presented in Table 4. Forty three teachers were at schools with less than 500 students, accounting for 47.25% of the sample; 12 teachers were at schools with 501–1,000 students accounting for 13.19% of the sample; 10 teachers were at schools with 1,001–1,500 students accounting for 10.99% of the sample; eight teachers were at schools with 1,501–2,000 students accounting for 8.79% of the sample; and 18 students were at schools with 2,001 or more students accounting for 19.78% of the sample.

Respondents by School Locale

The respondents were asked to classify their school locations as urban, suburban, or small town. Of the respondents, 10 taught in urban locales, accounting for 11.24% of the sample; 36 taught in suburban locales, accounting for 40.45% of the sample; and 43 taught in small town locales, accounting for 48.31% of the sample.

Respondents by Current Schedule Type

Research Question 1 explored what schedule types are currently used in ninth- through 12th-grade high school mathematics classes in Illinois. The respondents were asked to classify the schedule type used for mathematics class as traditional six-period, traditional seven-period, traditional eight-period, A/B block, 4 x 4 block, or trimester. Ten teachers were on a traditional six-period schedule, accounting for 11.11% of the sample; 36 teachers were on a traditional seven-period schedule, accounting for 40% of the sample; 31 teachers were on a traditional eight-period schedule, accounting for 34.44% of the sample; 12 teachers were on an A/B alternating block schedule, accounting for 13.33% of the sample; one teacher was on a 4 x 4 block schedule, accounting for 1.11% of the sample; and no teachers were currently teaching on a trimester schedule.

Respondents by Length on Current Schedule

The respondents were asked to indicate the number of years they had taught on their current schedules. The average number of years on the current schedule was 14.16, with one year being the lowest response and 50 years being the highest.

Reliability of the Scheduling for Math Instruction Survey

To report the reliability of the survey items measuring effectiveness, a coefficient alpha or Cronbach's alpha was used for each of the 11 student outcomes in mathematics by assessing

each statement and establishing an item analysis. The reliability analysis for each category was reported by statistically determining the scale mean for each item if deleted, the scale variance for each item if deleted, the corrected item correlation, and the alpha when the item is deleted.

This process was first conducted for the ratings for the traditional schedule. Cronbach's alpha resulted in all correlation values of the corrected item total correlation above .30, none of the values in the alpha if item deleted column substantially greater than the overall alpha value, an overall alpha value of .90, and a standardized item alpha of .90. These results are illustrated in Table 1 and indicate sufficient reliability.

Table 1

Reliability Analysis of Perception of Traditional Schedule Effectiveness

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Covering Material	37.73	35.84	.69	.71	.88
Focus and Attention	37.64	36.84	.60	.47	.89
Preparation for Future Math Classes	37.75	34.98	.69	.73	.88
Assessing Understanding	38.01	34.04	.73	.65	.88
Improving Math Grades	38.08	35.02	.70	.67	.88
Standardized Test Performance	38.05	33.83	.78	.66	.88

Table 1 (continued)

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Retention from One Class to Next	38.10	35.34	.62	.58	.89
Retention from One Year to Next	38.33	34.83	.60	.57	.89
Promoting Engagement	38.12	34.47	.64	.51	.89
Assisting Struggling Students	38.62	36.19	.44	.32	.90
Varying Instruction	38.62	35.52	.48	.38	.90

The analysis was repeated for the ratings for the 4 x 4 block schedule. Cronbach's alpha resulted in all correlation values of the corrected item total correlation above .30, none of the values in the alpha if item deleted column substantially greater than the overall alpha value, an overall alpha value of .93, and a standardized item alpha of .93. These results are illustrated in Table 2 and indicate sufficient reliability.

Table 2

Reliability Analysis of Perception of 4 x 4 Block Schedule Effectiveness

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Covering Material	29.54	73.51	.75	.78	.92
Focus and Attention	29.87	77.84	.51	.45	.93
Preparation for Future Math Classes	29.65	71.17	.89	.88	.92
Assessing Understanding	29.37	71.73	.82	.78	.92
Improving Math Grades	29.48	73.43	.75	.70	.92
Standardized Test Performance	29.79	73.62	.79	.82	.92
Retention from One Class to Next	29.94	73.47	.71	.89	.93
Retention from One Year to Next	30.15	75.67	.67	.88	.93
Promoting Engagement	29.23	73.67	.74	.63	.92
Assisting Struggling Students	29.35	73.68	.62	.57	.93
Varying Instruction	28.83	74.38	.64	.56	.93

The analysis was repeated for the ratings for the AB block schedule. Cronbach's alpha resulted in all correlation values of the corrected item total correlation above .30, none of the values in the alpha if item deleted column substantially greater than the overall alpha value, an overall alpha value of .90, and a standardized item alpha of .90. These results are illustrated in Table 3 and indicate sufficient reliability.

Table 3

Reliability Analysis of Perception of AB Block Schedule Effectiveness

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Covering Material	32.81	55.14	.67	.57	.89
Focus and Attention	33.00	56.87	.59	.54	.90
Preparation for Future Math Classes	32.52	54.48	.79	.76	.88
Assessing Understanding	32.43	56.70	.68	.60	.89
Improving Math Grades	32.74	57.67	.63	.58	.89
Standardized Test Performance	32.70	55.68	.76	.71	.89
Retention from One Class to Next	32.83	56.29	.69	.72	.89

Table 3 (continued)

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Retention from One Year to Next	32.81	57.47	.67	.73	.89
Promoting Engagement	32.33	55.09	.75	.69	.89
Assisting Struggling Students	32.44	59.31	.41	.32	.91
Varying Instruction	31.89	61.80	.42	.45	.90

The analysis was repeated for the ratings for the trimester schedule. Cronbach's alpha resulted in all correlation values of the corrected item total correlation above .30, none of the values in the alpha if item deleted column substantially greater than the overall alpha value, an overall alpha value of .91, and a standardized item alpha of .90. These results are illustrated in Table 4 and indicate sufficient reliability.

Table 4

Reliability Analysis of Perception of Trimester Schedule Effectiveness

Outcome	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Covering Material	30.30	50.66	.27	.48	.92
Focus and Attention	30.30	45.22	.73	.66	.89
Preparation for Future Math Classes	30.22	45.06	.64	.61	.90
Assessing Understanding	30.16	43.20	.80	.84	.89
Improving Math Grades	30.24	43.69	.77	.62	.89
Standardized Test Performance	30.27	42.98	.73	.66	.89
Retention from One Class to Next	30.27	41.98	.81	.88	.89
Retention from One Year to Next	30.41	43.41	.74	.79	.89
Promoting Engagement	30.00	47.94	.53	.69	.90
Assisting Struggling Students	29.95	46.67	.67	.81	.90
Varying Instruction	29.78	49.79	.39	.55	.91

Descriptive Data

The research focus of this study was Grades 9 through 12 in high schools in Illinois. A Scheduling for Math Instruction survey was sent to 350 lead math teachers or math department chairs. The analysis data set contained 91 records ($N = 91$), representing 26% of the teachers invited to participate and 11.5% of the high schools.

Comparison of Effectiveness Ratings by Current Schedule Type of Respondent

The third research question explored how the mean effectiveness rating given to a schedule type by lead math teachers or math department chairs who currently use that schedule compared to the mean effectiveness rating given by those who use a different schedule type. Each respondent was asked to provide his or her current schedule type as well as ranking the effectiveness of each schedule type on a scale of 1 to 5 for 11 different student outcomes in mathematics. Table 5 illustrates the mean effectiveness rating given to each schedule type for the eleven student outcomes in mathematics for teachers who currently teach on a traditional schedule as well as those who currently teach on a block schedule.

Table 5

Average Rating on Student Outcomes by Schedule Type

Item	Traditional	4 x 4	AB	Trimester
Covering Material				
On Traditional Schedule	4.17	2.50	2.42	2.58
On Block Schedule	4.00	2.89	3.83	3.00
Focus and Attention				
On Traditional Schedule	4.42	2.42	2.67	2.58
On Block Schedule	3.92	3.20	3.33	3.29
Preparation for Future Math Classes				
On Traditional Schedule	4.08	2.50	2.67	2.58
On Block Schedule	3.57	2.88	4.08	3.43

Table 5 (continued)

Item	Traditional	4 x 4	AB	Trimester
Assessing Understanding				
On Traditional Schedule	3.92	2.75	2.58	2.83
On Block Schedule	3.75	3.22	4.17	3.14
Improving Math Grades				
On Traditional Schedule	3.92	2.50	2.50	2.67
On Block Schedule	3.42	2.89	3.33	3.00
Performance on Standardized Tests				
On Traditional Schedule	3.67	2.83	2.67	2.83
On Block Schedule	3.75	2.89	3.67	3.14
Retention Between Classes				
On Traditional Schedule	3.67	2.33	2.58	2.83
On Block Schedule	3.67	2.33	3.17	3.14
Retention Between Years				
On Traditional Schedule	3.50	2.33	2.67	2.92
On Block Schedule	3.25	2.22	3.17	2.71
Promoting Student Engagement				
On Traditional Schedule	3.67	2.92	3.83	2.83
On Block Schedule	3.75	3.67	4.00	3.14
Assisting Struggling Students				
On Traditional Schedule	3.58	2.58	2.67	2.92
On Block Schedule	3.08	3.67	4.17	3.29
Varying Instructional Strategies				
On Traditional Schedule	3.17	3.33	3.50	3.17
On Block Schedule	3.17	3.44	4.25	3.14

Covering material. The average given to the traditional schedule by those currently teaching on a traditional schedule was 4.17 compared to an average rating of 4.00 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher on average than those currently teaching on a traditional schedule. Although the respondents currently teaching on a block schedule ranked block schedules more favorably, they ranked the traditional schedule higher than the block schedules on the ability to cover material.

Focus and attention. The average given to the traditional schedule by those currently teaching on a traditional schedule was 4.42 compared to an average rating of 3.92 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher on average than those currently teaching on a traditional schedule. Although the respondents currently teaching on a block schedule ranked block schedules more favorably, they ranked the traditional schedule higher than the block schedules on students' focus and attention.

Preparation for future math classes. The average given to the traditional schedule by those currently teaching on a traditional schedule was 4.08 compared to an average of 3.57 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher on average than those currently teaching on a traditional schedule. Respondents currently teaching on a block schedule rated the AB schedule highest for preparation for future math classes but ranked the traditional schedule higher than the other block schedules, while those currently teaching on a traditional schedule rated the traditional schedule highest.

Assessing understanding. The average given to the traditional schedule by those currently teaching on a traditional schedule was 3.92 compared to an average rating of 3.75 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher on average than those currently teaching on a traditional schedule. Respondents currently teaching on a block schedule rated the AB schedule highest for assessing understanding but ranked the traditional higher than the 4 x 4 and trimester schedules, while those currently teaching on a traditional schedule ranked the traditional schedule highest.

Improving grades. The average rating given to the traditional schedule by those currently teaching on a traditional schedule was 3.92 compared to an average rating of 3.42 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher than those currently teaching on a traditional schedule. Both the respondents currently teaching on a traditional schedule and those currently teaching on a block schedule rated the traditional schedule the highest for improving students' grades in mathematics.

Performance on standardized tests. The average rating given to the traditional schedule by those currently teaching on a traditional schedule was 3.67 compared to an average rating of 3.75 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4 and trimester schedules higher than those currently teaching on a traditional schedule, but those currently teaching on a traditional schedule rated the AB schedule higher. Respondents currently teaching on a traditional schedule rated the traditional schedule highest overall, while respondents currently teaching on a block schedule felt the AB and traditional schedule were equally effective in improving students' performance on standardized tests.

Retention between classes. Respondents currently teaching on a traditional schedule and those currently teaching on a block schedule received the same average rating given to the traditional schedule and the 4 x 4. Respondents currently teaching on a block schedule rated the AB and trimester schedules higher on average than those currently teaching on a traditional schedule. Both the respondents currently teaching on a traditional schedule and those currently teaching on a block schedule rated the traditional schedule highest on retention of material from one day to the next.

Retention between years. The average rating given to the traditional schedule by those currently on a traditional schedule was 3.50 compared to an average rating of 3.25 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a traditional schedule rated the 4 x 4 and trimester schedules higher than those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the AB schedule higher than those currently teaching on a traditional schedule. Both respondents who were currently teaching on a traditional schedule and those currently teaching on a block schedule rated the traditional schedule highest for retention of material from one year to the next.

Promoting student engagement. The average rating given to the traditional schedule by those currently teaching on a traditional schedule was 3.67 compared to an average rating of 3.75 given to the traditional schedule by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher than those currently teaching on a traditional schedule. Both respondents currently teaching on a traditional schedule and those currently teaching on a block schedule rated the AB schedule highest for promoting student engagement.

Assisting struggling students. The average rating given to the traditional schedule by those currently teaching on a traditional schedule was 3.58, compared to an average rating of 3.08 by those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4, AB, and trimester schedules higher than those currently teaching on a traditional schedule. Respondents currently teaching on a traditional schedule rated the traditional schedule highest, while those currently teaching on a block schedule rated the AB schedule highest.

Varied instructional strategies. The average rating given to the traditional schedule was the same for those currently teaching on a traditional schedule and those currently teaching on a block schedule. Respondents currently teaching on a block schedule rated the 4 x 4 and AB Block schedule higher than those teaching on a traditional schedule, while those currently teaching on a traditional schedule rated the trimester schedule higher than those currently teaching on a block schedule. Both respondents who were currently teaching on a traditional schedule and those currently teaching on a block schedule rated the AB schedule highest for varying instructional strategies.

Summary of Teachers' Perceptions of the Impact of Schedule Type on Instructional Effectiveness and Student Achievement in Mathematics

Respondents were asked to respond to how they feel schedule type impacts instructional effectiveness and student achievement in mathematics.

Retention. Respondents felt that retention was better with daily classes and, therefore, was greater with the traditional schedule. They indicated that students lose knowledge with extended breaks from instruction and, therefore, retention was impacted with a block scheduling format. One respondent noted that students struggle with retention and homework completion in an alternating block format because they often times put off homework knowing it is not due the next day.

Consistency of instruction. Respondents felt that the lack of consistency of instruction in a block schedule not only impacts retention but also the ability of a student to get assistance. In a traditional schedule, the teacher saw the students every day and could answer questions and provide assistance much quicker. The respondents felt that daily practice is necessary in mathematics. One respondent indicated that “daily exposure to the subject is vital to success.”

Although many saw benefits to a longer class period with a block schedule, they felt the consistency of instruction was more important. According to one respondent, “continuity in math trumps length of time in classes.”

Period length. Although the respondents generally agreed that the traditional schedule was more effective for retention and consistency of instruction, there were mixed responses on period length. Some respondents believed that the period length for the traditional schedule was better because the block periods were too long and students lost focus. One respondent noted that “students see the extra time as a punishment.” However, other respondents felt the extended time in a block schedule was an advantage. They felt the longer periods allowed for more options in the delivery of instruction as well as providing an opportunity for grouping, discovery, independent practice time, and homework completion.

Achievement level of student. Like period length, respondents had mixed feelings on which schedule was best for lower-achieving math students. Some respondents felt that students struggling in math needed the daily reinforcement and consistency of instruction provided by the traditional schedule. Others felt that the longer periods were conducive to more one-on-one instruction and provided more opportunities for re-teaching and assessment.

Teacher effectiveness/experience. Although many of the respondents felt that schedule type does impact instructional effectiveness and student achievement in mathematics, others felt schedule type did not make a difference. They felt that teacher experience and effectiveness was what impacted the achievement of students. One respondent noted that “good teachers are good teachers on any schedule.”

Teachers' Beliefs in the Effectiveness of Schedule Types on Various Student Outcomes

Mathematics

The second section of the Scheduling for Math Instruction survey dealt with the teachers' perceptions of the effectiveness of each schedule type for various student outcomes in mathematics. With the use of a five-point Likert scale, the participants ranked each schedule type for each student outcome with 1 being *not effective*, 2 being *somewhat effective*, 3 being *neutral*, 4 being *effective*, and 5 being *very effective*. Table 6 presents the means, standard deviations, and frequencies of responses for the 11 different student outcomes in mathematics.

Table 6

Mean Effectiveness Rating and Frequency of Responses by Schedule Type

Item	<i>M</i>	<i>SD</i>	<i>f</i> (1)	<i>f</i> (2)	<i>f</i> (3)	<i>f</i> (4)	<i>f</i> (5)
Covering Material							
Traditional	4.14	.72	0	4	6	54	27
AB Block	2.95	1.17	8	15	19	16	6
4 x 4	3.02	.99	4	13	24	16	3
Trimester	2.88	.82	5	4	31	8	0
Focus and Attention							
Traditional	4.23	.69	0	4	1	55	30
AB Block	2.84	1.17	10	13	19	15	4
4 x 4	2.73	1.00	8	14	24	12	1
Trimester	2.91	.91	5	5	26	9	1
Preparation for Future Math Classes							
Traditional	4.13	.81	2	3	3	56	27
AB Block	3.24	1.07	3	12	21	18	8
4 x 4	2.91	1.00	6	11	25	14	2
Trimester	2.98	.92	4	6	26	9	2
Assessing Understanding							
Traditional	3.88	.88	0	11	8	53	19
AB Block	3.30	1.07	4	11	16	26	6
4 x 4	3.19	1.03	4	11	17	24	3
Trimester	3.04	.93	4	6	22	14	1

Table 6 (continued)

Item	<i>M</i>	<i>SD</i>	<i>f</i> (1)	<i>f</i> (2)	<i>f</i> (3)	<i>f</i> (4)	<i>f</i> (5)
Improving Math Grades							
Traditional	3.81	.80	0	7	18	51	15
AB Block	3.00	1.03	6	12	24	18	3
4 x 4	3.10	.99	6	6	25	20	2
Trimester	2.98	.92	5	4	26	11	1
Performance on Standardized Tests							
Traditional	3.84	.85	1	7	13	52	16
AB Block	3.06	1.01	7	7	26	21	2
4 x 4	2.80	.94	8	9	29	13	0
Trimester	2.96	1.00	7	2	25	12	1
Retention Between Classes							
Traditional	3.83	.82	1	8	8	59	12
AB Block	2.95	1.05	6	15	19	20	2
4 x 4	2.69	1.08	10	14	19	14	1
Trimester	2.91	.98	7	2	26	9	1
Retention Between Years							
Traditional	3.54	.97	2	13	12	57	6
AB Block	2.97	.99	5	14	23	18	2
4 x 4	2.52	1.00	12	13	24	9	0
Trimester	2.85	.94	7	2	29	7	1
Promoting Student Engagement							
Traditional	3.76	.93	0	14	10	50	16
AB Block	3.47	1.08	3	9	16	24	10
4 x 4	3.36	.97	2	7	21	21	6
Trimester	3.20	.81	1	5	27	10	3
Assisting Struggling Students							
Traditional	3.27	.97	0	26	21	36	7
AB Block	3.39	1.11	4	9	17	23	9
4 x 4	3.34	1.07	3	8	22	16	9
Trimester	3.15	.84	2	5	25	12	2
Varied Instructional Strategies							
Traditional	3.27	1.00	3	21	21	40	6
AB Block	3.92	.85	1	1	16	29	16
4 x 4	3.78	1.04	3	2	15	24	15
Trimester	3.38	.71	1	0	30	13	3

For each schedule type and student outcome, the majority of the respondents rated the schedule effectiveness 3 or higher. Table 6 shows that the traditional schedule received the

highest rating overall for covering the appropriate amount of material, keeping students focused and attentive the entire class period, preparing students for future math classes, assessing students' understanding, improving students' math grades, students' performance on standardized tests, retention of concepts from one class to the next, retention of concepts from one school year to the next, and promoting student engagement. The AB block schedule was rated the highest for assisting students struggling with the content and allowing for varied instructional strategies. Although each schedule received mostly 3s or higher for their effectiveness, the traditional schedule received a much greater number of 4 and 5 ratings. The average number of respondents rating the traditional schedule a 4 or 5 was 67.64 for all student outcomes compared to 26.91 for AB block, 20.45 for 4 x 4 block, and 11.82 for trimester.

Inferential Analysis

Effect of Schedule Type on Student Achievement

The second research question explored whether there was a significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types. Null Hypothesis 1 was, "There is no significant difference in the percentage of students meeting or exceeding standards on the PSAE math test between high school schedule types." The respondents indicated the current schedule type used for mathematics and the percent of students meeting or exceeding standards on the 2011 PSAE mathematics exam was obtained using the IIRC.

This hypothesis was tested using a one-way ANOVA. Schedule type served as the independent variable and percent meeting on the 2011 PSAE served as the dependent variable. The assumptions within the one-way ANOVA were examined to ensure validity of results. The assumption of normality was tested by examining the skewness and kurtosis of the percentage of

students meeting or exceeding standards on the PSAE as well as by conducting a Shapiro-Wilk test. The skewness value for the dependent variable was $-.01$ and the kurtosis value was $-.71$. When conducting the Shapiro-Wilk test a result of $W(7) = .95, p > .05$ was obtained for traditional six-period; $W(26) = .94, p > .05$ was obtained for traditional seven-period; $W(26) = .98, p > .05$ was obtained for traditional eight-period; and $W(12) = .95, p > .05$ was obtained for block schedules. Since the skewness and kurtosis values for schedule type were between -1 and 1 and each level of the independent variable has significance values greater than $.05$, it was concluded that the assumption of normality of the dependent variable was met.

The assumption of homogeneity of variance was also tested. Using Levene's test for homogeneity of variance, it was found that $F(3, 67) = 2.33, p > .05$. Since the significance value was greater than $.05$, it was, therefore, not significant and the assumption of homogeneity of variance was met.

For Hypothesis 1, a one-way ANOVA was used to determine whether significant differences existed in the percentage of students meeting or exceeding standards on the 2011 PSAE mathematics test between schedule types. The one-way ANOVA did not determine significant differences between the four schedule types of traditional six-period, traditional seven-period, traditional eight-period, and block with $F(3, 67) = .32, p > .05$. Table 7 displays the sum of squares, degrees of freedom, mean square, F-ratio value, and significance value for the analysis. The mean and standard deviation for each schedule type is shown in Table 8.

Table 7

Significance for Schedule Type in Regards to Percent Meeting on 2011 PSAE Mathematics Test

	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Between Groups	152.83	3	50.94	.32	.81
Within Groups	10630.35	67	158.66		

Table 8

Mean and Standard Deviation for Schedule Type in Regards to Percent Meeting on 2011 PSAE Mathematics Test

Schedule Type	<i>N</i>	Mean	<i>SD</i>
Traditional 6	7	58.39	18.58
Traditional 7	26	57.81	12.76
Schedule Type	<i>N</i>	Mean	<i>SD</i>
Traditional 8	26	57.35	12.32
Block	12	61.50	7.96
Total	71	58.31	12.41

Effect of Schedule Type on Effectiveness Ratings for Student Outcomes in Mathematics

The fourth research question explored whether there were significant differences in the effectiveness ratings given by math department chairs or lead math teachers between schedule types on various student outcomes in mathematics.

Covering the appropriate amount of material. The second null hypothesis was, “There were no significant differences in the perceived effectiveness between schedule types on the ability to cover the appropriate amount of material.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness in covering the appropriate amount of material.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 8.70, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on the ability to cover appropriate material, $F(3, 141) = 24.23, p < .05$. Using Bonferonni post hoc tests it was then determined that significant differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of covering the appropriate amount of material. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types in covering the appropriate amount of material.

Maintaining students’ focus and attention. The third null hypothesis was, “There were no significant differences in the perceived effectiveness between schedule types on keeping students focused and attentive the entire class period.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness in keeping students focused and attentive the entire class period.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = .76, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on keeping the focus and attention of the students, $F(3, 135) = 33.34, p < .05$. Using

Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of focus and attention the entire class period. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types in maintaining the students' focus and attention the entire class period.

Preparation for future math classes. The fourth null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on preparing students for future math classes." Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness in preparing students for future math classes.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly's test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 6.61, p > .05$. Significant differences were found in the effectiveness ratings between schedule types in preparing students for future math classes, $F(3, 132) = 24.84, p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, the traditional and trimester schedules, and the 4 x 4 block and AB block schedules in the perceived effectiveness of preparing students for future math classes. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types while the AB schedule was more effective than the 4 x 4 block schedule in preparing students for future math classes.

Assessing students' understanding and mastery. The fifth null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on

assessing students' understanding and mastery of a math lesson/concept." Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness in assessing students' understanding and mastery of a math lesson/concept.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly's test was used to test the assumption of sphericity. The assumption of sphericity was not met, $X^2(5) = 11.85, p < .05$. To account for not meeting the assumption of sphericity, when running the ANOVA, the Greenhouse-Geisser correction was used. Significant differences were found in the effectiveness ratings between schedule types on assessing students' understanding and mastery of a math lesson/concept, $F(2.52, 115.76) = 8.60, p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of assessing students' mastery and understanding of a math lesson/concept. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types in assessing students' understanding and mastery of a math lesson/concept.

Improving students' math grades. The sixth null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on improving students' grades in math classes." Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness in improving students' grades in math classes.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly's test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 5.24, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on improving students' grades in math classes, $F(3, 138) = 11.66, p < .05$. Using

Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of improving students' grades in math classes. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types in improving students' grades in math classes.

Performance on standardized tests. The seventh null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on students' performance on standardized tests." Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness improving students' performance on standardized tests.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly's test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 8.47, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on improving students' performance on standardized tests, $F(3, 138) = 18.01, p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of improving students' performance on standardized tests. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types in improving students' performance on standardized tests.

Retention from one class to the next. The eighth null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on students'

retention of concepts from one class to the next.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness on students’ retention of concepts from one class to the next.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 8.36, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on students’ retention of concepts from one class to the next, $F(3, 135) = 14.32, p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules in the perceived effectiveness of students’ retention of concepts from one class to the next. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types on students’ retention of concepts from one class to the next.

Retention from one school year to the next. The ninth null hypothesis was, “There were no significant differences in the perceived effectiveness between schedule types on students’ retention of concepts from one school year to the next.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness on students’ retention of concepts from one school year to the next.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 7.34, p > .05$. Significant differences were found in the effectiveness ratings between schedule types on students’ retention of concepts from one school year to the next, $F(3, 135) = 10.28, p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, the

traditional and trimester schedules, and the 4 x 4 block and AB block schedules in the perceived effectiveness of students' retention of concepts from one school year to the next. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than all of the other schedule types and the AB schedule was perceived to be more effective than the 4 x 4 block schedule on students' retention of concepts from one school year to the next.

Promoting student engagement. The tenth null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on promoting student engagement during instruction." Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness on promoting student engagement during instruction.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly's test was used to test the assumption of sphericity. The assumption of sphericity was met, $X^2(5) = 9.70$ $p > .05$. Significant differences were found in the effectiveness ratings between schedule types on promoting student engagement during instruction, $F(3, 135) = 7.89$, $p < .05$. Using Bonferroni post hoc tests it was then determined that significant differences exist between the traditional and 4 x 4 block schedules, the traditional and trimester schedules, and the AB block and trimester schedules in the perceived effectiveness of promoting student engagement during instruction. Based on the mean rating of effectiveness for each schedule type, the traditional schedule was perceived to be more effective than the 4 x 4 and trimester schedule and the AB schedule was perceived to be more effective than the trimester in promoting student engagement during instruction.

Assisting struggling students. The 11th null hypothesis was, "There were no significant differences in the perceived effectiveness between schedule types on assisting students

struggling with the material.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness on assisting students struggling with the material.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was not met, $X^2(5) = 16.32$ $p < .05$. To account for the assumption of sphericity not being met, the Greenhouse-Geisser correction was used when running the ANOVA. Significant differences were not found in the effectiveness ratings between schedule types on assisting students struggling with the material, $F(2.38, 107.08) = 1.04$, $p > .05$.

Allowing for varied instructional strategies. The twelfth null hypothesis was, “There were no significant differences in the perceived effectiveness between schedule types on allowing for varied instructional strategies.” Respondents rated each schedule type on a scale of 1 to 5 on its effectiveness on allowing for varied instructional strategies.

This hypothesis was tested using a repeated measure one-way ANOVA. Mauchly’s test was used to test the assumption of sphericity. The assumption of sphericity was not met, $X^2(5) = 20.69$ $p < .05$. To account for the assumption of sphericity not being met, the Greenhouse-Geisser correction was used when running the ANOVA. Significant differences were found in the effectiveness ratings between schedule types on allowing for varied instructional strategies, $F(2.27, 104.37) = 6.99$, $p < .05$. Using Bonferroni post hoc tests, it was determined that significant differences existed between the traditional and AB block schedules, the 4 x 4 block schedule and the AB block schedules, and the AB block and trimester schedules. Based on the mean rating of effectiveness for each schedule type, the AB schedule was perceived as more effective than all other schedule types on allowing for varied instructional strategies.

Summary of Findings

This section provides a summary of the findings and is divided into two sections. Section 1 summarizes the descriptive data and Section 2 summarizes the findings of the 12 null hypotheses.

Summary of Descriptive Data

During the fall of 2012 the lead math teachers or department chairs of 350 high schools in Illinois with a grade configuration including Grades 9–12 were electronically mailed a survey in regards to the impact of schedule type on instructional effectiveness and student achievement in mathematics. The analysis data set contains 91 records ($N = 91$), representing 26% of the teachers invited to participate and 11.5% of the ninth through 12th grade high schools in Illinois.

Of the respondents the traditional schedule was more prevalent with 10 teachers on a traditional six-period, 36 on a traditional seven-period, and 31 on a traditional eight-period. Twelve teachers were currently teaching on an AB alternating block schedule and one was on a 4 x 4 block schedule. No teachers were currently using a trimester schedule. The length of time teaching on a particular schedule type ranged from one year as the lowest response to 50 years as the highest. The average number of years on a current schedule was 14.16.

Summary of Hypothesis Testing

Twelve null hypotheses were tested with the following summarized results:

1. Through the use of a one-way ANOVA, the results indicated that there was not a significant difference between the four schedule types of traditional six-period, traditional seven-period, traditional eight-period, and block on the percentage of students meeting or exceeding standards on the 2011 PSAE mathematics test. Table 7 illustrates these results.

2. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on the ability to cover appropriate material. Specifically, differences existed between the traditional and 4 x 4 schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
3. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on keeping students focused and attentive the entire class period. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
4. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on preparing students for future math classes. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, the traditional and trimester schedules, and the 4 x 4 block and AB block schedules.
5. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on assessing students' understanding and mastery of a math lesson or concept. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
6. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types

- on improving students' grades in math classes. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
7. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on students' performance on standardized tests. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
 8. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on students' retention of concepts from one class to the next. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, and the traditional and trimester schedules.
 9. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on students' retention of concepts from one school year to the next. Specifically, differences existed between the traditional and 4 x 4 block schedules, the traditional and AB block schedules, the traditional and trimester schedules, and the 4 x 4 block and AB block schedules.
 10. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on promoting student engagement during instruction. Specifically, differences

- existed between the traditional and 4 x 4 block schedules, the traditional and trimester schedules, and the AB block and trimester schedules.
11. Through the use of a repeated measure one-way ANOVA, the results showed that there were not significant differences in the effectiveness ratings between schedule types on assisting students struggling with the material.
 12. Through the use of a repeated measure one-way ANOVA, the results showed that there were significant differences in the effectiveness ratings between schedule types on allowing for varied instructional strategies. Specifically, differences existed between the traditional and AB block schedules, the 4 x 4 block and AB block schedules, and the AB block and trimester schedules.

CHAPTER 5

DISCUSSION OF FINDINGS AND CONCLUSIONS, SUMMARY, IMPLICATIONS

This chapter is organized into four sections. The first section presents a discussion of the findings including a summary of the descriptive data and a summary of the hypotheses testing. The second section includes conclusions and a summary of the research. The third section discusses the implications of the high school schedule type on instructional effectiveness and student achievement in mathematics as a result of this research. The final section discusses the recommendations for future research.

The purpose of this quantitative study was to determine the impact of high school schedule type on instructional effectiveness and student achievement in mathematics. An analysis was prepared to determine the current schedule types currently used in math classes, whether significant differences exist between schedule types on the percent of students meeting or exceeding standards on the 2011 PSAE math test, how teachers rate the effectiveness of a schedule they currently use versus how others who use a different schedule rate the same schedule for various student outcomes in mathematics, and whether significant differences exist in the effectiveness ratings between schedule types on various student outcomes in mathematics.

In general, the research design involved a population of 797 high schools serving Grades 9-12. Lead math teachers' or math department chairs' perceptions of effectiveness of the schedule types on various student outcomes were collected using a survey. Statistical analysis of

the data included descriptive statistics regarding the mean, standard deviation, and frequency of selected items. A comparison of means, one-way ANOVA, and repeated measure one-way ANOVAs were used to test the null hypotheses. Significance was identified at the .05 level.

Discussion of Findings

The following is a summary of the descriptive data findings and the conclusions of the analysis. Although the difference in means of the various schedule types was not significant, the block schedule did have the highest overall mean of the four schedule types compared. Among the traditional schedules, the traditional six-period had the highest mean followed by the traditional seven-period schedule and then the traditional eight-period schedule. Although not statistically significant, the difference between schedule types was practically significant since there was a 4% difference between the mean of the block schedule versus the mean of the traditional eight-period schedule. However, of the respondents only 12 were currently teaching on block schedule which could have affected the overall mean percent of students meeting or exceeding standards on the 2011 PSAE mathematics test.

Ability to Cover Material

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on the ability to cover the appropriate amount of material. Based on the mean ratings of effectiveness, the traditional schedule was perceived to more effective than all other schedules. This is possibly due to the lack of daily instruction and loss of instructional time that occur when on a block schedule.

Keeping Students Focused and Attentive

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on the ability to keep students focused and attentive the entire class

period. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedules. This is possibly due to the longer class periods on a block schedule making it more difficult to maintain the attention of the students.

Preparing Students for Future Math Classes

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on preparing students for future math classes. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedule types. This is possibly due to the daily instruction and longer instructional time associated with a traditional schedule. As a result, it is often possible to cover more material and therefore ensure students are better prepared for future math classes.

Assessing Students' Understanding and Mastery of a Math Lesson or Concept

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on assessing students' understanding and mastery of a math lesson or concept. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedule types. Again, this is possibly due to the daily instruction and the ability to assess the students daily. However, as the comparison of means for Research Question 3 showed, teachers on the block schedule rated the AB block schedule most effective for assessing understanding. With exposure or training on how to effectively utilize a block schedule, it is possible that teachers currently teaching on a traditional schedule would perceive the longer class periods as advantageous to assessing the students' understanding and mastery of a lesson.

Improving Students' Grades in Math Classes

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on improving students' grades in math classes. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than any other schedule type. This result is possibly due to the larger number of respondents currently teaching on a traditional schedule. According to the research in the literature review, the block schedule has been shown to promote a higher number of students on the honor roll and fewer Ds and Fs (Evans et al., 2002). Again, with more exposure or training to a block schedule, teachers may find the block schedule to be more suited to improving students' grades in math classes than the traditional format.

Students' Performance on Standardized Tests

Although in Hypothesis 2 it was determined from the data that there were not significant differences between the traditional and block schedules on students' performance on standardized tests, the respondents perceived a difference between the schedule types. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedule types. This perception is possibly related more to the respondents' experience with the traditional schedule than to the format of the schedule.

Retention of Concepts From One Class to the Next

According to the analysis, significant differences existed in the perceived effectiveness on students' retention of concepts from one class to the next. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedule types. This perception is possibly due to the lack of daily instruction on the block schedule, which can lead to students forgetting concepts from one class period to the next.

Retention of Concepts From One School Year to the Next

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on students' retention of concepts from one school year to the next. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than all other schedule types. The 4 x 4 block schedule, which has the potential of a one- to two-semester layoff between math classes, was rated the lowest of all schedules on retention of concepts from one school year to the next.

Promoting Student Engagement

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on promoting student engagement. Based on the mean ratings of effectiveness, the traditional schedule was perceived to be more effective than the 4 x 4 block and the trimester schedules while the AB schedule was perceived to be more effective than the trimester schedule. Although significant differences were not found between the traditional and AB schedule, with more exposure to the longer periods on a block schedule, teachers currently teaching on a traditional schedule could possibly learn to develop more engaging lessons on a block schedule.

Assisting Struggling Students

Based on the analysis, significant differences did not exist in the perceived effectiveness between schedule types on assisting students struggling with the material. This is possibly due to both schedule types having characteristics that are advantageous for this outcome. Teachers should ensure that their methods of assisting struggling students are aligned to the schedule type.

Allowing for Varied Instructional Strategies

According to the analysis, significant differences did exist in the perceived effectiveness between schedule types on allowing for varied instructional strategies. Based on the mean ratings of effectiveness, the AB block schedule was perceived to be more effective than all other schedule types. This is possibly due to the longer class periods on a block schedule and is consistent with the research presented in the literature review.

Connection of the Findings with Literature

This study was created to examine the impact of high school schedule type on instructional effectiveness and student achievement in mathematics. As reported in the review of literature, the traditional schedule was called into question beginning in the 1980s, and schools began looking at a restructuring of the high school schedule to provide a change in the expectations, content, and learning experiences of the students. Cawelti (1994) found in a national survey that 40% of the schools in the United States were using some form of block scheduling. Due to a lack of support by math teachers for the block and an increasing focus on student achievement scores in mathematics, a shift back to the traditional schedule has occurred in recent years. The results of this study support this shift with 10 respondents teaching on a traditional six-period schedule (11.11%), 36 on a traditional seven-period schedule (40%), 31 traditional eight-period (34.44%), 12 on an AB schedule (13.33%), and one on a 4 x 4 block (1.11%).

Although many schools and math teachers believe that the block schedule is to blame for low math scores on standardized tests and that the traditional schedule would produce better results, previous studies showed mixed results on the effect of schedule type on students' standardized test scores. Studies by Lewis et al. (2005) and Evans et al. (2002) found increases

in ACT and SAT scores for schools on a block while Plista et al. (2001) and Arnold (2002) found no significant differences in scores based on schedule type and Harmston et al. (2003) and Brake (2000) found decreases in ACT and SAT scores for schools on a block schedule. The results of this study support the studies that showed no significant difference in students' performance on standardized tests based on schedule type. Although the mean percent of students meeting or exceeding standards on the 2011 PSAE math test was slightly higher for students on a block schedule than the mean percent of students on the traditional schedules, the difference was not large enough to be statistically significant.

As indicated in Chapter 2, Kramer (1997a) found a lack of support for the block schedule among math teachers based on a fear that the curriculum would not fit into longer time blocks and a concern about covering two lessons' worth of material during a double block of time. The results of this study supported this finding. Both teachers currently teaching on a traditional schedule and those currently teaching on a block schedule rated the traditional schedule as more effective in covering the appropriate amount of material, keeping students focused and attentive the entire class period, improving students' grades mathematics, improving students' performance on standardized tests, retention of concepts from one class to the next, and retention of concepts from one school year to the next. The AB block was rated as most effective both by those on a traditional schedule and those on a block schedule for promoting student engagement and allowing for varied instructional strategies. When looking at the ratings given by all respondents regardless of current schedule type used, the traditional schedule was rated as significantly more effective for eight out of the 11 outcomes while the block schedule was only rated as significantly more effective in allowing for varied instructional strategies.

Implications for School Districts

The review of literature for this study contained a powerful quote by Watts and Castle (1993). This quote summarized the importance some people place on the effect of schedule on instruction when arguing the following:

The schedule is God. You can implement any innovation you want in your classroom as long as you don't mess with the schedule. Traditional, inflexible scheduling is based on administrative and institutional needs. New, more flexible scheduling patterns are based on pedagogical practices, the educational needs of students, and the professional needs of teachers. (Watts & Castle, 1993, pp. 306-307)

Although proponents of alternative scheduling formats would support this view, opponents of the block schedule would disagree and argue that the traditional schedule is a more effective schedule for improving instruction. The opinions associated with a particular schedule type can vary based on the subject matter, experience, or instructional goal. This study focused on the impact of schedule type on the instructional effectiveness and student achievement in mathematics for ninth through 12th-grade high schools in Illinois.

Effect of Schedule Type on Standardized Test Scores

Although some schools have looked to the schedule type as the solution to improve students' scores on standardized test scores, this study shows that a change of schedule type alone will more than likely not have a significant effect on performance on standardized tests. This is possibly due to the same instructional strategies being used in math classes regardless of schedule type or class length. Some teachers rely solely on lecture whether they have a 45-minute class period or an 80- to 90-minute class period. According to Gerking (1995), when lecturing is the sole methodology, especially for an 80- or 90-minute class, learning suffers. This

problem is possibly more prevalent in mathematics since math teachers tend to have more difficulty adapting instructional strategies (Reid, 1995).

The instruction and the students' performance on standardized tests can possibly be improved by ensuring that the instructional strategies used align to the schedule type. Regardless of the schedule type, instruction should not rely solely on lecture. Engagement of students, cooperative learning, and technology should be a part of every math lesson regardless of period length.

Effect of Professional Development and Experience with Block Schedule on Effectiveness Rating

The design of a block schedule leads to a lack of daily instruction in mathematics and typically a loss of instructional minutes over time. Based on the results of this study, math teachers felt that a traditional schedule was more effective for math instruction in terms of covering the appropriate amount of material, keeping students attentive and focused the entire class period, preparing students for future math classes, assessing students' understanding and mastery of a math lesson or concept, improving students' grades in math classes, performance on standardized tests, retention of concepts from one class to the next, and retention of concepts from one school year to the next. The only outcome that respondents rated the AB block schedule as more effective than all other schedule types was in allowing for varied instructional strategies. Although respondents who currently teach on a block schedule had a more favorable opinion of the block schedule format, they still rated the traditional schedule higher overall for most of the student outcomes.

One possible reason for the lower ratings given to the block schedule is the loss of instructional time and lack of daily instruction. However, respondents possibly rated the block

schedule lower because it is different from the way they have always taught mathematics and different from the way they were taught. Additionally, some teachers may not have a desire to consider benefits of alternative schedules because they are comfortable with the current traditional schedule. As evidenced in Hypothesis 2, exposure to a block schedule does improve teachers' perceptions of its effectiveness. The effectiveness rating given to the block schedule was higher for teachers on a block schedule than for those on a traditional schedule. Because teachers on a block schedule still felt the traditional schedule was more effective overall, additional professional development and training on how to effectively utilize longer class periods could lead to even more favorable ratings of the effectiveness of a block schedule. The block schedule forces math teachers to teach differently than they have in the past and therefore professional development is vital to its success.

Considerations When Choosing Schedule Type

Although math teachers overwhelmingly support the traditional format for math instruction, scheduling decisions are not made in a vacuum and schools must consider many other factors besides just math. Schools that are exploring the best format should expect disagreement between subject areas on the best schedule type for effective instruction. Although the traditional schedule is supported by subject areas that benefit from daily instruction such as math, music, and foreign language, other subject areas such as science, English, industrial arts, agriculture, and social studies tend to favor the longer time blocks for completing activities and projects during the class period. According to the literature review, Griffin and Nicholson (2002) found that 80% of teachers in the Broward County School District in Southeast Florida would rather stay on a block schedule than switch back to a traditional style schedule. With the time crunch to accomplish the mandates of No Child Left Behind, Common Core standards, and

Response to Intervention, schools will again need to look at how the day is structured and ensure that the instructional time is used efficiently and effectively.

To determine the schedule type that is most effective for a school, all stakeholders should be involved in the development of a plan. The overall instructional goals for the school should be determined and the advantages of each schedule choice should be considered. Schools should look at the research available on the various schedule types and ensure there is two-way communication throughout the process. In general, the schedule should not be dictated by math instruction but instead math instruction should be dictated by the schedule type.

Suggested Schedule Type for Mathematics

Although this study showed that math teachers have a more favorable opinion of the traditional schedule, the responses provided in the survey point to some advantages of the block in terms of math instruction. Although many teachers expressed concerns about the lack of consistency and daily instruction as well as the belief that 80 to 90 minutes is too long, many of the teachers felt that the block schedule allowed for more in-depth coverage of the material, made it easier to incorporate student grouping and discovery, and allowed more time for differentiation and remediation. One teacher summed up the ideal schedule for mathematics by stating that “one must have enough time to cover a topic but not so much time that too many topics are covered in one class period.” In a typical eight-period traditional schedule class periods range from 40 to 48 minutes, a seven-period schedule has class periods of 45 to 52 minutes, and a six-period traditional schedule has periods of 50 to 60 minutes.

One possible compromise would be a six-period traditional schedule. With class periods of approximately 60 minutes in length, this format could serve as a means to accomplish the benefits of both a traditional and block scheduling format. Although this format limits the class

options for students, it allows for up to 20 more minutes of instruction than an eight-period schedule. As a result, you are able to have the consistency of daily instruction while still keeping class periods long enough to accomplish the completion of activities, labs, differentiation and remediation, and student grouping. Additionally, many teachers felt the attention span of a typical high school student could not sustain 80 to 90 minutes of instruction at one time and therefore it was impossible to maintain quality instruction the entire class period. This problem is significantly minimized with a switch to 60-minute classes.

Assisting Struggling Students

According to the analysis in Hypothesis 12, there were not significant differences between schedule types in assisting students struggling with the material. This is possibly due to both schedules having components that are advantageous to providing assistance. In a traditional schedule, students who are struggling possibly benefit from the daily instruction and reinforcement. However, teachers could find it difficult to assess which students are struggling or to find time to provide assistance with 40- to 45-minute class period. The longer class periods in a block schedule are more conducive to one-on-one instruction as well as re-teaching and assessment. The block schedule is more conducive to providing one-on-one assistance by staff other than the classroom teacher whereas a traditional schedule would need to utilize more push-in services. Teachers need to ensure that they are effectively assisting struggling students regardless of schedule type or class length.

In conclusion, much discussion has been conducted in the past on the best schedule type for education and specifically for math. With the increased focus on student growth and achievement and the new mandates associated with the Common Core standards and Response to Intervention, more discussion seems certain for the future. People have touted various

schedule types as the driving force for improving student achievement, but I believe that schedule type alone will not bring about a significant difference in test scores. Although the type of schedule used is not a magic bullet for improving student achievement, it is an important factor for schools to consider when ensuring they maximize instructional effectiveness and efficiency of instruction. With the increase in requirements and a renewed focus on differentiated instruction, schools must be creative in how they structure their instructional schedule and day. The implementation of Common Core standards in the future will require all teachers in all subjects to ensure rigorous application of the standards and mastery of the content by their students. As a result, math instructors must ensure that they are meeting the essential student outcomes in mathematics regardless of schedule type.

Research Recommendations

Based upon the perceived levels of effectiveness of schedule types on various student outcomes in Illinois by math department chairs or lead math teachers, the following recommendations for future research can be made:

1. A comparative study should be conducted to examine the perceived effectiveness of the block schedule for mathematics at the middle school level.
2. A comparative study should be conducted to examine the perceived effects of schedule types for other subject areas such as English, science, social studies, music, band, and foreign language.
3. A comparative study should be conducted between the results of this study and studies done in other states.
4. A qualitative research design should be conducted to examine strategies for successful implementation of a traditional and a block schedule in mathematics.

5. A study should be conducted that examines the correlation between training or professional development provided to teachers prior to the implementation of a schedule type versus the perceived effectiveness of the schedule.
6. A comparative study should be conducted that examines the perceptions of all math teachers in school districts instead of just math department chairs or lead math teachers in order to gauge whether the courses taught impact the effectiveness ratings given to the various schedule types.
7. A comparative study possibly utilizing a multi-state sample should be conducted in order to expand the sample size and better determine whether significant differences exist on students' performance on standardized tests in mathematics.
8. A comparative study should be conducted with teachers that have taught on both a traditional and block schedule to gauge the effect of exposure to schedule type on the effectiveness rating.

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APPENDIX A: SCHEDULING FOR MATH INSTRUCTION SURVEY

Name of School: _____

Gender: _____ Male _____ Female

Age: _____

Years of Teaching Experience: _____

School Enrollment:

____ Less than 500 ____ 501-1,000 ____ 1,001-1,500 ____ 1,501-2,000 ____ Over 2,000

School Locale: ____ Urban ____ Suburban ____ Small Town

Please use the following definitions when responding to the questions below:

Traditional 6-period Schedule: Students take 6 classes that meet every day for the entire school year. Classes are typically 50 to 60 minutes in length.

Traditional 7-period Schedule: Students take 7 classes that meet every day for the entire school year. Classes are typically 45 to 52 minutes in length.

Traditional 8-period Schedule: Students take 8 classes that meet every day for the entire school year. Classes are typically 40 to 48 minutes in length.

4 x 4 Block Schedule: Students take 4 classes one semester and then 4 different classes the second semester. Classes meet every day for a semester and are typically 90 minutes in length.

Alternating A/B Schedule: Students take 4 classes one day and then 4 classes the next day. This alternating pattern is repeated throughout the entire school year. Classes are typically 80 to 120 minutes in length.

Trimester Schedule: Offers students the opportunity to focus on two related core classes for an intensive period of instruction. In this model, students enroll in two classes every 60 days with one class meeting in the morning and the other in the afternoon.

1) What schedule do you currently use in your math classes?

Traditional 6- period Traditional 7-period Traditional 8-period
 4 x 4 Block A/B Alternating Trimester
 Other (please specify) _____

2) How many years have you been on this current schedule?

2 or less 3-5 6-10 More than 10

3) Please mark all schedule types you have used in the past.

Traditional 6-Period Traditional 7-period Traditional 8-period
 4 x 4 Block A/B Alternating Trimester
 Other (Please specify) _____

4) Please use the following rating scale to rate the effectiveness for mathematics of each schedule type on the following areas:

1 = Not Effective 2 = Somewhat Effective 3 = Neutral 4 = Effective 5 = Very Effective

Student Outcomes	Traditional Schedule	4 x 4 Block Schedule	A/B Alternating Schedule	Trimester Schedule
Covering the appropriate amount of material				
Keeping students focused and attentive the entire class period				
Preparing students for future math classes				
Assessing students' understanding and mastery of a math lesson/concept				

Student Outcomes	Traditional Schedule	4 x 4 Block Schedule	A/B Alternating Schedule	Trimester Schedule
Improving students' grades in math classes				
Students' performance on standardized tests				
Retention of concepts from one math class to the next				
Retention of concepts from one school year to the next				
Promoting student engagement during instruction				
Assisting students struggling with the material				
Allowing for varied instructional strategies				

5) What impact do you think schedule type has on instructional effectiveness and student achievement in mathematics?

6) Other Comments:

APPENDIX B: SCHEDULING FOR MATH INSTRUCTION SURVEY WITH CITATIONS

Name of School: _____

Gender: _____ Male _____ Female

Age: _____

Years of Teaching Experience: _____

School Enrollment:

____ Less than 500 ____ 501-1000 ____ 1001-1500 ____ 1501-2000 ____ Over 2000

School Locale: ____ Urban ____ Suburban ____ Small Town

Please use the following definitions when responding to the questions below:

Traditional 6-period Schedule: Students take 6 classes that meet every day for the entire school year. Classes are typically 50 to 60 minutes in length (Canady & Rettig, 1997).

Traditional 7-period Schedule: Students take 7 classes that meet every day for the entire school year. Classes are typically 45 to 52 minutes in length (Canady & Rettig, 1997).

Traditional 8-period Schedule: Students take 8 classes that meet every day for the entire school year. Classes are typically 40 to 48 minutes in length (Canady & Rettig, 1997).

4 x 4 Block Schedule: Students take 4 classes one semester and then 4 different classes the second semester. Classes meet every day for a semester and are typically 90 minutes in length (Canady & Rettig, 1995).

Alternating A/B Schedule: Students take 4 classes one day and then 4 classes the next day. This alternating pattern is repeated throughout the entire school year. Classes are typically 80 to 120 minutes in length (Canady & Rettig, 1997).

Trimester Schedule: Offers students the opportunity to focus on two related core classes for an intensive period of instruction. In this model, students enroll in two classes every 60 days with one class meeting in the morning and the other in the afternoon (Canady & Rettig, 1995).

1) What schedule do you currently use in your math classes?

Traditional 6- period Traditional 7-period Traditional 8-period
 4 x 4 Block A/B Alternating Trimester
 Other (please specify) _____

2) How many years have you been on this current schedule?

2 or less 3-5 6-10 More than 10

3) Please mark all schedule types you have used in the past.

Traditional 6-Period Traditional 7-period Traditional 8-period
 4 x 4 Block A/B Alternating Trimester
 Other (Please specify) _____

4) Please use the following rating scale to rate the effectiveness for mathematics of each schedule type on the following areas:

1 = Not Effective 2 = Somewhat Effective 3 = Neutral 4 = Effective 5 = Very Effective

Student Outcomes	Traditional Schedule	4 x 4 Block Schedule	A/B Alternating Schedule	Trimester Schedule
Covering the appropriate amount of material (Kramer, 1997a)				
Keeping students focused and attentive the entire class period (Canady & Rettig, 1997)				
Preparing students for future math classes (Kramer, 1997a)				

Student Outcomes	Traditional Schedule	4 x 4 Block Schedule	A/B Alternating Schedule	Trimester Schedule
Assessing students' understanding and mastery of a math lesson/concept (Wronkovich, Hess, & Robinson, 1997)				
Improving students' grades in math classes (Kramer, 1997a)				
Students' performance on standardized tests (Kramer, 1997a; Wronkovich, Hess, & Robinson, 1997)				
Retention of concepts from one math class to the next (Canady & Rettig, 1997)				
Retention of concepts from one school year to the next (Kramer, 1997a; Kramer, 1997b)				
Promoting student engagement during instruction (Canady & Rettig, 1997)				
Assisting students struggling with the material (Kramer, 1997a; Kramer,				

1997b)				
Allowing for varied instructional strategies (Canady & Rettig, 1997)				

5) What impact do you think schedule type has on instructional effectiveness and student achievement in mathematics?

6) Other Comments:

APPENDIX C: EMAIL TO HIGH SCHOOL PRINCIPALS

Dear Principal,

I am a doctoral student at Indiana State University and I am conducting a study of the impact of high school schedule type on instructional effectiveness and student achievement in mathematics. The objective of this research project is to attempt to understand whether differences exist in student achievement between schedule types and whether there are differences in the perceptions of the effectiveness between schedule types for various student outcomes in mathematics.

The data for this study will be collected through the use of an on-line survey to be completed by lead math teachers or math department chairs. To assist with the collection of data, I am in need of the email address of your math department chair or lead math teacher. The survey will ask for basic demographic information about the math teacher as well as the school. Additionally, the survey will ask about the teacher's current and past experience with various schedule types. Finally, the teacher will be asked to rate the effectiveness of each schedule type on a scale of 1 to 5 for various student outcomes in mathematics.

If your lead math teacher or math department chair chooses to participate, it will take only a few minutes to complete the survey and responses to the survey will be confidential. Since the Internet is being used to collect and transfer data, complete confidentiality cannot be guaranteed however we expect any risks, discomforts, or inconveniences to be minor and we believe they are unlikely to occur.

The teacher's participation is voluntary and there is no penalty if he or she does not participate. The teacher will be free to withdraw from the study at any time by simply closing out of the survey without submitting his or her answers.

Please reply back with the email address of your lead math teacher or math department chair at your earliest convenience. If you have any questions or concerns about this study, you may contact me at (217) 620-8459 or at jhackney@okawvalley.org.

Sincerely,

Joel Hackney

Joel Hackney
Principal Investigator

APPENDIX D: EMAIL TO MATH TEACHERS

Dear Respondent,

I am a doctoral student at Indiana State University and I am conducting a study of the impact of high school schedule type on instructional effectiveness and student achievement in mathematics. The objective of this research project is to attempt to understand whether differences exist in student achievement between schedule types and whether there are differences in the perceptions of the effectiveness between schedule types for various student outcomes in mathematics.

At the end of this email is a link to a survey asking for basic demographic information about you as well as the school you represent. Additionally, the survey will ask about your current and past experience with various schedule types. Finally, you will be asked to rate the effectiveness of each schedule type on a scale of 1 to 5 for various student outcomes in mathematics. I am asking you to click the link at the end of this email to access, complete, and submit the survey.

If you choose to participate, your responses to the survey will be confidential. Since the Internet is being used to collect and transfer data, complete confidentiality cannot be guaranteed however we expect any risks, discomforts, or inconveniences to be minor and we believe they are unlikely to occur.

I hope you will take a few minutes to complete this survey. Your participation is voluntary and there is no penalty if you do not participate. You are free to withdraw from the study at any time by simply closing out of the survey without submitting your answers.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me at (217) 620-8459 or at jhackney@okawvalley.org. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by email at irb@indstate.edu.

Sincerely,

Joel Hackney

Joel Hackney
Principal Investigator

APPENDIX E: CONSENT TO PARTICIPATE IN RESEARCH

The Impact of High School Schedule Type on Instructional Effectiveness and Student Achievement in Mathematics

You are invited to participate in a research study conducted by Joel Hackney, who is a doctoral student from the Educational Leadership Department at Indiana State University. Mr. Hackney is conducting this study for his doctoral dissertation. Dr. Todd Whitaker is his faculty sponsor for this project.

Your participation in this study is entirely voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether or not to participate. You are being asked to participate in this study because you are a math department chair or lead math teacher at a ninth through twelfth grade high school in Illinois.

PURPOSE OF THE STUDY

The purpose of this study is to examine the various schedule types used by ninth through twelfth grade high schools in Illinois. Data from the 2011 Prairie State Achievement Exam (PSAE) obtained on the Illinois Interactive Report Card (IIRC) website will be used to determine if significant differences exist in the percentage of students meeting or exceeding on the PSAE math test between high school schedule types. Additionally, survey data will be used to determine if significant differences exist in the effectiveness rating given by lead math teachers or math department chairs to a schedule type between those who currently use that schedule type and those that use a different schedule type. Finally, survey data will be used to determine if significant differences exist in the perceived effectiveness by lead math teachers and math department chairs between schedule types on various student outcomes in mathematics.

PROCEDURES

If you volunteer to participate in this study, you will be asked to complete the survey on the following pages. The survey consists of questions asking for demographic information about you and the school you represent. Additionally, you will be asked about your past and current experience with different schedule types. Finally, the survey will ask you to rate each type of schedule on an effectiveness scale from 1 to 5 for various student outcomes in mathematics.

POTENTIAL RISKS AND DISCOMFORTS

A potential risk of this study is a breach of confidentiality since the internet is being used to collect or transfer data. Additionally, you may feel uncomfortable answering some of the questions. We expect that any risks, discomforts, or inconveniences will be minor and we believe that they are not likely to happen. You may choose not to answer any question that makes you

uncomfortable and you may discontinue your participation in the study at any time by simply closing out of the survey and not submitting your answers.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

It is not likely that you will benefit directly from participation in this study, but the research should help us gain a better understanding of whether differences exist in student achievement scores between schedule types as well as the perception of the effectiveness of schedule types for various student outcomes in mathematics.

PAYMENT FOR PARTICIPATION

You will not receive any payment or other compensation for participation in this study. There is also no cost to you for participation.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. We will not use your name in any of the information we get from this study or in any of the research reports. Mr. Hackney will, however, use the information collected in his dissertation. We also may use any information that we get from this study in any way we think is best for publication or education. Any information we use for publication will not identify you individually.

The survey data will be transferred to an excel file and then removed from the survey site. Data will be maintained on a password protected server for three years after the end of the study.

PARTICIPATION AND WITHDRAWAL

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind by simply closing out of the survey without submitting your answers. You may also refuse to answer any questions you do not want to answer.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact

Joel Hackney
Principal Investigator
email: jhackney@okawvalley.org
(217) 620-8459

Dr. Todd Whitaker
Faculty Supervisor
email: todd.whitaker@indstate.edu
(812) 237-2904

RIGHTS OF RESEARCH SUBJECTS

If you have any questions about your rights as a research subject, you may contact the Indiana

State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or email the IRB at irb@indstate.edu. You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with ISU. The IRB has reviewed and approved this study.

APPENDIX F: RESPONSES TO TEACHERS' PERCEPTION OF THE IMPACT OF SCHEDULE TYPE ON INSTRUCTIONAL EFFECTIVENESS AND STUDENT ACHIEVEMENT IN MATHEMATICS

- I really believe that a 4 x 4 block or trimester schedule would seriously hurt a student's chances for successfully retaining material from one class to the next.
- In returning to the 7-period day from a 4 x 4 block, I have found that we cannot teach the depth of material that we did on the 4x4. When students start to see the connections the bell rings. We do less discovery and more just teaching concepts.
- The biggest impact happens in individual cases comparing block to traditional. For example a below average student may take Algebra 1 at the beginning of freshman year and not take another class until the second half of his or her sophomore year. I do feel that block gives more freedom to differentiate instruction and include RTI. The other upside is it gives teachers more prep time, which is often overlooked.
- I really think that it depends on the teacher's style and what they are willing to do with the time they are given.
- I think it has a big impact.
- I don't think the type of schedule matters if all other factors are equal (such as the quality of the teacher). I do worry about extended periods of time in which a student may not have a math class. Numerous studies have shown various amounts of loss in student's knowledge of concepts when there is an extended period of time without a class. Skipping a year of math and summer breaks both apply here.

- I have taught in both settings; however, A/B block was only one year. However, I believe students can learn in either setting. I believe the question has more to do with the teacher and his/her effectiveness in the classroom.
- I think that the schedule type has minimal impact on the instructional effectiveness and student achievement in mathematics.
- I believe that different students require different types of instruction and attention to succeed. Certainly any of the schedules which allow for more classroom time will lend themselves to varied instructional strategies. I do not believe that schedule type is the number one factor in instructional effectiveness and student achievement in mathematics. Although you will probably have some significant differences, I think you need to beware confounding variables such as teacher experience and who the students are and where the school is located.
- I have very limited experience with block scheduling and no experience with trimesters. That said, I do not think that block scheduling allows for the greatest student achievement in mathematics. In my experience, students can only process a certain amount of information at a time. They need time to absorb and reflect upon what has been taught. With block scheduling, you have to teach two sections per day to make sure you cover everything in the curriculum. Most students cannot handle that much new information at once. In short, I think block scheduling has a negative impact on student achievement in mathematics. The traditional schedule allows students time to digest the material. As in the A/B block, the students will also be doing mathematics all year long, but not in the 4 x 4 block, leading to better retention. However, in the 4 x 4 block, as in the traditional schedule, the teacher gets to see the students every day so that they can get questions answered quicker than in the A/B

block. The traditional schedule is not perfect, but I believe it allows for the most student achievement for most types of learners.

- I think gaps in instruction are the biggest problems. I think the 4 x 4 leaves open the opportunity to be away from math for too long. I also believe the availability of extended instructional time on either traditional or A/B alternating when needed, is more important than schedule type (for example, having math on both A and B day on A/B alternating schedule may be needed to overcome deficits or two periods with one being further instruction or small group support.)
- Continuity in mathematics trumps length of time in class. The more continuity, the better the achievement.
- Traditional has more opportunities to see the student to deal with problems as you go along; block would allow for more lab opportunities, etc.
- No specific impact. The impact on students is by the way the time is used by the adults in the system.
- If classes feel rushed in any schedule effectiveness drops.
- I think it can have a great adverse effect if the teacher does not adapt to the time.
- Daily practice is necessary for retention of mathematics skills. 4 x 4 Block schedules where students may have a math class first semester one year and not another math class until second semester of the next do not promote math retention because there is no opportunity for practice.
- A/B block is ineffective and hinders student achievement.

- I have seen greater retention with daily classes. Too much wasted time in the A/B schedule with having to reteach material. Students' attention spans are getting shorter and long class periods make it too difficult to keep the students engaged.
- Retention of concepts is very low when there is less consistency in meeting, as in A/B Alternating Schedule. The teacher also has less time to adjust plans in this setting to meet the needs of learners.
- The teacher makes the biggest impact. A different schedule will only make a positive impact if the activities and curriculum are also aligned.
- Block schedule allows for more time in class to vary activities but students are pushed to learn topics too quickly. With block schedule, retention between courses can be an issue if a student has a math class 1st semester one year and then not again until 2nd semester the next year. Students struggle with retention from day to day with the A/B Alternating Schedule because they put off their homework knowing it is not due the next day. A lot of class time is spent reviewing the lesson from the previous class. Traditional schedules allow students more time on a topic and improve retention from class to class, and year-to-year, since students are practicing their skills every day. The shorter class periods do not allow for as much of a variety of activities during the class.
- I think teacher competence has MORE to do with achievement than the schedule.
- The greatest effect is the amount of material covered. Math needs to be taught every day and the amount of time for the class is the greatest determining factor. No matter how effective the instructor is, the material must be presented sequentially with proper review and tying ideas together. Some schedules do not lend themselves well to this. A traditional schedule is much more effective with a 55-minute class period than a 42-minute class period.

- Very much.
- Not as much as most people seem to have.
- Very little. The important factors that lead to improved student achievement are as follows: a quality teacher, the desire and motivation of the student and the importance of education in the home. The format of the school schedule is in my opinion irrelevant.
- I think schedule is important in education. We have been very pleased with what we do with our traditional schedule. I am sure there are some benefits to other types of schedules but we have never seriously talked about changing. We are pleased with the traditional schedule.
- A great deal of impact. The amount of time devoted to math has a lot to do with how well the students learn.
- The longer the class period there is a rise in options for the way in which material is delivered. Grouping and discovery is something that can be done every class period even when a test is given.
- There are many times that the A/B block becomes long and instructing that long wears on the students.
- I think a good teacher can be effective on any type of schedule, therefore positively impacting student achievement in mathematics. I have taught on two different schedules and both have positive and negative impact on instruction and achievement.
- It depends on how each student learns. Some will need the daily contact and some need the longer class time.
- We need enough time for individual help and our school has some long periods and short periods during the week. I give tests and quizzes on long days.

- It would be nice to have time to review, teach the new concept, and let them work on homework/projects in one class sitting.
- I have no experience in a block environment, but I think quality math instruction would be hard to maintain for 90 minutes. On the other hand, the extended periods may make differentiated instruction and remedial work easier—don't know.
- I think it's more about what you do with what time you have.
- Math is a use it or lose it activity for most people. 4 x 4 and trimester generate gaps of no math practice that are too long, summers are bad enough.
- I have never taught in block schedules. I do think the length of our periods is just right as far as the amount of material presented versus student ability to absorb it.
- I think that schedule type has impact in mathematics when there is a gap of time between courses. This is the strongest disadvantage for 4 x 4. The advantage for 4 x 4 is allowing students to be reintroduced if failing and to get back on track. Scheduling has a smaller impact than teacher adaptation to developing a lesson plan that is conducive to the scheduling type.
- I believe that for lower-achieving students, a traditional schedule is most effective. These students need math every day and for shorter amounts of time. Their attention span tends to be limited. For higher-level students, I believe a block schedule is most effective as it gives the instructor more time to provide enrichment activities and give one-on-one assistance. I also believe that, no matter the schedule, an effective teacher will make the most of whatever time he/she is allotted.
- It allows students more time with the material which directly impacts their achievement, especially with struggling students.

- I think students in mathematics (especially younger students and those in lower math classes) need to meet every day or they forget what was taught.
- I think the traditional method or the A/B schedule work the best for learning the material and retaining it for longer periods. If a student doesn't have math for one semester (plus over the summer) it is difficult for them to retain the material. So often the beginning of the first quarter is spent reviewing previous concepts while introducing new material.
- Math is a language and needs the daily prodding and reinforcement to grow properly, but there also needs to be time for the lessons to concretize. It is my opinion that daily exposure to the subject is vital for success.
- I think the teacher has more influence than the schedule. That said, math is a difficult subject to schedule. One must have enough time to cover a topic but not so much time that too many topics are covered. In my class, I need enough time to cover one section from the book and allow for some practice. I cannot however, speaking from experience, try to teach more than one section in a period. Even if I have two hours to teach two sections, it is information overload for the students and they will retain little or nothing. It is far more effective for them to learn one topic, practice, learn a second topic, practice, and continue in this manner.
- I believe it has considerable impact because it is frequently a major factor in determining the culture of the school.
- I think in the traditional schedule you can spend more time learning each area and they have the class all year which helps them retain the material longer. They also do not have time to do their work in class so they are more prepared for college by doing homework at home. The 4-block systems require a teacher to go faster and not spend as much time on certain subjects because you can only pound so much on the students each day. Their grades do go

up however because they have some class time to do their work. On the other hand, are they really prepared for college by having time to do work in class.

- A majority of our students are fine with a once a day, 50-minute schedule. For our lowest achieving students, we have them take a two-period Algebra class in order to give them the extra time and help they need.
- Some students are able to handle longer class periods better than other students. Block scheduling will work for some students and some classes.
- I think in HS students need some time to work on an assignment.
- I think the instructional strategies used have a greater impact on student achievement more so than the schedule of the classes.
- I don't think schedule type matters all that much in terms of effectiveness of math instruction, although I do think a longer 90-minute block does allow for a bit more time for struggle, re-teaching, and performance assessments. I think what matters most is how the teacher uses the time, not what the schedule is.
- We have 8-period days, and only 43-minutes of instructional time per day which is too little. I believe a traditional schedule with seven periods per day would be most effective in addressing all of the above issues with students.
- I think it varies widely by the course, teacher, and school climate.
- The more time between math classes, the more students will forget. Summer break causes a lot of this and if students are taking an entire semester off of math, they will forget a large amount of what they have previously learned.
- The teacher and his or her creativity have more to do with instructional effectiveness than the school class schedule. Good teachers are good teachers on any schedule.

- A student can only absorb material so fast. Daily reinforcement over a reasonable length of time is needed.
- For math, too much time is detrimental and students see sitting in math class for long blocks of time as a punishment rather than understanding that more time means we can do more with the material.
- I believe that for core content classes, such as mathematics, students benefit from longer periods where they can learn one or more concepts and still have ample practice time independently or with instructor oversight. Therefore, I think the block schedule lends itself to higher instructional effectiveness and achievement in mathematics.
- Kids need math every day; it's the repetition that conveys learning. I've vehemently opposed 8-block because of this and because chunking is the best way to teach math. 4-block is deadly because of the potential delay between math classes.
- Math is best remembered when done daily, which is the benefit of traditional. There is less forgetfulness from class period to class period. On the other hand, with AB, students are able to ask questions and work on homework with a teacher present. It is best for RTI and spotting problems before they are out of hand.
- I have taught under a traditional and block schedule. I love the block schedule because I have adapted my activities to fit the 85 minutes. Students are engaged and busy the majority of the time. Traditional does not allow the break from the teacher (every other day).
- I think schedule type affects the teacher more than the students. It is up to the teacher to use the time properly and prepare the students to the best ability possible.
- It will vary with the expertise of the instructor and the abilities and motivation of the students.

- It depends on what is being emphasized. For retention, I believe traditional is most appropriate. For varying teaching methods, more cooperative learning and discovery learning experiences a block schedule is more effective.
- We cover less material using the A/B schedule and the students remember less from one class to the next.
- I believe students need to be in math class every day. Having A/B alternating schedules makes classes too long and kids lose focus. I also feel like you have to cover too much material in one class with this schedule type.
- There are pros and cons to both of the recent schedules we have been a part of. Block allowed for some further understanding and quality differentiation, where students have continuity and are more engaged on our current 8-period schedule.
- Block allows for more time for different instructional strategies and a better understanding of student knowledge. The problem with block schedule is that gap that students have in their schedule either yearly or daily.
- On a block schedule of any type, students have more time to work in class to develop and master skills. On a traditional schedule, between going over previous lesson and presenting/developing new lesson, there is little or no time for students to work in class on skill development. There is also much more time for assessment in block scheduling compared to traditional schedule. It is imperative for the teacher to be trained in use of block schedule to make sure they get through all the necessary material-it is easy to not get through enough material when working with block schedule if the teacher is not organized and keeps on task. I prefer the block schedule and feel it is much more instructionally effective, as students can concentrate on a few subjects per day rather than 6, 7, or 8 subjects. Students

can work more in depth on a day-by-day basis when there is more time devoted to the subject. The 4 x 4 block is difficult for math students because they will most likely end up not having math for one semester each year, which can have an impact on standardized testing if the student is not in a math class when the testing takes place.

- I am only familiar with the traditional 7-period schedule in my teaching career. I think there can be a correlation between schedule type and instructional effectiveness particularly for the struggling student who may need differentiated instruction. The traditional schedule does not always allow for that to happen within the time frame allowed and if it does happen, it sometimes hinders the opportunity to move forward and cover more mathematical material.
- I think that some disciplines work better in different schedule types than others. Foreign language and math need the everyday approach. Science benefits from the block with longer class periods to do labs.
- It all depends on what is occurring during the additional minutes in the classroom. If you have additional time and you use it for homework, I am not sure the learning will improve.