A COMPREHENSIVE STUDY OF THE RELATIONSHIP OF BLOCK SCHEDULING TO THE TEACHING OF MATHEMATICS

By

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ABSTRACT

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Block scheduling is a topic selected by this researcher. This researcher investigated the effects of block scheduling in relationship to Mathematics instruction. Block scheduling is a very hotly contested subject for schools at this time and this researcher was concerned about the effects of this type of scheduling on high school Mathematics instruction.

Block scheduling was developed in response to criticisms regarding the ineffective use of school time. With block scheduling, students take four classes per day, each lasting 90 minutes. Classes are completed in one semester rather than lasting for an entire year under a traditional schedule.

Benefits of block scheduling are that students are able to take more courses throughout high school and have more time available for electives. Less time is wasted on transitioning

between classes and administrative duties, allowing this time to be used for instruction. Teachers are able to use innovative instructional strategies as they have a longer time period in which to complete their lessons.

Issues with block scheduling include students having to focus their attention for longer periods of time. Some teachers continue to use lecturing as their only instructional tool, and 90 minutes is too long for students to listen to lecture. The pace is also much quicker as the classes are completed in one semester rather than one year. Some students have difficulty processing a large amount of information in such a short period of time.

Mathematics is a subject that can be difficult to comprehend. This subject builds upon itself and each step must be understood before students can proceed to the next level. Block scheduling does allow more time during each class period to ensure that comprehension occurs, but the course must move at a faster pace so that all content can be covered. Some students have much difficulty with this pace of instruction.

Several recommendations have been developed following the research completed in this study. It is important to have the support of the staff, students, parents, and community prior to block scheduling implementation. Community meetings should be held to explain the new system and the benefits to the students. Teachers and faculty members should be afforded the opportunity to visit other schools with a similar scheduling system. In turn, teachers should be surveyed to determine specific training needs they have in teaching under block scheduling.

In order for Mathematics instruction to be effective under block scheduling, staff development and training must be a part of the process. Teachers must be trained in a variety of instructional strategies so that the class time can be best utilized. Special training should be

offered to teachers on time and classroom management. Time should also be allotted at staff meetings to review and discuss best practices. Teachers must be afforded the opportunity to share concerns, problems, and successes. Mentoring systems have been found to be effective, especially with new teachers. Peer coaching promotes active learning based on the individual teacher's needs.

Mathematics comprehension must be monitored to determine the success of instruction under the block scheduling system. Benchmarks should be developed to study the student grades over the first five years of implementation to ensure that student grades are not declining with the new system. In the event that block scheduling is not conducive to learning Mathematics, schools must be open to modification of the current system. System flexibility is a must in order for education to be a success. The pace of instruction may need to be modified to ensure that in-depth learning is taking place. Surveys should be completed by parents and students on a regular basis to determine the effectiveness of block scheduling.

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CHAPTER ONE

Introduction

Time is of the essence when educating youth. Parents want to ensure that their children will get the most from their education and will be well prepared for the future. Teachers are concerned with making every minute count in the classroom. They spend countless hours developing lesson plans and activities to peak the child's interest and assist in the learning process. Administrators work to find the best scheduling options for the school district that are most conducive to learning. All groups must work together to ensure that the best educational system possible is in place for optimum learning.

At present, scheduling of high school classes is of paramount concern for administrators, educators, and parents, as well as the students themselves. The debate over traditional six or seven period days versus block scheduling is occurring in many school districts across the country. There are pros and cons to each side, with strong advocates campaigning for their scheduling preference. The main concern must be finding the scheduling system that is most conducive to learning. Some teachers find the block scheduling system advantageous as they have more time for classroom activities. According to Canady and Rettig (1995), many teachers have moved away from the traditional format of lecturing and need more time in which to accomplish new instructional strategies. A feeling of trying to beat the clock is common when only being allotted 45-50 minutes of traditional instructional time.

A concern with traditional scheduling is also wasted time. Administrative duties can take up much of the teachable time in each class. Teachers must take roll call and focus the attention of the entire class on the new subject. In traditional scheduling, this does not leave much time

for actual instruction. Other teachers find it very difficult to teach for a long period of time. They must come up with different activities to keep the students' interest and to keep them focused. This can be very difficult for teachers who are unable to move away from their traditional styles of teaching.

School climate is also an issue addressed with regards to scheduling. School districts are trying to find the best scheduling options to promote a positive school climate. First, concerns have been addressed with the teacher's ability to provide the best service to the student. According to Talbert and McLaughlin (1993), in the traditional scheduling system, teachers instruct 5-7 different classes of generally 25-35 students per class. This means that they come in contact with 150-200 students each day. It is almost impossible to develop a rapport with the students and to provide them with the individual attention that some need to succeed. Focusing for the students is also of extreme importance and concern. They are expected to change their focus in many different arenas throughout the day. "Imagine adults going to work each day and having to work for seven or more supervisors, often in eight or more workplaces, in seven or more areas of expertise" (Canady & Rettig, 1995, p.5).

Another point of consideration in regard to school climate is the benefit to the students themselves. The students must be in an atmosphere that is conducive to learning. Proponents of block scheduling feel that block scheduling is a better option as students spend less time in the hallways and this leads to a decrease in disciplinary problems. According to Canady and Rettig (1995), an increase in times that students are transitioning from class to class means an increase in disciplinary problems. The time between classes is usually under-supervised and students are rushing to get to their next class. This can cause outbursts between the students, which often

leads to disciplinary action. Schools where the number of transitions are lower seem to have a decrease in disciplinary problems (Canady & Rettig, 1995).

One subject that is of primary concern regarding block scheduling is Mathematics. Mathematics is a subject that builds upon itself and becomes more complicated at the higher levels. This is especially true in high school, where students are learning Algebra, Geometry, Trigonometry, and Calculus. It is important for students to grasp every step or they will have great difficulty as time goes on. Classes taught in a block scheduling format go at a much faster pace than classes taught in a traditional scheduling format, taking one semester to finish a course rather than an entire year. Some students are extremely talented in Mathematics and comprehend the new lessons quickly. Other students need more time to process the steps. In block scheduling, the lessons must go at a fast pace due to time constraints. The students must learn an entire subject in one semester rather than taking an entire year to grasp the concepts. Some students thrive in this type of scheduling system while others struggle. Also, students who miss classes due to an illness are concerned about being able to catch up with the fast paced lessons.

Mathematics classes are consecutive in nature and this fact raises another point of concern. With each class building upon the previous class, it is best for students to continue to take successive courses immediately following each other. In traditional scheduling, some students take year-long Mathematics courses each of the four years they are in high school. With the block scheduling system, students may take a course in the fall and not take another Mathematics course until the next fall semester. This means that they will have had no

Mathematics instruction for nine months. This extended break can cause problems as students may have forgotten the key concepts they need to succeed in the future courses.

Proponents of block scheduling state that the traditional teaching methods of lecturing must change. This group further offers that students learn best when given group activities and time to learn on their own. Block scheduling allows teachers time to complete laboratory experiments and different activities. It is nearly impossible for the teacher to lecture for the entire time and for the student to remain focused. However, literature on Mathematics instruction poses a different viewpoint. According to Reynolds and Muijs (1999), research has indicated that children learn more when taught or supervised directly by the teacher, rather than working on their own. Higher pupil achievement has been found where the instructor's time is spent teaching the entire class, rather than on letting children work independently on projects and assignments. Some teachers, not being able to change their teaching habits and not having the skills and techniques to use with the additional class time, will simply give students assignments to work on for the remaining time. This seems to be an ineffective way of instructing the students.

The objective of this study is to look at block scheduling, Mathematics instruction, and the effects of block scheduling in relation to Mathematics instruction. Mathematics is viewed by this author as a very critical subject. It is a subject that builds upon itself and can have detrimental effects for the student if it is not learned correctly. It is important to find the best instructional techniques and scheduling to assist the students in mastering this subject. Block scheduling is a greatly debated topic at this time for many school districts. All components must be researched so that the change is beneficial for the education of the students. The relation of

block scheduling to Mathematics instruction will be researched by conducting a comprehensive critical analysis of literature and research focused on the objective of the study. It is the intent of this author to find research in relation to block scheduling and Mathematics instruction. It is unknown at this time whether block scheduling is beneficial or detrimental in teaching Mathematics, but the hope is that the literature will be definitive in finding a relation between block scheduling and Mathematics instruction, either positive or negative.

Statement of the Problem

Mathematics is an important subject to teach, especially in the high school arena. School districts are currently struggling with choosing a type of scheduling system in the high schools that is conducive to learning for the students. Block scheduling has come to the forefront of this debate. The concern is whether block scheduling is conducive to Mathematics instruction. A review of current research and literature was conducted to determine whether there is a relationship between block scheduling and Mathematics instruction. A critical analysis was completed on the research to determine the effects of block scheduling on Mathematics instruction.

Purpose of the Study

The purpose of this study was to determine whether the block scheduling system for high school students is conducive to learning Mathematics. This study reviewed the literature available in relation to block scheduling, Mathematics instruction, and the effects of block scheduling on Mathematics instruction. A critical analysis was completed on the literature reviewed.

Research Objectives

The objectives of this research are twofold. First, an in-depth study was completed covering three areas. Research was completed on Mathematics instruction, block scheduling, and finally the relation of block scheduling on Mathematics instruction. This research was critically analyzed to determine if there is a relationship between block scheduling and the quality of instruction of Mathematics. Second, the results of this study are made available to administrators and educators to aid in determining whether block scheduling is beneficial for the instruction of Mathematics.

Definition of Terms

There are two terms that must be identified to aid in the understanding of this study. These are:

Block Scheduling – A 4/4 semester plan in which students enroll in four courses each 90 day semester. Each course meets daily for approximately 90 minutes. A course taught in the traditional scheduling system takes one year to complete where the same class is completed in one semester with the block scheduling system.

Traditional Scheduling – Students participate in 6-8 classes per day for 40-60 minutes per class period. Each class takes one year to complete.

Assumptions

It is assumed that sufficient literature will be available to complete a comprehensive critical analysis to determine whether there is a relationship between block scheduling and Mathematics instruction.

CHAPTER TWO

Literature Review

Introduction

Block scheduling has become a hotly debated topic in high schools today. At issue in regard to block scheduling is whether the pace is too quick for instructing Mathematics. This chapter will discuss the pros and cons of block scheduling. Also to be addressed will be Mathematics instruction and the strategies best used to teach Mathematics. Finally, research will be reviewed on block scheduling in relation to Mathematics instruction.

Block Scheduling

Changes in scheduling came about following criticism of teachers and administrators in the 1980's regarding the ineffective use of school time (Lawrence & McPherson, 2000). Over time, due to technology and changes in society, the expectations of what students learn have greatly increased. Education changed from teaching manners, obedience, and punctuality, to teaching decision-making, independence, and highly technological skills (Lawrence & McPherson, 2000). Changing graduation requirements as well as expectations of student learning and academic requirements have increased the amount of learning necessary in the schools (Grossman, 1998). Due to rising expectations as well as social and academic needs, schools had to rethink how they were teaching (Grossman, 1998). The allocation of time in schools became perceived as flexible, and modification of time was examined to provide more effective teaching and learning for greater student success (Benton-Kupper, 1999). Schools were advised to become less rigid in how they used time (Sommerfeld, 1996). Traditional scheduling did not seem to offer sufficient time for in-depth learning of various subjects (Khazzaka,

1997/98). Block scheduling offered a positive alternative to traditional scheduling in meeting the new goals of education. A more flexible school learning environment is the goal of block scheduling (Schultz, 2000).

According to Manzo (1997), it is estimated that 40% of high schools nationwide are changing from traditional schedules. Due to the nature of the current focus on block scheduling, much research has been conducted on the benefits and detriments of block scheduling. Since this is such an extremely debated topic, it is natural for the proponents and opponents to be very strong advocates for their side of the issue. Both sides seem to have valid points in relation to the benefits and detriments of the scheduling system. Both of these sides will be reviewed.

One benefit listed in relation to block scheduling is that less time is wasted on administrative duties. With traditional scheduling, students spend more time transitioning between classes and teachers must spend more time with administrative duties, such as taking roll call and focusing the students' attention on the current subject matter. Actual teaching time can be very limited with this type of scheduling. Under block scheduling, students spend less time between classes and can instead use this time engaged in learning (Richmond, 1999). Due to the decrease in student interaction between classes, schools have found a decrease in disciplinary action. "Frequently, problems start in the hallway during passage between classes, and under a block schedule students spend less time each day passing through hallways" (Kramer, 1997, p.21). According to a study by Brandenburg (1996), in and out-of-school suspensions as well as discipline referrals decreased significantly following implementation of a block scheduling system in ten California schools (Wilson & Stokes, 1999b). Attendance has also increased in schools with block scheduling (Khazzaka, 1997/98).

Furthermore, the changes have also caused a more positive school climate. "Implementing block scheduling created a learning climate that was quieter, less stressful, less harried, and more relaxed" (Wilson & Stokes, 1999b, p.44). Students appear more relaxed as they are not rushing to so many different classes numerous times throughout the day. Teachers are able to spend more time with a smaller number of students, which has increased interaction time and has improved teacher/student relationships. The instructional time is much less fragmented, which offers increased opportunities for instruction (Knight & DeLeon, 1999). Students are able to concentrate for longer periods of time without interruptions from the bell (Sommerfeld, 1996). Teachers have found that lessons flow better and are much less disjointed in block scheduling (Benton-Kupper, 1999). "Positive changes in both interpersonal and group dynamics were largely attributed to working with fewer students, longer class periods in which to get to know students, and more opportunities for individual attention" (Veal & Flinders, 2001, p.29).

Some teachers feel that their students are able to get more individual attention with block scheduling, which is imperative for the success of many students (Veal & Flinders, 2001). This individualized interaction is also a benefit to teachers as they can assess the learning levels of the students, allowing them to plan lessons aimed at the current levels of the students (Benton-Kupper, 1999). Teachers have more opportunity to notice personal characteristics of the students, in turn gaining perspective on the student and tailoring the curriculum to promote learning (Schultz, 2000). Parents were also pleased that their children could interact with other students and the teacher for an extended period of time (Knight & DeLeon, 1999). Additionally,

parents noted that their children had less homework and were more interested in taking advanced placement (AP) courses (Khazzaka, 1997/98).

A study of teacher perceptions was completed by Wilson and Stokes. The study concluded that teachers believed that block scheduling was more effective than traditional scheduling (Wilson & Stokes, 1999a). Another study showed block scheduling as positive for the teachers as long as planning time was addressed and made available (Benton-Kupper, 1999). All literature seems to support the fact that block scheduling will only be as effective as the teachers who are teaching in this format. Without the full support of instructors, education cannot achieve its maximum benefit for students. A number of positives have been listed by teachers regarding block scheduling and these will be reviewed.

As stated earlier, individual help from the teachers has been a benefit of block scheduling. "Teachers noted that they have more time to communicate with individual students, have fewer students each day with whom to interact, can more easily facilitate individualized instruction, and students feel more interested and involved in the subject, all of which reflect a more positive learning environment" (Wilson & Stokes, 1999b, p.45). According to Veal and Flinders (2001), one teacher stated that she was able to spend more time listening closely to her students. Another teacher felt that the learning taking place in the classroom had a more continuous flow (Benton-Kupper, 1999). Students felt that teachers had more time and cared more about their learning and educational needs (Veal & Flinders, 2001). Teachers have more time to get to know the students, which improves the relationship and ability to assess each student's requirements. With more individual attention, active learning and the quality of instruction improves (Wilson & Stokes, 1999b). "Because they could cover concepts with more

depth, teachers perceived teaching to be more interesting and challenging" (Evans, Tokarczyk, Rice, & McCray, 2002, p.320).

Another benefit cited regarding block scheduling is that students are responsible for less classes at any given time. They are able to focus their attention on three or four classes, rather than six or seven. It is unreasonable to expect that students have enough time to adequately prepare for numerous classes each day (Sommerfeld, 1996). It is unlikely that a student will have more than one or two tests to prepare for at any one time (Philips, 1997). This means that pupils are able to spend more quality time on each subject rather than doing the minimum to get by in a larger number of classes. "While the pace of content coverage was more rapid in the traditional classes, (students) generally thought the block schedule was easier because the teacher cuts out all the busy work, tests occur closer to content presentation, and they don't have as many classes to study for" (Knight & DeLeon, 1999, p.6).

Students seem to enjoy the pace of the classes and compression of the material covered, feeling that time is not being wasted on consistently covering the same material (Knight & DeLeon, 1999). Students are able to fully produce a solution to a problem in one to two class periods without having to spend time on repetition and review necessary for shorter class periods (Richmond, 1999). Students don't get bored with lessons that previously seemed to last for days in traditional scheduling (Queen & Gaskey, 1997). Block scheduling also provides gifted and talented students with a pace conducive to their learning abilities, rather than allowing them to become bogged down with the slow pace of a traditional class (Schultz, 2000). According to Queen (2000), less time is wasted in class changes and students are able to immerse themselves into each subject far greater due to only having three or four courses. Students under block

scheduling have reported greater involvement in activities and better study habits (Knight & DeLeon, 1999).

Even though the students are taking fewer classes each semester, the number of classes a student can take each year is increased. With block scheduling, four traditional year-long classes are completed in one semester which allows students to take eight courses per year. Students are able to progress at their own pace (Khazzaka, 1997/98). This allows students an opportunity to take more electives. Course offerings and options are more flexible with block scheduling (Schultz, 2000). Block scheduling is very favorable in regards to the ability to offer more courses (Hannaford, Fouraker, & Dickerson, 2000). Students can reserve their third and fourth years for career training or college courses (Khazzaka, 1997/98). Due to the changes in scheduling, it is possible to increase the number of courses offered, giving students more choices (Queen & Algozzine, 1997/98). Students can utilize this time to master college-level content and acquire skills to begin to prepare for careers (Philips, 1997).

In the event a student has failed a course, block scheduling allows students to retake the class the very next semester, rather than waiting an entire year, which is necessary in traditional scheduling (Wilson & Stokes, 1999b). This can only help the students as the information they learned in the first class will still be fresh in their minds when the course is retaken. Students are also less apt to feel totally defeated as they have adequate time to retake a failed course (Queen & Gaskey, 1997).

In their study, Wilson and Stokes (1999b) cited results of numerous studies on achievement of students under block scheduling. Although most studies show varying results, Wilson and Stokes stated that over time, students show an increase in scores on tests of basic

skills. The increase is not noticeable after one year of block scheduling instruction, but does show up after five years of block scheduling instruction. One possible reason for this change is that teachers do not cover as much content the first year as the adjustment is very demanding (Lawrence & McPherson, 2000). Alternative explanations have been given regarding studies where block scheduling scores are higher, stating that smaller class size could be the reason for success (Knight & DeLeon, 1999). Other studies, however, have disagreed with these results. According to Bowman (1998), there is an absence of data stating that block scheduling shows significantly improved results over traditional scheduling.

Scientific support is lacking regarding student achievement under block scheduling (Lawrence & McPherson, 2000). Similarly, a number of studies have found no significant differences either way between block scheduling and traditional scheduling (Dyrli, 2000). Another study revealed that students on the traditional schedule scored significantly higher on Algebra I tests than those students on the block schedule (Lawrence & McPherson, 2000). This lack of hard evidence one way or the other makes it difficult to determine which scheduling system is better. Since a significant difference is not evident, some studies have looked to the students to see which scheduling system they prefer. Some research compiled by schools indicated that students and teachers preferred block scheduling (Khazzaka, 1997/98). According to Slate and Jones (2000), however, students showed a preference for traditional scheduling. This preference was not strong, but showed that there are characteristics of block scheduling that are not preferred, and these will be reviewed.

Throughout different resources, teachers concerns with block scheduling have been addressed. According to Evans, Tokarczyk, Rice, and McCray (2002), teachers were concerned

about providing enough material for a substitute teacher for the extended period of time as well as additional activities for students who finish assignments early. This is a greater concern for teachers who must utilize substitute teachers for an extended period of time. The question arises whether a substitute teacher would be able to teach a more complex course, such as Physics, for a longer time period (Cromwell, 1997). Furthermore, extended student absences are an additional issue of concern. Students have commented on the weight of homework and tests, causing devastating effects when absent (Knight & DeLeon, 1999). Students will have twice the information to learn, making it much more difficult for them to catch up with the other students. A week long absence for a student means that they will miss two weeks worth of lessons, making it extremely difficult for the student to make up the work (Cromwell, 1997).

Student concerns have been addressed in the research as well. Other than those already addressed, students noted that some teachers lacked the ability to offer enough activities to keep them engaged for an extended period of time (Evans, Tokarczyk, Rice, and McCray, 2002). Some students get bored easily, especially in such a long class period. According to Queen & Gaskey (1997), the structure of class should change every 20-30 minutes to maintain the student's interest. Students also expressed concerns over covering less content, making them ill-prepared for taking advanced placement (AP) exams (Knight & DeLeon, 1999).

Parents offered different concerns above and beyond the concerns addressed by students and teachers. According to Evans, Tokarczyk, Rice, and McCray (2002), parents were concerned about their child's lack of ability to socialize with other students as they are interacting with fewer students in the classroom and have less interactions in the hallways due to fewer breaks between classes. Another concern listed is that the length of class time is too long

for students in a class in which they may be struggling. They can become extremely frustrated and lose their motivation to work. Also, parents were concerned with the accelerated pace of the classes, placing increased pressure on their children (Knight & DeLeon, 1999).

Even though it appears that block scheduling and traditional scheduling offer the same amount of instructional time, the pace of learning in block scheduling is difficult for some students. "Giving students more time in a single day to learn material but reducing the amount of time to one semester or less instead of a full year does not translate to escaping the prison of time" (Thomas, 2001, p.75). According to Canady (1995), certain students need an increased amount of time to learn than others. Some students function very well in a block scheduling format, while others struggle. Teachers can provide instruction to diverse students with different learning styles by varying lessons (Queen & Gaskey, 1997). According to Thomas (2001), a student's level of cognitive development can be an important factor in determining how well a student will function in block scheduling. It is not surprising that bright students do well, but other students can run into trouble (Lawrence & McPherson, 2000). More mature students are better able to function in block scheduling as they are able to handle the fast pace, whereas lower functioning students may struggle in this type of system. Lower functioning students must be allotted more time to grasp each lesson and can have more difficulty understanding all of the concepts in one semester. "It takes time for these students to mature enough to grasp concepts that the high-ability students can understand, discuss, and relate to life in one semester" (Thomas, 2001, p.76). One study does support the implication that "at risk" students would benefit from being grouped with one teacher for an extended period of time during the school day (Wilson & Stokes, 1999b).

Another concern related to comprehension of information is the time frame between courses that build upon each other. Although teachers stated that they didn't notice a real difference, parents were concerned about the students taking a Mathematics or foreign language course in the fall semester and not having the subsequent course until the following fall (Rettig & Canady, 1997). According to Queen and Algozzine, et.al. (1997/98), students could go for two years before taking a second language course. The concern is that the gap is too large and the students will forget what they learned previously. This is especially a concern with courses such as Mathematics and foreign languages, as they build upon each other. Nine months is a long period of time to remember the key concepts of what was learned. Critics have also stated that greater memory loss occurs over longer periods of time (Cromwell, 1997).

Attention span of the students is also a concern for educators. In a study conducted by Slate and Jones (2000), students reported increased difficulty sustaining attention. The study stated that block scheduling has the ability to tax the attention span of all students, even those who are normally most attentive. According to Cromwell (1997), many teachers continued to lecture rather than providing active learning lessons. In block scheduling, teachers often do not provide appropriate activities but rather rely on presentation followed by extensive seatwork (Knight & DeLeon, 1999). Some first-year teachers seemed to rely on methods of instructing in which students remained in their seats as they felt a loss of control otherwise (Zepeda & Mayers, 2001). "Teachers, in turn, try to control student behavior with content and a single, one-dimensional instructional strategy—lecturing—which puts the teacher in a power-authority stance over students and their learning" (Zepeda & Mayers, 2001, p.7). This can make paying

attention extremely difficult for students. Teachers have expressed concern regarding keeping at-risk students on task for a long class period (Khazzaka, 1997/98).

Rettig and Canady (1997) found, however, that keeping the student's attention depended more on the use of active learning strategies, rather than on the actual length of the class period. Therefore, teaching style has more to do with keeping the attention of the students than the length of the class. "Experts agree that whether a school makes a success of its nontraditional schedule has everything to do with what teachers do with the extra minutes they're given" (Viadero, 2001, p.40). "It remains the task of the teacher to use time effectively in order to meet learner needs" (Schultz, 2000, p.31). Varied teaching methods utilized in block schedules seems to hold the student's attention (Queen & Gaskey, 1997). Effective techniques in maintaining attention included asking students to analyze their viewpoints, in turn maintaining a high level of engagement (Adams & Salvaterra, 1997/98).

Block scheduling affords teachers the opportunity to use more varied instructional strategies (Knight & DeLeon, 1999). "By utilizing activities that are relevant to real life situations, by stimulating serious questions in students' minds, and by providing application tasks, teachers are able to create higher levels of student motivation required in longer block periods" (Wilson & Stokes, 1999a, p.36). Some teachers enjoy the flexibility in using varied instructional strategies that block scheduling affords them (Queen & Algozzine, et.al., 1997/98). Teachers are able to provide more involved content and more actively engage the students by utilizing in-depth materials, projects, and discussions (Benton-Kupper, 1999). In traditional scheduling, students must independently process concepts, while block scheduling offers time

for genuine learning, mastering the materials, and allowing students to critically apply what they are learning (Khazzaka, 1997/98).

Even though the length of the class period is increased, some studies show that teachers actually have less time with their students. "Looking strictly at the numbers, a block schedule of 90 minutes per day for 90 days yields 8,100 minutes in class compared with 9,000 minutes in a traditional schedule. That means a block actually shortens each course by 15 hours" (Philips, 1997, p.34). "Block schedules may give students more freedom within a day to discuss ideas and concepts but less time over the course of the year to develop and internalize concepts as part of a larger whole" (Thomas, 2001, p.75). Taking more courses in larger lengths of time might mean students actually have less time with their teachers (Viadero, 2001). Teachers feel that they have more time to assist some students with individual problems, but this is limited as well. According to Veal and Flinders (2001), teachers assert that they must push from one activity to another as they have material that they need to cover. They only have so much time to devote to students and often can't provide the extra time needed for students who are having difficulties. One teacher even stated that as soon as she figures out the key to the students, the semester is over and those students are gone (Veal & Flinders, 2001).

If teachers did take more time explaining each lesson, they found the end of the term coming without having finished their entire curriculum. They found it necessary to change their curriculum in order to complete the prescribed content (Veal & Flinders, 2001). Some teachers feel a sense of urgency in the need to cover the entire book (Adams & Salvaterra, 1997/98). Teachers found the task of restructuring year-long classes into one semester to be quite difficult

(Grossman, 1998). Some teachers feel that certain subjects do not fit well into one semester (Furner, 1998).

Throughout the literature related to block scheduling, whether positive or negative, it is evident that different teaching techniques need to be utilized. "Traditional teaching strategies, such as lecturing, must give way to strategies that work in the longer block classes" (Wilson & Stokes, 1999a, p.36). "Supporters of the block schedule predict that the failure to vary strategies in the classroom will destroy the block schedule as an educational innovation" (Jenkins, Queen, & Algozzine, 2002, p.198). "Longer class periods require careful planning, utilization of a variety of instructional methods, and diverse student assessment practices to complement extended learning opportunities" (Zepeda & Mayers, 2001, p.8). According to Queen and Algozzine, et.al. (1997/98), during the 1980's teachers entering the profession were prepared to utilize a greater variety of instructional strategies. One teacher utilizes more of a facilitator role, giving her a chance to move around the class and assist as needed, which she finds more effective (Benton-Kupper, 1999).

A common teaching strategy for many is lecturing, which has been found to be ineffective in a block scheduling system. According to Thomas (2001), "no one can listen to a 90-minute lecture or practice math for an hour and a half without losing focus and interest" (p.76). Unfortunately, some teachers feel that even though lecturing is a less effective method of teaching, they view it as the best way to cover a large amount of material (Veal & Flinders, 2001). However, if the attention of the students is lost, lecturing is no longer effective either. "There is a clear consensus that maintaining a pure direct instruction/lecture mode of instruction does not work as well in a longer time block. Students find it difficult to sit through two lectures

in a row" (Kramer, 1997, p.31). Block scheduling can be a disaster if daily instruction is not varied in the classroom (Philips, 1997). Teachers can utilize writing, experiments, and other active learning techniques to engage the students during these longer periods (Cromwell, 1997). Regardless of the techniques being used, students must consistently be monitored so they don't become bored or side-tracked (Benton-Kupper, 1999). Student input should also be sought for effective teaching strategies as well (Cunningham & Nogle, 1996).

This raises the concern that teachers are not covering all that they need to in their current curriculum. Teachers have the attitude that less is more, meaning that covering less materials well results in better learning (Rettig & Canady, 1997). Although teachers admit less content is covered, they feel the students are learning the content to a greater extent (Benton-Kupper, 1999). Curriculum must be modified to relieve the pressure of having to cover everything, thereby allowing teachers to focus on what is necessary (Adams & Salvaterra, 1997/98). This can address the problem of cramming too much information into a short period of time.

Another concern with block scheduling, is students having sufficient time to learn the concepts. Without a change in the amount of material that needs to be covered, students have less time throughout the year to process and conceptualize what they are learning (Thomas, 2001). Teachers do not feel there is enough time to cover the information they were able to cover under a traditional schedule (Furner, 1998). Although narrowing course content is an option, teachers have found difficulty determining what course content can be eliminated (Veal & Flinders, 2001). Some have eliminated more of the entertaining activities as they don't feel able to waste time on activities not directly related to the course content. "I have to cover materials faster, having less time to elicit individual responses from students, practice

pronunciation, fewer videos, fewer 'fun' things" (Veal & Flinders, 2001, p.24). Others are removing overly repetitive material or material they feel is not essential (Furner, 1998). Some schools have used pacing guides to assist teachers in planning how much time should be spent on each course topic (Queen & Gaskey, 1997).

Some teachers have done extremely well with structuring their time to cover course content and keeping the students engaged in learning. A study by Adams completed in 1994 indicated that teachers' positive attitudes towards change were directly related to their comfort levels and abilities in adapting to new teaching styles (Adams & Salvaterra, 1997/98). According to Jenkins, Queen, and Algozzine (2002), some teachers have utilized teamwork with the students to address various learning styles and to allow them to apply knowledge to real-world problems, finding this to be effective. One teacher views block scheduling as a great opportunity to accomplish more and views her classroom as a very active setting (Benton-Kupper, 1999). Block scheduling allows for alternative activities such as guest speakers and field trips (Philips, 1997). Some teachers state that they could not switch back to a traditional schedule as teaching under block scheduling has become more meaningful (Khazzaka, 1997/98).

Varied teaching strategies not only help to reduce boredom, but they also keep the students actively learning throughout the class period. Block scheduling affords teachers the opportunity to utilize different teaching strategies that can be more effective for learning. Effective teachers are consistently striving to find engaging activities for the students (Jenkins, Queen, & Algozzine, 2001). One teacher stated that the change to block scheduling involved much more work in the first year, but was definitely worth it in the end (Furner, 1998). Some teachers feel the increased block of time allows them to further develop more difficult key

concepts and to offer additional assistance in student understanding of these concepts (Benton-Kupper, 1999). According to Viadero (2001), the success of block scheduling ultimately lies in the teacher's abilities. Success of block scheduling is ultimately determined by what teachers do with the extra time that they are given. The attitude of teachers is also important, as a block scheduling system cannot be successful if unaccompanied by changes in teachers' skills, attitudes, and behaviors (Adams & Salvaterra, 1997/98). "The success of block scheduling depends directly on the professionals implementing the model in their schools" (Jenkins, Queen, & Algozzine, 2001, p.61). Surviving the first year of a block scheduling system requires flexibility, an open mind, and dedication to the chosen system (Queen & Gaskey, 1997).

It is important to remember, however, that the teachers are not alone in the endeavor. They are only as successful as their support system affords them to be. "Teachers are the critical link to the success or failure of any curriculum change. As such, teachers require professional development to understand and meet their students' needs" (Schultz, 2000, p.30). Therefore, staff development is a critical component of block scheduling success. Teachers must be patient and positive throughout the process, and support from administration is necessary in order for block scheduling to work (Furner, 1998). Districts experiencing a smooth transition to block scheduling are those in which the administration dealt with internal opposition and included teachers in planning prior to implementation (Cromwell, 1997). "Besides investing in professional development and cultivating community support, the local leadership or steering committee must also seek teacher and student input for the plan and instill a sense of ownership" (Harrison, 1997, p.6).

A strong staff development program is necessary in preparing teachers to convert from a traditional to a block scheduling system (Queen & Algozzine, et.al., 1997/98). According to Evans, Tokarczyk, Rice, and McCray (2002), a recommendation that came from their evaluation of block scheduling was that on-going staff development occur, especially for new teachers. A faculty survey can be used to determine the staff development needs of teachers (Cunningham & Nogle, 1996). Surveys should also be completed with parents and students to gauge the success of the new system and to provide feedback (Cunningham & Nogle, 1996). Training must continue throughout the entire process for change to be successful. "The teachers from the school with training were very positive about the block schedule; the ones from the school without the training were very negative" (Kramer, 1997, p.33).

In schools where staff development continued, teachers were more committed to block scheduling (Adams & Salvaterra, 1997/98). "Staff development activities should be appropriate, continual, and available to all teachers throughout the year" (Jenkins, Queen, & Algozzine, 2001, p.60). Time should be devoted at staff meetings to discuss best practices in time organization and teaching (Harrison, 1997). This also provides an essential opportunity for teachers to share problems, concerns, and successes (Cunningham & Nogle, 1996). Mentoring experiences are also very helpful for teachers (Zepeda & Mayers, 2001). "Peer coaching is a model that can promote more active learning based on the immediate experiences and needs of first-year teachers on the block" (Zepeda & Mayers, 2001, p.9). "Feedback from department chairs, mentors, peers, and supervisors should be available to provide needed assistance in refining practices" (Zepeda & Mayers, 2001, p.7).

A switch from traditional class periods to teaching in a block scheduling system is a monumental change for teachers. Change is often met with negativism as teachers often prefer to retain the status quo (Schultz, 2001). Teachers need assistance in adjusting to this change. Without appropriate training, teachers are left to develop lesson plans on their own. According to Jenkins, Queen, and Algozzine (2001), most teachers stated that they have extensive training in lecturing. Many lack extensive training in interactive instructional strategies, and these are critical in a block scheduling system. Teachers need training in a variety of instructional strategies, thereby better utilizing the longer class time (Knight & DeLeon, 1999). "New teachers on the block need to stay engaged in long-term learning" (Zepeda & Mayers, 2001, p.10). Teachers also need detailed training on classroom management as this can be a concern in longer class periods (Queen & Algozzine, et.al., 1997/98). According to Khazzaka (1997/98), administrators acknowledged the need for more in-service training for the teachers.

It is recommended that teachers be afforded the opportunity to visit other schools using a block scheduling system (Dyrli, 2000). Cunningham and Nogle (1996) support a similar position that faculty members should visit schools using similar scheduling systems. Staff support and involvement during the decision-making process will increase staff acceptance (Queen & Algozzine, et.al., 1997/98). It is also beneficial to meet with other schools that are using a similar block scheduling system on a regular basis (Queen & Algozzine, et.al., 1997/98). Throughout the literature, it appears that block scheduling can have a very positive impact on the school environment with the right support and training offered to the staff. Without this training, the students will not obtain the necessary education in the high school setting.

Staff development and training seems to make the greatest difference in success rates of block scheduling programs. "Once block scheduling is approved, schools that have had the easiest transition have provided extensive staff development on how to plan and implement new teaching methods and allowed adequate time for teachers to redesign curriculum for the longer class periods" (Philips, 1997, p.34). "Teachers believe adequate planning time and relevant faculty training are essential when implementing block scheduling" (Wilson & Stokes, 1999a, p.42). "Adequate teacher planning time may be particularly critical during the first few years after a school has adopted a block schedule" (Kramer, 1997, p.34).

Along with staff involvement, community involvement prior to block scheduling integration also breeds success. In one community, block scheduling was strongly supported following full participation of staff and community during the decision-making process (Dyrli, 2000). School districts should form a committee of stakeholders to research different scheduling options available to find the best fit for the school (Harrison, 1997). Greater involvement and planning in the community will increase the chances of success during a scheduling change. "It is imperative that the teachers, principals, students, and parents give the same level of attention and effort to block scheduling as they would to any other school schedule. Thoughtful planning, organization, implementation, and evaluation are also imperative to the success of a block schedule" (Queen, 2000, p.220).

Some schools have also set up evaluation systems for the first few years of block scheduling to determine the success of the new system (Furner, 1998). The evaluation gives schools hard data to review in regards to the success of the block scheduling system. It is important to continually evaluate the scheduling system to determine whether some

modifications are necessary to improve the system (Queen & Algozzine, et.al., 1997/98). A school should also develop benchmarks to monitor in determining whether the new system is resulting in student success (Harrison, 1997). By monitoring grades and student achievement, the school can determine if educational needs are being met. Pacing guides should also be developed for each course to ensure that course objectives are met within the dedicated timeline (Philips, 1997). "Educators must continue to study research conducted in the area and conduct research themselves in an attempt to design better scheduling alternatives that more adequately meet the needs of students and teachers if block scheduling does not meet all the desired outcomes" (Lawrence & McPherson, 2000, p.182).

Mathematics Instruction

While it has been examined how scheduling affects the learning process, it is also important to look at the teaching strategies utilized regardless of the amount of time in each class. Whether a class is 45 or 90 minutes long, it is important to make every minute count. Mathematics is a course in which time definitely needs to be accounted for. The Mathematics curriculum is very stringent on what needs to be taught, not offering much time for alternative activities. Students are often challenged by the symbolic language of Mathematics (Rubenstein & Thompson, 2001). Due to this, as well as future classes building on what was learned in previous classes, the content of each class is extremely important. "Teachers are called on to teach new, more challenging mathematics to a diverse audience using active learning approaches designed to develop understanding" (Dickey, 1997, p.1). This section will research what strategies and techniques are most effective in teaching high school Mathematics.

First and foremost, it is important for the teachers to believe in their students. According to Reynolds and Muijs (1999), effective teachers are those who believe all children can master the curriculum. It is extremely important for these positive expectations to be forwarded on to the students. If pupils do not believe they can accomplish the tasks, and feel that the teacher has doubts as well, it is likely that they will not succeed. "In schools where the staffs share high expectations for student performance, students show relatively high levels of engagement in the life of the school, including academic aspects of school life" (Talbert & McLaughlin, 1993, p.52). Teachers also need to appreciate the effort students put forth, knowing that some try extremely hard to accomplish the lessons. According to Talbert and McLaughlin (1993), students showed high levels of engagement in schools where the staff had high expectations of student performance and supported the students in their learning.

A popular strategy used by some Mathematics teachers is using student teams. Small group work is an obvious means to promote classroom discussion and learning (Artzt, 1999). These can be arranged in many different ways, as well as utilized for different projects. According to Heron (1990), student-learning teams have been very effective. This technique has helped slower and faster learners alike as they support each other. Groups should consist of students of heterogeneous ability to better produce more discussion and different solutions (Artzt, 1999). This technique has a long history, being used in one-room school houses. "Schools can better meet the need of belonging by using various team approaches in the classroom – much like athletic coaches do in extracurricular activities" (Heron, 1990, p.14). Student-learning teams provide greater student-to-student interaction as well as tutoring. Oral work is very beneficial in helping the students vocalize and interpret Mathematics symbols

(Rubenstein & Thompson, 2001). The benefits of group learning are wide-spread. Since the group as a whole contains more knowledge than the individual, problem-solving strategies are more powerful (Reynolds & Muijs, 1999). Learning skills are enhanced as members serve as models to each other. Children also develop better thinking skills as they must learn how to verbalize their thoughts and interact with others. Students comprehend Mathematics better when they are able to verbalize the symbols (Rubenstein & Thompson, 2001).

However, small groups are not without their own problems. According to Reynolds and Muijs (1999), several problems can be evidenced in group work. First of all, students must be kept on track as off-task social interaction can be a problem. Also, some students may perceive themselves as not having enough to contribute to the group, in turn sitting back and not participating in the group. Therefore, the small group activities might only benefit the high ability students who are more comfortable expressing themselves, leaving the low ability students out of the loop. A cooperative incentive structure is effective in that group members can only produce a group product if each member has done his or her part (Artzt, 1999). Classroom management is much more important in small group activities. With good planning from the teacher, small group work can be beneficial for all. According to a study completed by Slavin, "research has shown that when small-group work is structured so that students are made to feel mutually interdependent and individually accountable for their work, maximum communication and active participation of all group members are likely to occur" (Artzt, 1999, p.12).

Teaching the entire class is also an important strategy. Small group work is effective, but least effective is having students work on their own. Research has shown that students succeed

more in classes where time is spent being taught by the teacher, rather than working on their own (Reynolds & Muijs, 1999). Ineffective teachers have been found to rely too much on individual work. It is important for individual accountability as some students will attempt to allow leaders of groups to complete all of the work (Reynolds & Muijs, 1999). However, individual work should be closely monitored to ensure that the students are comprehending the lessons. Those teachers who are most effective balance their time between lecture and direct demonstration. According to Reynolds and Muijs (1999), the most effective type of instruction includes brief presentations followed by recitation and application. The teacher takes an active role in delivering the information to the students. Active teachers also ask many questions to engage the students in the discussion. The instructor is able to monitor the level of understanding and involve each student in the class (Reynolds & Muijs, 1999).

The content of instruction is also important, especially if the teacher is to facilitate learning. It is important for the teacher to challenge the students, attempting to increase their understanding of the subject matter. An important balance must be found in the instructional material. "Due to the subject specialization found in the content areas in high schools, attention needs to be focused on varying instructional activities that can work alongside traditional lectures such as cooperative learning, Socratic questioning, the utilization of technology, and transition techniques" (Zepeda & Mayers, 2001, p.7). Students feel that more difficult problems facilitate more discussion, but might preclude involvement from less able group members (Artzt, 1999). According to Reynolds and Muijs (1999), tasks should be challenging enough to elicit group problem-solving, but not so challenging that group members will want to give up prior to completing the assignments. Projects are a successful way to build the students' understanding

of Mathematics (Rubenstein & Thompson, 2001). Enough time should be given to allow the group to listen to each other, but not so much time that they no longer work together effectively (Artzt, 1999).

Teaching for understanding is a standard that education researchers feel schools should reach for (Talbert & McLaughlin, 1993). The goal of this concept is to increase the level of understanding of the subject matter, as well as to increase the problem-solving skills of the students. Students are able to use what they have learned to solve problems (Ruenzel, 1996). According to Talbert and McLaughlin (1993), the difference with teaching for understanding is that it places more emphasis on tasks that require analytical thinking rather than emphasizing rote memory. This type of system places greater pressure on the teacher. Educators must have an in-depth knowledge of the subject matter in order to teach in such a manner (Talbert & McLaughlin, 1993). They must have the knowledge to develop activities and strategies for teaching understanding. They also must have the ability to understand the students' level of comprehension and to view the instruction from the students' eyes. This system can be a great benefit to the students if it is run well. "People learn by going through the experience of finding something out" (Ruenzel, 1996, p.35). Teachers have to be willing to change their teaching practices. Without this willingness to change, teaching for understanding will not be effective. "Teachers must recognize that good mathematics teaching often involves students moving around the classroom or school building, talking, arguing, and, generally, making more noise than math classes of the past" (Dickey, 1997, p.6).

It is also important in this system to acknowledge all students and levels of understanding. According to Talbert and McLaughlin (1993), it is possible for the middle level

students to be forgotten. Teachers work with the higher-level students on challenging them and spend time with the lower-level students, attempting to explain the material. The middle-level students can be left to take care of themselves and to facilitate their own learning. Teachers must be cognizant of all students in the class. This can be challenging, especially when trying to meet the separate levels of understanding among the students.

Staff development is extremely important in this regard. It is important for the teachers to have the support of the administration in developing a curriculum that does meet the needs of all students. Unfortunately, due to placement and basic skills tests, the curriculum is often set up to teach to the test (Talbert & McLaughlin, 1993). This encourages a more hurried approach to covering the necessary curriculum, rather than taking time to enrich the students' learning. According to Talbert and McLaughlin (1993), changing the pace of instruction will create greater learning as students will have more time to develop an in-depth knowledge of the material.

Constraints on teaching practices do not benefit the student. The best teachers are those who have a strong support system in their district as well as from professional organizations that they belong to (Talbert & McLaughlin, 1993). Teachers who are given time to learn new teaching practices will likely be the most effective teachers. Teachers must also be willing to utilize new and improved ways of teaching Mathematics (Ruenzel, 1996). "By considering the changing views of how people learn mathematics, new teachers must be challenged to understand the necessity for new models of teaching" (Artzt, 1999, p.11). "Educational leaders should provide ongoing staff development related to review and selection of new curriculum resources appropriate for the broader, more diverse audience of students" (Dickey, 1997, p. 6). The time and money spent on teacher education will improve the level of teaching that takes

place. Leadership can also encourage teachers to document the effectiveness of the new techniques that they adopt (Dickey, 1997).

Mathematics Instruction in Block Scheduling

After reviewing block scheduling and Mathematics instruction as separate issues, it is important to review the research on how block scheduling affects Mathematics instruction. As was evidenced in the research on block scheduling, the results of the research are varied. This section will review the points addressed in the research on block scheduling relating to Mathematics instruction.

A study was completed by Wronkovich, Hess, and Robinson researching Mathematics outcomes in block scheduling. According to Wronkovich, Hess, and Robinson (1997), the central question of the value of block scheduling for Mathematics instruction is still unresolved. This study listed concerns for teachers and students alike. A paramount concern for teachers was covering all of the material. "Often, math teachers are less than supportive of the move to a block schedule, fearing the math curriculum will not fit well into longer time blocks" (Kramer, 1997, p.18). "Comparing math classrooms in these schools to ones they had observed operating under a traditional schedule, they noted that under a block schedule math teachers frequently used up more instructional time to cover the same content" (Kramer, 1997, p.32). The classes were intensified to cover all of the material, and this fast pace was of concern to the students as well. According to Kramer (1997), teachers are concerned about covering two complete lessons in one class period. Some instructors are finding it necessary to cover three major concepts per day, which is too much information for the students to absorb (Adams & Salvaterra, 1997/98). It

is very difficult to cover this much material as well as taking the time to ensure that students are comprehending the lessons.

"Block mathematics is an ideal format for obtaining more credits in mathematics, but the block format does little for mathematics achievement and conceptual understanding" (Glass, 1999, p.2). Teachers have found that they do not have enough time to cover all of the material in block scheduling. "Teachers seem to be rushed to get the material covered that is 'suppose' to be covered. It is hard to keep up sometimes especially in math or science" (Veal & Flinders, 2001, p.23). According to Wronkovich, Hess, and Robinson (1997), this fast pace is adequate for some students, but others lack the skills to absorb that quantity of material in a shorter period of time. Lower functioning students show much more frustration due to the increase of time spent on a subject like Mathematics (Adams & Salvaterra, 1997/98).

Furthermore, holding the students attention presents additional concern. "No one can listen to a 90-minute lecture or practice math for an hour and a half without losing focus and interest" (Thomas, 2001, p.76). Teachers have found a need in reducing the amount of lecturing and trying to incorporate three activities per class period (Kramer, 1997). "It is also generally accepted that 'lecturing' is not an appropriate substitute for more effective instructional methods, but the lack of skills, facilities, support, and sufficient class time often inhibits the use of other approaches" (Durkin, 2002, p.2). "Other classes, such as mathematics or social studies, require that the teacher enlist hands-on activities to make the block work well. The teachers must plan a variety of activities within the block period to keep students' minds from wandering" (Thomas, 2001, p.76). Block scheduling offers longer classes, affording teachers the opportunity to utilize some of these more effective and creative teaching strategies. This creativeness in attempting to

keep the students' interest will ultimately take more time from the learning process. According to Wronkovich, Hess, and Robinson (1997), students found math lessons under block scheduling to be more appealing, but the data suggests they may not be learning as much or have mastered the information as well as they should.

Another matter is the extended gaps between courses. According to Kramer (1997), students can take one course in the fall semester and not take the next course until the following fall. This might necessitate the teachers having to devote more class time to review, taking time away from the new material. There is no documentation from research that this gap is truly a problem (Dickey, 1997). It does, however, remain a constant concern with teachers.

One benefit with block scheduling is that students are able to retake classes that they have failed in a shorter period of time. According to Kramer (1997), students are able to catch up to their classmates by retaking the class the next semester. By allowing students to retake a course within the same year, the student should still remember what was learned in the first class, hopefully increasing the ability to succeed the second time.

It is important to remember that some students take longer to learn than others. Block scheduling can be a difficult forum in which to learn for these students. Rettig and Canady (1998) stated that Mathematics courses are very demanding and students can fall behind quickly. As these courses build on themselves, students that do fall behind are unable to comprehend the more advanced concepts taught later in the course. According to Glass (1999), the traditional scheduling format seems more appropriate for understanding and retention of Mathematics. Mathematics teachers polled in Texas asked that Mathematics classes only be offered under a traditional schedule (Manzo, 1997). Mathematics standards stipulate that one hour of

Mathematics instruction should occur each day for all students (Durkin, 2002). This gives students time to learn and comprehend the lessons.

As was stated previously, the literature varies in its support for block scheduling in relation to Mathematics instruction. Data collected stated that most teachers felt that the advantages outweighed the disadvantages in block scheduling (Gruber & Onwuegbuzie, 2001). Results of their investigation, however, showed that block scheduling appeared to have a slight negative effect on academic performance. Another study found that Algebra I scores were significantly higher for students on the traditional schedule as opposed to those on the block schedule (Lawrence & McPherson, 2000). Glass (1999), however, stated that results are unresolved whether block scheduling is better or worse for Mathematics instruction, stating that studies have been inconsistent. Some studies report gains, some report no differences, and some report losses in comparing block scheduling students with traditional students.

In reviewing Mathematics scores, most research stated that scores are lower in block scheduling. The scores of students under traditional scheduling were significantly higher than those students being taught under block scheduling (Glass, 1999). These same results were cited in a study by Gruber and Onwuegbuzie (2001). Through investigating numerous studies, data showed that traditional scheduling students achieved higher mean scores than students under block scheduling (Kramer, 1997).

Besides reviewing the literature on student success rates, it is important to look at the views of teachers and their success under the block scheduling system. According to Kramer (1997), Mathematics teachers have had mixed views regarding block scheduling. In one study surveying teachers from all disciplines, a majority of teachers preferred block scheduling, but

Mathematics instructors disagreed. Some teachers feel that students need daily instruction in Mathematics, and block scheduling does not seem to afford this option (Khazzaka, 1997/98). Given a choice, the Mathematics teachers stated that they would rather work in a traditional scheduling format. This research indicated a general concern that Mathematics teachers have in teaching in a block scheduling format. Previously, it has been determined that the traditional lecturing format is not effective in block scheduling. This means that the teachers are challenged by facing the need to change the way that they teach. According to Dickey (1997), the teachers' willingness to involve students more and lecture less is necessary in making learning in block scheduling effective.

What is most critical beyond the teacher's willingness to change is the support they receive from the administration. According to Dickey (1997), in order for the switch to block scheduling to be effective, adequate planning time and staff development addressing new techniques is paramount. "As with other organizational changes, when considering the shift from traditional to block scheduling, much planning and preparation must be done" (Wilson & Stokes, 1999a, p.36). "Educational leaders should provide meaningful, ongoing staff development opportunities that assist teachers in developing new teaching methods proven effective with today's students" (Dickey, 1997, p.6). "A math teacher in Colorado emphasized the importance of finding other schools to use as models when moving to a block schedule" (Kramer, 1997, p.33).

Mathematics teachers have a more difficult time changing their teaching methods than teachers in other subjects (Kramer, 1997). Mathematics is a critical course in that each class builds upon the previous course and the information is vital to student success. Math teachers

must adjust teaching strategies to account for higher expectations for Mathematics success (Dickey, 1997). Teachers need the time and support to be able to adopt new methods. "It is critical that schools moving to a block schedule provide sufficient support for teachers—particularly math teachers—to adopt teaching methods appropriate to the longer time blocks" (Kramer, 1997, p.33). With the skills and support, teachers can be effective in a block scheduling format.

Another critical component is to restructure the Mathematics curriculum. "Among the math teachers who were satisfied with the change to a block schedule, the overwhelming majority were at schools that had adjusted the curriculum" (Kramer, 1997, p.36). For block scheduling to be most effective with Mathematics instruction, the Mathematics curriculum may need to be changed to cover less topics in more depth and to reduce redundancy (Kramer, 1997). "Those teachers who seemed to have changed and modified the curriculum the most tended to have more energy, knowledge of pedagogy, content knowledge, and commitment to students" (Veal & Flinders, 2001, p.30). "Educational leaders should review carefully the type and content of tests used to assess mathematics achievement and determine if the tests are aligned with your curriculum goals" (Dickey, 1997, p.8). One recommendation is to extend the Mathematics courses to one year to accommodate all types of learners (Rettig & Canady, 1998). This would allow sufficient time for all students to comprehend the information. According to Kramer (1997), schools that have been more successful in making the change to block scheduling have adjusted the Mathematics curriculum. "Thus, the argument that block scheduling would allow more students to take more mathematics classes is true, the impact of the increased learning is not justified due to the lack of time and curriculum in the mathematics classes due to the shorter

class hours in the block format" (Glass, 1999, p.12). Since students in block scheduling are able to take more courses, more Mathematics courses could be offered in the sequence with less material being covered in each course. This would slow down the pace of instruction and increase comprehension. Likewise, expanding the curriculum to include new materials, such as computer-delivered instructional resources and video resources can be beneficial (Dickey, 1997). "With such a wealth of materials and new delivery systems, teachers can plan courses by using materials from different sources to enhance the students' experience" (Dickey, 1997, p.6).

Although the results of research on Mathematics instruction in block scheduling are not conclusive one way or another, one fact does remain steady throughout the literature. Regardless of the scheduling system, the support of the administration for the teachers and staff development seems paramount. With the necessary support and time for planning in learning new teaching strategies, it appears that teachers can be effective in any type of scheduling system.

CHAPTER THREE

SUMMARY, CRITICAL ANALYSIS, AND RECOMMENDATIONS

Summary

This study has reviewed the pros and cons of block scheduling as well as the value of block scheduling to Mathematics instruction. Points were addressed throughout the literature in support and contrast of block scheduling. The main points of this review will be addressed. First, the main benefit of block scheduling was listed as teachers having less administrative duties that detract from available instruction time. Since they were taking attendance less and having smaller classes, they were spending less time on administrative duties and spending that time teaching. There has also been a decrease in discipline problems at schools utilizing block scheduling as the interaction time among students has decreased.

Due to having fewer classes, the teachers are able to spend more time with a smaller group of students. This enables them to get to know the students better as they have more interaction and can provide more individual attention. This is a direct benefit for the teachers and students. A concern with this, however, is that as soon as the teacher becomes familiar with the student, the semester is over and they are no longer together.

A benefit for the students is that they are only responsible for three to four classes per day in a block scheduling system. They are able to devote their full attention to a smaller number of classes. Also, due to the fact that eight classes can be taken per year, the block scheduling system allows for more courses to be taken by each student. Students can take more electives and also have time available in the event that they should need to retake a course.

The pace of the courses is much faster under block scheduling. Teachers are responsible for instructing students on two lessons per class period rather than one. It is difficult to keep the students' attention for this length of time and to ensure that the lessons are comprehended. Some teachers are concerned that this is too much information to cover in a short period of time. They must give students time to comprehend the information, and this pace can be too fast for some students. This concern is definitely raised in relation to Mathematics instruction. Inasmuch as this subject builds on itself, if a student falls behind in the beginning, they will have difficulty catching up and will not comprehend the concepts further into the course. Finally, if students are absent, they have more work to complete to catch up to the other students. A week long absence would mean missing two weeks worth of material. This presents a disastrous situation for a student who might already be struggling.

Another concern raised with block scheduling is the gap between courses. A student could take a Mathematics course in the fall and not take the next course until the following fall. It is of concern whether the student will still remember the important concepts needed for the next course. Research is inconclusive on whether this gap is a problem for students or not, but is of concern to opponents of block scheduling.

Block scheduling is not without its benefits. Teachers are able to utilize more active teaching strategies. It has been found that lecturing is problematic in the block scheduling system. Teachers must be willing to adapt their teaching styles for block scheduling. They must learn new strategies so that the students' attention can be maintained and active learning can take place. Some teachers have utilized small group work, which seems to be effective. Students are

able to assist each other in the learning process and the teacher can monitor the learning that is taking place.

As stated previously, the research completed thus far is inconclusive regarding the effects of block scheduling on Mathematics instruction. It appears that for every study supporting this system, another piece of literature disputes it. Some suggestions have been made to aid in making Mathematics instruction in block scheduling a success. A beginning step toward this success is to change the Mathematics curriculum. Educators are concerned that Mathematics instruction is very fast paced in a block scheduling format, and many students are unable to handle this pace. An option would be to offer more Mathematics courses and to decrease the amount of information taught in each course. This would give students adequate time to learn the concepts. Due to the ability to take more courses under the block scheduling system, this would be a possibility.

The most important recommendation throughout all of the literature is the requirement for unconditional support from the administration, along with staff development. Teachers can only be as strong as the support they receive. They must be given time to observe a block scheduling system, as well as time for planning so that they can learn the alternative strategies necessary to succeed. Without staff development, Mathematics instruction under block scheduling will have much difficulty succeeding. Mathematics instruction can be successful in a block scheduling system with the appropriate instruction and support for the teachers.

Critical Analysis

Throughout the research completed on this project, it appeared evident that nothing is conclusive in regards to the success of block scheduling in relation to Mathematics instruction.

Much research has been completed on this subject, but there is no strong evidence on one side of the issue or the other. It appears that proponents and opponents alike would have no difficulty finding support for their cause, limiting their research to one side of the issue. This has made the research for this project extremely challenging. It is difficult to discern the information when there is no clear-cut evidence supporting or disputing the claims.

Even though the research did not lend itself to a positive or negative response in relation to the topic, one issue remains clear throughout the literature. Any type of scheduling system can succeed or fail dependent on the teacher, the strategies that they utilize to teach, and the support they have from the administration. Teachers who are very willing to try anything and work hard on developing new lesson plans and strategies will likely be successful in any type of scheduling system, with the support of the administration. Teachers who are strongly set in their styles of teaching and unwilling to change can likewise have difficulty in any teaching situation. It doesn't appear that the scheduling system is as important as the type of support and knowledge each teacher has. With the right support, any system can succeed.

Recommendations

Based on a critical analysis of the literature review, this researcher advises that school districts follow these recommendations when implementing a block scheduling system.

1. Faculty, parents, and students should be involved in the initial stages of the planning process, prior to implementation of a block scheduling system. Research indicates that the scheduling transition is much smoother when support is received by all interested parties from the start. Community meetings should be held to inform parents and residents of how block scheduling

will benefit learning. These meetings should be approached as a way to sell the plan to the community.

2. Teachers and faculty members should be given the opportunity to visit other schools using a similar block scheduling system. Furthermore, it is beneficial to have regular meetings with other schools on the same system.

3. Staff development and training should be offered prior to implementation as well as continuing throughout the entire process. Teachers should be instructed on time and classroom management as well as interactive instructional strategies that are best utilized in a block scheduling environment. In-service meetings can be offered specifically aimed at training teachers on different techniques that can be utilized in regards to classroom management. Training is especially important for new teachers.

4. A faculty survey should be completed to determine specific training needs.

5. Student and parent surveys should be completed for feedback and to gauge the success of the block scheduling system.

6. Time should be devoted at staff meetings to review and discuss best practices in teaching and time organization. Teachers are afforded the opportunity to share concerns and problems, as well as successes.

7. A mentoring system should be arranged for the instructors. Peer coaching can promote active learning based on the needs of teachers. Teachers should also be allotted time to observe the classrooms of experiences teachers. Also, mentors need to observe the classrooms of new teachers for essential feedback.

8. An evaluation system should be developed and utilized in the first few years of block scheduling to determine the success of the new system and to evaluate whether modifications should be made to improve the system.

9. Benchmarks should be developed by the school to be used as a monitoring tool to determine if block scheduling is resulting in student success. Schools should review the grades of students for the first five years following implementation of the block scheduling system to see whether grades are improving or declining with the new schedule.

10. The pace of Mathematics instruction should be changed to facilitate in-depth learning for the students, giving them more time to comprehend the material.

11. Mathematics grades should be continuously monitored to determine whether there is a change following implementation of the block scheduling system. The school needs to be open to system modifications if it is found to be detrimental to the success of Mathematics instruction.

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