2019

White Paper: The Effects of Block Scheduling and Traditional Scheduling on High School Student Achievement

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Since the National Education Commission on Time and Learning published *Prisoners of Time* in 1994, which criticized the use of traditional schedules and asked readers to think differently about class scheduling in schools, the use of block scheduling in high schools has increased. However, there is still a lack of well-implemented and well-designed studies that explore the effects of block scheduling on high school student achievement. The purpose of this white paper is to investigate the effects of block and traditional scheduling on high school student achievement, as measured by grade-point averages and standardized test scores, by analyzing ten research studies. Although teachers and students have generally positive views of block scheduling, no consistent effects of block scheduling, as compared to traditional scheduling, on high school student achievement were found. Recommendations are made for future research.

Keywords: block schedule, block scheduling, student achievement, traditional schedule, traditional scheduling, GPA, high school

Introduction

In high schools across the United States, many students experience a traditional class schedule, with 45- to 60-minute classes that meet at the same hour every school day. Thus, students take all of their different classes every day. However, in 1994, the U.S. Department of Education published *Prisoners of Time,* a report from the National Education Commission on Time and Learning that criticized the traditional schedule and challenged readers to think differently about class scheduling in high schools (e.g., Sadowski, 1998). Using a tone of urgency, the National Education Commission on Time and Learning (1994) stated, "American students must have more time for learning. The six-hour, 180-day school year should be relegated to museums, an exhibit from our education past" (p. 8). They also argued that American students spent less time on core subjects than students in France, Japan, and Germany, which they believed was a "a recipe for a kind of slow-motion social suicide" (National Education Commission on Time and Learning, 1994, p. 8). The report further argued that "a new standard for an educated citizenry is required, a standard suited to the 21st century, not the 19th or the 20th" (National Education Commission on Time and Learning, 1994, p. 7). Based on this report, the U.S. Department of Education recommended that schools follow a block-scheduled model to improve student performance. Accordingly, the use of block scheduling in high schools has increased: 37.4% of public high schools used blocked scheduling by 2008 (National Center for Education Statistics, 2009). Yet the call for more time for learning continues to be echoed by education reformers today who argue that, in order to meet the needs of 21st century schools and students, more class time allowing for more learning opportunities for students to enhance their skills is needed (e.g., Liebtag & Ryerse, 2017). This white paper will investigate the differences between the effects of block scheduling and traditional scheduling on high school student achievement, measured by scores on standardized tests and grade point averages (GPAs).

Block Schedules

In a high school following a block schedule, students attend fewer classes per day. Instead of 45- to 60-minute classes, block-scheduled classes are longer, averaging 90 minutes per class. In studies that have observed the transition to a different schedule in schools, the most observed transition has been from a

traditional schedule to a block schedule. Schools have created a variety of different block schedule models (Rettig, 2019). The studies discussed in this white paper used a 4x4 block schedule, A/B block schedule, and a hybrid block schedule.

4x4 Block Schedule

In a 4x4 block schedule, a school year is divided into two semesters. During the first semester, students take only 4 courses every day at the same hour. During the second semester, students take a different set of 4 courses every day at the same hour. Each class is 90 minutes (Rettig, 2019).

Example:

Semester 1	Semester 2
Block 1- Geometry	Block 1- Art I
Block 2-Physics	Block 2- Spanish I
Block 3-English I	Block 3- Health
Block 4- World Studies	Block 4- Geography

A/B Block Schedule

In an A/B block schedule, students take three or four 90- to 120-minute courses on alternating days throughout the school year. Thus, students take 6 to 8 courses per year. If students take 8 courses throughout the year, they will take 4 courses per day – but different courses on alternating days. For example, on Monday, Day A, students take 4 courses. On Tuesday, Day B, students take 4 different courses. The A and B days continue to alternate throughout the year (Rettig, 2019).

Example:

Monday Day A	Tuesday Day B	Wednesday Day A	Thursday Day B	Friday Day A	Monday Day B
1- Geometry	1-Art	1- Geometry	1-Art	1- Geometry	1-Art
2-Physics	2-Spanish I	2-Physics	2-Spanish I	2-Physics	2-Spanish I
3-English I	3-Health	3-English I	3-Health	3-English I	3-Health
4-World Studies	4- Geography	4-World Studies	4- Geography	4-World Studies	4- Geography

Hybrid Block Schedule

A hybrid block schedule combines aspects of both traditional and block schedules. For example, one hybrid schedule combines aspects of a traditional schedule and a 4x4 block schedule. In this model, students get to decide whether to replace the time of 2 traditional courses with 1 block course. In addition, students get to decide whether to take all block courses or all traditional courses. Each block course is 90 minutes long, while each traditional course is 45 minutes long. If students take a block course, they only take that course for one semester, following the 4x4 model. If they choose a traditional course, they take that course throughout the year (Hess, Wronkovich, & Robinson, 1999).

Example:

Block 1	Traditional Period 1
	Traditional Period 2
Block 2	Traditional Period 3
	Traditional Period 4
Block 3	Traditional Period 5
	Traditional Period 6
Block 4	Traditional Period 7
	Traditional Period 8

Perspectives on Block Schedules

Teachers' Perspectives

Zepeda and Stewart (2006) analyzed 14 studies to learn more about teachers' instructional perceptions of shifting to block scheduling. They found that teachers and faculty members had generally positive perspectives on the change from a traditional schedule to a block schedule. On a block schedule, teachers reported that they could use more in-class activities (rather than just teacher-oriented lectures), expand lessons, work with individual students to build stronger relationships, have a lighter student load, add more student-independent projects, and that there were fewer interruptions (e.g., Evans, Tokarczyk, Rice, & McCray, 2002; Small, 2000). However, teachers also reported

having difficulties teaching a block-scheduled classroom. For example, they noted that when students missed a class, it was harder for those students to catch up with the work and content time (Evans et al., 2002; Small, 2000). They also expressed difficulty in creating enough activities for the allotted class time (Evans et al., 2002; Small, 2000). Although the positive aspects of blocked schedules appear to outweigh the negative aspects in this analysis of teachers' perspectives, it is important to note that some of the studies included in Zepeda and Stewart (2006) did not include details about how the data were gathered, which limits interpretability of the findings. In addition, the sample size of several of the studies was small, which can affect results and lead to biases.

Students' Perspective

Zepeda and Stewart (2006) also analyzed six studies concerning students' perceptions of block scheduling. They reported that, like teachers, students had generally positive perspectives on the change from a traditional to a block schedule. For example, students reported that they had more opportunities to take different courses, more time to work with other students on activities, fewer classes to focus on (in comparison to a traditional schedule), more interactions with their teachers, and more time to ask questions during class time (Zepeda & Stewart, 2006). However, students also reported that teachers had difficulties providing enough activities for class (consistent with what teachers themselves noted). With inadequate activities to fill class time, students reported experiencing greater boredom in blocked schedule classes (e.g., Evans et al., 2002; Gruber & Onwuegbuzie, 2001; Small, 2000). Although some of the studies did not provide details about the types of surveys used with students (Zepeda & Stewart, 2006), the analysis does seem to relatively reliably indicate both positive and negative aspects of a block schedule from the student perspective.

Research Studies on Blocked Schedules

Quality of Evidence

The Every Student Succeeds Act (ESSA) is a U.S. law passed in 2015 that guides Kindergarten to 12th grade public school policy (e.g., U.S. Department of Education, 2016). The ESSA encourages schools to use evidence-based interventions, strategies, and approaches that will help increase student achievement. To assist schools in distinguishing between strong and weak evidence, guidance identifies tiers, or levels, of evidence (U.S. Department of Education, 2016).

Tier 1- Strong Evidence. Tier 1 evidence is strong evidence that is supported by at least one or more well-implemented and well-designed randomized control experimental studies (U.S. Department of Education, 2016). A randomized control experimental study, also called a randomized control trial (RCT), is a study design in which participants are randomly assigned into either a control group or an experimental group. The goal is that all variables will be the same in both groups, with the only difference between groups being the variable that is being studied. In terms of investigating the effects of block scheduling, an RCT would involve a large group of students who were randomly assigned to either an experimental group with block scheduling or a control group with no block scheduling. This design allows for interpretation in terms of a cause and effect relationship (e.g., Himmelfarb Health Sciences Library, 2018). Given that random assignment of either large numbers of students or whole schools to a traditional or blocked schedule is impractical (and, likely, impossible, as every school already uses some schedule and, thus, transitions would need to occur both ways), it is unlikely that there would ever be strong evidence regarding the effects of block scheduling on student achievement.

Tier 2- Moderate Evidence. Tier 2 evidence is moderate evidence that is supported by at least one or more well-implemented and well-designed quasi-experimental studies (U.S. Department of Education,

2016). A quasi-experimental study is similar to a randomized control trial; however, participants in this type of study are not randomly assigned (e.g., Sousa, Driessnack, & Mendes, 2007).

Tier 3- Promising Evidence. Tier 3 evidence is promising evidence that is supported by at least one or more well-implemented and well-designed correlational studies with statistical control for selection bias (U.S. Department of Education, 2016). A correlational study is a non-experimental study that tries to document associations between two variables using statistical analysis. However, if correlation is found, it does not mean that causation is present (Statistics Solution, 2019).

Tier 4- Demonstrates a Rationale. Tier 4 interventions, strategies, and approaches are not supported by tier 1, 2, or 3 evidence from research studies, but are instead supported by a well-designed logic model or theory (U.S. Department of Education, 2016). This is the weakest type of evidence in the ESSA scheme.

The Current Study

Following, 10 research studies are analyzed in order to investigate the effects of block scheduling and traditional scheduling on high school student achievement, as measured by GPAs or standardized test scores. It was difficult to find well-designed and well-implemented research studies on this topic; most of the studies considered provided only tier 3 or 4 evidence. Moreover, given the practicalities of conducting this kind of research, nine of the studies used an ex-post facto design. Ex-post facto, or after-the-fact, research involves investigations of the topic after the event has occurred (Nunes Silva, 2010). Thus, researchers cannot ensure that the occurring event is well-designed because they have no opportunity for influence or interreference. There are many limitations in education that can create difficulties for producing high quality research. In this case, comparing students before and after a schedule-change transition (as in the studies reviewed here) is more feasible than random assignment to a block or traditional schedule.

Review of Research Studies

Effects on GPA. Four studies measured student achievement by using GPA. One ex-post facto study of a high school in Georgia used the GPA data of 146 students who followed the traditional schedule during their four years and graduated in 1997 as a sort of control group (Gruber & Onwuegbuzie, 2001). The whole school switched to a 4x4 block schedule in the school year following their graduation (1997-1998). The researchers compared the group of 146 students with 115 students who graduated in 2000; that is, students who had had one year of traditional scheduling and three years of block scheduling. There was no significant difference in the average GPAs of the two groups: The traditional schedule group had a mean GPA of 84.21, and the block schedule group had a mean GPA of 84.77. However, because of the limitations of this study, it is difficult to conclude that scheduling has no effect on GPA. For example, the authors did not report on the courses that the schools offered, which courses students took, or on the way that GPA was calculated. In addition, the block scheduling group did have one year of traditional scheduling, which means that they experienced the transition during their high school career, both of which could have affected the results.

Indeed, findings from three other studies suggest that block scheduling may have positive effects on GPA. In one ex-post facto study, Nichols (2005) gathered GPA data from English and Language Arts courses in five different high schools in an urban district to investigate the effects of the transition from a traditional schedule to a block schedule over several years. Each of the five schools converted to block scheduling in a different year; three high schools switched from traditional to 4x4 block scheduling while the other two transitioned from traditional to A/B block scheduling. Overall, Nichols (2005) reported a trend of students' GPAs slightly increasing over time, which might suggest positive effects of blocked scheduling. However, average GPA at two of the schools showed no increase.

In the other three schools, GPA increased during the years of traditional scheduling and then continued to increase after the change to block scheduling. Without a causal design, the author cannot prove that block scheduling was the reason that GPAs rose (especially given the pattern of evidence that GPA was already rising during the traditional scheduling years).

Trenta and Newman (2002) also reported positive effects of block scheduling on high school GPA, for students in a small Midwest high school. The high school transitioned to 4x4 block scheduling in 1998. The authors considered GPA data from 500 students who graduated in 1997, 2000, 2001, and 2002, comparing the graduating class who had 4 years of traditional scheduling with the graduating classes who had at least 2 years of block scheduling. The class with four years of traditional scheduling had a mean GPA of 2.8 while the classes who had three years of block scheduling had a mean GPA of 3.0, a small but significant difference. The conclusion of positive effects of block, as compared to traditional, scheduling on GPA is limited, however, as the researchers did not discuss how the students were performing before the transition to block scheduling, no graduating class provided data of a full high school career on block scheduling, using only one class as a control group and many as a comparison is problematic, and the data are correlational, and therefore cannot be used to argue causation.

Hess et al. (1999), in another ex-post facto study, also concluded that block scheduling improved student GPAs. The researchers studied a school in Ohio that changed from a traditional schedule to a hybrid schedule that consisted of both 4x4 and traditional scheduling. As noted above, in this scheme, if students decided to take a traditional scheduled class, they would take that class for one year, as compared to a semester-long block schedule class; this difference in time-length could have affected the results. In addition, teachers decided the type of scheduled course they wanted to teach and were given training 3 years prior to the study on how to teach a block-scheduled class if that is what they chose. The authors reported that block scheduled students had higher GPAs than traditional scheduled students. However, no tables with data were shown and effect sizes were not mentioned, and the authors could not be reached. Other limitations temper the conclusion. For example, students were told that the results would be used to evaluate the effectiveness of the types of schedules, which could have led to bias. In addition, there was no control for what courses students actually took; for example, not all sophomores took biology and geometry, which could have affected GPAs. Finally, given the combination of both traditional and 4x4 periods, it is difficult to pinpoint the differences when both variables are present in a student's schedule.

Effects on Standardized Test Scores. The nine studies considered here reported different results concerning the effects of block and traditional schedules on high school standardized test scores. Different studies used different types of standardized tests, which affects comparability due to the different types of questions and difficulty levels. In addition, all nine were ex-post facto studies, which, as noted above, do not allow researchers to influence the event that the study is analyzing.

Two research studies found that block scheduling had positive effects on standardized test scores. Evans et al. (2002) studied three high schools in different districts that transitioned to a 4x4 block schedule from a traditional schedule at the beginning of the 1997-1998 school year. They compared students who followed a traditional schedule throughout their four years in high school to students who followed a block schedule for three years in terms of scores on The Scholastic Aptitude Test (SAT) and the High School Proficiency Test (HSPT). All 11^{th} graders at the three high schools took both of these tests (the SAT for college admissions and the HSPT as a requirement for graduation in New Jersey). In comparing the block schedule group to the traditional schedule group, the authors found that the average combined SAT score increased by 14% and that 6% more students passed

the HSPT exam. However, the actual scores were not reported, which makes it difficult to know whether these effects were large or meaningful.

Lewis, Dugan, Winokur, and Cobb (2005) also reported positive effects across three high schools in a district, by looking at one high school with A/B block scheduling, one high school with 4x4 block scheduling, and one high school with traditional scheduling. Scores from 355 students were analyzed in this study. Each student attended 1 of the 3 high schools (grades 10-12) that each had one of the three schedules, attended a junior high school (grades 7-9) with the same type of schedule, completed a reading/and or mathematics standardized Levels test in the 9th grade, and completed the reading and/or math ACT assessment in the 11th grade (Lewis et al., 2005). The authors found that block schedule students performed just as well or slightly better than traditional schedule students. They also found that the 4x4 block schedule provided students with an advantage over students in both traditional and A/B schedules. With the exception of reading scores in 4x4 scheduling (d = 1.93), the effect sizes for reading and math scores in 4x4 and A/B schedules, as compared to scores for students using a traditional schedule, were smaller than .2. Thus, these were small but significant effects in favor of block scheduling. The different natures of the Levels and ACT tests (the former voluntary and low-stakes, the latter high-stakes) and the lack of details regarding the high schools, the junior high schools, the teachers, the classes provided, and the lessons taught, as well as the small sample size, are potential limitations of this study.

In contrast, four studies found that block scheduling had negative effects on standardized test scores. Gruber and Onwuegbuzie (2001), who considered effects of block scheduling on GPA (see above), also considered effects on scores on the Georgia High School Graduation Test (GHSGT), which tests Writing, Language Arts, Mathematics, Science, and Social Studies during the junior year. In their ex-post facto study, they found no statistically significant difference in scores on the Writing portion of the GHSGT between the two groups. However, traditional-schedule students had statistically significantly higher scores on the Language Arts (d =. 34), Mathematics (d = .52), Social Studies (d = .51), and Science (d = .46) portions. They concluded that block scheduling does not have a positive effect on academic achievement. Although these effect sizes are large for education, the study is limited in that a change in attendance policy occurred at the same time as the transition to a block schedule, there are few details about the implementation of the block schedule, and the size of the sample is small.

However, Lawrence and McPherson (2000) came to a similar conclusion in their study of 4,759 low-income high school students in two high schools in North Carolina that transitioned from a traditional schedule to a block schedule. Students took the North Carolina End-of-Course Assessment in Algebra I, Biology, English I, and U.S. History. Test scores from the 1992-93 and 1993-94 school years represented the traditional schedule and scores from the 1994-95 and 1995-96 years represented block scheduling. Mean scores for traditional schedule students were: 54.20 in Algebra, 39 in Biology, 47.47 in English I, and 47.46 in U.S. History. Mean scores for block schedule students were: 48.22 in Algebra, 34.78 in Biology, 38.67 in English I, and 39.68 in U.S. History. Scores were statistically significantly higher on each of the four tests for the traditional schedule students. Although the authors did not provide effect sizes, my calculations indicate d = .15 for Biology scores, d = .22 for Algebra I, d = .29 for English I, and d = .24 for U.S. History. The number of students tested per subject and per method of scheduling varied from 1029 to 412. No information was provided regarding similarity of the classes across high schools, teachers, block schedule format, or the type of block scheduling.

Terrazas, Slate, and Achilles (2003) also reported effects suggesting benefits of traditional over block scheduling on standardized test scores. In their ex-post facto study, they considered 399 high schools on a traditional schedule (T) and 398 high schools on a

block schedule (B) in Texas during the 1999-2000 school year (Terrazas et al., 2003). Students took standardized tests including the Texas state exam (TASS) that had math, reading, and writing; end of course tests in Algebra I, Biology, English II, and U.S. History; the SAT I; and the ACT. The authors found that students at schools with the traditional schedule outperformed students with a block schedule on almost all of the standardized tests. The scores were the following: TASS math (T: 89.00, B: 87.58), TASS reading (T: 91.61, B: 90.75), TASS writing (T: 92.97, B: 91.36), Biology (T: 83.05, B: 80.80), and English II (T: 79.25, B: 78.36). the SAT I (T: 970.71, B: 959.40), and the ACT (T: 19.95, B: 19.74). The exceptions were the Algebra 1 end-of-course exam, for which students in block schedule outperformed students in traditional schedule (T: 30.93; B: 32.59) and the U.S. History end-of-course exam (T: 69.46, B: 69.78). The authors stated that the effect sizes of these differences were small. The authors did not provide any details about the schools using traditional schedule vs. block schedule, teachers, students, or the type of block scheduling.

The fourth study to report negative effects on achievement associated with block scheduling was a correlational study with 1,449 students based on 1988-1994 data from the National Education Longitudinal Study (NELS) (Rice, Croninger, & Roellke, 2002). Tenth graders were tested in mathematics using cognitive standardized tests made by the authors of the NELS. However, the NELS did not collect data regarding scheduling. Thus, the authors used mathematical empirical models to figure out which students had block-scheduled courses based on mathematics teachers' reports of how many minutes were allocated for the most recent class session. The authors found that enrollment in block-scheduled 10th grade mathematics classes had a significant but negative impact on student achievement scores. Although the authors did not report the actual test scores, they did state that the effect sizes related to scheduling were small. In addition to the lack of actual data, limitations of this study include the lack of information about the high schools, students, teachers, and types of mathematical courses. The calculations to determine whether students took block-scheduled courses based on teacher reports may have led to inaccuracies. In addition, only 60 students followed a block schedule based on these calculations, which is a small sample size.

Finally, three studies reported mixed results regarding differential effects of traditional and block scheduling on standardized test scores. Arnold (2002), in an ex-post facto study in Virginia, looked at student achievement within 51 schools that were on seven-period A/B block schedules and 104 schools that were on seven-period traditional schedules. The outcome measure was scores on the 1991-1996 11th grade Tests of Achievement and Proficiency (TAP), which measure student progress on reading comprehension, mathematics, written expression, using sources of information, social studies, and science (Arnold, 2002). The mean TAP score for traditional schedule students was 192.33, and for block schedule was 191.75. Although this was a significant difference in favor of traditional scheduling, the effect size was very small; thus, the author concluded that there were essentially no differences in the effects of block scheduling and traditional scheduling on TAP performance. Hess et al. (1999) reported no statistically significant difference in scores on tests of Geometry and World history in terms of scheduling but found statistical differences that favored block scheduling in English and Biology. The limitations of this study were noted above. In addition to GPA (see above), Trenta and Newman (2002) considered 9th grade Ohio Proficiency Test (OPT) scores and ACT scores. The class with four years of traditional scheduling had a higher mean OPT score than the classes that had three years of block scheduling. However, these students took the OPT in the spring of their 8th grade – before experiencing any high school scheduling. In addition, the class with four years of traditional scheduling had a mean ACT score of 21, whereas the classes that had three years of block scheduling had a mean ACT score of 20. The authors found no significant relationship between the number

of years in block scheduling and ACT scores. Limitations of this study are also noted above.

Conclusion

Based on the findings of these 10 research studies, it is difficult to determine the effects of block and traditional scheduling on high school student achievement as measured by GPA and standardized test scores. A guarded conclusion would be that block scheduling is not associated with marked improvements in academic performance, regardless of whether those are measured by GPA or standardized test scores. While there is positive evidence, the effects are not large, and there is also negative and mixed evidence; thus, there appears to be little support from this research for changing to a block schedule in order to improve high school student achievement.

As noted above, because most of the studies were ex-post facto, the researchers were not able to control for different variables that could have affected the results. In addition, there are inconsistencies when measuring student achievement by using GPA and different standardized tests. The way GPAs are calculated can vary among different schools. Teachers can also have different grading systems across subjects. When using standardized test scores, it is important to know the type of standardized tests given as well as the importance of the tests in order to avoid bias. For the most part, the studies analyzed in this white paper did not fully report about the population of the students, the population of the teachers, the performances of the schools, the support given to teachers during their transition to block scheduling, and the courses offered at schools. In addition, some studies did not mention the type of block schedule used.

In order to have more reliable research findings, and thus better evidence upon which to base decisions about high school scheduling, future studies should:

- Avoid using an ex-post facto design due to the lack of variable control
- Avoid using inconsistent standardized test scores and GPA as ways of measuring student achievement
- Investigate whether providing teacher support for transitioning of schedules leads to better results (e.g., Hess et al., 1999)
- Avoid using a hybrid model schedule to investigate the effects of traditional and block schedules due to confounding variables
- Increase the time-span of studies to see whether effects are gradual and maintained over time
- Stay consistent with the type of block schedule used
- Investigate whether teachers change their curriculum when transitioning to block scheduling and what activities or models are used
- Investigate whether block scheduling works differently for different subject areas
- Investigate whether certain activities in a block scheduled classroom have a greater effect on student achievement

In addition, based on the issues that teachers and students face, if a school does transition to block scheduling, it is recommended that:

- Teachers are supported in tackling the issue of not having enough activities for their classes
- Students are provided with adequate support and resources when they are absent in order to help them catch up with the content missed

Overall, the conclusion of this analysis is that more research on both the academic effects of block and traditional schedules and the perspectives of students and teachers on block and traditional schedules needs to be done in order to be able to make strongly evidence-based decisions regarding high school scheduling.

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