



A Survey of High School Block Scheduling Versus Traditional Scheduling

Technical Report

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Overview

During the past decade, various leaders of the Knox County Schools (KCS) have expressed interest in studying the KCS high school scheduling structure. This analysis attempts to combine recent research, available KCS data, and legacy information from the 2013 Parthenon Smarter School Spending analysis as a basis for surveying the strengths and weaknesses of block schedules in comparison to traditional seven-period schedules.

4-by-4 Block		Traditional Schedule
Semester 1	Semester 2	Full-year
English	US History	English
Algebra II	Chemistry	US History
Lunch		Algebra II
Physical Education	Art	Art
Health	Anatomy	Lunch
		Physical Education
		Chemistry
		Health

The findings of this study did not provide compelling evidence that either a block schedule or a traditional schedule is inherently better than the other. The decision to utilize a specific schedule structure should be dictated by which structure aligns better with the strategic goals of the district.

Methodology

The literature review used research databases that were accessible by the KCS department of Research, Evaluation, and Assessment (REA). These included the Institute of Education Sciences' (IES) What Works Clearinghouse, archived publications of the American Education Research Association (AERA), the JSTOR digital library, and following citation chains in relevant research via Google Scholar. The literature review only included research that was published between 2000 and 2019.

Transcript data for school year 2015-2016 (SY1516) through school year 2018-2019 (SY1819) were obtained through the ASPEN database and the EMIS data warehouse. Student demographic data was likewise extracted from the ASPEN database. All ASPEN data was extracted using Microsoft SQL Server Management Studio v 18.1.

Survey data was collected in the spring semester of SY1819 through the KCS SurveyMonkey interface. The ability to respond to the survey was predicated on a respondent having access to an internet connection.

Ordinal logistic regression was used to model performance on Advanced Placement (AP) assessments. The regression was completed using R version 3.6.1 running on R Studio

version 1.2.1335 using the polr function of the MASS package (version 7.3-51.4). AP test data was sourced from College Board electronic files. Students were exact-matched to scheduled data based on a unique combination of student name, school, and birthdate. The probability of a student scoring a 3 on the AP exam was extracted from the KCS Tennessee Value Added Assessment System (TVAAS) archives. These probabilities were derived only from Tennessee state test data. Data was only modeled for teachers whose students had AP test results in both semesters. Teachers were only included in the model if the balance between the number of tested students in each semester was within 15%. As a result, only outcomes from AP Language, United States History and Psychology could be included in the modeling. The final regression model is below.

$$\text{logit}(P(Y \leq j)) = \beta_{0j} + \beta_{AP \text{ Probability of } 3} * x_{1j} + \beta_{AP \text{ exam}} * x_{2j} + \beta_{\text{semester}} * x_{3j}$$

Results: Literature Review

The literature review indicates that the research conducted in the last two decades comparing block and traditional scheduling is sparse and the quality of most of the research is such that it fails to meet the IES requirements for inclusion in the What Works Clearinghouse. Many studies lack direct counterfactuals, and none of the referenced studies utilized the gold standard in current education research: the randomized control trial. Findings on some outcomes were inconsistent from study-to-study, which may indicate that the effects these studies attributed to block scheduling may actually have arisen from other sources (Zepeda, 2006). We therefore sought to document the consensus strengths and weaknesses of block and traditional schedules.

One strength associated with block scheduling is related to course availability for both high performing and low performing students. The four-by-four block should facilitate the progress of struggling students towards graduation (Rettig, 2001). A student who fails a course required for graduation can retake the course in the next semester in a block schedule, whereas a student in a traditional schedule will not be able to retake the failed course until the next academic year (Wilson, 2000). Additionally, under the block schedule format, students have access to more classes when compared to traditional seven-period days. This should allow students to schedule a greater number of courses per year, facilitate exposure to non-core academic content, and accelerate access to more advanced courses. (Evans, 2002) As a result of increasing the number of advanced courses available to students and increasing the number of opportunities struggling students can retake courses, block scheduling has been generally found to have significant positive impacts on grade point averages and graduation rates (Zepeda, 2006; Trenta, 2002).

The increased access to classes comes with a cost. The total number of instructional hours available in an academic year is fixed regardless of the schedule structure. Adding additional

periods through a block schedule means that each class is shortened when compared to the traditional seven-period day (Dexter, 2006). The same class content needs to be delivered on an accelerated basis or content needs to be omitted to span the curriculum under the block schedule (Veal, 2001). The impacts of student absences can become magnified, as missing a single day of class will result in the student missing larger chunks of the curriculum when compared to the traditional schedule (Wilson, 2000). The block schedule can also limit student access to courses with specific prerequisites that are not offered each semester (Zelkowski, 2010). Finally, while the block schedules increase within-class continuity due to longer classes, it can create within-content area fragmentation since students may not be exposed to content throughout the entire year. Research indicates that fragmentation may have negative consequences on student academic attainment in mathematics (Zelkowski, 2010) and science (Dexter, 2006).

Block scheduling tends to be popular with teachers, parents, and students when compared to the traditional schedule (Evans, 2002). The teaching workforce tends to be more satisfied with the block schedule because block schedules tend to increase the amount of teacher release time during the instructional day, increase student learning opportunities through longer classes, decrease the number of classroom transitions, and decrease grading loads (Rikard, 2005). Teachers generally feel that the block schedule creates opportunities for peer-to-peer learning, Socratic discussions, in-depth laboratory study, and project-based learning. “One of the cited aims of block scheduling is to allow greater time for student-oriented activities in order to promote in-depth discussion and increased interaction. In line with this, teachers are expected to use a variety of teaching strategies and engage in learning-oriented activities.” (Dickson, 2010, pg. 11). These learning-oriented activities tend to have positive effects on student engagement in the classroom (Wilson, 2000). The increased continual instructional time with students has been cited as a factor to increase teacher-student rapport and to facilitate the diagnosis of student strengths and weaknesses (Veal, 2002). Students and parents seem to hold generally positive views of the block schedule for similar reasons (Rettig, 2001). The block schedule offers more time to move beyond less engaging lecture-based instruction and decreases in student homework loads (Pettus, 2001). Less unstructured transition time in the hallways and deeper student-teacher relationships can theoretically decrease discipline incidents (Stader, 2001; Rettig, 2001). Studies that correlate schedules to absenteeism tend to note that student absenteeism is lower with block schedules (Trenta, 2002). Biesinger (2008) documented increased feelings of student self-efficacy and increased opportunities to learn from other students at block schools.

The attributes that make block scheduling popular may also contribute to tension with other strategic goals. The block schedule offers teachers more individual planning time, but leads to fewer opportunities for common planning time within content areas (Jenkins, 2002). Decreases in teacher utilization efficiency (the number of minutes per day a teacher is

scheduled with students and/or the number of courses per day a teacher can lead) associated with block scheduling also leads to increased fragmentation of classes and increase staff costs (Zelkowski, 2010; Lare, 2002). Although one of the theoretical benefits of the block schedule involves the utilization of continuous blocks of time for new learning activities, some studies find that some teachers use the increased block time for little more than allowing students to complete homework (Ratcliff, 2014; Muir 2005). These findings are consistent with those of Jenkins (2002), which suggests that the instructional approaches a teacher uses in their classroom are no different between block and traditional schedules.

Of primary interest to the KCS leadership that commissioned this study is the impact of block scheduling on standardized test results. One large meta-study found that few high-quality studies on the impact of schedule on academic achievement exist and that the evidence across subjects is not convincing (Dickson, 2006). Most of the studies that have been conducted in the last two decades do not involve high school students or are focused on a different outcome variable (Biesinger 2008).

One study of Georgia high school students found that students utilizing a traditional schedule had higher state test results in Language Arts, Math, Science, and Social Studies (when compared to block scheduled students), but no difference in writing scores (Gruber, 2001). The study, however, fails to use a robust methodology to deal with dependent observations and ignores a policy change that may influence the findings. Other research found similar positive impacts on standardized testing for students instructed under traditional schedules (Lawrence, 2000). A study of a small Ohio high school found no discernable correlation between ACT scores and schedule but the study did not control for any observable covariates and was only looking for significant correlations between the treatment condition and the outcome variables (Trenta, 2002). Zelkowski (2019) found that the results on national standardized math tests (NAEP, NELS88) were significantly lower for students that did not have year-round access to math curriculum, which is common for students scheduled with block. Other studies reported inconsistent results where advanced placement (AP) test scores increased, decreased, or remained constant depending on the subject matter (Zepeda, 2006). Mixed results were also found in a ten-year longitudinal study of a Georgia school system on state-test results (Reams, 2009). Ratcliff (2014) hypothesizes that a lack of difference in student achievement between block and traditional schedules is related to how teachers utilize the time in the block. Per Ratcliff (2014, pg. 3), “Educational research should focus on teacher and student interactions and how teachers structure the learning environment to encourage these interactions. Research which focuses on how an average student or average teacher functions on an isolated task fails to consider the importance of understanding how teachers and students interact in the learning environment and the impact that this interaction has on both the quality of instruction and the amount of learning that takes place.” Block scheduling will not likely impact student outcomes unless the

promises of the schedule (longer class time, fewer transitions, increased learning opportunities, etc.) are appropriately harnessed to allow teachers to deliver content differently (Gullat, 2006).

Results: Knox County Trends

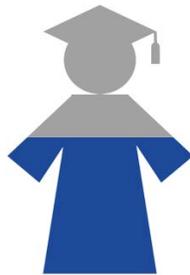
The Knox County Schools moved from a six-period instructional day to a block schedule format during the 1995-1996 school year ([SY9596], after a small scale pilot in SY9495), but current KCS scheduling practices do not adhere to one specific model. The majority of KCS courses are scheduled in the four-by-four block structure where students are generally scheduled for four 90-minute classes per semester. Two KCS high schools (West High and L&N STEM Academy) deploy an alternating A/B block schedule, in which four 90-minute classes are rotated between odd and even days. However, many schedules are hybridized into a non-traditional block in which at least one 90-minute block is divided into two year-long 45-minute classes.

4-by-4 Block		A/B Block		Non-Traditional Block	
Semester 1	Semester 2	Odd Day	Even Day	Semester 1	Semester 2
English	US History	English	US History	English	
				Chemistry	
Algebra II	Chemistry	Algebra II	Chemistry	Physical Education	Art
Lunch		Lunch		Lunch	
Physical Education	Art	Physical Education	Art	US History	
				Algebra II	
Health	Anatomy	Health	Anatomy	Health	Anatomy

Hybrid schedules seem to be used to some extent at every KCS high school. Approximately 15% of all high school credits earned at four-by-four block schools by the class of 2018-2019 (CO1819) were year-long, either explicitly in the schedule or through deliberate course pairings (i.e. Algebra I A and Algebra I B, or Honors Biology II and AP Biology). There were three schools in which at least one in every five credits earned were done so through a year-long course (Karns High: 25%, Fulton High: 21% and Career Magnet Academy: 20%). The lowest utilization of year-long courses among the CO1819 in a 4-by-4 block school was at Farragut High School (8%). There seems to be little consistency in how courses are considered for year-long hybridization between high schools.

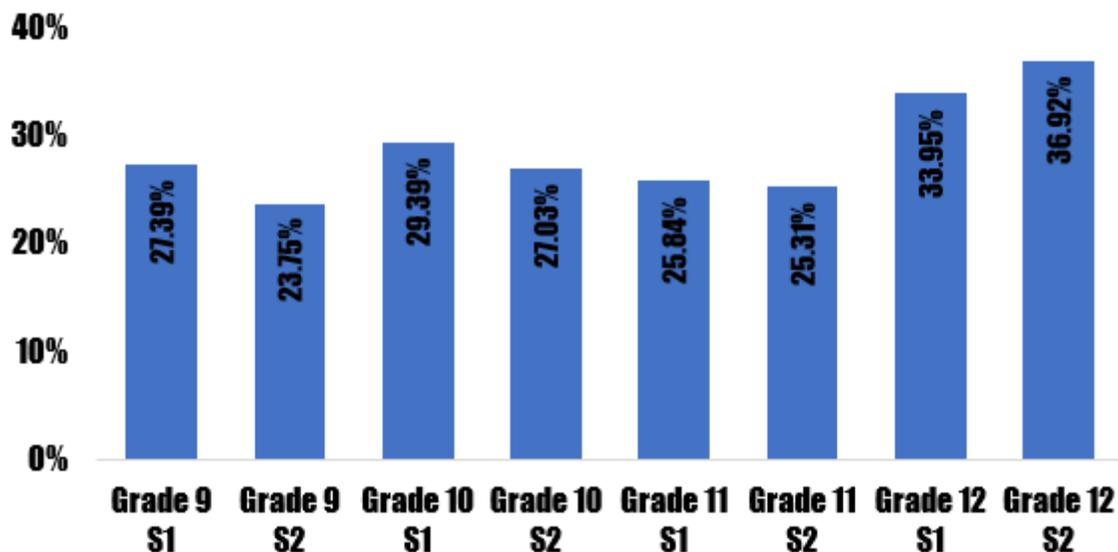
Data from Knox County transcripts support the assertion that the block schedule format increases the number of high school credits students are earning. Among the CO1819, 3,554 students had four years of credits earned within the KCS system. The average number of credits earned by the second semester of their senior year was 32 (with an average of 33

attempted). Knox County requires that students earn a minimum of 28 credits in order to graduate. Among the students who only attended a four-by-four block school, 76% had earned 28 credits by the end of the first semester of their senior year. Additionally, 57% of the C01819 earned at least 1 AP, International Baccalaureate (IB), or dual enrollment credit before graduating. This is congruent with the findings in the research that block scheduling increases opportunities for advanced coursework in addition to credit attainment for struggling students.



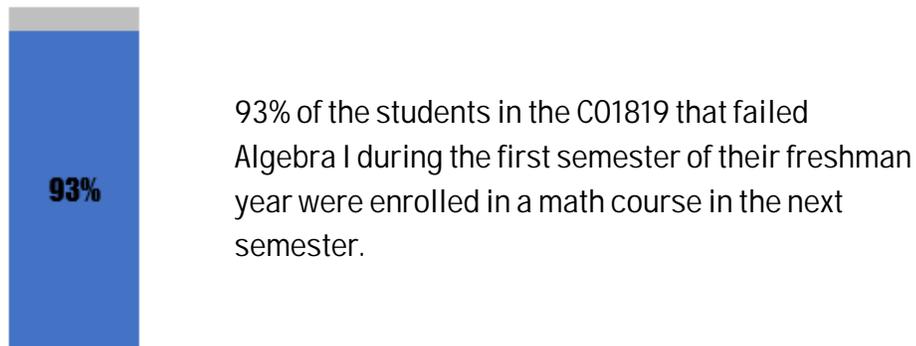
57% of 4-year KCS students in the C01819 earned at least 1 AP, IB, or dual enrollment credit before graduating.

One of the documented benefits of block scheduling is increased access to courses outside of the traditional academic core of English, Math, Science, Social Studies, and World Languages. C01819 data suggested that more than a third of the courses in which students were enrolled during their senior year were vocational, technology, fine arts, or enrichment (i.e. work-based learning, leadership, peer tutoring, etc.) courses. The data provides evidence to suggest that the additional courses offered by the block structure allowed students to enroll in courses outside of the traditional academic core.

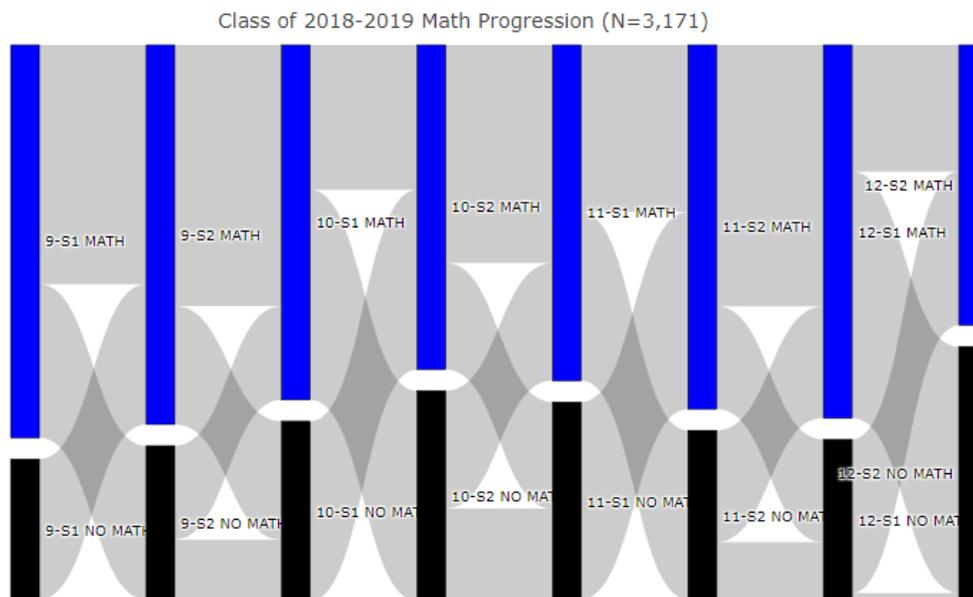


More than a third of courses in which students are enrolled during their senior year fall outside of the traditional academic core courses.

Analysis of the transcript data from SY1516 through SY1819 show that 435 students earned a failing grade in Algebra I and returned to a KCS school in the next term. The majority of these students were upperclassmen who had failed Algebra I at least one previous time and were subsequently enrolled in a recovery credit program. Among the C01819, 93% of students who failed Algebra I during the first semester of their freshman year were enrolled in a math course the following semester. The KCS data supports the findings of the available research that block scheduling allows for students who fail to immediately retake a course and get back on track to graduate. The 90.2% graduation rate among the C01819 also supports these findings.



KCS transcript data provides evidence of within-content fragmentation. Analysis of the KCS C01819 schedule indicates that 35% of regular education students who attended KCS for four years were not scheduled in an English class for two consecutive semesters (i.e. semester 1 and semester 2 during the same academic year or semester 2 of the previous academic year and semester 1 of the next academic year) and 40% of the same students were not scheduled in a math class for two consecutive semesters. These numbers are considerably lower if we consider two consecutive blocks within the same academic year (i.e. semester 1 and semester 2 during the same academic year: 2.2% in English and 2.4% in Math). The visualization below illustrates the enrollment patterns in Math, by semester, among the general education students who constituted the C01819. Blue bands provide visual cues to the proportion of the students enrolled in a mathematics course within a given semester, and the black bands represent the proportion of students who were not enrolled in a math course in a given semester. Students at A/B block schools were included in this visualization.



Fragmentation of math content across years is evident in the KCS transcript data.

Results of regression modeling indicate that this fragmentation can lead to adverse impacts on the students enrolled in Advanced Placement courses. College Board administers AP tests only in the spring of a given academic year. However, 28% of KCS AP courses are completed in the fall semester when the AP test will not be taken until the end of the spring semester. Ordered logistic regression models suggest that students who were enrolled in an AP course in the fall semester but took the AP exam in the spring semester were 3.5 times less likely to score as well as their peers after controlling for previous test performance, AP test content area, and teacher.

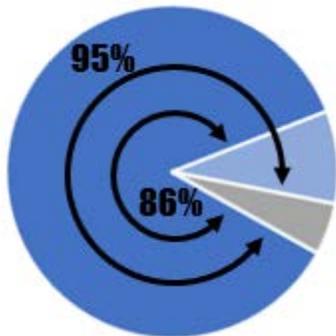


Students who took an AP course in the first semester were 3.5 times LESS likely to score as well as their peers who took a year-long or second semester AP course, after controlling for other variables.

Some schools have created full-year AP sequences that require prerequisite classes to stretch the AP and supporting curriculum to a full academic year. For example, some schools have created full-year AP science tracks by combining Honors Biology II with AP Biology or Honors Chemistry II with AP Chemistry. This full-year sequencing ensures that students will

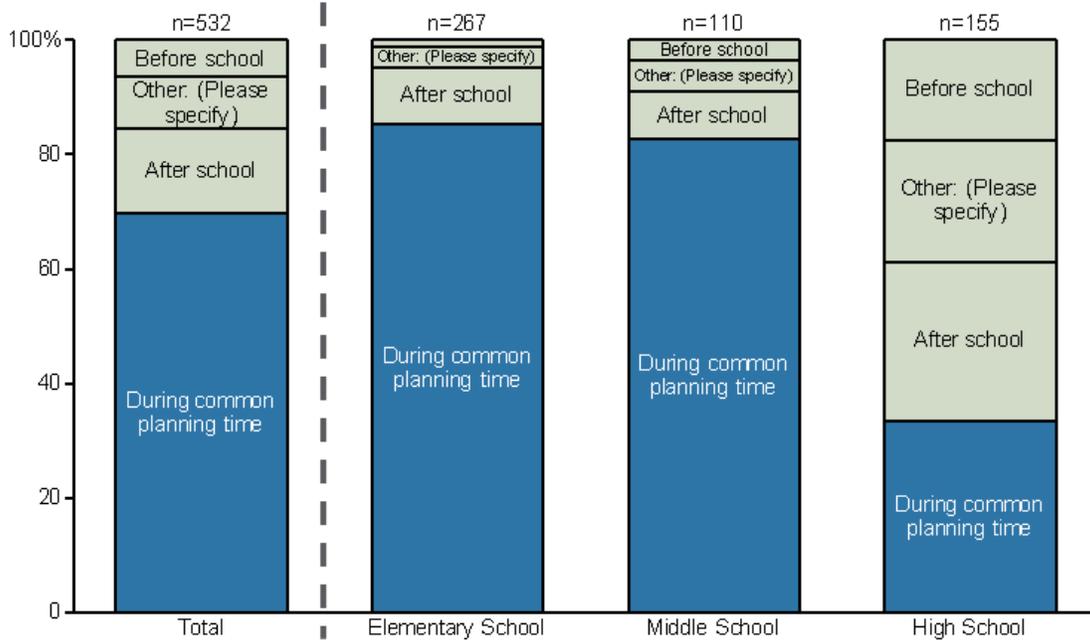
take the AP test during the same term in which they are enrolled in the class. However, when a student chooses to enter this AP course track, they are committing a quarter of their available schedule to a single class, which negates some of the benefits of the block schedule structure.

Despite possible issues with schedule fragmentation, data from the parent survey provides evidence to support that block scheduling is generally well received. Eight-one percent (81%) of the parents of high school students who responded to the survey agreed or strongly agreed that the homework demands placed on their student were reasonable. Eight-one percent (81%) of the respondents also agreed or strongly agreed that their student had appropriate access to the classes they wanted to take. The agree/strongly agree response ratio increased to 95% when respondents were asked if their student had appropriate access to classes they needed to take to graduate. Finally, 86% of respondents agreed or strongly agreed that their student's class schedule supported their student's academic needs. Results from the survey could not be compared to an appropriate counterfactual since there are no KCS high schools implementing a traditional schedule, nor was survey data available about parent perceptions prior to the implementation of block scheduling. However, the response patterns align with the consensus in the literature regarding high satisfaction with block scheduling.



86% of survey respondents agreed or strongly agreed that their student's schedule supported their academic needs and 95% of survey respondents agreed or strongly agreed that students had access to the courses they needed to graduate.

Survey data collected by Parthenon in 2013 showed that approximately 30% of high school teachers were able to meet during a common planning time to participate in school-level professional learning communities (PLCs). Approximately 85% of elementary and middle school teachers reported PLC meetings during common planning time. In order to execute the PLC structure, high school teachers were much more likely to report attending PLC meetings either before or after school. This evidence suggests that the implementation of block scheduling in the KCS high schools is a barrier to common planning time during the school day.



Parthenon’s analysis of classroom observation scripting notes suggested that there was considerable between-classroom variation into how class time was devoted to different classroom activities. Some scripted observations at some schools show a large amount of class time devoted to in-class homework, silent reading, and worksheet completion. These findings are consistent with the literature which indicates that the block schedule structure can allow for a variety of high-value learning activities, but the schedule itself does not guarantee that these will occur.

In 2013, the Parthenon group estimated the investment required by the district to invest in block scheduling was 7 million USD. The current KCS investment in block scheduling is closer to 7.8 million because of raises in teacher base pay between SY1213 and SY1920. The increase in cost associated with the block schedule is derived from lower teacher utilization rates when compared to a traditional seven-period schedule. A traditional schedule requires fewer staff members per school and decreases the amount of non-instructional time included in contract time.

Conclusions & Considerations

Any decision to implement a specific scheduling strategy should focus on how well that strategy aligns with the overall priorities of the school system. According to the preponderance of evidence available to the KCS Research, Evaluation, and Assessment team, both block and traditional schedules have specific strengths.

	<u>Block</u>	<u>Traditional</u>
Access to courses	✓	

Both the literature and the results from an analysis of KCS transcript data support the assertion that block scheduling generally allows increased access to courses for most students when compared to a seven-period traditional schedule. The additional class slot provides opportunities for students to take additional advanced courses, retake classes that they have failed, and earn more credits. This likely contributes to higher graduation rates and grade point averages for students who are enrolled in schools utilizing block schedules. However, in some circumstances, the block scheduling structure constrains student access to classes. At some schools, courses have been sequenced with prerequisites (such as Honors Biology II as a prerequisite for AP Biology) so that a student entering a subject area has a quarter of their schedule devoted to one course sequence. Students in related arts courses (band, chorus, etc.) find themselves similarly constrained. This may limit access to other classes, especially those that are only offered once a semester. Despite these constraints, the vast majority of KCS parents who chose to respond via survey were satisfied that their student had access to the courses they wanted to take and the courses they needed to graduate.

	<u>Block</u>	<u>Traditional</u>
Less compressed class pacing		✓

The access to courses is increased under the block schedule, but the number of instructional hours in a given course is increased in a seven-period tradition schedule. Less time in class for block schedule means accelerated pacing through the curriculum, which may be challenging for struggling students. Many KCS schools have recognized this and have offered year-long versions of courses to help meet the needs of struggling students (for example Algebra I A and Algebra I B as replacements for Algebra I or “skinny” courses offered as part of a non-traditional block schedule). However, in doing so, the benefits related to increased course access in the block schedule may be somewhat negated.

	<u>Block</u>	<u>Traditional</u>
Financial cost of implementation		✓

The financial cost of implementing a traditional seven-period schedule is lower than that of an eight-period block schedule. The elimination of one class period a day and the higher instructional utilization rate of the traditional schedule requires fewer staff members. The current analysis of KCS staffing data suggests that close to eight million dollars could be saved by switching from the current block schedule to a traditional seven-period schedule. However, such a decision would have non-financial costs associated with staff and student morale. Additionally, short-term costs would likely be incurred through training and intensive professional development to effectively transition to a different schedule.

	<u>Block</u>	<u>Traditional</u>
Increased test scores	-	-

The results of block scheduling on student achievement appear to be best summed up by the findings of Holley, in which data from thirty-one studies suggest that test scores are increased under block schedules, thirty studies suggest that test score gains are increased under traditional schedules, and 16 studies could not detect any differences in student outcome related to schedules (Holley, 2017). Dickson noted that generally, research does not broadly indicate that participating in block schedules would produce negative outcomes for students, but the findings on positive effects are not strong enough to recommend the block schedule as superior to the traditional schedule (Dickson, 2006). Such assertions could not be tested within Knox County because adequate counterfactuals do not currently exist.

It should be noted that the current KCS high school scheduling structure does not fit a single schedule definition. Many schools are using different non-traditional schedules in an attempt to harness the strengths of both schedules. This local flexibility in scheduling allows schools to mold the schedule to best meet the school’s strategic goal. However, a sizable portion of Knox County students are mobile and attend more than one school in a given year. Non-uniformity in the schedules between schools likely creates barriers to seamless transitions from one school to another. KCS may benefit from choosing specific schedule structures for specific core classes to ease students’ transitions.

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