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The unique relationship between research and practice is appreciated, recognizing the mutual benefit to those educators who conduct the research and seek out evidence-based practice and those educators whose responsibility it is to carry out the mission of school districts in the education of children.

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Editorial

A Consideration of Time in Our COVID-19 Moment

Ken Mitchell, EdD
Editor
AASA Journal of Scholarship and Practice

"*Time* isn't the main thing. It's the *only* thing."
- Miles Davis

In this moment of COVID-19, we are in the liminal space—a time between what was and what will be. Such a moment, indeed a luxury for a few, especially those currently immune from the physical and economic wrath of the virus, provides an opportunity to ruminate on the precious commodity of time.

Time is expensive. Legislative leaders at all levels balk when asked to pay for more of it. In spite of evidence that school systems are run with great efficiency, their leaders are once again asked to do more with less money but the same amount of time.

Time is squandered. Educators, in a Sisyphean struggle to maximize efficiency, are often frustrated by the speed at which the days, weeks, and months pass as time for teaching and learning evaporates. There are also conflicts within our institutions about who "owns" the limited allotments within the school day and year or how much time it will take to transform ideas into feasible and sustainable solutions.

Underestimating time's boundaries and pace is a human foible to which educational leaders are not immune. Like rodeo riders on a wild bull, we struggle to tame it, knowing that we will inevitably lose control. The summer 2020 volume of the *AASA Journal of Scholarship and Practice* is focused on such a struggle.

The *JSP* editorial staff had planned to examine the theme of time in schools in the Summer 2020 issue prior to the onset of the pandemic. Events, however, are requiring us to reconsider how time management is being reshaped by demands beyond our control. As this issue goes to print, school district leaders across the US are being faced with the challenge of developing "Recovery Plan Timelines" with inadequate information to help ensure student safety and insufficient resources of both money and time.

The issue's authors examine how we use time to prepare for and respond to disasters. They study how scheduling matters, not just for seeking efficiency but in its alignment with student needs, as related to length of day and start times, and how time dependent decisions can be done with fiscal prudence while ensuring student needs are met.

The articles in this issue were written before the COVID-19 crisis. Yet they still provide a lens for a consideration of the challenges that we will face as we move out of the liminal space across the threshold of what might be to what is. One of our first challenges will be contending with a "COVID slide," an unprecedented loss of instructional time that is being exacerbated by a digital divide that is further illuminating the vast equity gaps within and across America's school systems.

For decades we have been aware of the summer slump that occurs when students in lower socioeconomic communities fall behind their more affluent peers by at least one month as a result of the loss of learning during the summer break from school.

The loss of instructional time, no matter how advanced or robust a school system's digital learning platform and training, will be difficult to reclaim. What ways can we restructure how we use learning time in schools—throughout the year—to mitigate a devastating setback to the intellectual and social development of our children?

This work will need to be conducted during a period of economic downturn. As in any crisis, there will be opportunists offering cost-saving solutions or efficiency driven-approaches—likely digitally-driven and market-oriented—to make up for what has been lost and provide a new "vision" of how to deliver instruction.

We must be wary. Some systems will move quickly with a priority on efficiency while others will proceed prudently with an investment of time and research-based practices. As a superintendent, when presenting to the community the importance of expensive preventative measures— academic programs or facility maintenance—I would warn: Spend more now or a lot more later. This admonition pertained not just to fiscal expenditures, but to the investment of time, which may turn out to be the only thing we have.

Research Article

Preparing for the Next Natural Disaster: Understanding How Hurricanes Affect Educators and Schooling

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Abstract

After a natural disaster hits, schools often focus on a recovery plan that meets the immediate needs of students. Unfortunately, teachers' needs are not prioritized, leaving them to address personal and professional disruptions on their own. We studied 20 school districts in North Carolina and Texas that were affected by Hurricanes Matthew and Harvey. We found that after a hurricane, teachers' experience disruptions in the form of personal damage, damages at school, disruption to the school calendar, and disruption to the class routine. We recommend supporting teachers' physical, social-emotional, and classroom needs to assist and expedite recovery.

Key words

school recovery, educator support, natural disasters, and resiliency

School leaders often face challenging problems; however, sometimes a true crisis arises that test even the most effective leadership. Considering in advance what crises may occur within a district and how school leaders would respond to these crises is a crucial part of being a prepared leader (Bishop et al., 2015; Pepper et al., 2010).

Among these reflections are natural disasters. Every area is at risk for some form of natural disaster and the number of major disasters declarations in the United States has increased since 1953 (Vroman, 2019). Although it is possible to predict the type of natural disaster most likely to affect a given community, the timing and severity of any given disaster is unpredictable. Therefore, it is important for school leadership to consider their plans for recovery after a natural disaster.

This planning should account for what we know about how disasters affect schools. Unfortunately, although the disruption following natural disasters is widespread, few research studies show how they affect schools. Some studies document negative effects on student achievement (Dogan-Ates, 2010; Lamb et al., 2013; Pane et al., 2008; Shannon et al., 1994; Vogel & Vernberg, 1993). Other studies document mental health effects, especially increases in students' symptoms of posttraumatic stress (Baggerly & Ferretti, 2008; Hansel et al., 2013; La Greca et al., 2010, 2013; Lonigan et al., 1994; Neria et al., 2008; Osofsky et al., 2009; Russoniello et al., 2002; Shannon et al., 1994). However, prior research largely focuses on the effect of disasters on students and rarely explores the effect on school personnel.

If we believe in the importance of teachers for student learning, then it is vital to consider how teachers' experiences of a disaster and the recovery mediate the effects of the storm on student learning. How are teachers affected by a disaster in both their personal and professional life? How can recovery efforts be improved to better help teachers? In order to answer these questions, our research team interviewed teachers, principals, and district superintendents who had been affected by one of the most expensive forms of natural disaster: a hurricane.

This paper studies the impact of and recovery from Hurricane Matthew in North Carolina and Hurricane Harvey in Texas. In this paper, we first provided a brief overview of the two hurricanes and described the interview data. Next, we presented our analysis of how teachers are affected by hurricanes through four forms of disruption: personal damage, damages at school, disruption to the school calendar, and disruption to the class routine. Finally, we conclude with analysis on three areas where districts can support teachers' recovery after a hurricane: physical needs, social-emotional needs, and classroom needs.

The Storms

Hurricane Matthew

On October 8, 2016 Hurricane Matthew arrived at the North Carolina coast. Matthew affected five states, and severely impacted Haiti, the Dominica Republic, and Saint Vincent. The National Oceanic and Atmospheric Administration (NOAA, 2017) estimated that the hurricane created around $10 billion in damage nationally, which resulted in the destruction of over 100,000 structures. Due to the destruction, the US Federal agencies evacuated approximately 3 million residents from coastal communities. Roughly 3.5 million people between Virginia and Florida were without power, while a quarter of those were located in North Carolina.

Hurricane Harvey

Hurricane Harvey made landfall in Texas on August 25, 2017 and would later severely impact seven states across the US. According

to the NOAA (2018), Hurricane Harvey estimated around $125 billion in damage, resulting as the second costliest US tropical cyclone in history. In addition to being costly, Harvey released the most tropical cyclone rainfall in history. With at least 103 deaths, Harvey is also the deadliest storm to hit Texas since 1919. To combat the destruction of the storm, the Federal Emergency Management Agency (FEMA) constructed roughly 4,500 trailers and mobile homes, and about 700 emergency shelters to support residents impacted by the storm (FEMA, 2018).

Methods

This study uses data collected between March and October 2018 from 20 districts that were impacted by recent hurricanes. Specifically, we recruited participants from 10 districts in North Carolina that were affected by Hurricane Matthew in October 2016, and 10 districts in Texas that were affected by Hurricane Harvey in August 2017. For each district, data was collected through one interview with a superintendent-level administrator; three interviews with principals representing the elementary, middle, and high school levels; and one to three group interviews with teachers and other school personnel (Table 1).

Two key differences in data collection between North Carolina and Texas are relevant for this study. First, North Carolina interviews were conducted 18 months after Hurricane Matthew while Texas interviews were six to 13 months after Hurricane Harvey. Second, in North Carolina each participating district had one teacher group interview while in Texas there was one teacher group interview at each participating school.

Table 1

Data Collected From 20 Districts across North Carolina and Texas

	North Carolina	Texas	Total
School personnel group interviews	10	24	34
School-level interviews	29	25	54
District-level interviews	10	10	20
State-level interviews	2	5	7
Total interviews	51	64	115

District Characteristics

Districts were recruited from areas that were heavily damaged by hurricanes, based on data about when schools reopened after the storm and FEMA estimates of damage. The research team recruited districts to represent the demographics of those affected by the storm in each state. In North Carolina, where the hurricane primarily affected the rural coastline, all but one of the participating districts are classified as rural (Table 2). In Texas, where the hurricane affected rural areas, as well as

Houston's urban and suburban areas, the participating districts include rural, towns, and suburban areas. North Carolina generally has one school district in each county, while Texas often has multiple school districts within a county. This led to North Carolina having a greater average number of schools in each district than Texas. In Texas, slightly less than half of the students enrolled in participating districts were classified as economically disadvantaged, while in North Carolina a majority of students were identified as economically disadvantaged.

Table 2

Descriptive Statistics on Participating North Carolina and Texas School Districts

	North Carolina	**Texas**
Average number of schools in district	24.5	15.3
Range of number of schools	8 to 48	2 to 69
Average number of students	13960.0	13585.1
Range of number of students	2,435 to 34,857	511 to 75,428
Average percent economically disadvantaged	82%	47%
Average percent racial/ethnic minorities	62%	51%
Average per pupil expenditure	$9,031	$9,649

Data Analysis

The research team coded interview transcripts for emergent themes. The initial transcripts were coded to consensus, and later transcripts were coded by individual researchers.

Hurricanes Effects on Teachers

A primary theme to emerge from interview data was that the storm disrupted life. While the literature acknowledges that students are disrupted by natural disasters, it is important to remember that teachers also experience trauma. We highlight four categories of disruptions that affected teachers: personal damage, damages at school, disruption to the school calendar, and disruption to the class routine.

The first category of disruption is personal damage. School personnel reported being personally impacted by damage to their homes, loss of personal items, and relocation from their homes. Teachers who were displaced reported being less focused on their classroom after the hurricane as compared to other years, simply because they were preoccupied with addressing personal needs at home.

The trauma from dealing with the disaster also affected mental health. Teachers and principals reported dealing with post-traumatic stress and depression after the hurricanes ravaged their communities.

A school administrator recalled the ways in which their teacher's ability to focus on work was diminished by the destruction of the storm. The administrator stated:

> *[Teachers are] just tired, stressed. They are trying to work with FEMA, they're trying to get contractors … and they want their house back and that just took priority that takes priority over everything.*

At school, teachers were affected by a variety of operational damages. These disruptions ranged from classrooms with minor flooding to the total loss of school buildings. Respondents reported that teachers also lost personal items stored in their classrooms, including supplies they had individually purchased for their classroom to mementos from throughout their career.

Teachers described a rush after the storm to salvage supplies from their classrooms—deciding what needed to be discarded, what could be saved in long-term storage, and what supplies were most necessary for their curriculum until they returned to their classrooms.

In addition to operational damages, teachers were affected by disruptions to the school calendar. Schools lost instructional time due to school closures, absenteeism, and tardiness. Teachers expressed having great concern for "getting back on track" with coursework. In some instances, educators recalled losing anywhere from two to three weeks of instructional time and momentum.

In areas that experienced heavy damage from the storms, schools were closed for two to six weeks until buildings could be repaired, transportation could be restored, and alternative locations were identified for students to attend classes. This loss of class time meant teachers had less time to cover key content areas required by the state curriculum. One teacher asked:

> *"How are we going to compact all of that material in the time that we have left in this nine weeks to make sure that we teach everything, and cover all the standards. We can't just start where we are today?"*

Another teacher stated:

> *[The storm] got us off our schedule and teachers like to maintain a schedule. We have a pacing guide that we follow … so suddenly, [we] were faced with how can we compact and chunk the material that we missed because the children were out of school?*

Finally, teachers were disrupted by changes to their classroom routine. Many teachers said it was essential to devote time to their students' social-emotional needs when schools reopened. One teacher specified:

> *I think it was difficult for the staff to be dealing with it on a personal level, but at the same time, when they walked in the door at school, everything else was checked at the door, they focused on the students.*

Additionally, some schools that were not damaged by the storm had an influx of students from other schools. Teachers at these schools had to adapt to a shifting roster of students and ensure their lessons were accessible to new students with varying learning levels and unavailable academic records.

Helping Teachers Recover

The personal damages, damages to schools, disruptions to the school calendar, and disruptions to class routine affect students as well as teachers. Our interviews show that

teachers are integral to helping students recover from hurricanes. Although teachers agreed that meeting the needs of students is the first priority following the hurricane, they reported that their needs were sidelined. Respondents emphasized the importance of supporting teachers' physical, social-emotional, and classroom needs throughout their experience of the storm and its aftermath.

Respondents said that districts can provide teachers with resources to address basic physical needs during the recovery efforts. For example, some respondents valued that they continued to be paid while schools were closed immediately after the storm. This reduces worries about financial burden at a time when teachers are at a critical junction for paying bills and contractors.

Similarly, participants expressed the significance of leadership providing flexibility to address personal issues. In the months after the storm, it is important that teachers have flexible time off to address home repairs during the workday.

Respondents said that teachers need social-emotional support following a storm. Supports to address mental health concerns are necessary in the immediate aftermath of the storm and continue to be needed months into the recovery process. Educators also expressed the need to allow their teachers to grieve and mentally recover at their own pace:

> *I think to give the teachers a sense of security and the permission to allow themselves to go through this and have ups and downs, I think just knowing that they were supported in all that they were doing in the sacrifices they were making so that we could provide this for the kids.*

Finally, respondents said that teachers need support in restructuring their curriculum to fit the compressed instructional time following the storm. Some schools attempted to recover lost learning time—using snow days, eliminating in-service, and extending the school day.

However, teachers reported that these attempts at recovering time was not beneficial. For them, the extended time did not significantly impact their instruction and missing the necessary breaks proved to exhaust them further. Instead, teachers wanted guidance about where to resume teaching when schools reopened. Some teachers consolidated the lost learning time by looking at what was missed and skipped units by "trimming the fat" off lessons. Other teachers recalled their curriculum to be "crunched" as compared to previous years. One teacher said:

> *"We just had to cover [the content] quickly and not as thorough as what we'd have covered this year. We made it to the end."*

Teachers turned to peers for support in modifying lessons to address students' social-emotional needs. Multiple teachers said they had increased journal writing or other reflective writing exercises to help students' process feelings about the storm and to open lines of communication.

Some teachers recognized that students learned from their experiences in the storm and tried to relate their content to the general effects of the hurricane. Overall, participants argued that providing resources for teachers following a storm, allows them to focus on meeting the needs of their students and assist school-wide recovery.

Respondents emphasized the importance of supporting teachers' physical, social-emotional, and classroom needs

throughout their experience of the storm and its aftermath. When asked to describe what went well following the storm, an administrator described the unity and collegiality of their peers. The administrator stated:

> *"People came together. A lot of empathy was shown. Teachers opened up their homes for family members … the close-knit community, the transparency of all of us working together."*

Conclusion

In this paper, we analyzed interviews from teachers, principals, and district superintendents who had been affected by hurricanes to better understand the challenges that teachers face after a disaster. We find that hurricanes have a variety of ways of disrupting teachers' lives.

Teachers may experience destruction of property at home and at school, requiring time and finances to repair. The needs of the classroom may shift to address students' social-emotional condition and to compress curriculum into a shortened school calendar. During recovery efforts, teachers take on additional roles as emergency responders.

During these times of crisis, district and school leaders should be prepared to support teachers. Our analysis suggests some key questions that leaders consider when creating crisis management plans:

- How can a district help address teachers' physical needs? Are teachers paid if school is unexpectedly closed? How is this accounted for in the budget? Is there a policy for emergency leave to allow teachers to deal with personal property? When is it enacted?
- How can a district help address teachers' social-emotional needs? What mental health professionals are able to provide services to students and teachers after a crisis? How long would they be able to provide services?
- How can a district help address teachers' curricula needs? How would the curricula be compressed if schools are closed for an extended time? Who would lead this effort? Are there people at the state level or beyond who could advise teachers on revising pacing guides? How are teachers equipped to recognize prior gaps in student learning?
- Is there professional development to help teachers address students' social-emotional needs after a disaster? How could the curriculum be compressed if schools are closed for an extended time? Who would lead this effort? Are there people at the state level or beyond who could advise teachers on adjusting the curriculum?

Every disaster brings unique challenges that will ultimately disrupt schooling. During the recovery process, educators make personal and professional sacrifices to ensure that schools return to normal and that students' needs are fully met.

Although, none of the educators we interviewed disagreed with this emphasis on students, educators expressed feeling left behind in the overall recovery process. We believe that helping teachers recover from a disaster is key to facilitating school-wide recovery.

Author Biographies

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Research Article

Does Start Time at High School Really Matter? Studying the Impact of High School Start Time on Achievement, Attendance, and Graduation Rates of High School Students

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Abstract

This study examined the impact of school start times on student achievement, attendance, and graduation rates for high school students. Data from a purposeful sample of 256 high schools across three regions centers (Region IV, Region V, and Region VI) in southeast Texas for the 2017-2018 school year were analyzed. These 256 high schools were sorted by size (small, medium, and large) based on student enrollment. Additionally, interviews from 15 superintendents provided a unique perspective on the process and implementation of altering high school start times. Findings of this research indicated that delaying school start times had a positive impact on achievement, attendance, and graduation rates. Specific insights are provided in terms of the logistical, practical, and political aspects behind the healthy alignment of school start times and the internal clocks of teenagers.

Key Words

high school start time, achievement, attendance, graduation rates, internal clocks of teenagers, superintendent's perspectives

Introduction

Excessive sleep loss among teenagers has prevailed in school settings for years (Jacob & Rockoff, 2011). Adolescents average less than eight hours of sleep a night; while their bodies require 9-10 hours per night (Martin, Gaudreault, Perron, & Laberge, 2016). According to the American Physiological Association (APA, 2014), the optimal amount of sleep for adolescents is approximately 9.25 hours per night, yet only 29% of 12-14-year-olds and 10% of 15-17-year-olds are reportedly getting enough sleep.

In the teenage years, sleep patterns drastically transformed with after school activities, homework, and social media feeds. Teenagers in grades 9 through 12 unwind after eleven o'clock on school nights (National Sleep Foundation, 2006). Adolescents' biological rhythms shift in high school; therefore, high school students do not experience a full sleep cycle until the weekend (Wheaton, Ferro, & Croft, 2015).

Traditionally, high school classes started as early as seven o'clock (Wahlstrom, 2002). High school students wake up even earlier than other students due to bus routes in most districts which leads to sleep deprivation (Boyland, Harvey, Riggs, & Campbell, 2015). Many school districts have not changed their transportation schedules in decades (Owens et al., 2014b). The routines of school systems collided with the biological needs of teenagers, contributing to sleep deprivation in teenagers (van der Vinne et al., 2015). Even the American Academy of Pediatrics requested that secondary schools modify their start times to begin no earlier than 8:30 a.m. in the morning (Wheaton et al., 2015). However, most school districts had traditional transportation tiers, with high schools starting school an hour prior to elementary schools (Wolfson & Carskadon, 2005).

With high schools starting earlier, teenagers report missing school or arriving late due to oversleeping at least once a week (Indiana Youth Institute, 2011; National Sleep Foundation, 2006). Schools with early start times deal with discipline issues related to unexcused tardiness, limited concentration, moodiness, and difficulty staying awake in class (Barnes & Drake, 2015). It is evident that school systems adhere to traditional schedules; although, researchers suggest aligning high school start times to accommodate the physiological needs of teenagers (American Academy of Pediatrics, 2014a; American Medical Association 2016; National Sleep Foundation, 2006).

With chronic absenteeism on the rise in secondary schools, start times may have the potential to improve attendance rates in secondary schools (Wolfson & Carskadon, 2005). In our nation, sleep deprivation among our teenagers is evident with daytime sleepiness, absenteeism, tardiness, and social jetlag present in the high school classrooms (Wahlstrom, 2002). Social jetlag describes the incongruity between work and free time, connected with their sleep patterns and social time (Wittmann, Dinch, Merrow, & Roenneberg, 2006). This continues to affect teenagers as they balance school schedules and biological sleep patterns.

Teenagers struggling to get the recommended amount of sleep per night, often experience emotional issues such as depression, anxiety, and moodiness (Wahlstrom, 2016); therefore, discipline issues could result in the lack of sleep among teenagers in high school. With the rise in teenage issues, research will need to address altering school start times (Owens et al., 2014b). The procedures in switching time frames could show a cost savings in transportation, depending on size and type of district (Owens et al., 2014a).

Along with transportation savings, a decrease in absenteeism could be a financial advantage to districts when considering altering start times (Wheaton et al., 2015). Texas school districts receive funding per student based on their daily attendance throughout the year (Henderson, 2015).

Considering the current research suggesting teenagers' sleep wake cycle is disrupted due to early start times, it seems necessary to address the issue of sleep deprivation among teenagers and the consequential impact on student achievement. This study looks to be a contribution to current studies looking for answers in terms of the potential effect that school start times may have on the general performance of teenagers.

Methods

Participants

The population of the study consisted of Texas high schools including public, charter, private, academies, and technical schools. The total number of high schools in Texas is 3,709 consisting of 3,263 public schools and 446 private schools (Texas High Schools, 2018). A purposeful sample of 256 high schools with various school start times from Region IV, V, and VI were selected for participation in this study (81 Large; 91 Medium; 79 Small).

High schools across Texas are classified based on University Interscholastic League (UIL) conference cutoffs; UIL football conference cutoff numbers based on student enrollment into categories (UIL, 2016). For this study, high schools will be categorized by student enrollment into three categories: (Small) 1A, 2A, and 3A, 18—479 students; (Medium) 4A and 5A, 480—2,149 students; and (Large) 6A, 2,150—4,835 students (UIL, 2016).

Student enrollment ranged from 26 to 4,835, with the average number of economically disadvantaged students per region are as follows: Region IV (58.6%), Region V (59.3%), and Region VI (50.1%) (Texas Education Agency [TEA], 2018). The earliest start time was determined to be 6:30 a.m. with 8:30 a.m. being the latest start time. The average start time for small schools was 7:45 am, 7:31 am for medium schools, and 7:17 am for large schools.

High schools located in Major Suburban areas represented the biggest community type with 104 schools, while the Independent Town areas represented the lowest with 13 high schools. Additionally, a purposeful sample of 15 superintendents, based on experience in small, medium, and large districts, were solicited evenly from each of the regions. Seven of the 15 participants were female (46.7%), comprised of 28.6% Hispanic and 71.4% Caucasian, and ranging in age from 45 to 55, while the eight males (53.3%) consisted of 50.0% Caucasian, 12.0% Hispanic, and 37.5% African American, and ranging in age from 45 to 65. The experience level ranged from first year to 12 years in a superintendent's role.

Instrumentation

In the state of Texas, high school campus performance is measured based on their student achievement on standardized testing. At the high school level, students are administered the STAAR (State of Texas Assessment of Academic Readiness) End of Course (EOC) exams in English I, English II, Algebra, Biology, and U.S. History. Following administration, campuses are measured based on average student performance on each test. The purpose of the EOC exams is to guarantee high school graduates master specific skills; thereby, meeting the state standards for graduation criteria (TEA, 2017b).

The EOC assessments are formulated based on the Texas Essential Knowledge and

Skills (TEKS) which is the state mandated curriculum in Texas (TEA, 2017b). Students in high school must pass the EOC exams to be eligible for graduation. If students pass one of these courses but do not pass the EOC exam, they must retake it until they pass it for graduation (TEA, 2019b). Due to a lower percentage of students passing the EOC exams, seniors have been allowed to produce alternative projects or assignments by adhering to the requirements approved by districts and the Individual Graduation Committee in order to graduate (TEA, 2019b).

As a campus, the accountability measures are dependent on the success rates of student EOC scores. There are no provisions to alternatively assess campus scores to improve campus accountability measures. Therefore, campuses are held accountable by their students' success rate on the EOC exams.

Data Collection and Analysis

IRB approval was granted prior to any data being collected. Once approval was granted, data were collected from the Texas Student Data Systems (TSDS). This data included enrollment and demographic data as well as campus achievement scores from the 2017-2018 school year for multiple high schools. TSDS also provides names of principals, high schools, and email addresses to collect start time information. The quantitative data were collected, sorted, and uploaded into an SPSS database for subsequent analysis.

A purposeful sample of 15 superintendents were solicited from a framework of participating school districts to participate in the qualitative portion of this study. The participants were asked to engage in a face to face semi-structured interviews. The superintendents were orginally contacted via email with a formal request to participate in the interview. Once consent was given, the interviews were scheduled, and the particpants were formally apprised of the study details through a consent form. The form also included assurance that participation in the study was voluntary, that their identities would remain confidential, and that the participants would experience no undue harm while participating in the interivew. Participants were also provided with the consent forms which included information on the interview process. The semi-structured interviews lasted on average between 20-45 minutes.

In the interviews, participants were asked to consider how high school start times affect student acheivement. Specifically, superintendents were asked how the barriers of activities, transportation, parents, and community opinions impact high school start times. After each interview, the interviews were transcribed. The data collected including field notes, audio-tapes, and transcription were stored in three locations: on the researcher's external drive, a cloud server, and on a memory drive. The data were password-protected for security purposes.

IBM SPSS was utilized to analyze all of the data obtained from TSDS (attendance, achievement, and graduation rates) from Regions IV, V, and VI. This archival data were analyzed using Pearson's product moment correlations (r) to determine if there was a relationship between high school start times and student achievement in English I, English II, Algebra, Biology, and U.S. History; between high school start times and attendance; and between high school start times and graduation rates.

Student attendance was measured using the high school attendance percentage calculated by an average of attendance for each campus (TEA, 2019a). Effect size was measured using the coefficient of determination (r^2), which measured the proportion of variation that was shared by both variables. A

significance value of .05 was used for this study.

The qualitative part of the study included a generic approach to coding (Lichtman, 2013) to analyze the face-to-face transcribed interviews from the purposeful sample of 15 superintendents. The interview questions asked participants about their perceptions of the impact of school start times on high school students.

The qualitative data obtained from the interviews were analyzed using the three Cs of analysis: from coding to categorizing to concepts (Lichtman, 2013). Axial coding strategies and open coding were also employed "to make connections between category and its subcategories" (Strauss & Corbin, 1990, p. 97) to further explain and categorize the data for the emerging themes. Validity was strengthened by triangulating the results across the data, along with peer reviewing and member checking.

Results

Student achievement

When analyzing the relationship between start times of all of the high schools and achievement scores on STAAR EOC Exams in English I, English II, Algebra, Biology, and U.S. History, the relationship between school start times and achievement scores was not evident in the grouping of Region IV, V, and VI ($p > .05$).

When examining the dynamics in terms of school size, a statistically significant positive relationship was found to exist between school start times and student achievement in biology in small sized schools, $r(75) = .310$, $p = .007$, $r^2 = .096$. The later the start time, the higher the biology scores for small schools. The proportion of variation in biology scores attributed to high school start time was 9.6%.

School attendance

When analyzing the relationship between the start times of high schools and school attendance, results indicated a statistically significant positive relationship existed across all high schools in Region IV, V, and VI, $r(248) = .166$, $p = .009$, $r^2 = .027$: The later the start time, the higher the school attendance. The proportion of variation in school attendance attributed to high school start times was 2.7%.

When examining the dynamics in terms of school size, a statistically significant relationship was not found to exist between school start times and student attendance in medium or large sized schools ($p > .05$). Findings, however, did indicate a statistically significant positive relationship between school start times and student attendance in small sized schools, $r(76) = .380$, $p = .001$, $r^2 = .144$: The later the start time, the higher the school attendance for small schools. The proportion of variation in school attendance attributed to high school start times was 14.4%.

Graduation rates

When analyzing the relationship between the high school start times and graduation rates, results indicated a statistically significant positive relationship existed across all high schools in Region IV, V, and VI, $r(232) = .147$, $p < .001$, $r^2 = .021$: The later the start time, the higher the graduation rate. The proportion of variation in graduation rates attributed to high school start times was 2.1%.

When examining the dynamics in terms of school size, a statistically significant relationship was not found to exist between school start times and graduation rates in medium or large sized schools ($p > .05$). Findings, however, did indicate a statistically significant positive relationship between school start times and graduation rates in small sized

schools, $r(70) = .293$, $p = .014$, $r^2 = .085$: The later the start time, the higher the graduation rate for small schools. The proportion of variation in graduation rates attributed to high school start times was 8.5%.

Superintendents' perceptions

Among the superintendent participants, 40% expressed start time decisions should relate to research; however, "competing forces in education sometimes delay common sense improvements" according to one of the participants. They face competing interest groups when considering changing school start times especially in high schools. These competing forces were evident in the findings of the study with robust discussions of research along with the logistics of running a district.

A few superintendents were compelled to follow research and shared the results of their success. Other superintendents desired the alignment with research; yet the financial and political issues were a controlling factor in their decisions. A common thread among the superintendent participants was intensive knowledge and experience in sleep deprivation among teenagers.

The semi-structured interviews opened with personal experience to explore sleep deprivation in teenagers with ease. When probing questions shifted to more of a campus perspective, the participants seemed comfortable sharing their expertise.

Although the superintendents were often very political in their responses, they conveyed a sense of realism in their roles as superintendents. In their roles, they juggle research-based decisions with logistics to ensure proposals to change have been vetted before implementation.

One superintendent of a small district stated:

> *I believe secondary students' sleep patterns vary based on their level of engagement outside of school. Students who are actively engaged in their school or participate in community-based events tend to go to bed earlier than non-active students. Students who have more time to engage in video games and social media tend to stay up later navigating those avenues.*

The responses from participants were conclusive that the decision-making role of superintendents typically involved research and data to support their opinions or decisions when serving as superintendents.

A few of the school district superintendents with later start times were confident that the alignment with research resulted in the growth in attendance and achievement. On the contrary, several school district superintendents were adamant that high school start times do not matter when it relates to attendance and achievement. Although all parties acknowledged the sleep deprivation research, a few superintendents voiced that the parental role is essential in teenagers getting the proper amount of sleep at night regardless of the high school start time.

A superintendent with small and large sized school district experience stated:

> *Start times do not matter. It is about those students, concerned about their education, who will be engaged regardless of the start time. On the other hand, students, who don't care, will not be concerned when classes start.*

The superintendents, with experience with later start times, have shared that later start times do matter; however, parenting was

mentioned 100% by all participants as the key factor in improving attendance. Among all interviews, 20% of the superintendents, from medium and large sized school districts, stressed the importance of parenting in the home to enforce attendance.

The large sized school districts were knowledgeable of research in relation to late start times and attendance; however, 53% wanted to see more data to support this relationship. All superintendents were knowledgeable about research regarding late start times; hence, the superintendents with direct experience anticipated an increase in attendance with later start times.

A superintendent from a large school district shared:

> *In a large district, high school students were not making it to school on time due to dropping off little brother or sister. Parents were quite reliant on the older siblings to take care of the younger ones. Then students without siblings were just not making it to school on time because they had trouble waking up for an earlier start time. In the larger school district, we saw improvements by moving from an earlier to a later start time because the kids were sleeping later. Parents were quite reliant on the older siblings to take care of the younger ones.*

Discussion

Throughout the investigation, the findings analyzed whether high school start times influenced achievement scores in high schools. The participating high schools were categorized into small, medium, and large sized high schools as well as analyzing the all high school category. These results found a positive relationship in English I, English II, Biology, and U.S. History with an average start time of 7:51 a.m. in the small sized high schools. These results were consistent in the findings from Carrell, Maghakian, and West (2011) and Perkinson-Gloor, Lemola, and Grob, (2013) who reported late start times showed a positive effect on student achievement for small schools. Previous related studies tend to analyze on-line surveys, time of day protocol, self-reported surveys, and a few studies disseminated testing data. However, these studies lacked generalizability due to the participants consisting of homogenous populations in private, boarding, and military school settings (Edwards, 2012; Thatcher & Onyper, 2016; Valdez, Ramirez, & Garcia, 2014).

The viewpoint of most superintendents that participated in this study did not believe there would be a correlation with achievement. However, superintendents with late start time involvement expressed that the results would show a relationship based on their experience. One superintendent of a large sized school district reported evidence of improvement with a late start time; while another superintendent of a large sized school district was confident the results would not show a correlation. Thus, the intense data analysis of achievement scores and interview transcripts fell on both sides of the issue.

The results of the interview analysis mirrored the results of the study which portrayed variances between opinions on the relationship between school start times and achievement. The results of the data analysis and superintendent interviews depicted a wide range of outcomes without full consensus on matters.

The simple statement that late start times impacted attendance has been highly controversial since the release of recommendations from the American Academy of Pediatrics (2014b), American Academy of

Sleep Medicine (2018), and American Medical Association (2016) to start high schools at 8:30 a.m. or later. In this study, the analysis of high school start times and attendance found significance in specific areas aligned to previous research.

In the semi-structured interviews, a few superintendents anticipated positive results while many were cautious to confirm a relationship between attendance and school start times. Superintendents stressed the importance of parenting as well as the students' responsibility to attend school in a timely manner, which would impact the attendance rates more than school start times.

In this study, a significant relationship was found with attendance and school start times among all high schools in Region IV, V, and VI, as well as a higher significance with small sized schools as compared to medium or large sized schools. The average start time for all participating small sized high schools was 7:45 a.m. with an attendance average of 94.7%. These results were reflective of a small sized high school, with only four miles surrounding the school, that experienced a 30% increase in attendance after the implementation of a late start time (Wechsler, 2018).

Thus, this study found that the later the start time the higher the attendance average which supported research from Kelley et al. (2017), Edwards (2012), McKeever and Clark (2017), Owens et al. (2010), Wahlstrom (2002), and Wechsler (2018). These findings were consistent with previous research, where small, medium, or large sized schools had an average start time of 7:31 a.m. with 94.4% attendance averages. These data described the typical start times in high schools among Region IV, V, and VI, which aligns with previous research from Kelley et al. (2017), Owens et al. (2010), and Wechsler (2018).

When this study analyzed the relationship of graduation averages and high school start times, 80% of the superintendents stated that high school start times would not have an impact on the graduation averages. While 20% of the superintendents felt that later start times impacted graduation rated due to increased attendance averages.

In this study, significance was found in all high schools from Region IV, V, and VI with a graduation average of 92.8%. These findings supported previous researchers' findings (McKeever & Clark, 2017; Sabit et al., 2016; Wechsler, 2018) portraying increases in graduation with later start times.

Although previous research indicated later start times of 8:30 a.m. or later, the latest start time average that showed significance for this study was 7:52 a.m. in small sized high schools. In a previous study, it was reported that graduation improved from 70% to 88% with a delayed start time (McKeever & Clark, 2017).

The results of this data analysis reflected superintendent comments on the importance of intrinsic motivation among seniors, to reach their educational attainment of graduation, in order to see a relationship between start times and graduation rates. This study was conducted 2-years after the start time was implemented to assess the impact on attendance and graduation rates. The findings correlated with the superintendents' often shared perceptions of graduation rates, which were that seniors will figure out a way to graduate regardless of the start time of the high school.

Implications

As this study has found, even the slightest increase in start times portrayed a relationship with attendance, achievement, and graduation

percentages in small sized high schools. Often small sized high schools were found in rural settings which could require additional time for transportation. Superintendents with small sized school districts experienced issues with limited transportation, which included single routes and same start times for the entire district.

Thus, school district superintendents should check the pulse of the district to see if shifting all start times by fifteen minutes would possess positive outcomes in achievement, attendance, and graduation especially in small sized high schools. In small sized schools, the increase in attendance alone would benefit any school district due to attendance being a direct source of funding (Jones et al., 2008). With a crisis in school funding in Texas, attendance rates have been critical to school districts; whereas small sized high schools should shift to later start times to seize the opportunity of increased funding.

After all, this study referenced an average start time of 7:51 a.m. verses the claims from the American Academy of Pediatrics (2014a) and American Medical Association (2016) that recommended starting an 8:30 a.m. or later. With 256 high schools, the average start time was found at 7:31 a.m., perhaps a slight shift in scheduling would improve achievement and attendance averages. However, the challenge in changing start times must be weighed carefully due to the disruption of the family, community, and transportation routines.

Information from superintendents indicated the risk of changing start times in a district would not be worth the trouble due to the drastic differing opinions superintendents faced when changing traditional routines in a district. However, the superintendents who have addressed this issue by changing to a later start time have been successful when they implemented change through strategic planning with key stakeholders. A recommended pathway would be to follow the components of Michael Fullan's change theory when working through the exploration stages of educational reform when considering changing start times in a district (Fullan, 2006; Johnson, 2012).

This study had few data points with significance; thus, superintendents should move cautiously when approached to change high school start times. The high schools that showed significance had a start time average of 7:51 a.m. which is not close to the recommended start time of 8:30 in the morning. The in-depth interviews with superintendents were indicative of the struggles they face when considering shifting or flipping start times. Policy makers should consider start times as a reportable indicator to aid in further research; however, start times should be a local decision due to the financial aspect tied to changing start times.

Although school districts of all sizes may face similar issues, large sized school districts, according to superintendent interviews, were faced with funding issues linked to transportation costs such as buses, fuel, and drivers after switching to later start times. It would be beneficial if large sized school districts shifted all routes at least fifteen to twenty minutes later to avoid students waiting sometimes as early as 5:30 a.m., along dark streets, for their ride to school.

A delayed start of 15-20 minutes would attribute to higher attendance rates; thereby, the districts would receive more funding from the state for the higher attendance rates. Students that gained a 90% attendance rate for the year would count towards additional Average Daily Attendance (ADA) funds which could be between $3,500 to $6,000 per student from the state (CERPS, 2018; TEA, 2019a).

The larger sized school districts which typically averaged a 7:17 a.m. start time should consider the impact of shifting start times to 7:45 a.m. or 7:50 a.m. without changing the order of elementary, middle, or high school routes. Based on the results from this study, for the most part large sized school districts have flipped start times with the elementary and high school schedules, they received negative feedback from parents due to lack of after school care for the younger siblings. Thus, a shift of all school start times would eliminate this occurrence.

Also, changes in start times may potentially impact securing jobs and participating in athletics. This would require a consortium of superintendents united to take a stance against early start times to propose plans for the after-school activities such as fine arts and athletics as a group. This coordination would be necessary for the logistics of handling daily high school functions among multiple school district competitions. The financial gain of later start times would be a primary advantage to larger sized school districts not to mention the healthy alignment of the circadian rhythms among teenagers.

Those superintendents experiencing success in changing start times tend to apply research and theorical concepts to adjust the mindset of their district and community. This means alignment in terms school schedules with the unique health needs of teenagers. The medium and small sized school districts with later start times focused on the teenagers first in relation to the logistics of the district.

These superintendents described the battles with parents regardless of an earlier or later start time; however, the data found that small sized high schools with an average 7:51 a.m. start time experienced success in achievement, attendance, and graduation. These small sized school districts function with fewer funds; hence, students matter in relationship to attendance averages. The funding aspect alone pushes superintendents to figure out what works to improve school attendance.

Superintendents mentioned conversations with multiple parents stressing out over the struggle to wake their teenagers. These struggles turn into battles in the classrooms as teachers rattle teenagers out of deep slumber to engage in the learning process. Even moving the start time by 15-20 minutes would impact attendance averages according to this study.

Superintendents from small sized school districts should adhere to later start times to not only accommodate the sleep and wake cycles of teenagers but increase funding from improved attendance averages.

Superintendents from small, medium, and large sized school districts commented that parental controls in the home environment were necessary to implement later start times. This supports research that healthy sleep concepts must be addressed to provide a successful implementation of late start times (Wechsler, 2018). Superintendents discussed teenagers go to bed but not to sleep with endless hours spent in a digital world which supported previous researcher studies (Boergers, Gable, & Owens, 2014; Dimitriou et al., 2015).

Legislatures should propose a health credit as a requirement across the state to address issues such as healthy sleep routines among teenagers. A health class along with parental training on the importance of teenage sleep habits would be essential with late start time proposals. The moodiness teenagers experience with sleep deprivation due to the misalignment of their internal clock verses school start times could drastically affect their daily routines with depression, anxiety, daytime

sleepiness, and excessive caffeine use (Boergers et al., 2014; Valdez et al., 2014; Wahlstrom, 2016).

Perhaps the combination of health classes, parent training, and implementation of late start times would eliminate the constant stream of students facing emotional turmoil in their lives due to unhealthy sleep patterns.

Conclusions

Research has abounded over the years calling for a healthy alignment of the internal clocks in teenagers and school start times. Parents have been quick to resist later start times based on personal preferences, whether they need teenagers to assist with siblings or difficulty in waking their teenagers. School districts have traditionally had earlier start times especially in high schools among the large sized school districts.

School start times were established based on logistical and financial needs. When the American Medical Association (2016), American Academy of Pediatrics (2014a), American Academy of Sleep Medicine (2019), and the National Sleep Foundation (2006) stressed the importance of 8:30 a.m. or later in middle and high school start times, this was a critical turning point for advocates of late start times.

School districts were functioning with a traditional bus route system with high school students on the earliest start time which was often 7:40 a.m. or earlier (Wolfson & Carskadon, 2005).

After reviewing the literature on high school start times, sleep deprivation was prevalent among teenagers especially in high schools with earlier start times (Lin and Yi, 2015; Martin et al., 2016; Urrila et al., 2017). The timing issue became evident when most research indicates only 29% of 12-14-year-olds and 10% of 15-17-year-olds are reportedly getting enough sleep (APA, 2014).

Clearly, the synchronization of teenage sleep patterns and school start times led to sleep deprivation over time which impacted attendance issues on campus (Barnes et al., 2016). Hence, the practitioner and researcher found that the average start time, for all high schools in Region IV, V, and VI, was 7:31 a.m. which carried a lower attendance rate than the small sized high schools with a start time of 7:45 a.m. on average.

Based on the extensive research involved in this study, educational practices do not align with proven medical and psychological research when making healthy decisions for teenagers (Pradhan and Sinha, 2017; Valdez et al., 2014; Wahlstrom, 2002).

In regard to future research, it would be helpful to conduct student, teacher, and administrative focus groups in order to complement the findings on this topic. Involving these stakeholders may contribute to the school start time discussion beyond school superintendents' opinions.

Future research can also focus on specifics within demographic similarities or differences among schools and how these may impact students in general. In parallel, future research can emphasize specific differences in start times in terms of school sizes in comparison with average sizes.

Finally, future research can look to analyze additional variables impacting the findings as related to student achievement. Researchers, parents, and practitioners should collaborate, communicate, and commit to obtain a healthy alignment between high school start times and teenage sleep patterns to improve achievement, attendance, and graduation.

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Research Article

The Influence of Length of School Day on Student Achievement in Grades 8 and Grade 11 in New Jersey

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Abstract

The purpose for this correlational, explanatory study was to explain the influence of the length of the school day on the mean Partnership for Assessment of Readiness for College and Careers (PARCC) scores on the 2016 Grade 8 Mathematics and 2016 Algebra II tests for students in various socio-economic strata. The Grade 8 Mathematics sample included 150 public schools and the Algebra II sample included 166 public comprehensive high schools. The analyses controlled for various student, staff, and school variables. The results suggest that longer school days benefit students from wealthier school districts more so than students living in poverty or middle class students.

Key Words

school reform, extended school day, standardized testing

The length of the school day is a limited resource. There are only so many hours in a day and most schools operate six to seven-hour school day schedules. Extending the length of the school day is a reform idea that some superintendents implement to address perceived problems associated with low levels of student achievement in some school districts.

New Jersey is a state in which superintendents in some of the state's school districts experimented with the length of the school day. Some superintendents took advantage of funds from the federal School Improvement Grant (SIG) program and other state funding mechanisms. New Jersey defines the length of the school day as the amount of time a school is in session for a typical student on a normal school day (NJDOE, 2011). Length of school day is different than instructional minutes, which is defined as the actual total minutes students spend in classroom instruction.

Despite mixed results from the early rounds of extending the school day, many of the schools that extended their school day as part of a SIG grant or state funded opportunity continued their extended days after funding ran out. Local taxpayers were required to pick up the tab and/or the districts moved funds from other programs such as athletics or enrichment programs to continue to pay for extended school days.

Literature Overview in Length of School Day in New Jersey

New Jersey presents an interesting lens from which to study the influence nationally of the length of school day on student achievement. By 2011, 99 High Schools and 178 schools that housed grade 8 in New Jersey had school days that were 30-60 minutes longer than the average school day of 341-355 minutes in the state. The SIG program directly funded 20 schools in New Jersey for at least three years. Other schools either had longer school days or extended their days as a result of the influence of SIG grants.

The empirical research on the relationship between the length of the school day and student academic achievement in New Jersey centers on a group of studies conducted mainly using data from the 2010-2011 school year. Sammarone (2014) conducted an initial study of the relationship between the length of the school day and student achievement in New Jersey middle school grades 6-8 for the 2011 administration of the state tests in English language arts and mathematics. The samples in the study ranged from 640 schools that served students in grade 8 to 746 schools that served students in grade 6.

The results from Sammarone's (2014) study suggested that students in schools that served the least poor students, 10% or less of the students eligible for free or reduced lunch, demonstrated the greatest gains by increasing their school day by 30-60 minutes. Students in schools in which 50% or more of the students were eligible for free or reduced lunch only demonstrated positive effects of the longer school day on the grade 8 test of English language arts and only when the school day was lengthened by 60 minutes.

The proficiency percentages for students eligible for free or reduced lunch on the grade 8 test increased only 9 percentage points, from 61% to 70%. The cost of extending the regular school day 60 minutes for an entire year, in a school of about 1,200 students, was approximately 1 million dollars in 2011, or about $110,000 per percentage point increase on the Grade 8 English language arts exam for student eligible for free or reduced lunch.

Similarly, deAngelis (2014) studied the relationship between an extended school day

and achievement on the 2011 New Jersey high school exit exam in math and language arts. Results indicated that school day length did not have a significant influence on high school LAL achievement overall, and it accounted for only 1.8% of the variance in high school Math achievement scores.

Yikon'a (2017) examined the relationship between length of school day and student achievement on the 2011 New Jersey grade 3 state tests in mathematics and English language arts. The results indicated that length of school day had no statistical significance as a predictor of student achievement. Socioeconomic status was the strongest predictor of student achievement, accounting for 28% of the explained variance in LAL and 9% of the explained variance in Mathematics.

One criticism of length of day studies is that schools can lengthen the school day, but the time might not translate into more time spent on academics. Tully (2017) conducted a study to examine the relationship between the actual number of instructional minutes in a school day and student achievement on the 2011 New Jersey mandated tests in mathematics and LAL in grades 6-8.

Tully's (2017) sample included approximately 200 schools that served students in grade 8. The percentage of students eligible for free and reduced lunch was found to be the strongest predictor of achievement in grades 6-8 LAL and Mathematics. Student attendance was also found to be a statistically significant predictor of the percentage of student scoring Proficient and Advanced Proficient on the LAL and Mathematics tests in grades 6-8. There was no statistically significant relationship between the instructional minutes and the percentage of students scoring Proficient or above on statewide tests of Language Arts and Mathematics scores for Grades 6, 7 and 8.

Pleiver (2016) found no statistically significant relationship existed between the length of school day and students' proficiency percentages on the 2011 grades 4 and 5 tests of LAL and math. The results suggested that the percentage of students eligible for free and reduced lunch (SES), student attendance, percentage of students with disabilities, and percentage of staff with master's degree or higher were found to be statistically significant predictors of student achievement. Additionally, school size and student mobility were found to be statistically significant predictors of student achievement when the dependent variables were the grade 4 and 5 Math tests.

Theoretical Framework to Support Time

The use of time as an input intervention is supported by production-function theory (Pigott, et al., 2012). Policy makers claim that more time in school should equate to more learning. It is a straightforward assumption similar to that of eating more food will lead to gaining more weight. (Pigott, 2012) explained, "Education production functions are commonly used to study the relationship between school inputs (predictors) such as per pupil expenditure (PPE) and student inputs (outcomes) such as academic achievement" (p.1).

Policymakers seem drawn to production function theory as a means to guide policies aimed to increase student achievement because the theory aligns well with a resource-based perspective of education reform (Hannushek & Rivkin, 2006; Resnick & Scherrer, 2012). The general idea behind the resource-based perspective of reform is that if you give a school and its students more resources, they will be able to achieve more. This perspective is rife throughout various reform programs like one-to-one technology initiatives, longer school days, and longer school years.

Some education reforms based on production/function and resource-based perspectives often fail to attain their stated objectives because students from poverty cannot make full use of the resources provided due to the debilitating effects of poverty. Scherrer (2014) put forth a competing theory to the resource-based perspective of reform: the capabilities perspective. The capabilities perspective is based on the student's ability to convert educational resources into the intended outcomes: higher levels of learning.

Poverty causes a negative drag on student achievement (Scherrer, 2014; Tienken, 2017). Factors related to poorer health, higher levels of student mobility, housing insecurity, mental and physical trauma, sleep deprivation, lack of effective childcare, and a host of other issues that impede reaching one's academic potential despite of having access to educational resources influence student achievement on standardized tests (Sirin, 2005; Tienken, 2016).

The capabilities perspective explains why, that as a group, students from poverty score lower on all state and national standardized tests and why standardized test results are highly predictable based on student and community demographic factors (Currie, 2009; Scherrer, 2014; Tienken 2020; Tienken, Colella, Angelillo, Fox, McCahill, and Wolfe, 2017).

Problem and Questions

There has been a dearth of research on the topic since New Jersey and most other states moved to assessments aligned to the Common Core, like the Partnership for Assessment of Readiness for College and Careers (PARCC) assessment platform.

The extant literature and theoretical construct led us to the following overarching research question and sub-questions:

What is the influence of the length of the school day on student achievement in Mathematics in grades 8 and 11 Algebra 2 on the 2016 PARCC when controlling for various staff, student and school-level variables?

Sub-question 1: What is the influence of the length of the school day on the percentage of Proficient and Advanced Proficient students in Grade 8 as measured by the 2016 PARCC test in Mathematics when controlling for staff, student, and school variables?

Sub-question 2: What is the influence of the length of the school day on the percentage of Proficient and Advanced Proficient students as measured by the 2016 PARCC test in Algebra 2 when controlling for staff, student, and school variables?

Methodology and Results

We used a correlational, explanatory, cross-sectional design (Johnson, 2001) with quantitative methods as the backbone for the study. We created hierarchical regression models to examine the influence of the independent variable on the dependent variables.

The following variables were included in the analyses of the results from grade 8 and grade 11 PARCC tests: School Day Length, SES (student economic status), Percentage Chronic Absenteeism, and Percentage of Students with Disabilities. The dependent variables studied were the influence of the length of the school day and student poverty on PARCC test results for Grade 8 Math and Language Arts and Grade 11 Algebra 2. We conducted stratified, proportional random sampling to ensure the sample of schools represented the various socio-economic strata that exist in New Jersey for grade levels of interest; 8 and 11. (See Table 1)

PARCC grade 8 SPSS data models

Table 1

Distribution of Schools in Stratified Sample by District Factor Group (DFG)

DFG Group	Number of Schools
A	22
B	19
CD	14
DE	21
FG	24
GH	19
I	27
J	4
Total	150

The New Jersey Department of Education categorizes districts from A-J according to their communities' ability to financially support public education. School located in "A" districts serve communities in the poorest towns in New Jersey, whereas "J" districts service communities in the wealthiest towns.

In the fourth model Hierarchical regression models were run and all models were statistically significant ($p \leq .05$). The fourth model accounted for the greatest amount of variance with an R square of .45. See Table 2.

PARCC 8th Grade Mathematics results analysis

Table 2

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.21[a]	.04	.04	11.63	.04	6.66	1	147	.011	
2	.57[b]	.32	.31	9.84	.28	59.35	1	146	.000	
3	.64[c]	.41	.40	9.21	.09	21.62	1	145	.000	
4	.67[d]	.45	.43	8.93	.04	10.25	1	144	.002	1.84

a. Predictors: (Constant), SCHLDAYLENGTH

b. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage

c. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage, ChronicAbs

d. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage, ChronicAbs, Disability_ Percentage

e. Dependent Variable: MEAN_SCORE

Only approximately 4 % of the variance of the 2016 Grade 8 Math PARCC scores was accounted for by the length of the school day whereas student eligibility for free or reduced lunch accounted for 27% of the variance. The negative standardized beta for school day length suggests that schools with longer days tend to have a lower average Grade 8 Math PARCC score (See Table 3).

Grade 8 Math PARCC score

Table 3

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	769.64	15.64		49.20	.000		
	SCHLDAYLENGTH	-.12	.05	-.21	-2.58	.011	1.00	1.00
2	(Constant)	765.43	13.25		57.78	.000		
	SCHLDAYLENGTH	-.08	.04	-.14	-2.09	.038	.99	1.02
	Final_SES_Percentage	-.22	.03	-.53	-7.70	.000	.99	1.02
3	(Constant)	749.82	12.85		58.37	.000		
	SCHLDAYLENGTH	-.03	.04	-.05	-.69	.494	.89	1.12
	Final_SES_Percentage	-.16	.03	-.40	-5.61	.000	.82	1.22
	ChronicAbs	-.68	.15	-.35	-4.65	.000	.74	1.35
4	(Constant)	751.24	12.46		60.28	.000		
	SCHLDAYLENGTH	-.01	.04	-.02	-.25	.805	.87	1.15
	Final_SES_Percentage	-.19	.03	-.47	-6.50	.000	.74	1.35
	ChronicAbs	-.60	.14	-.30	-4.15	.000	.72	1.39
	Disability_ Percentage	-.30	.09	-.21	-3.20	.002	.88	1.14

a. Dependent Variable: MEAN_SCORE

This is probably an artifact of more schools that serve students from lower socio-economic strata more frequently had longer school days. The results should not be interpreted to mean that long school days cause lower achievement.

We used a factorial ANOVA with visual binning to divide the SES of the school and length of the school day variables into three equal size groups to test the interaction of SES and length of day: wealthy, Middle, and Poor, and Long, Medium, and Short day. Wealthy income schools were defined by SPSS as schools that had between 0 and 18.67% of students eligible for reduced for free lunch. Medium income schools were identified as schools having 18.68-50% of students eligible for free/reduced lunch and poor schools had more than 50% of students eligible. Schools with 50% or more students eligible for free or reduced lunch receive additional funding from the state in New Jersey. Short-day schools were defined as those with a school day consisting of 340 minutes or less. Mean-day length schools were identified as a day that ranged from 341 to 355 minutes, and long-day schools were those with a school day of 356 or more minutes.

Results in Table 4 suggest that the socioeconomic status (SES) grouping variables were statistically significant (p = .000); however, the length of the school day variable was not (p = .246). Moreover, there was no significant interaction between SES and school day length grouping variable on the Grade 8 Math mean PARCC scores (p = .435).

Table 4

Tests of Between-Subjects Effects

Dependent Variable: MEAN_SCORE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6097.80[a]	8	762.23	7.27	.000
Intercept	71763566.52	1	71763566.52	684284.16	.000
SCHLDAYLENGTHBIN	296.88	2	148.44	1.42	.246
SES_BINN	5305.69	2	2652.85	25.30	.000
SCHLDAYLENGTHBIN * SES_BINN	400.52	4	100.13	.96	.435
Error	14682.35	140	104.87		
Total	79282782.00	149			
Corrected Total	20780.15	148			

a. R Squared = .29 (Adjusted R Squared = .25)

In order to determine the specific pairs of SES groups that had significant differences, a post-hoc analysis was run (see Table 5).

Table 5

Multiple Comparisons

Dependent Variable: MEAN_SCORE
Tukey HSD

(I) Final_SES_Percentage (Binned)	(J) Final_SES_Percentage (Binned)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Wealthy	Middle	7.64*	2.05	.001	2.79	12.49
	Poor	14.90*	2.06	.000	10.03	19.78
Middle	Wealthy	-7.64*	2.05	.001	-12.49	-2.79
	Poor	7.26*	2.06	.002	2.39	12.14
Poor	Wealthy	-14.90*	2.06	.000	-19.78	-10.03
	Middle	-7.26*	2.06	.002	-12.14	-2.39

Based on observed means.

The error term is Mean Square (Error) = 104.87.

* The mean square difference is significant at the .05 level.

The average mean score for middle-wealth schools was 7.64 scale score points higher than poor schools. Overall, wealthy schools' mean scores were 14.90 scale points higher than those for poor schools. All of these pairwise differences were statistically significant. We also ran a one-way ANOVA that used nine different groupings set to each possible combination of the three SES levels and the three levels of length of the school day. The purpose for this analysis was to determine whether there were any significant differences in the mean PARCC math scores between the three length of school day bins and SES stratum. No statistically significant relationships were detected (see Table 6).

Table 6

Multiple Comparisons

Dependent Variable: MEAN_SCORE

Games-Howell

(I) SDLSESBin	(J) SDLSESBin	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Short Day Wealthy	Medium Day Wealthy	1.30	3.89	1.000	-11.71	14.31
	Long Day Wealthy	1.57	3.79	1.000	-11.28	14.42
Short Day Middle	Medium Day Middle	-.51	3.02	1.000	-10.59	9.58
	Long Day Middle	3.84	2.35	.775	-4.51	12.19
Short Day Poor	Medium Day Poor	8.14	3.50	.364	-3.70	19.98
	Long Day Poor	4.10	3.59	.963	-7.82	16.01
Medium Day Wealthy	Short Day Wealthy	-1.30	3.89	1.000	-14.31	11.71
	Long Day Wealthy	.27	3.25	1.000	-10.55	11.09
Medium Day Middle	Short Day Middle	.51	3.02	1.000	-9.58	10.59
	Long Day Middle	4.35	3.23	.907	-6.56	15.26
Medium Day Poor	Short Day Poor	-8.14	3.50	.364	-19.98	3.70
	Long Day Poor	-4.05	3.85	.977	-16.84	8.75
Long Day Wealthy	Short Day Wealthy	-1.57	3.79	1.000	-14.42	11.28
	Medium Day Wealthy	-.27	3.25	1.000	-11.09	10.55
Long Day Middle	Short Day Middle	-3.84	2.35	.775	-12.19	4.51
	Medium Day Middle	-4.35	3.23	.907	-15.26	6.56
Long Day Poor	Short Day Poor	-4.10	3.59	.963	-16.01	7.82
	Medium Day Poor	4.05	3.85	.977	-8.75	16.84

* The mean difference is significant at the .05 level.

Grade 11 PARCC—Algebra 2 analysis

The grade 11 sample included 150 schools from the various socio-economic strata (see Table 7).

Table 7

Distribution of Schools in PARCC Algebra 2 Sample by District Factor Group (DFG)

DFG Group	Number of Schools
A	6
B	12
CD	19
DE	25
FG	28
GH	40
I	29
J	7
Total	166

A hierarchical regression was run with three variables. In model 1 the sole predictor variable was school day length. In the second model the low SES predictor was added to the model. The third model included the two predictors from the previous model as well as the percentage of students with disabilities variable. Finally, the fourth model included school day length, the low SES percentage, the percentage of students with disabilities, and chronic absenteeism as predictors (see Tables 8 and 9).

The third model had the largest adjusted R square of 35%. The model summary reveals that SES was statistically significant and explained 27% of the variance of the 2016 Algebra 2 PARCC Math scores. School day length had a positive relationship to the mean Algebra 2 PARCC score but only accounted for 2% of the variance.

A two-way factorial analysis of variance (ANOVA) along with a univariate ANOVA analysis was conducted to better understand the interaction of the various lengths of the school day and the various socio-economic strata on the mean PARCC score.

For the factorial ANOVA, the visual binning utility was used again to divide both the percentage of low SES and the length of the school day variables into three equal size groups.

Wealthy income schools were defined by SPSS as schools that had between 0% and 8.88% of students eligible for reduced or free lunch. Medium income schools were identified as schools having between 8.89% and 22.77% of students' eligible for free/reduced lunch, and poor schools had more than 22.77% of students eligible. Short-day schools were defined as those with a school day consisting of 400 minutes or less. Medium day schools were identified as a day that ranged from 401 to 415 minutes, and long day schools were those with a school day of 416 or more minutes.

Table 8

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.15[a]	.02	.02	14.44	.02	3.52	1	164	.062	
2	.55[b]	.30	.29	12.22	.28	65.84	1	163	.000	
3	.60[c]	.36	.35	11.71	.06	15.67	1	162	.000	
4	.61[d]	.37	.36	11.67	.01	2.05	1	161	.154	1.801

a. Predictors: (Constant), SCHLDAYLENGTH

b. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage

c. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage, Disability_ Percentage

d. Predictors: (Constant), SCHLDAYLENGTH, Final_SES_Percentage, Disability_ Percentage, ChronicAbs

e. Dependent Variable: MEAN_SCORE

Table 9

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	703.42	12.58		55.91	.000		
	SCHLDAYLENGTH	.06	.03	.15	1.88	.062	1.00	1.00
2	(Constant)	724.71	10.97		66.07	.000		
	SCHLDAYLENGTH	.03	.03	.07	1.05	.296	.98	1.02
	Final_SES_Percentage	-0.43	.05	-.54	-8.11	.000	.98	1.02
3	(Constant)	731.32	10.64		68.74	.000		
	SCHLDAYLENGTH	.03	.03	.09	1.34	.184	.98	1.02
	Final_SES_Percentage	-.40	.05	-.50	-7.82	.000	.96	1.04
	Disability_ Percentage	-.81	.21	-.25	-3.96	.000	.98	1.02
4	(Constant)	731.79	10.61		68.98	.000		
	SCHLDAYLENGTH	.04	.03	.09	1.44	.152	.97	1.03
	Final_SES_Percentage	-.35	.06	-.43	-5.53	.000	.63	1.58
	Disability_ Percentage	-.83	.21	-.25	-4.03	.000	.98	1.02
	ChronicAbs	-.23	.16	-.11	-1.43	.154	.66	1.52

a. Dependent Variable: MEAN_SCORE

Table 10 shows that the socioeconomic status (SES) grouping variable and the length of school day grouping variable were statistically significant with p-values of .000 and .020, respectively. Moreover, the SES and school day length grouping variables had a significant interaction on the Algebra 2 mean PARCC scores (p =.041).

Table 10

Tests of Between-Subjects Effects

Dependent Variable: MEAN_SCORE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12892.65[a]	8	1611.58	11.49	.000
Intercept	84726686.89	1	84726686.89	603890.13	.000
SES_BINN	10257.74	2	5128.87	36.56	.000
SCHLDAY_BIN	1130.52	2	565.26	4.03	.020
SES_BINN * SCHLDAY_BIN	1435.21	4	358.80	2.56	.041
Error	22027.34	157	140.30		
Total	87751833.00	166			
Corrected Total	34919.98	165			

a. R Squared = .37 (Adjusted R Squared = .34)

In order to determine the specific pairs of SES groups that had significant differences, a post-hoc analysis was run. The average mean score for wealthy schools was 5.22 scale score points higher than medium wealth SES schools (see Table 11).

Table 11

Multiple Comparisons
Dependent Variable: MEAN_SCORE
Tukey HSD

(I) Final_SES_Percentage (Binned)	(J) Final_SES_Percentage (Binned)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Wealthy	Middle	5.22	2.25	.056	-.10	10.54
	Poor	18.62*	2.25	.000	13.30	23.94
Middle	Wealthy	-5.22	2.25	.056	-10.54	0.10
	Poor	13.40*	2.26	.000	8.06	18.74
Poor	Wealthy	-18.62*	2.25	.000	-23.94	-13.30
	Middle	-13.40*	2.26	.000	-18.74	-8.06

Based on observed means.

The error term is Mean Square(Error) = 140.30.

*. The mean difference is significant at the .05 level.

Mean scores for schools in the middle were 13.40 points higher than poor schools. Overall, wealthy schools' mean scores were, on average, 18.62 scale score points higher than those for poor schools. The differences between the wealthy and poor schools, wealthy and middle SES schools and middle SES and poor schools were statistically significant.

A post-hoc analysis was run to determine the specific pairs of school day length groups that had significant differences. The average mean scale score increase for long day schools was 2.22 points higher than medium length day schools. Mean scores for medium length day schools averaged 4.78 points higher than those for short day schools (see Table 12). Overall, long day schools' mean scores were 7.00 points higher than that for short day schools. The difference between the long day and the short-day schools was statistically significant. On the other hand, long day schools and medium day schools did not have a statistically significant difference in the mean PARCC score.

Visualizing the Differences

Figure 1 depicts the differences in mean Algebra 2 PARCC scores for the three SES categories and the short, medium, and long day schools.

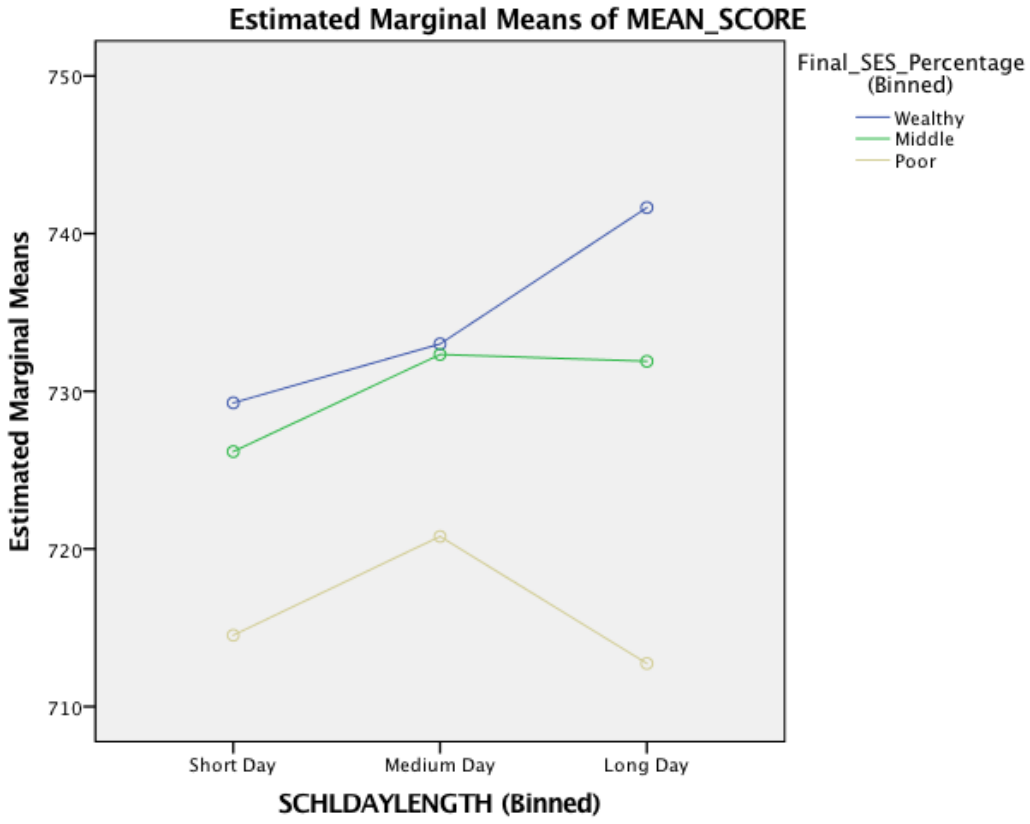

Figure 1. PARCC Algebra 2 estimated marginal means plot.

For wealthy schools, the mean PARCC score increased by four scale score points (from 729 to 733) as the school day length went from short to medium and then rose another nine scale score points (to 742) as the school day increased from medium to long. The average PARCC score for schools in the middle SES stratum rose by six scale points (from 726 to 732) as the school day length went from short to medium but then remained unchanged as the school day duration moved from medium to long.

In schools categorized as poor, the mean PARCC score rose by six scale score points (from 715 to 721) as the school day increased from short to medium but then dropped by eight scale score points (to 713) when the school day became long.

Although the interaction between the SES and school day length grouping variables was statistically significant the average mean PARCC scale score for wealthy schools was always higher than that for middle SES schools, and poor schools. Achievement on the PARCC settles along SES strata. Time did not level the academic playing field in terms of test scores.

A one-way ANOVA was run to examine the interaction between the SES and the length of school day. The post-hoc results in Table 12 show that for both the poor and medium SES school groups there were no significant differences in the mean PARCC scores between schools with short, medium, and long days.

Table 12

Multiple Comparisons
Dependent Variable: MEAN_SCORE
Tukey HSD

(I) COMBO	(J) COMBO	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Short Day Wealthy	Medium Day Wealthy	-3.74	3.95	.990	-16.18	8.70
	Long Day Wealthy	-12.39*	3.80	.035	-24.32	-.45
Short Day Middle	Medium Day Middle	-6.16	4.22	.872	-19.43	7.11
	Long Day Middle	-5.73	3.62	.814	-17.12	5.67
Short Day Poor	Medium Day Poor	-6.27	3.75	.763	-18.06	5.53
	Long Day Poor	1.79	4.00	1.000	-10.81	14.39
Medium Day Wealthy	Short Day Wealthy	3.74	3.95	.990	-8.70	16.18
	Long Day Wealthy	-8.65	3.91	.402	-20.94	3.64
Medium Day Middle	Short Day Middle	6.16	4.22	.872	-7.11	19.43
	Long Day Middle	.43	4.33	1.000	-13.17	14.04
Medium Day Poor	Short Day Poor	6.27	3.75	.763	-5.53	18.06
	Long Day Poor	8.06	4.09	.567	-4.81	20.93
Long Day Wealthy	Short Day Wealthy	12.39*	3.80	.035	.45	24.32
	Medium Day Wealthy	8.65	3.91	.402	-3.64	20.94
Long Day Middle	Short Day Middle	5.73	3.62	.814	-5.67	17.12
	Medium Day Middle	-.43	4.33	1.000	-14.04	13.17
Long Day Poor	Short Day Poor	-1.79	4.00	1.000	-14.39	10.81
	Medium Day Poor	-8.06	4.09	.567	-20.93	4.81

*. The mean difference is significant at the .05 level.

On the other hand, for the wealthy schools, there was a statistically significant difference of 12.39 points in the average mean Algebra 2 PARCC schools between the long day schools and the short day schools, respectively. Across the board, schools serving a wealthy student population benefited from longer school days compared to schools serving a majority of students eligible for free or reduced lunch.

Conclusion

The length of the school day did little to level the standardized test results playing field. These results are consistent with other results of education reform initiatives based on a resource allocation approach. Resources alone cannot overcome the drag that poverty has on the capability to use the resources to their fullest potential (Scherrer, 2014).

Superintendents should pursue a more coordinated approach that includes addressing some of the root causes of underachievement on standardized tests—poverty. For example, the 1.1 million dollars used to extend the school year 60 minutes in school with 1,200 students cited earlier might be better spent on providing and/or coordinating things like health, child care, food security, and housing security for the students. Superintendents should also continue to lobby policy makers to consider alternative ways to use funding to mediate some of the issues that cause resources to be underutilized before spending more time and money on those resources.

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Effects of Time Metrics on Student Learning

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Abstract

Educational reform thinking is plagued with contradictions. Scheduling, the structure of the school day, the length of school year and pedagogic practices in general, although moderately successful, are frequently defined by mantras and rationales out of step with current research or anchored on educational myth. This duality of educational practices is often similarly and vehemently supported by academia and practice. This creates a nebulous and needlessly complex roadmap for reform. Administrators are encouraged to identify the needs of their school communities and implement practices that best fit their unique identity keeping in mind the human element and the nature of change. Consideration for a fluid and agile mindset that is growth focused is suggested for negotiating change.

Key Words

reform, purpose of education, scheduling, circadian rhythms, school day and year, change

Herbert Simon in his seminal work "the proverbs of administration" published in 1946 discusses at length the merits (or lack of) of classical organizational theory. Simon, the *enfant terrible* of the neo classicists, challenged the accepted dogma at the time and defined a body of knowledge that has affected organized institutions since. Notwithstanding his insightful deconstruction of administration, perhaps the most significant element of his dissertation is his choice of words for the title of his salvo across the bow of administrative dogma: *proverbs of administration.*

Proverbs are metaphoric, formulaic language, fixed in form, attitudinal in meaning and subject to context in their interpretation. As such, Simon astutely observed, they naturally occur in contradictory pairs.

Educational reform, a stereotype of institutionalization, is rife with proverbial advice. Not surprisingly, educational thought seems to be at the mercy of such paradigms. Practices deemed *Avant-garde* and innovative naturally lose their legitimacy with new research and understanding.

However, despite the debunking of the mythology surrounding such practices, some of the more charismatic methodologies persist and slowly become engrained in the fabric of education despite their inefficiency and the harm they cause. Examples of this dissonance are abundant. Of significance are those defined by the metrics of time: the anachronism of the school year, school scheduling choices, the absurdity of early starting times, and the misconceptions of longer school days. These structural and pedagogic follies can be remedied.

The purpose of this article is to provide a summary of the current research in regard to the most egregious practices currently in use and advocate for systemic change to address the inequalities that are fostered by the current educational horizon.

The Proverbs of Education

The charm and allure of an educational panacea is understandable given the political and societal pressure placed upon educators. Common sense intimates that each silver bullet ought to be measured and critically evaluated before being fired at an ever-shifting target. Unfortunately, that cannot always be the case. Michael Fullan in his book, *Motion Leadership in Action*, borrows from the work of Tom Peters and Robert Waterman in advocating for the exact opposite. He encourages dynamic change with less, not more, consideration for rigid evaluation (Fullan, 2010).

The expression "Ready, Fire, Aim" figures prominently in the early chapters of the book. This phrase, popularized by Peters and Waterman, and later adopted by Michael Masterson in corporate thinking, implies that change is urgent and as such cannot afford to account for every contingency before implementation. The source of information most valued to affect success is intrinsic to the process and as such, feedback (or feedforward) is most significant at the source.

Change takes place when practices are implemented, and feedback during the process of execution affects direction. The goal is met with constant adjustments to the original plan, which, by definition, is a blueprint of the final strategy. No one plan can be replicated since each is contingent on the circumstances of the problem at hand and is affected, in turn, by external agents that may be unpredictable or unforeseeable.

This ideology indirectly echoes Herbert Simon's argument for Bounded Rationality. The necessity for omniscience in decision making is an unattainable fabrication (Puranam, Stieglitz, Osman & Pillutla, 2015;

Stiggelbout, Pieterse, and De Haes, 2015; Van Knippenberg, Dahlander, Haas, and George, 2015) Thus the alternative, Bounded Rationality, suggests that decisions are made with the best information available at the time taking into consideration the limitations of the selective pressures affecting the outcome of the decision.

This convoluted logic makes sense when considering the burdens under which government agencies must operate and the diverse, and often opposing, needs that they must meet. Ironically, this is one such proverb in education. So, how do we reconcile the need for profound reflection with immediate action in discerning educational reform? The answer lies in an examination of the fundamental purpose of education.

The Purpose of Education

There is a need for meaningful reform, reconceptualization, and a focused strategy that is integrated and comprehensive when surveying the educational skyline. The purpose of school has evolved in complexity since the arguments put forth by the early Greek philosophers, Aristotle and Plato, to include realms of responsibility not envisioned by the most ambitious modern thinkers like John Dewey, George Counts and Mortimer Adler. What started out as simply the education of children to read for the purposes of spiritual salvation, quickly evolved into teaching pragmatism, citizenship, employability, and personal development. The multi-dimensionality of education (or its proverbial nature) is clearly evident in its origin.

While Dewey suggested that education is meant to prepare individuals to be rational and immediate (a perspective that is self-centered and exclusive), Counts advocated for the exact opposite, suggesting that education ought to prepare the individual for their assimilation into society (Stemler, 2016). Their perspectives are predictably vague in their discussion of details, perhaps recognizing that the purpose of education shifts over time and is subject to historical context. To reconcile their dissenting opinions, Adler drew from both Dewey and Counts in synthesizing his version of education. The purpose, according to Adler, was to develop citizenship, personal growth, and employability—a dual purpose of individual and social growth (Adler, 1988).

This ideology seemed sufficient for a generation but was found lacking just before the turn of the century. DeMarrais and LeCompte, not content with the scope defined by Adler, further distinguished the purpose of schooling into specific realms of knowledge: intellectual. political, economic, and social (Stemler, 2016). This approach, although more comprehensive, still lacked differentiation.

At the turn of the century, as society embraced technology and globalization, suddenly, the teaching of fundamental skills was not enough. Nationalism was replaced by a flat world, and tribalism was buried by multiculturalism. This necessitated a new approach that was more inclusive and cognizant of a shifting reality, a new philosophy for the new millennia.

Enter the proponents of education for the 21st century, the latest think tank attempting to conceptualize educational purpose. This loose assortment of educational thinkers and government sponsored bodies chronicled a laundry list of skills and abilities that were thought to be essential for success in a global society (Sullivan and Downey, 2015; Greenstein, 2012; Wolters, 2010). This “new vision” was in response to perceived deficiencies and poor showings in educational world rankings. They include among others, content knowledge, learning and innovation skills, information and technology, and life and most importantly, career skills (flexibility and

adaptability, initiative and self- direction, social and cross cultural skills, productivity and accountability, leadership and responsibility) Although clearly relevant, few would disagree that this litany of purpose is too large to be managed effectively and efficiently. No one disagrees with the importance of these skills; however, schools in their present form are not equipped nor able to provide the services required for an inclusive education of this magnitude.

It is evident that the intellectual progression of education has outpaced the infrastructure that houses it. This co-evolution, once synchronous, has devolved into a survival of the fittest. The majority of schools in America are no longer enlightened, relevant, or even current with the needs of the communities they serve.

A great divide has emerged between elementary knowledge and the world at large. The competitive edge granted by educated societies is no longer a safe investment in the global market. This seemingly hopeless statement is circular and self-defeating yet significant when one considers the dissonance in pedagogic practices.

Carnegie vs. Copernican scheduling

As a researcher, it never ceases to surprise me how much at odds we are as educators in what constitutes best practice. Granted, a concept of this caliber is difficult to define and quantify. But, by definition, best practice refers to a singularity, one approach that is superior to all others in attaining the perceived goal. Thus, there ought to be no competing strategies if the circumstances and the selective pressures are identical. In the proverb of scheduling, the Carnegie and the Copernican system originate from the same principle of effective instructional time. However, although they share a common philosophical origin, they end up at completely different destinations.

Joseph Carroll, in his articles on evaluating the Copernican system, lavishly praises the merits of the abbreviated system quoting improvements in almost all significant categories of success (Carroll 1994, 1990). However, notwithstanding the apparent superiority of the Copernican system, research by the Washington School Research Centre equally championed the Carnegie system echoing the success claimed by Carroll in his measurements. Their study highlighted the benefits of greater exposure to courses, achievement, and retention.

A comprehensive literary review of the topic would probably show the exact same paradigm. Support for each model would be equally as convincing and probably as truthful. John Hattie in his research measuring effect size, suggest that scheduling, either Copernican or Carnegian, is insignificant in affecting student learning (effect size .09) (Hattie, 2008) As it is often the case, the positive outcomes of either system are contextual to a combination of other interventions and school characteristics.

Early starting time and circadian rhythm of teenagers

The design of schools given the current demographic needs is inherently flawed. When schools were first built in the early 1800's, there was no blueprint to guide the establishment of these new "unknown" entities. The only compass available at the time was the church (for curriculum and instruction) and the factories mushrooming in the cities (for design and operation). Schools became, for a lack of a better alternative, mini factories tasked with fabricating individuals ready to serve church and god. That model, rigid and inflexible, has persisted through time and still defines today's modern schools. Schedules, timetables, school bells, and the length of the school day are all relics of the industrial revolution.

Research by Zerbibi and Merrow (2017), Tonetti, Adan, Di Milia, Randler, & Natale, (2015) and previously by Hagenauer, Perryman, Lee and Carskadon (2009) has shown that adolescents have a delayed circadian cycle. They are physiologically incapable of falling asleep early or wake up to be in time for the early start of school. In essence the teenage brain, high school teenagers in particular, "wake up" approximately two hours after school starts. So, why do we continue to start school two hours before they wake up?

A report conducted by Brian Jacob and Jonah Rockoff in the Hamilton Project in 2011, and replicated by the Hanover Research Group (2013) highlighted the many benefits of a late starting time which included improvements in alertness, mood and physical health (as cited in Dewald, Meijer, Ooart, Kerkhof, and Bogels, 2011). Furthermore, late starting times allow longer sleep periods which greatly improved learning retention and cognitive functioning (Boergers, Gable and Owens, 2014)

Notwithstanding the compelling biological evidence to support a late start to the day, the economic pressures that most families must contend with make early starts a necessity as the school day must correspond to the start of their workday. Furthermore, elementary schools, traditionally and unofficially tasked with the raising of young children, must be available to receive their charges when their parents drop them off before heading off to work.

Length of school day

Brain research by multiple authors suggest the teenage brain to be plastic and malleable (Dahl and Suleiman, 2017; Fuhrmann, Knoll and Blakemore, 2015; Blakemore and Choudhury, 2006). The development of synaptic connections and new neural pathways continues well into young adulthood contradicting outdated research that suggested an end to brain growth after puberty (Dahl and Suleiman, 2017). This suggests that the development of executive function and higher-level thinking has not attained maturity in high school. This new research challenges education in its present state as it creates conflict between nature and nurture.

Schools in their present form place a significant mental burden on students. The length of the school day may create a cognitive deficit that often impairs decision making and learning (Sievertsen, Gino and Piovesan, 2016; Matos, Gaspar, Tome and Paiva, 2016). Thus, to expect the teenage brain to fit a restricted model better suited for mature brains would be counter intuitive. Given the cognitive demands of everyday activities, the teenage brain is apt to exhibit signs of mental fatigue when forced to meet schedules and timelines that are designed to suit adulthood.

The cost of a lengthier day is not simply sleepy students; it may have a much more significant negative impact on learning. Categorical work by Sievertsen, Gino and Piovesan (2016), Marcora, Staiano, and Manning (2009) and Boksem, Meijan and Lorist (2006, 2005) suggested that fatigue results in a decrease in attention, listless behaviour and poor performance in simple cognitive and physical tasks. Similarly, Kaplan (2001, 1995) and more recently Shochat, Cohen-Zion, and Tzischinsky (2014) observed that mental fatigue in teenagers resulted in increased aggressive behavior, restlessness, and violent outbursts.

Notwithstanding this research, it should be noted that the length of the day is a relative term as the typical day is approximately 7 to 8 hours. Although this seems excessive, multiple breaks and other environmental stimuli contribute to a de-escalation of stressing factors, thus reducing mental fatigue in general

(Kaplan 2001, 1995). However, if one considers the vulnerability of the teenage brain and the escalated state at which teenagers often start the day, 7 hours of sustained mental alertness, despite the ameliorating factors outlined above, may be excessive (Kelley, Lockley, Foster and Kelley, 2015).

The merits of a longer day have been documented by various school districts and researchers (Rivkin and Schiman, (2015); Angrist, Cohodes, Dynarski, Pathak, and Walters,2016). More learning time, a greater diversity of courses, and more opportunities for student engagement are some of the benefits touted by an extended school day.

However, these studies caution, that length of day may be secondary to quality of instruction and richness of programming in affecting learning outcomes.

More recently, research on chronotypes and optimal learning time suggests that not all students reach their ideal learning window during traditional schedules (Zerbini and Merrow, 2017; Van der Vinne, Zerbini, Siersema, Pieper, Merrow, Hut, and Kantermann, 2015; Wile and Shouppe, 2011). Some students are better suited for morning classes while others show increased learning in the afternoons. The practical application of the research suggests that an ideal school sensitive to learning chronotypes would offer the same classes at different times of the day to accommodate student needs (Zerbini and Merrow, 2017; Callan 1998). This perfect set up is neither farfetched nor unfeasible if schools are redesigned to offer either morning or afternoon classes where students would be expected to attend one or the other depending on their needs and learning styles.

The length of the day is a contributing factor to decreased cognitive abilities if devoid of stimuli and opportunities for mental rejuvenation. Furthermore, schools ought to be redesigned to meet the learning chronotypes of students in a more effective and efficient manner. Although the length of the day is increased, less instruction should take place in a more effective and efficient manner with longer breaks for students and with greater mental stimulation and downtime.

Length of school year

The Center of Public Education, an American think tank funded by the National School Boards Association, raised an interesting point when it questioned then Secretary of Education Arne Duncan on his claims that American students need to spend more time in school to catch up to other world leaders in education. His assertion that American schools spend 25% less time in the classroom than China or India stirred controversy. Notwithstanding the inaccuracy of his statement, time in school cannot and should not be equated with learning. Longer tenures engaged in bad practices does not change outcomes, it exacerbates them.

According to the OECD, Finland, a world leader in educational achievement, requires students to attend 602 hours of instruction a year. Similarly, Sweden, another high achiever, requires 741 hours of instruction. The U.S. ranges from 700 (Vermont) to 1200 hours of required instruction (California). Ironically, there is an inverse correlation between the highest achieving states and the amount of time spent in school. Vermont is among the highest achievers in the US while California is among the poorest.

As indicated earlier, the length of the school year is tied to the agrarian systems that existed at the time of the universal inception of schooling as a formalized process in the western world. As indicated by Malcom Gladwell in his book *Outliers*, the agricultural system of western civilizations greatly affected many aspects of their present condition. A

dependence on the seasons for food production meant alternating periods of labor and exertion. This meant that child labor was needed for planting and harvesting during the summer and fall and thus time off from school. In china and South East Asia, a year-long agricultural economy meant no such reservations for schooling and predictably, the summer vacations are much shorter.

This seemingly simple fact has radical repercussions for learning as "summer loss," a term coined to describe the reversal of learning that happens during summer holidays, can greatly impact on financially and socially deprived families (Tiruchittampalam, Nicholson, Levin, and Ferron, 2018; Rambo-Hernandez and McCoach, 2015). Work by Cooper (2003), and more recently, Rambo Hernandez and McCoach (2015) suggested that the loss of learning can be equivalent to a full month of instruction in factual and procedural learning (math and language skills).

This alarming statistic is worthy of consideration in changing the structure of our educational systems as schools were originally designed primarily to help those less affluent to exceed their current condition. Historical justification notwithstanding, the anachronistic nature of summer holidays, once useful, is now a deterrent to success. Its permanence has more to do with tradition than sound pedagogic reason. To this end, three suggestions are often cited to minimize learning loss and reduce the achievement gap that has plagued modern western educational systems: year-long schooling, summer school and/or shorter breaks (Cooper, 2003)

Studies conducted by Miller (2007), Chaplin & Capizzano (2006) and Cooper, B., Charlton, K., Valentine, J.C., & Muhlenbruck, L. (2000) unequivocally showed that students from poor families have equal achievement during the school year and only lag behind after summer holidays.

This discrepancy is directly related to the lack of educational enrichment and engagement that characterizes summer holidays for less affluent families. In contrast, well off children with access to summer programs and opportunities for learning new skills and practicing existing knowledge maintained or increased their learning by the beginning of the school year.

It should be noted that opportunities for learning are not restricted to traditional schooling as Meyer, Princiotta and Lanahan (2004) identified physical activity, visits to zoos, libraries, museums, art galleries, camps, etc. as rich opportunities for learning. Predictably, 20% of children from less affluent families took part in these types of activities while 62% of affluent children reported being involved.

Research in support of longer school days is misleading. Although definitive gains can be achieved through longer school years, the key is not on the length of time, but the quality of instruction (Parinduri, 2014). Other previously thought unrelated factors may also play a significant effect on achievement. Aucejo and Romano (2016) observed that lengthening the school year by 10 days improved learning by an equivalent increase in grades of 1.7% while an equivalent decrease in absences during the year had a much greater significant change of 5.5%. Similarly, a study by Crede, Wirthwein, McElvany and Steinmayr (2015) looking at German adolescents, noted that parental education had a significant effect on their success and life satisfaction suggesting that attitude and predisposition my play a significant role in academic success regardless of the mechanics of the system.

Conclusion

The multiple moving parts that construct an educational system make it difficult to identify a keystone element. The structure of the school timetables, the length of the school day and school year, the starting times of the school day and many more insignificant minutiae may influence student achievement to a greater extent than previously thought (for a continuously growing list of effect size and school related interventions, see John Hattie's *Visible Learning*).

The quality of instruction cannot exceed the quality of the teacher in the classroom, and as such, regardless of the systemic changes that improve learning, none will be greater than improving the quality and expertise of teachers. The school system is often tasked with a growing laundry list of impossible missions with no option for refusal. Some obstacles cannot be easily resolved without a sustained, multi-dimensional and widely inclusive approach that is costly, complex, and conditional on external factors outside the jurisdiction of the educational system. However, there are others that are simple. Time dependent considerations are fiscally prudent and have the potential to generate the greatest benefit, not just with student readiness, but also remunerations that perhaps far exceed the initial intended goal.

Author Biography

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