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Optimal Start Times of Secondary Schools

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Abstract

Debate on optimal secondary school start times has been taking place for decades. Research on the subject has been varied and sparse until recent years. However, the important question is not whether secondary schools should start later (the literature universally agrees that they should), but what the ideal start time actually is. The benefits of delaying start times are potentially great if applied well, but districts must take subtle considerations into account before moving forward. This research brief details a variety of studies and surveys that establish the benefits of a delayed school time. It also seeks to provide guidelines and suggestions for districts to apply when implementing this change in policy.

Research Topic

What is the optimal start time for secondary schools?

Introduction

There are many factors that influence student achievement in K-12 education. According to a report shared in 2013, Smith elaborates on nine design factors that reliably show a strong influence on academic performance and eleven design factors that show varied influences. Included in these are environmental design, nutritional adequacy, participation in physical activity, and good physical fitness. Another influencing factor Smith identifies is school start time. The conclusion cited in the report is that learning outcomes are largely influenced by design factors and conditions and that the education system must acknowledge, with a healthy degree of skepticism, these factors and resource allocation techniques in order to positively impact student performance. It seems to be in the interest of the district to create a learning environment suited to the biological and socioeconomic constraints of its students rather than expecting students to fit into system for the sake of convenience.

Researchers first documented a change in the circadian rhythm in adolescents in the 1970s, and debates over optimal school start time have taken place since (Lamberg, 2014). While it has been confirmed that this biological process is present in teenagers across the world, there is resistance along the lines that delaying start times coddles students. Regardless, the research is clear that sleep is vital to student physical and mental health and likely has an influence on academics, extracurricular activities, safety, and transportation budgets as well.

Factors Affecting Student Sleep

There are multiple variables that determine the effects and quality of sleep in secondary students. First, the shift to adolescence causes a biological adjustment that affects natural sleep patterns. According to the American Association of Pediatrics (AAP) (2014), at the onset of puberty, adolescents begin to have a delayed sleep-wake cycle typically resulting in a two hour shift in bedtime and waking time, though the amount of necessary sleep is still between eight and a half to nine and a half hours. One reason for this is a change in timing of nocturnal melatonin secretions that occurs across all adolescents, but the secretions are also affected by rising time (Carissimi, Martins, Dresch, Correa da Silva, Zeni, & Hidalgo, 2016). In addition, adolescents' sleep drive is slowed, resulting in less pressure to fall asleep after being awake for long periods. These results are universal and result from a biological cause, not a cultural or otherwise conditional one (American Academy of Pediatrics, 2014). According to Paksarian, Rudolph, He, & Merikangas, in results from a 2015 national survey, the average student still requires around nine hours of sleep. Adolescents have difficulty falling asleep before 11:00 P.M. or waking up before 8:00 A.M., and secondary students go to bed at 10:32 P.M. on average (Owens, Droblich, Baylor, & Lewin, 2014). In addition, secondary students face academic demands, and the amount of sleep they get is affected by school start times. Surveys show that adolescents with earlier start times have shorter weekday sleep durations (Owens et al, 2014; Paksarian et al., 2015).

Effects Sleep Loss Has on Adolescent Student Health

Adolescent sleep loss is widespread in the United States, and medical techniques to address the issue are poorly established and few in number (Millman, 2005). The AAP (2014)

identifies 21 impacts of chronic sleep loss including increased obesity, diabetes type 2, motor vehicle crashes, caffeine consumption, anxiety, depression, suicidal ideation, poor impulse control, decreased motivation, poor attendance, and increased dropout rates. Barnes et al., (2016) report a statistically significant percentage of students were found to experience daytime sleepiness, struggling to stay awake during class, feeling too tired to do homework, falling asleep during class, arriving late, taking extra naps, and requiring assistance in waking up in the morning. Proper sleep is vital to health and mental development in adolescents (Paksarian et al., 2015).

Factors Influencing Secondary School Start Times

According to research from Wolfson and Carskadon in 2005, the largest factor affecting school start times was busing; multi-tiered bus systems tend to start earlier. Socioeconomic conditions are also linked, with more affluent districts starting earlier. Urban districts tend to start earlier than rural schools. Schools with larger student populations tend to start earlier as well (Wolfson & Carskadon, 2005). Transportation costs, extracurricular activities, and local economic impacts are sometimes cited as reasons, but little data is available as to the measurable impact of these policies prior to start time changes (Boyland, Harvey, Riggs, & Campbell, 2015).

Summary of Findings

Researchers have focused on a variety of primary and secondary impacts involving districts that have implemented delayed school start time policies, though the amount of focus and data on each topic varies in depth. In a 2016 meta-analysis, Morgenthaler et al., found that

later school start times are associated with increased total student sleep time on weekdays. The authors found that schools with later start times are associated with less of a difference between student weekday and weekend sleep time. Delays of more than an hour were found to be the most significant. A 2016 study showed there is also a positive correlation between morning school start time and melatonin production. Students are biologically less able to maintain healthy sleep cycles with early school start times (Carissimi et al., 2016).

There is insufficient data on measured, causal reductions in obesity, reductions in depression, and increases in energy directly associated with delayed school start times. As previously indicated, however, insufficient sleep is common in secondary students and is associated with a myriad of physical and mental health problems (Carissimi et al., 2016; Boergers, Gable, & Owens, 2014; Hodge et al., 2015; Kelley, Lockley, Foster, & Kelley, 2015; Morgenthaler et al., 2016; Owens et al., 2014; Paksarian et al., 2015; Thacher & Onyper, 2016; Weller, 2016). These studies suggest that if students achieve more sleep on weekdays, the negative health effects may be relieved. The AAP (2014) refers to adolescent sleep patterns as an epidemic and makes clear recommendations to delay school start times in order to improve upon those health deficits.

Delaying secondary school start times may reduce motor vehicle accidents (Paksarian, et al., 2015). Morgenthaler et al., (2016) reports from their meta-analysis that studies indicate significant improvements in crash rates in geographically similar regions as a result of delaying school start times.

Effects on academics are mixed. Morgenthaler et al. (2016) found that improvement in performance measured by grades was minimal in schools that delayed school start times by 30

minutes or less. Boergers and colleagues (2014) found insignificant difference in homework activity and self-reported grades between start times. A 2012 study based in Wake County, North Carolina, a district of 100,000 students found that after an hour delay in start times, standardized math scores increased 1.8 points and reading scores increased 1 point, statistically significant at a 99 and 95 percent confidence levels respectively. Teenagers benefitted the most of those measured with 14-year-olds improving math scores by 3.7 points and reading scores by 2.8 points at 99 percent confidence levels (Edwards, 2012). Further analysis revealed that the largest gain was at the lower end of the test scores and that students' scores stayed consistent from eighth to tenth grade (Kelley et al., 2015). In a New York longitudinal study, there was no statistically significant difference in GPA over four years after an implementation of a delayed start time (Thacher & Onyper, 2016).

Studies found a link between later school start times and a reduction in tardiness and absenteeism (American Academy of Pediatrics, 2014). Barnes and colleagues (2016) report that two school districts studied in Alabama with delayed start times saw a decrease in tardiness and late check-ins. Thacher and Onyper (2016) found in their longitudinal study that while there was little significant difference in tardiness in the first two years there was a significant reduction in unexcused tardies, especially among older students. The authors also showed a significant reduction in disciplinary violations.

One of the biggest impacts policy makers are concerned with when determining school start times is the impact on communities. Special interests include extracurricular and athletic activities, economic effects on local businesses, and scheduling conflicts with families pertaining to transportation and childcare. There is little in regards to longitudinal data or

comparative studies. Research that does mention community impacts focuses on qualitative responses from community stakeholders. One study found qualitative data that showed a significant increase in approval of the implemented delay school start time compared to prior to implementation amongst parents, teachers, and local business owners (Boyland, et al., 2015). The author's give a series of guidelines and steps for policy makers to use in implementing a delayed start time, and emphasis is placed on analysis of the specific constituents of the district. Some districts reported that some scheduling difficulties arise with delayed school start time in regards to after school athletic events, particularly in regards to traveling, rush hour traffic, and darkness during winter months (American Academy of Pediatrics, 2014; Morgenthaler et al., 2016) .

Optimal Start Time for Secondary Schools

The AAP recommended in 2014 that, because of the biological limitations of adolescents and the myriad of harms associated with lack of sleep, secondary schools should start at 8:30 A.M. at the earliest. Through the House of Representatives Concurrent Resolution 176 in 2009, Congress expressed that secondary schools should not start earlier than 9:00 A.M. (Kelley et al., 2015).

Other studies focused on the effects of their sample groups after specific delays in start times. In their study, Boergers et al. (2014) noted modest improvements in reduced daytime sleepiness and attendance rates with a 25 minute delay in school start times. Carissimi et al., (2016) also found significant benefits with a 25 minute delay and noted the importance of such policy change due to the impairment in adolescent physiology inherent with sleep loss. In Wake County, North Carolina, the district delayed their secondary schools by one hour. In

addition to a significant improvement to academics and sleep duration, they also noted saving money due to bus rescheduling (Edwards, 2012). In their 2016 study, Thacher and Onyper found that their sample district that delayed start times by 20 minutes recorded minimal benefits, but a 45 minute delay produced much better results.

Implications of the Findings and Application to MOEC

It should go without saying that there is no one size fits all solution. Districts work under a variety of frameworks with different obligations and resources. That being said, there are common challenges to address when considering this particular policy change. There are some suggestions offered by those who have studied the application and outcomes of delaying school start time for secondary schools based on successful case studies (Barnes et al., 2016; Edwards, 2012; Owens et al., 2014). In addition to specific recommendations, it is important to understand that adjustments and benefits will take time to manifest, and the anticipation is often worse than the reality.

Implications of Findings

Transportation system and costs. Edwards (2012) found that while there are challenges to the costs associated with changing a transportation model, there are potential benefits. Wake County in North Carolina, in a district of 100,000 students, estimated that by switching to a three-tiered bus system the district saved roughly \$100 million over a ten year period. The author also discusses weighing the cost benefit analysis of delaying start times and increasing bussing against decreasing class sizes. Edwards writes that the the cost of changing busing schedules to accommodate for the natural sleep patterns, which improved test scores, of

students would be roughly \$150 per student. This was compared to the results of an experimental study in Tennessee that found reducing class sizes by a third also improved tests scores to a similar degree but costed the district \$2,151 per student per year in 1996 dollars. When these policies are compared, delaying start times and tiering the bussing schedule is likely the more pragmatic solution.

Districts also have the option to flip their bussing schedules. If elementary schools start significantly earlier than secondary schools, a district can simply reverse the times to better match adolescent biology. Owens et al., (2014) provide a series of case studies. For example, they write that in 2012 the Pulaski County Special School District in Arkansas flipped their elementary school and secondary school schedules. The change was announced in January and implemented in September to give families and business time to plan for the adjustment. They also set up a toll-free line to answer questions and take comments from the community.

Other potential options to alleviate transportation pressures include encouraging carpools, incentivizing public transportation, charging fees, and allowing middle and high school students to ride busses together. Each district will need to assess projected costs of each transportation option to optimize logistic and financial outcomes while maximizing the benefits of a delayed start time. Other potential challenges may include increased traffic congestion, which may cause unexpected schedule delays and adjustments for the school, families, and community.

Extracurriculars. While athletics and activities are often cited as a concern, Owens and colleagues note that most of the perceived negative outcomes do not materialize. Solutions

for these types of scheduling issues include moving practices and games later and installing extra lighting. Working with teachers and building schedules to make instruction more flexible on certain days helps head off potential conflicts. The authors also note that increased sleep duration as a result of delayed start times actually sometimes increases both participation and performance (2014). Selling the lack of negative outcomes is important to implementation, but the key is educating those involved about the vital nature of the benefits of a delayed start time.

Family Stress. Families with children have finely tuned schedules that will be disrupted with a change to school start times. Solutions lay in how the plan is presented and implemented to the community. Involving families in the process and providing hotlines, message boards, and meetings to improve problem solving could all help the process. The most important tool, though, is education on the beneficial impacts and scientific rationale.

Teachers. Some teachers may be resistant to change. However, with a significant schedule change, the district actually has an opportunity to work with teachers to improve flexibility. Buildings could utilize morning time for planning, collaboration, meetings, and staff development, or the staff could simply shift along with the students.

Recommendations for Implementation

The AAP (2014) urges an increase in education and awareness of the effects of sleep deprivation on adolescents. This is the primary tool at a policy maker's disposal when implementing a delayed school start time. Owens and colleagues found in their survey of case studies that successful implementations all had a few traits in common, including strong leadership, an emphasis on communicating the science and benefits to beneficiaries, and monitoring outcomes (2014).

Strong Leadership. Owens and colleagues (2014) note that across case studies, strong leadership from the superintendent, board, and staff is vital to success. Each must communicate the scientific justification of the policy, commitment to working with key community organizations to address logistical and financial challenges, and the beneficial outcomes in student health, academics, and athletic performance. The method in which the superintendent publicly states the position is key to determining success. It sets the tone. Leadership must establish a relationship of trust with the community, and everyone involved must communicate their strong support.

Communicating science and benefits to beneficiaries. Districts that have successfully implemented a delayed start time all had leaders with a working knowledge of the research, such as the information detailed in this brief. The superintendent, school board, district staff, and administrators need to be able to point to research in order to communicate the benefits, refute misconceptions, and respond to legitimate concerns.

Leadership must also take conscious, purposeful steps to build consensus with community stakeholders. Lack of knowledge of the negative outcomes of sleep deprivation in adolescents will decrease buy-in. Expressing the benefits and addressing concerns directly will increase buy-in. Involving principals at all three levels and discussing flexible options with teachers may build consensus and potentially improve outcomes. While challenging, it is important that leaders, when dealing with opposition, be able to recognize the personal and contractual interests compared to education and health related interests. Constituents have their own priorities, but it is the agenda of the school to weigh and maximize learning outcomes.

Owens and colleagues suggest an emphasis of sleep related curriculum in relevant classes (2014).

Monitor outcomes. Measuring the outcomes of implementation will inform leadership on future adjustments, but will also further justify the decision to stakeholders. This kind of policy change is easily observable and the effects may be noticed quickly. This could result in increased confidence and trust among staff and constituents. Barnes and colleagues (2016) encourage districts to report their findings in order to inform policy and support change on the national level, considering the benefits are obvious and important.

Applications for Metropolitan Omaha Education Consortium

This brief can be used by metropolitan area school leadership and MOEC to inform discussion on policy regarding secondary school start times. As detailed in the research, the impact of lack of sleep in adolescents is damaging to their physical and mental health, and it potentially harms academic performance. The information outlined in this brief can be used to facilitate discussion within multiple MOEC work groups and task forces. The Assessment Task Force could look into the possible benefits at a relatively inexpensive cost. The Safety Work Group could be interested in potentially reducing traffic accidents and health concerns associated with sleep loss. The Transportation Work Group could coordinate optimal schedules to facilitate appropriate school start times. MOEC is in an ideal position to facilitate discussion; districts will be able to identify which schedule best suites their needs using the guidance and support of the rest of the education community. Given the weight of evidence and the obligation schools have to their students' wellbeing, district leaders should begin discussing what new school start times they should strive for and strategies on how to implement them.

According to their homepages, metropolitan area districts start their middle and high schools between 7:40 A.M. and 8:15 A.M. The research in this brief indicates that these times are too early and are detrimental to the students attending these schools. The AAP (2014) indicates that the earliest a secondary school should start is 8:30 A.M., and several other studies described in this brief show that it should be even later than that. Some districts, like Omaha Public Schools, have their elementary schools start significantly later than their secondary schools, while others start their elementary and secondary schools at roughly the same time. Some districts, like Millard Public Schools and Ralston Public Schools, have days set aside for Professional Learning Community time, which utilize a delayed start time already once per week at 8:45 A.M. and 8:40 A.M. respectively. These variations in times, along with options suggested in previous sections of this brief, indicate there are grounds for discussion and different possible methods of implementation for each district.

For districts whose elementary schools start significantly later, utilizing a flipped schedule strategy would allow them to access benefits while causing little disruption to bussing resources. Other districts may consider using a variation on their PLC schedule, making slight adjustments to include time for home room. It may be more feasible to push the entire schedule back, both start and end times. In this instance, more research would need to be done on optimal class length and instruction time, appropriate allotment for passing periods, and alternative bell schedules. Other restraints on schedules must be taken into account as well, though MOEC has the advantage of having a collaborative relationship already; for example, athletic schedules can be aligned between districts if each is making changes to their start times.

This brief also details strategies for implementation that MOEC is well-equipped to deploy. Owens et al., (2014) noted that strong leaders and relationships of trust with constituencies and staff is vital to success. Superintendents will need to ensure that the board and all district staff and principals are educated in the rationale and benefits and be ready to express their full support of the policy change. Each district will need to address the interests and concerns of their communities respectively, and specific communication methods will need to be widely applied through easily accessible means. MOEC resources and established work groups and task forces can support districts in determining their own optimal secondary school start times and the best methods of implementing them. The potential impacts behind delaying school start times is too important to ignore and should be prioritized as soon as possible.

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