

# Later High School Start Times' Effect on Physical Fitness And Relationships with Peers and Family

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## Introduction

The future presidents and CEOs will most likely go through high school, and one of the most important things one learns in high school is how to interact with people. High school is where most people develop their social skills and learn how to effectively communicate through friendship and teamwork, and sleep is where all this learning gets encoded. Therefore it is beneficial to study how sleep can affect high school students' ability to communicate and connect with their peers and family as well as its effects on physical fitness.

A study by Lufi, Tzischinsky, and Hadar (2011) measured how later school start times affected middle school students' sleeping patterns and attention levels. Lufi et al. experimented during a two week period where certain students were instructed to go to bed at their regular time, but had an hour later start time. They had the students record their sleeping patterns and measured their attention via a computerized test. Lufi et al. found that students that had the later start time slept more and had slightly better attention than students that started at the regular time. A limitation this study is that it was only over a 2 week period. The effects of sleep are significant, especially when done over a longer period of time. Our yearlong study aims to study the long term effects of sleep on high school students.

A similar study by Preckel et al. (2011) measured how certain chronotypes (certain time preferences for sleeping) in high school students affected their academic performance. They used

the Lark-Owl Chronotype Indicator to measure morningness and eveningness and other questionnaires to measure cognitive ability, conscientiousness, need for cognition, and achievement goals, and measured students' GPA along with alcohol, nicotine, cola, and coffee consumption. Preckel et al. found that morningness directly correlated with higher GPA and lower consumption of the substances listed. However, other factors such as conscientiousness and need for cognition were just as predictive, sometimes even more predictive, than morningness / eveningness. Our study aims to study keystone factors that may be able to predict a wide range of attributes such as conscientiousness and need for cognition.

The current knowledge of the effect of sleep on students is limited in scope and aims to measure certain end goals without an explanation as to how those goals are reached via sleep. There have been numerous studies on how later school start times affect various higher-level cognitive aspects such as academic performance, attention, and car crash rates, however, our study regards sleep as a catalyst for other keystone factors that may impact these higher-level attributes.

We plan to study the effect of later start times on students' relationships with peers and family along with students' physical fitness and see how these two factors are correlated with the higher-level attributes listed above. Our hypothesis is that later school start times will improve students' relationships with their peers and families and will also improve their physical fitness. We hypothesize that these trends will be positively correlated with GPA and attention levels and negatively correlated with crash rates.

## Method

*Participants:* There were a total of 1000 students across two public schools tested, 500 students at one school waking at an earlier start time of 8:00am and the other 500 at the other school waking up an hour later at 9:00am. To account for confounding variables, all students in each grade were within one year age difference from each other, and they were all randomly chosen from two schools in a Maryland suburb with similar distributions in race, socioeconomic status, and gender. Differences in extracurricular activities, previous GPA, and other qualities related to the students were not altered, because the schools were normal in relation to other schools in the US. There was also a normal distribution within each school for race, gender, and socioeconomic status, allowing our findings to be generalized to high school students around the country.

*Procedures:* The students went about their normal schedules and activities. A coin was flipped to see which school would start at 8:00am and which school would start at 9:00am. The most difficult part of this study was getting the physical education class and teachers to be in sync between the two schools. The same classes had to be offered at both schools, and all the material covered, pace, intensity, and teaching style had to be consistent between the schools. Before the school year started, teachers from both schools met for 2 months to try and minimize the differences in their courses. Over the course of the year, the students were given bimonthly questionnaires regarding their relationships with the peers and family along with physical tests to see if the students had become more physically fit. Students were also given attention tests via MATH-CPT and extra questionnaires that asked them how much they slept, how they felt throughout the day, and what kind of diets they had. These secondary questionnaires were given

to help find correlations between peer relationships / physical well-being and various other factors, as well as to give a more subjective account of the students' experiences.

*Measures:* Students' relationships were measured via questionnaires asking about quality of friendships, relationships with parents and siblings, arguments they've participated in, and various other factors. The physical tests tested how many push ups and sit ups students could do in a minute, and how quickly they could run a mile. Their attention was measured via the MATH-CPT. We recorded their GPA at the end of the year along with in the crash rates of teenagers in the zip codes that the schools were in. The questionnaires asked students to record how many hours they slept, how they felt throughout the day, and what their diets were. The dependent variable was when the school start time was, and the independent variable was how the students' relationships and physical well-being were affected.

## Discussion

Students in the school with later start times reported more positive and a higher number of quality friendships and found it easier to work with others in projects and in sports. In general, they became closer to their families, argued less, and were happier being around their families. The students showed an average increase of 9% in the number of push ups done in a minute, 7% increase in the number of sit ups done in a minute, and a 4% faster mile time. Their attention scores increased by 7% by the end of the year, the average GPA increased by 0.3 points, and the crash rates decreased by 12%. In response to the questionnaires, the students reported having more high-quality sleep, felt more energetic and positive throughout the day, and their diets remained relatively the same.

The purpose of this study was to see how later school start times affect students' relationships and fitness, and the results seem to suggest that later start times are positively correlated with positive relationships and an increase in fitness, thus supporting our hypothesis. We examined peer relationships because we believe that it is a keystone factor in adolescent growth, since teenagers often look to their peers for opinions and help, and that adequate sleep is a keystone factor in determining peer relationships. Instead of looking at higher-level attributes, this study focused on the underlying factors of relationships and fitness. Whether the increase in attention, GPA, and decrease in crash rates are due to peer relations, general fitness, or more quality sleep is unclear.

Our conclusion is that later school start times resulted in a series of events that accumulated in the higher-level attributes mentioned above. We believe that later school start times led to an increase in sleep and sleep quality and a decrease in the stress on the body caused by disturbing the body's natural circadian rhythm. This improvement in health led to the students feeling like they had more energy throughout the day, as they reported in the questionnaires and shown in the physical tests. The students also said that the increase in energy made them more aware and they felt more motivated to talk to and interact with their peers. In a few cases, this increase in interaction led to more conflicts such as arguments and social outcasting, but in general, the students reported feeling closer to their peers.

These positive interactions seem to be the cause of the increase in academic performance. Students reported that they felt more motivated to study because of the encouraging interactions with their friends. Not only did they feel more mentally able to perform well, but they also had the desire to impress their friends through friendly competition and improve their social standing.

This study had many limitations. By using two different schools as our groups, we introduced many confounding variables such as the differences in teachers, administration, sports teams, and school related events. Each of these factors plays a small part in how the students at the schools feel, but it is difficult to standardize them without fundamentally changing the students' high school experience. Also, the very act of measuring a student's physical fitness might make students more aware of their physical well-being, leading to them exercising more. However, before the study, the schools required all students to take a physical education class every year, which had students do basic physical tests such as mile runs, push ups, and sit ups. Our testing was comprised of the same tests and should not have made the students desire to exercise more than previously.

A possible improvement that will account for many confounding variables is to study the two schools for two years instead of one and swapping the start times for the second year. This would require more planning but will account for many confounding variables and allow a more accurate correlation to form. We hope that more studies will be conducted to find the relationship between underlying factors such as health and sleep to higher level attributes.

The above results shows that there is a significant correlation between later school start times and an increase in academic performance, peer relationships, and general well-being. This raises the issue of whether or not it is worth it to spend money and time into changing the start times. We do not have a definitive answer to this, but we hope that this study can lead to more studies regarding the health and potential of young people - the people that will be building and leading our future.

Journal Articles:

Lufi, D.; Tzischinsky, O.; Hadar, S. (2011) [Delaying School Starting Time by One Hour: Some Effects on Attention Levels in Adolescents](#). *Journal of Clinical Sleep Medicine*, 7, 137-143.

Preckel, F.; Lipnevich, A.; Boehme, K.; Brandner, L.; Georgi, K.; Konen, T.; Mursin, K.; Roberts, R. (2011) [Morningness-eveningness and educational outcomes: the lark has an advantage over the owl at high school](#). *British Journal of Educational Psychology*, 1-21