Sleep Quality, Sleep Quantity, and Sleep Habits: How They Affect Academic Performance

Viveka Lawson

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Mr. Jason Scott

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Abstract

Past research has suggested that there is a lack of certainty of the significance of the relationship between sleep quality/quantity and academic performance. This study examined the relationships between sleep quality, sleep quantity, sleep habits, and academic performance in a high school setting. Over 60 students from The Neighborhood Academy (TNA) ranging from 10th to 12th grade were given surveys asking about their sleep the night before they survey and the habits they partake in regularly. There were not any significant relationships between sleep quality, sleep quantity, sleep habits, and academic performance based on the results, but it was found that students who attend The Neighborhood Academy have significantly worse sleep quality and quantity than what is recommended for teenagers. These results suggest a change in school schedules in order to prioritize the well-being of students should be considered.

Introduction

The National Sleep Foundation recommends between 8 and 10 hours of sleep every night for high school students (1). In 2015, researchers found that 70% of high school students slept the recommended duration while the other 30% slept too little or too long (1). While sleep deprivation can lead to behavioral and medical issues, we believe that it may also have a significant effect on academic performance. Multiple factors play into sleep loss. Sometimes students will purposefully impose sleep loss to study for exams (2). There are even more common factors like the use of electronic devices and drinking caffeinated beverages (3,4). There are some actions people can take to improve sleep, like increasing physical activity (5). This current study is important because the physical and mental health of high school students is something people should prioritize. In our study, we gave students questionnaires about their sleep quality, sleep habits, in order to investigate their effect on academic performance.

Both sleep quality and quantity may matter when it comes to a student's academic performance. Lowry et al. explored the correlation between how much sleep college students get and their GPAs. They used the Groninger Sleep Quality Questionnaire on 103 students ranging from 18 to 45 years old. After the students answered the questions they asked for the student's GPAs. After the data was calculated into a line of best fit, it was found that GPA is not related to the quality of sleep but is positively related to the quantity of sleep ($r= 0.20$). Sleep quantity accounted for 4% of the variation in GPA (6).

In addition to sleep quantity and quality, sleep deprivation could affect a student's grades. Sygaco wanted to see if chronic sleep deprivation (less than 7 hours) affected a student's academic performance. The researcher gave 50 high school seniors a questionnaire on Facebook Messenger asking about their sleep patterns and habits. It was found that there was not a linear correlation between sleep deprivation and academic performance (7). Even though there was no relationship, students were advised to decrease social media use at night and to exercise time management. Sleep deprivation can lead to health problems like anxiety and depression (8, 9). Students in the study were reporting exhaustion, pessimism, and fatigue. Knowing if a student constantly deprives themselves of sleep can be useful since TNA has a later dismissal than most high schools.

In some cases, self-imposed sleep deprivation could be beneficial to a student's short-term performance. Friedman and Reila tested the relationship between self-imposed acute sleep deprivation and effort and performance on exams in college students. Two-hundred seventy college students were given questionnaires, although only 82 completed them. The questionnaires were given after lectures and exams. The grades for each exam were collected. The first questionnaire was asking about their sleep quality, and the second asked them what type of activity they would want to do. Each activity ranged from 1-6, 1 being the least effort and 6 being the most. Based on their answers, students slept less the night before an exam due to last-minute studying. Those students had higher scores than the students who slept at a normal time. Even though those students did better on their tests they had little to no energy left for the rest of the day, and most of them chose the option with the least effort on the second questionnaire (2). Though depriving themselves of sleep to study paid off in the end, it was advised to not do it constantly due to the health risks and the lower motivation participants exhibited.

Being physically active can play a part in someone's sleep quality (5). Researchers investigated the correlation between sleep quality, physical activity, and academic performance (5). Seventeen students attending TNA from 9th to 12th grade were given a questionnaire, and an activity survey, and were asked to use an app called Sleep Bot to log their sleep schedules. Data was recorded for 5 days, but some data

was corrupted due to some students not filling out the questionnaires or not using the app. It was found that sleep did not correlate with academic performance, but the level of activity had a positive correlation with sleep quantity (5).

Students, teachers, and parents need to know the relationship between their sleep habits and academic performance (3). Rupashri wanted to give students an understanding of how their sleep relates to their academic performance (3). One hundred college students ranging from 15-20 years old answered a questionnaire consisting of 20 questions asking about sleep habits. Questions ranged from asking about the amount of sleep they had to the use of any medication to sleep. Based on the data collected, it was shown that sleep loss has a negative relationship with academic performance (3). The most common sleep habits that lead to sleep deprivation are stress-inducing: being on electronics, late bedtimes, substance abuse, and catch-up sleep on weekends (3). The researchers conclude sleep loss can lead to serious problems like insomnia, anxiety, and depression, so the authors suggest students should create fixed sleep schedules, and schools should have later start times to prioritize healthy sleep.

Certain sleep habits have a significant impact on sleep (4). Aydin et al. measured the relationship between sleep habits and sleep quality to understand sleep problems and find possible solutions. Researchers knew that sleep loss/deprivation can cause worsened cognitive and behavioral performance and serious health problems. Three-thousand four-hundred forty-one high school students ranging from 15-18 years old answered 2 questionnaires. The first questionnaire asked about sleep quality, and the second asked about academics. After the data was collected researchers found that the average high school student slept for 7.42 hours on school nights, and 9.4 hours on weekends. The most common sleep habits that caused the lowest averages were drinking caffeinated beverages and being on electronics before bed. It was also found that poor sleep was associated with poor academic performance (4). Therefore, this suggests that certain sleep habits may impact sleep quality and as a result, academic performance.

Certain actions and habits can change someone’s sleep quantity significantly (1). Mireku and Rodriguez surveyed people (teens and adults) asking about their daily routines and their sleep quantity. Based on the 15,631 results, it was found that hours spent working, watching TV, being on electronics, being in school, and socializing have significant effects on one's sleep quantity. People who sleep the average recommended time spend an average of 165 minutes on electronics and those who slept less than recommended used electronics for 16.6 additional minutes per day. Therefore, this suggests sleep habits may have a significant effect on sleep quality.

Overall, past research says that sleep affects academic performance, but mixed findings on if it helps, hurts, or has no effect (3, 4, 6, 7). This study expands on the understanding of sleep quality, quantity, and sleep habits and their relationships with academic performance. While research has been done in a multitude of high schools and colleges, this is one of the very few studies to be done in a predominantly Black school. Our data came from a survey that asked about sleep quantity, quality (measured by the Groningen Sleep Questionnaire), and sleep habits. To gather data we planned on giving students this questionnaire and comparing the results from sleep quality, quantity, and sleep habits with academic performance.

In this current study, we hypothesized that sleep quantity would have a significant relationship with academic performance. A majority of sources have conflicting results when it comes to sleep quantity and academic performance (6, 7). Next, we hypothesized quality is related to academic

performance, as research suggests sleep has a negative relationship with academic performance but also sleep has no relationship at all (3, 5, 6, 7). Third, we hypothesized a negative relationship between poor sleep habits and academic performance. Past research suggested that people who partook in these habits had lower grades (5). Next, we thought sleep would affect exam scores. People with more positive sleep habits in general will score higher on exams, those with higher sleep quality the night before a test will have higher test scores, and sleep quantity the night before a test and exam scores will be negatively correlated. Also, we expected the less one sleeps compared to their normal amount, will negatively affect test scores. Lastly, we hypothesized that TNA students have a significantly poorer sleep quantity and quality than what is recommended.

Method

The participants in the survey came from an all-Black private school in Pittsburgh, Pennsylvania. There were a total of 61 students surveyed who ranged from 10th to 12th grade. Each student attended Spanish 1, 2, or 3 with the same teacher. The average grade in semester 1 for each class was 82% for 10th, 84% for 11th, and 83% for 12th grade, respectively.

In the survey, we used the Groningen Sleep Quality Questionnaire which consisted of 15 true/false questions. Fourteen of those questions counted towards the scoring system. Along with the questionnaire, a few questions were asked to the students about their sleep habits during the school week and the weekend. Those questions were inspired by Rupashri's questionnaire (3). An example of some of the questions is, "I woke up several times last night. True or False." or "I drink caffeinated beverages after 7 pm. True or False."

Each class took the survey twice, once during a regular class, and once after a test a week later. It took around 10 minutes for a student to finish the survey. About 40% of the students failed to answer the question, "If you use your phone at night, approximately how long do you use it?", but all other questions were answered. We had a follow-up rate of 59% for the second survey.

Results

The purpose of these surveys were to test the relationship between sleep quality, sleep quantity, sleep habits, and academic performance. We hypothesized that sleep quantity would have a significant relationship with academic performance, sleep quality is related to academic performance, there is a negative relationship between poor sleep habits and academic performance, and TNA students have a significantly poorer sleep quantity and quality than what is recommended.

In Figure 1 the total sleep time is very common around 6-7 hours with a few outliers at 2.5 and 9.8 and is relatively mound-shaped. Table 1 shows an average score of 5.8 out of 13. Students tend to sleep 4 hours more on the weekends than on weekdays, and their GPAs are slightly above average. In Table 2, 95% of students use their phones before going to sleep. Of that 95%, identified with '*', 93% use social media, 70% use FaceTime, only 30% play games, and 48% use streaming services. Surprisingly, only 5% of students drink caffeinated beverages after 7 pm.

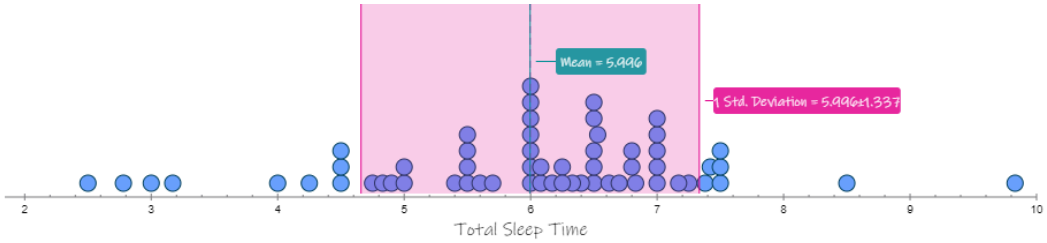

Figure 1. Distribution of students' Total Sleep Time (TST) on a regular weekday.

Bedtime	Wake-Up	TST	Sleep Quality	Weekend Bedtime	Weekend Wake-Up	Weekend TST	GPA
12:06 AM	6:14 AM	6.0 hours	5.8/13	12:35 AM	10:20 AM	10.0 hours	3.36

Table 1. Averages for sleep quality and quantity questions. *Above are the average scores of the 61 students who answered the first questionnaire.*

Phone Use	Social Media	Facetime	Games	Streaming	TV	Caffeine	Exercise	Video Games	Naps
95%	93%*	70%*	30%*	48%*	43%	5%	27%	25%	35%

Table 2. Results for sleep habit questions. *Above are the percentages of the 61 students who partake in detrimental sleep habits from the first questionnaire.*

Our first two hypotheses are that total sleep time and sleep quality are related to GPA. Two correlation coefficient r-tests found no significant relationship between sleep quantity and GPA ($r(58)=0.14$, $p=0.27$), and no significant relationship between sleep quality and GPA ($r(58)=-0.09$, $p=0.51$). Therefore, students who sleep more or better on a typical night do not have higher GPAs.

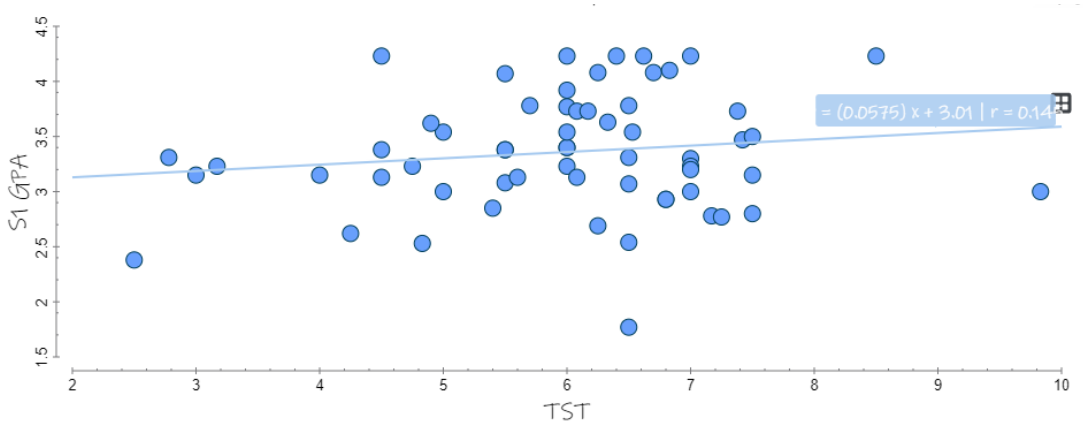

Figure 2. Relationship between Total Sleep Time (TST) and GPA. *A positive non-significant relationship existed between total sleep on a typical school night and semester GPA (p>0.05).*

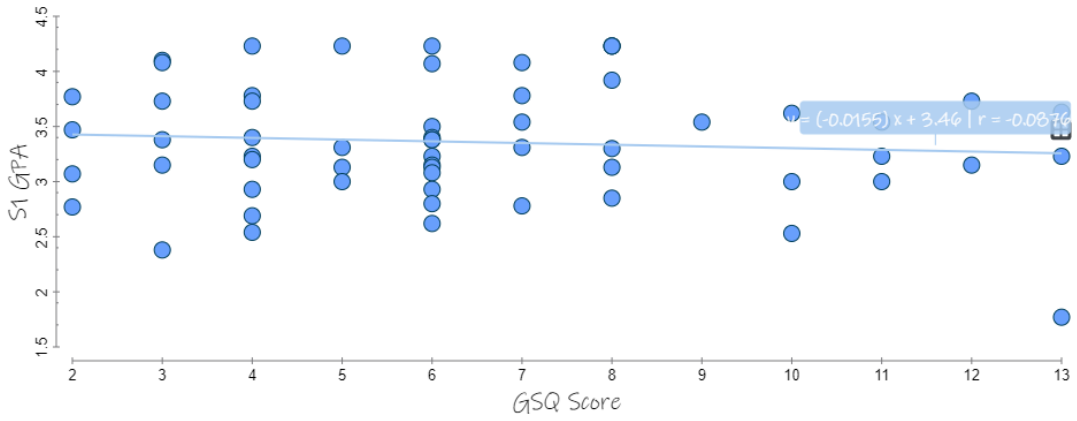

Figure 3. Relationship between Sleep Quality Test Score (GSQ Score) and GPA. *A negative non-significant relationship existed between Groningen Sleep Quality Questionnaire Scores and semester GPA (p>0.05).*

Our third hypothesis is that there was a negative relationship between the number of bad sleeping habits and GPA. A correlation coefficient r-test found no significant relationship between the number of bad habits and GPA (r(58)= -0.12, p=0.17). Students who tend to partake in bad sleep habits have similar GPAs to those with better sleep habits.

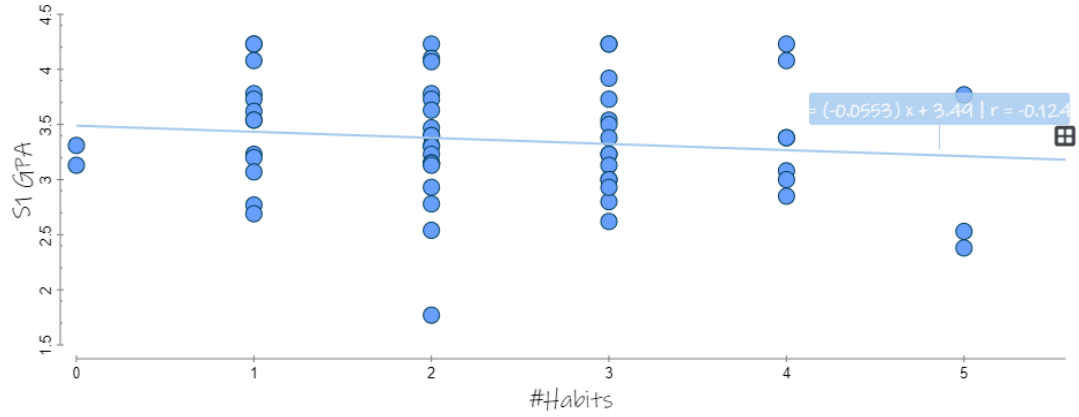

Figure 4. Relationship between the number of bad sleep habits and GPA. *There was a negative non-significant relationship between the number of bad sleep habits and semester GPA (p>0.05).*

Our fourth and fifth hypotheses are that sleep quantity and quality the night before will affect Spanish test scores. Two correlation coefficient r-tests found no significant relationship between sleep quality and test scores (r(36)=-0.01, p=0.94), and no significant relationship between sleep quantity and

test scores (r(36)=0.055, p=0.75). Students who sleep more or better the night before a test do not have a higher test score.

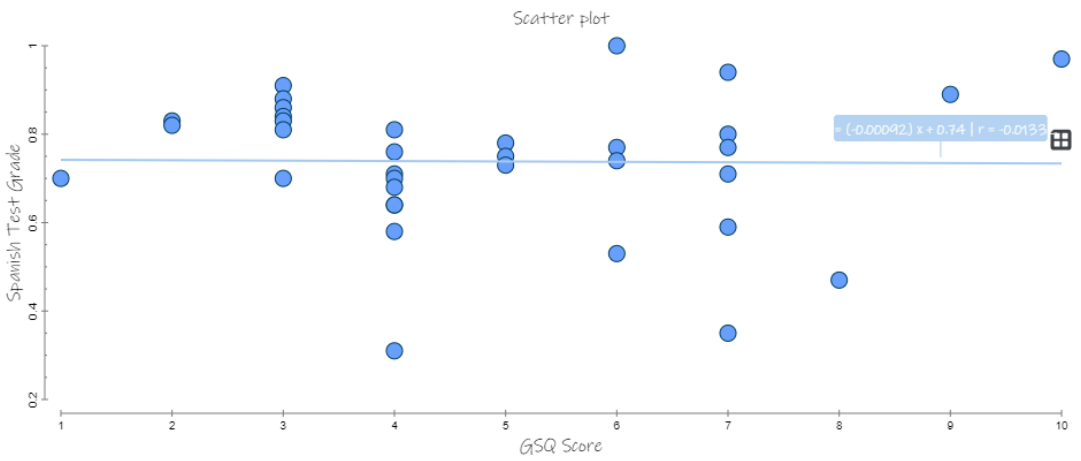

Figure 5. Relationship between Sleep Quality Test Score (GSQ Score) and Spanish test scores. *There was a negative non-significant relationship between Groningen Sleep Quality Questionnaire Scores and Spanish test scores (p>0.05).*

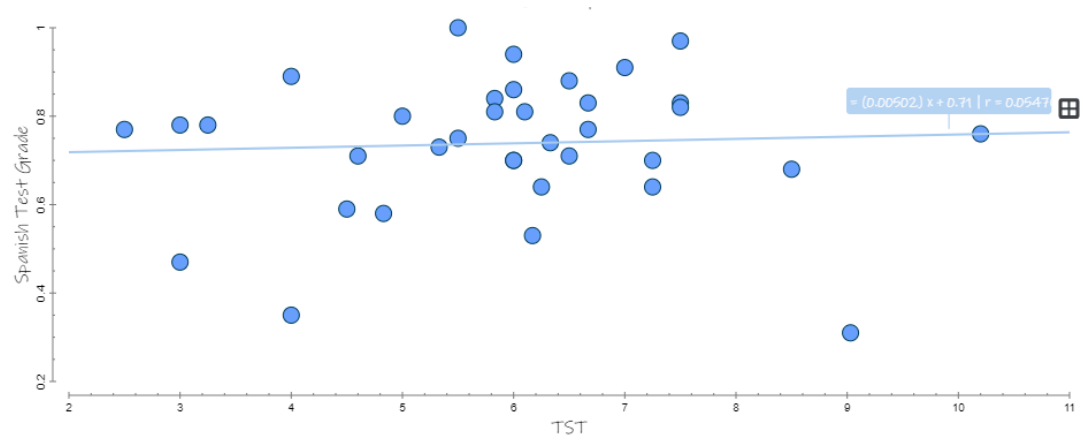

Figure 6. Relationship between Total Sleep Time (TST) and Spanish test scores. *There was a positive non-significant relationship between total time slept the night before a test and Spanish test scores (p>0.05).*

Our sixth hypothesis was that the difference between a student's regular sleep schedule and the amount of sleep they had before the test will be negatively correlated with their test scores. A correlation coefficient r-test found no significant relationship between the difference in total sleep time and test scores (r(36)=-0.07, p=0.34). Students who change their sleep schedules and/or habits the night before have similar test scores as those whose sleep schedules stay the same.

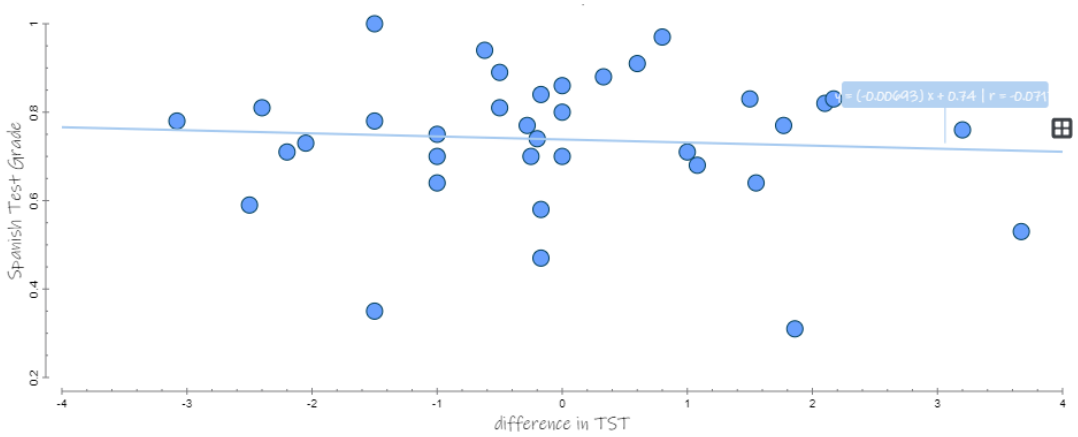

Figure 7. Relationship between Difference in Total Sleep Time (TST) and Spanish test scores. *There was a negative non-significant relationship between the difference in total time slept and Spanish test scores (p>0.05).*

	Total Sleep Time (TST)	Sleep Quality	Number of Bad Habits	Quality Before Exam	Quantity Before Exam	Sleep Differential
GPA	r =0.14	r = -0.09	r = -0.12			
Exam Score				r = -0.01	r= 0.055	r = -0.07

Table 3. Correlations between Sleep and Academic Performance *Above are the correlation coefficients.* ***None of these correlations had significant relationships.***

Our last hypothesis is that TNA students have poorer sleep quantity and quality than what's recommended. High school students are recommended to have at least 8 hours of sleep every night. For a student to have a decent sleep quality, they needed to have scored a 5 or less on the Sleep Quality Questionnaire. Two single-sample t-tests found that TNA students sleep significantly less than what's recommended by The National Sleep Foundation ($t(60)=-11.60$, $p<0.0001$, $M=6.0$). Also, TNA students tend to have significantly poor sleep quality ($t(60)=3.70$, $p=0.0002$, $M=5.8$).

Discussion

In our study, we hoped to find significant relationships between sleep quality, sleep quantity, sleep habits, and academic performance. Our first and second hypotheses were that total sleep time and sleep quality are related to GPA. These hypotheses were not supported *(Figures 2 & 3)*. It was found that both sleep quality and quantity do not significantly determine a student's GPA. Our third hypothesis was that there was a negative relationship between the number of bad sleeping habits and GPA. This hypothesis was not supported *(Figure 4)*. A student's sleep habits do not directly affect their GPA. Our fourth and fifth hypotheses are that sleep quantity and quality the night before will affect Spanish test scores. These hypotheses were not supported *(Figures 5 & 6)*. A student's sleep quality or quantity will not significantly

affect their test score. Our sixth hypothesis was that the difference between a student's regular sleep schedule and the amount of sleep they had before the test will be negatively correlated with their test scores. This hypothesis was not supported *(Figure 7)*. It does not matter if a student changes their sleep habits or schedules the night before, their test score would not be significantly different from someone who didn't change them. Our last hypothesis is that TNA students have poorer sleep quantity and quality than what's recommended. This hypothesis was supported. It was found that TNA students sleep 2 hours less than what is recommended and their sleep quality is poorer *(Table 1)*.

Our first results were consistent with McCaskill and Scott who found no correlation between sleep quantity and GPA but conflicted with Lowry et al. who found a positive correlation between sleep quantity and GPA. We found that there was an insignificant relationship between a student's sleep quantity and GPA. One of the reasons McCaskill's results agree with ours is that they also surveyed TNA students. TNA is a smaller school that has a schedule everyone follows unlike Lowry et al. who surveyed a college campus. This may be why Lowry et al. found a positive relationship. College students who get to choose their classes and alter their sleep schedules to work with it will have a more significant impact on their GPA than a high school student who routinely wakes up at 5:30-6:00 AM to get to school by 7:30 AM every day. Therefore the effect sleep has on grades in a specific population has more to do with the constraints of their environment than their sleep schedule itself.

Our results on sleep quality and GPA agreed with previous results from both Sygaco and McCaskill and Scott, that higher quality does not lead to better grades. Our results are inconsistent with Friedman and Reila, who found that sleep deprivation can improve a student's performance in a short term. We found that sleep quality does not correlate with a student's GPA. Friedman and Reila might have found a significant relationship because they had a larger sample of students. While we only had 60 they had over 200 students. Another difference is that they surveyed college students and they had a more flexible schedule, unlike TNA students. Like sleep quantity, the effect of sleep quality may be more dependent on a student's environment than their sleep schedule.

Next, our findings on sleep habits and GPA disagreed with everyone's previous results. Both Rupashri and Aydin found a significant relationship between sleep habits and academic performance. In Rupashri's study, they surveyed over 100 college students ranging from 15-20 years old. They found that certain sleep habits had a negative correlation with academic performance. Aydin surveyed over 3,000 high school students ranging from 15-18 years old. They found that poor sleep habits have a significant impact on sleep quality and therefore academic performance. We found a nonsignificant relationship between sleep habits and GPA. The difference in results is due to the difference in sample sizes and populations. Both studies had significantly larger sample sizes and more racially diverse populations.

Our results on cramming before a test disagreed with Friedman and Reila's results. Friedman and Reila found that students who crammed the night before the test had higher scores than people who did not. We found that cramming the night before a test did not matter, and there was no significant relationship between cramming and test scores. Our difference in results is likely due to us surveying high school students with a directed schedule rather than college students with a more flexible one. It is also possible the low response rate for the follow-up (59%) means we missed crucial data. Students who did badly on the test might have little interest in taking a survey asking how they prepared for the test.

There were several limitations to our project. First, we had a 59% follow-up rate for students answering the surveys causing us to lose a lot of data. Next, most students failed to answer one question

in the questionnaire. Lastly, there was little to no variation in TST in students, thus making it difficult to find a significant relationship. Future researchers may want to consider a similar test at a larger school to ensure a higher follow-up rate and more variety in answers.

In addition to there being no significant relationships between sleep quality, quantity, habits, and GPA, we found that TNA students have significantly poorer sleep quality and quantity than the recommended amount. We advise students to monitor their caffeine intake and use of electronics late at night. While there may not be a significant impact on their academic performance, sleep deprivation and poor sleep quality have been proven to be detrimental to a person's physical and mental health. Things like insomnia, depression, and anxiety are common in people with poor sleep quality (3). Therefore, we encourage students to take their sleep seriously, even if our results do not suggest it harms their grades in the short term.

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