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What Effect Does a High School Student's Sleep Habits Have on His/her Academic Success? A Study of the Factors Associated with Sleep Loss in Adolescence.

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What Effect Does a High School Student's Sleep Habits Have on His/her Academic Success? A Study of the Factors Associated with Sleep Loss in Adolescence.

A Thesis

By

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The thesis entitled '**What Effect Does a High School Student's Sleep Habits Have on His/her Academic Success? A Study of the Factors Associated with Sleep Loss in Adolescence**' presented by **Mackenzie Krieger**, a candidate for the degree of **Master of Science in Mathematics,** has been approved and is worthy of acceptance.

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ABSTRACT

Background

Adequate sleep suggested for adolescence is between 8-10 hours per night, however teenagers often fall short in meeting this recommendation. Current research is aimed at determining factors that contribute most to this shortcoming, as well as the impact sleep has on the body, mainly through the ideas of the brain plasticity framework. The purpose of this study is to examine the relationship between sleep habits, academic success, and attendance rate in high school students with the aim to show that sleep is an essential aspect in adolescent students as well as identify different contributors as to why teens are unable to maintain a healthy sleep pattern.

Methods

Students enrolled at Bridgeport High School in Bridgeport, Ohio will be surveyed via the *Teen Sleep Habits Survey* as developed by the University of Minnesota. Responses were analyzed using R and hypotheses are tested using multiple regression techniques. Relationships between variables are examined and conclusions will be drawn based on the implications of the findings.

Results

A sample size of 69 students were surveyed and data was collected from January 2024 through April 2024. Variables such as students end of course scores, grade point average (GPA), school attendance, LED light usage, work status, activity participation, and sleep habits were tested against respective hypotheses. Some variables, such as work status, end of course scores, and attendance were found to be significant in determining a

student's GPA; none of the tested variables showed a significant impact on attendance, and only an individual's gender was shown to determine sleep habits.

Conclusion

The study illustrates the effect of numerous variables on overall student life, including their GPA, school attendance, and their sleep habits. Complex relationships among these factors exist and further research should be done to determine mitigation strategies related to overcoming the challenges presented.

Key words: Adequate sleep, brain plasticity framework, academic success, healthy sleep patterns

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CHAPTER I: Introduction

Many experts agree that the optimal amount of sleep an adolescent should receive per night is between eight to ten hours. The effects of violating this truth are still being studied. Furthermore, many researchers are trying to find distinct factors that are guilty of causing teens to lose out on valuable sleep time. This study will examine the relationship between sleep habits, academic success, and attendance rate in high school students with the aim to show that sleep is an essential aspect in adolescent students as well as identify different contributors as to why teens are unable to maintain a healthy sleep pattern.

Chapter One focuses on establishing the patterns of sleep as well as determining if there is a significant relationship between the effect that sleep has on a student's academic success and attendance rate. Recommendations from many areas of expertise, including the CDC, are analyzed and compared to the averages found across the United States. Furthermore, many factors that cause a disconnect between a student's ability to achieve the adequate recommended sleep are evaluated and explained. These factors include but are not limited to a biological phenomenon that impacts all adolescents, a reported high rate of usage from LED light technology before bed, and the typical start time of the students' school day.

Additionally, the purpose and significance of the study will be evaluated as the relationship among factors is determined. Specifically, the students at Bridgeport High School will be categorized on the basis of their sleep obtained, grade point averages, and daily school attendance, which will all be investigated through correlational and descriptive designs. Substantial data collection obtained from both independent

responses via surveys as well as background report of academic from the individuals schooling.

Overall, the focal point includes determining whether hypotheses surrounding a student's sleep, specifically a lack thereof and his/her attendance, are predictors of cumulative grade point averages. Furthermore, factors surrounding the ability to obtain the proper amount of sleep will be dissected.

Finally, Chapter One will conclude with information surrounding the sample of the study, the data obtainment methodology, as well as a breakdown of how the data analysis will be conducted. Definitions of key terms used throughout the course of the entire study and assumptions, limitations, and scope therewithin are justified and expressed.

Background of the Problem

Extensive research he been conducted to show the role sleep plays in an adolescent's life. It is recommended that teenagers aged 13-18 should receive 8 to 10 hours of sleep a night. Yet, a national study conducted by the Centers for Disease Control and Prevention (CDC) shows that about 7 out of 10 (72.7%) of students from grades 9-12 do not get 8 to 10 hours of sleep on school nights (2020). This leaves parents, teachers and school administrators questioning why teenagers are not able to achieve the recommended amount of sleep and what effect this has in the classroom.

There is a natural explanation as to why teenagers start to lose sleep as they mature. The brain is constantly developing and maturing in adolescence, causing many teenagers to encounter a biological delay of sleep onset, thereby staying awake later (Suni

& Dimitriu, 2023). Partner this with early school start times and the inability to achieve 9 hours of sleep becomes a norm. Even worse, many teenagers try to use the weekends to catch up on rest by sleeping much more than on a weekday. This causes a seemingly endless cycle of an inconsistent sleep schedule, especially through the school year.

A study conducted by the University of Cincinnati showed that students who report high usage of LED light technology, such as cell phones or video games, report a longer time to fall asleep and less overall sleep that night (Kestler, 2017). Cellphone usage among adolescents continues to grow every year leaving teenagers more dependent on them than ever. From accessing social media, listening to music, communicating with friends, playing mobile games, and even setting alarms, cell phones are often a teenager's prized possession. Video gaming is another method of LED technology that many adolescents experience prior to lying down to sleep at night. These are some of the growing lists of LED technology students not only access but also utilize on a nightly manor. Whatever the screen, LED technology before bed is no doubt a growing and nullifying contributor to poor sleep habits in teens.

School start time is something that has been examined and discussed at great length in many school districts across the United States. The University of Minnesota conducted a three-year study in eight public high schools in three different states. The goal of this study was to examine the effects of different start times for high schools. It was revealed that 60% of students at high schools with start times at 8:30 AM or later were able to achieve at least eight hours of sleep a night. However, many districts are reluctant to move the start time of school later due to family life patterns and community norms (Wahlstrom, 2014). Early start time paired with an increase in pressure from

sports and homework are possible contributors to students' inability to achieve adequate sleep.

Despite the cause, the inability for a teenager to sleep for the recommended 8 to 10 hours can be very harmful for his or her overall well-being. Wahlstrom warns that it can have a negative effect on a teenager's mental health and behavioral outcomes. This can also then lead to an inability to focus not only on the academic realm but also during activities such as driving where inattentive behavior can be devastating. Wahlstrom also states that a lack of sleep in teenagers can increase the likelihood of high-risk behaviors such as drugs and alcohol (2014). Teens who report insufficient sleep have been found to be more likely to smoke cigarettes, use marijuana, drink alcohol, and engage in sexual activity (Telzer et al., 2013).

With the advancement in technology and evolution of social media as well as the continued pressure of school, sports, jobs, and society, it is no secret that the life of a teenager is much different than that of an adult. Sleep is something that needs to be a focal point in adolescence. Society has a responsibility to continue to conduct research on factors that affect an adolescent's sleep schedule, as the consequences for a sleep deprived teenager can be detrimental to his or her current and future success.

Statement of the Problem and Significance of the Study

There are two main goals of this research. First, the study will test if the use of LED technology before bed, work status, participation in organized sports, and sleep habits are predictors of academic success as measured by cumulative grade point average.

Second, the study will test if the use of LED technology before bed, work status, participation in organized sports, and sleep habits are predictors of attendance. Furthermore, the role LED technology, work status, and participation in organized sports has on a student's sleep will be assessed. This information will be crucial for all stakeholders in an individual child's education which includes, but is not limited to the individuals themselves, their teachers, family members, and school districts alike. If correlation is determined among these variables, it can be suggestive evidence to conclude the need for adequate sleep in order for students to be able to perform optimally in the classroom.

Purpose of the Study

The purpose of this study is to determine if there is a correlation between inadequate sleep and poor academic performance. This study will be conducted at Bridgeport Exempted Village School District in Bridgeport, Ohio. The sample, 25 students from each grade 9-12, will be surveyed using the *Teen Sleep Habits Survey* to establish data about the quality as well as quantity of sleep the child receives a night. In addition, factors relating to inadequate sleep obtainment will be assessed. The information from this survey will be matched to each student's cumulative grade point average and number of absences. Baseline data will be established using each student's eighth-grade state test scores. All data collection will be carried out with approval from participants, their guardians, and the administration at Bridgeport Exempted Village School District.

Primary Research Questions

This study will investigate the following questions about students in grades 9, 10, 11, and 12 at Bridgeport High School:

1. Are End-of-Course English Language Arts (EOC ELA) scores, use of LED technology, work status, participation in organized sports, sleep habits, and attendance significant predictors of academic performance as measured by cumulative GPA?"
2. Are EOC ELA scores, the use of LED technology, work status, participation in organized sports, and sleep habits significant predictors of attendance?"
3. Are gender, race, and work status significant predictors of sleep habits?

Hypotheses

The hypotheses for the three research questions include:

1. EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance are all significant predictors of academic performance as measured by cumulative GPA.
2. EOC ELA scores, LED light usage before bed, work status, participation in organized sports, and sleep habits are all significant predictors of attendance.
3. Gender, race, work status, are significant predictors of sleep habits.

Research Design

The research design for this study is both a correlational design and a descriptive design. Correlational research design is used to test the relationship between the amount and quality of sleep, attendance rate, and overall grade point average. In addition, this study uses a descriptive design to distinguish the factors that adolescents share who report an inability to achieve adequate sleep. Hypothesis testing will occur, but the results can only describe the relationships between variables; causation cannot be determined due to the nonexperimental nature of the study. All information on a participant's sleep comes strictly from the *Teen Sleep Habits Survey.*

Theoretical Framework

Though sleep has been extensively studied, there are still many unknowns surrounding the topic. According to Brinkman, brain plasticity theory is the framework behind connecting sleep to brain development. It theorizes that sleep is essential for neural reorganization and growth of the brain's structure and function. It is well known that the brain is constantly developing in children, which is why it is crucial they receive an adequate amount of sleep each night, and why infants sleep around 14 hours a day. Brain plasticity theory is appropriate in this research because it tells us the "why" behind a possible connection between lack of adequate sleep in adolescence and their subsequent academic success (Brinkman et al., 2020).

Data Collection Overview

Participants in this study will be selected from Bridgeport High School in Bridgeport, Ohio. Bridgeport High School is a public school district in Belmont County. As of the 2023-2024 school year, Bridgeport High School has 190 students in grades 9-12 with a student-teacher ratio of 12 to 1. The school has an average graduation rate of 95%. Based on federal standards, Bridgeport School District is considered a low-income school district with 68.7% of students qualifying for free/reduced lunch in 2023.

All students in grades 9-12 were required to gain consent from a parent/guardian to be part of the study. Participation was completely voluntary on both the part of the parent/guardian as well as the student. Of the students who received parental consent, 69 students (45%) returned with proper documentation to participate in the study. The 69 students were between the ages of 14 – 18 years old and made up of 8 ninth graders, 18 tenth graders, 16 eleventh graders, and 27 twelfth graders. All 69 of the students agreed to participate by signing an assent form.

Once all parties returned the required permission forms, student participants were given a survey developed by the University of Minnesota called the *Teen Sleep Habits Survey.* The survey gathered information on the participants' amount and quality of sleep as well as asking extensive questions on factors that relate to sleep loss such as: caffeine use, access to LED light technology before bed, part-time job status, and participation in organized sports or activities. The survey was not anonymous so that the results could be paired with student academic factors; however, all identifiers would be removed from the data before being analyzed by the researcher. The personal identity of the participants is protected through the use of general questions that are not specific to any one person.

Student grade point averages, attendance data, and eighth grade state test scores for each of the participants will be provided by the administration at Bridgeport Exempted Village School District. In addition to giving consent to take the *Teen Sleep Habits Survey*, both the parent and student consent forms give permission for such data to be accessed. Data obtained from administrators were matched to the student's survey results and wiped clean of all personal identifiers for future analysis.

Data Analysis Overview

All analyses will be conducted using R (R Core Team, 2020). All three hypotheses are tested using multiple regression techniques. Hypothesis one aims to assess the impact of EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance on a student's cumulative GPA. This analysis is done using multiple regression techniques with six predictors. Hypothesis two aims to test the impact of EOC Math scores, LED light usage before bed, work status, participation in organized sports, and sleep habits on attendance. This analysis is done using linear regression techniques with five predictors. Hypothesis three aims to assess the impact of gender, race, and work status on sleep habits. This analysis is done using linear regression techniques with three predictors. In addition to the hypotheses being tested, a detailed item analysis is conducted and reported for each question on the *Teen Sleep Habits Survey*.

Assumptions, Limitations, and Scope

For the *Teen Sleep Habits Survey*, the research presumes participants will provide truthful and honest responses by putting forth their best effort. As with any research, there are several limitations to report. One limitation is that a person's sleep patterns often circumstantially fluctuate. Additionally, the standard of comparison for cumulative grade point averages is limited to the number of courses completed, thus causing potential discrepancies between grade levels. It is also important to stress that this research is limited to a sample population of Bridgeport High School students, and the results from this study should not be generalized for other districts. Lastly, the randomness of sampling students was hindered due to the low return rate of parental consent forms.

CHAPTER II: Literature Review

Overview

The purpose of this chapter is to provide a comprehensive overview of relevant literature related to the importance of sleep in adolescence, the relationship between a high school student's sleep habits and his or her use of LED light technology as well as part-time job status, and the relationship between high school attendance and academic performance. A thorough search was done using a range of databases and various search terms to provide relevant information from reliable sources. This process involved careful analysis of each source and its references, seeking out relevant research and data that would help to build a more informed perspective on the above topics. This chapter will start with information on the theoretical framework guiding the research that follows.

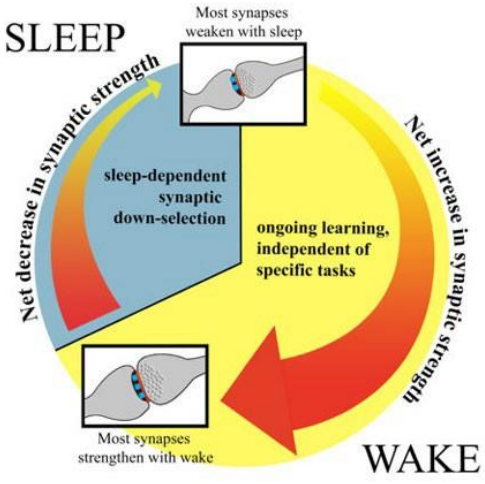
Theoretical Framework Guiding the Research

The framework for this present study is developed around the synaptic homeostasis hypothesis and brain plasticity theory. The synaptic homeostasis hypothesis gives a theory on why sleep is needed for the brain to disconnect from the environment for hours every day. Brain plasticity theory, also known as neuroplasticity, is the study of the brain's ability to modify its connections or rewire itself in response to learning and the various experiences that a person encounters. Together, these theories will be essential in driving the rest of the literature review for this study.

Synaptic Homeostasis Hypothesis and Brain Plasticity

Synaptic homeostasis hypothesis is a theory that provides information on why sleep is essential for the brain to function properly. Synaptic homeostasis hypothesis proposes that sleep is needed to restore synaptic homeostasis (Tononi & Cirelli, 2020). To better understand synaptic homeostasis hypothesis, it is important to first explain brain plasticity. The term synapse was coined by Charles Sherrington and is used to describe when two neurons (nerve cells) communicate with each other or with other cells (Bennett, 1999). Brain synapses occur when organisms learn or memorize information they encounter in their environment. For humans, this learning happens every day and often without even realizing it is happening such as practicing a sport, meeting new people, or performing well in school or a career. Synaptic strengthening happens via learning during a person's wake cycle, thus synaptic renormalization is essential to avoid runaway potentiation and saturation of the ability to learn. Synaptic homeostasis hypothesis suggests that the fundamental function of sleep is to restore synaptic homeostasis (see figure 1). Simply put, when it comes to brain function, sleep is "the price we pay for plasticity" (Tononi & Cirelli, 2020).

Figure 1



Importance of Sleep in Adolescence

Stemming from a public-school teacher background, Patricia Wolfe uses research and her interest in neuroscience to connect the brain and education. She applies the ideas and research done through neuroscience, cognitive science, and educational research for teaching and learning to help educators better understand the role of the brain in how adolescents' function and learn.

Sleep has long been uncharted territory for researchers. Modern technology and the use of electroencephalographic (EEG) recordings have identified two states of sleep that alternate many times a night: REM and non-REM. REM, or rapid eye movement sleep, shows similarities to an awake state, with high frequency/low amplitude waves. During non-REM sleep, waves are slow and have a low frequency/high amplitude. When sleeping, consolidation occurs, which is "the process of stabilizing a memory trace over time, moving it from short-term to long-term memory" (Wolfe, P., 2010). Additionally, during sleep the hippocampus and neocortex of the brain work in tandem to solidify memory and information processing. The teenage brain is often not ready to wake until well after school begins, causing them to miss REM sleep. As such, students frequently miss the connections made during sleep cycles when they are unable to achieve them.

Wolfe focuses extensively on the work of Mary Carskadon from Brown University, who has done significant research in the world of sleep requirements of teenagers as compared to young children. Traditionally, children and adults are expected to obtain ten and eight hours of sleep at night respectively, and teenagers often fall between the two with a suggested average of nine hours and fifteen minutes of sleep per night. Numerous biological factors contribute to the need for an increase in a teen's

sleep, including the ability of growth hormones to be released during sleep, and the ability of brain cells to make daily connections and replenishments as needed. Further, the natural circadian rhythm and biological clock of teens are vastly different from those both older and younger than them; it is often set later. Teens often will stay up late and subsequently wake up later in the mornings (Wolfe, P., 2010).

Brain function is altered when optimal sleep is not obtained; however, the severity is dependent upon how much sleep was lost. The continuum of sleep deprivation varies from mild to extreme; however, every level cause challenges and issues to the adolescent. These challenges include, but are not limited to, poor academic performance and brain development delays. Knowing that brain cells focus on making connections during sleep, deprivation can lead to significant effects on learning and memory. Studies indicate that during sleep, the brain will replay memories and patterns that occurred throughout the day. Without proper sleep, adolescents are risking their ability to solidify knowledge and information obtained causing them to reduce memory and learning. Further, scientists have discovered that the different types of sleep (REM vs non-REM) have important roles in contributing to memory formation. During REM cycles, skills and habits are often consolidated whereas during non-REM cycles, facts and concepts are solidified. Sleep also allows for the brain to make sense of information collected throughout the day (Wolfe, P., 2010).

William Killgore extends further on the research of scientists like Carskadon. He focuses on the impact sleep has on individuals with an emphasis on sleep deprivation. He indicates that there has been much debate surrounding this area and the significant impact a lack of sleep may have on an individual. Continuing with expansion from MRI

imaging, it can be concluded that higher level cognition is impacted more than previously expected when an individual faces sleep deprivation. However, he has indicated that many factors are at play in present research when looking at cognitive processes, including an overarching decline on a global scale (Killgore, 2010).

Killgore elaborates further by focusing on areas that are shown to be hindered when sleep deprivation occurs. This includes alertness, vigilance, and simple attention. It is important to point out that it does not need to be a significant amount of lack of sleep but consistent restriction that can lead to an extended lowering of response times. The longer a person continues to not get enough sleep, the more detrimental it is on an individual. The same can be concluded regarding the number and duration of attention lapses an individual may face (Killgore, 2010).

Wolfe's work is relevant to the study being conducted as its focus includes almost all of the areas of interest being examined. The knowledge of how the brain functions is a steppingstone to looking more in depth at sleep and its effect on learners and children. By focusing on the biological components of brain function and sleep as well as its implications on the students in the classroom, it allows all stake holders involved in a child's educational pathway to work to best suit the needs of the student and mitigate hindering factors that may arise. Further, Killgore's work is important to further indicate the importance of sleep on a student's learning abilities. His contributions to the field show the significant impacts that prolonged and consistent sleep deprivation can have in the classroom setting. This knowledge is crucial to teach mitigating issues that may arise in the classroom stemming from the lack of sleep that is being obtained at home.

How School Affects Sleep in Adolescence

One of the most significant problems pressing on society is the demand that is put on individuals. Research conducted by Curcio, et al quotes a study completed by Pilcher and Huffcut in which they suggest that "sleep-deprived individuals functioned at a level that is comparable with the ninth percentile of non-sleep-deprived subjects" (2006). Though the research regarding connections between sleep and learning capabilities are limited, consensus agrees that both REM and non-REM sleep are important for processing memories in humans, with the most harmful component being a lack of sleep (Curcio et al., 2006).

School achievement can be measured in a multitude of ways, including grade point average (GPA) and test scores. Curcio's research study indicates that most school achievement difficulties occurred in individuals with reported fatigue (Curcio et al., 2006). It was also reported that students who have a better night's sleep tend to have a higher GPA. The general measurement of a student's functionality in schools is also correlated to their sleep quality and quantity obtained. Similar findings were reported at the collegiate level as well (Curcio et al., 2006). While similarities are found in numerous studies, some studies indicate evidence on the contrary. For example, research by Arne H Eliasson did not show a significant association between the two factors (Curcio et al., 2006).

Additionally, a key component reported among students was a lack of ability to pay attention in the classroom (Curcio et al., 2006). However, those same individuals who reported an inability to focus also tended to have more irregular bedtimes and thus received less sleep. The relationship between sleep and a child's ability to focus and

learn were also evaluated, and though correlations were not overly significant, they were strong enough to give merit to the notion that there is a core relationship (Curcio et al., 2006).

Overall, it can be generally concluded that there is a link between a student's sleep habits, daytime sleepiness levels, and their overall academic performance. However, often there are more factors at play in a child's school day. As of 2020, it is estimated that 44% of male students and 34.6% of female students are involved in extracurricular sports (Bureau, 2022). Similarly, 24% of males and 29% of females were involved in clubs and lessons outside of the school day (Bureau, 2022). Both numbers are significantly higher than previously recorded. For example, participation in sports has risen 3% in males and 4.6% in female populations. Likewise, participation in clubs has risen in similar numbers since 1998 (Bureau, 2022).

According to Kalenkoski and Pabilonia, a high school student who works for pay in the United States spends significantly less time on other activities. Not only is homework affected, but also other activities such as sleeping, housework, and screen time. Overall, an increase in a student's paid work time leads to a reduction of time spent on the previously mentioned activities by up to 84% (Kalenkoski & Pabilonia, 2009).

A comparison analysis was completed by Short, Gradisar, Lack, Wright, Dewald, Wolfson and Carskadon between US schools and Australian schools, with a focus on three areas: School start times, parent-set bedtimes, and extracurricular load. They focus on extracurricular load as a whole, meaning it is inclusive of paid work, sports, homework, and other miscellaneous activities (Short et al., 2012). Findings conclude that

cultural differences among these three factors lead to an increase in Australian adolescents sleep duration compared to those in the United States. Although biology cannot be negated as a contributing factor, societal and sociocultural norms are involved in the delay of bedtimes and earlier wake times, thus leading to insufficient sleep obtained (Short et al., 2012).

The research conducted is important when focusing on the needs of students in the classroom. To best serve students and allow them to reach their full academic potential, it is imperative that society, families, and schools alike understand the growing pressures and decreasing time adolescents have in their busy lives. Schools can aid in this burden by focusing on their daily start times and how it has a significant impact on their students. The time that students begin school in the morning sets the precedent for not only their day, but also subsequent weeks and even their overall academic success.

Technology Use and Its Impact on Adolescent Sleep

A significant area of focus conducted by Wahlstrom includes factors that influence the amount of sleep an adolescent receives. This is inclusive of biological changes, societal expectations, use of technology, light exposure, and caffein intake. Her research relating to the use of technology includes many negative aspects related to the action, including the overreliance of technology from a social standpoint and its role as an inhibitor in allowing individuals to fall asleep. Further, many teens report waking up during the night due to receiving notifications on their cell phones (Wahlstrom, 2014). Another focus of Wahlstrom includes light exposure, of both natural and artificial nature.

Blue light use before bed is linked to artificially affecting adolescents' natural circadian rhythm (2014).

Wahlstrom conducted the *Teen Sleep Habits Survey* to numerous schools across different states. The results of this indicated teen sleep patterns, sleep quality and daytime sleepiness. Further, students' perceptions of ideal start times for school as well as in and out of school activities were analyzed compared to students' letter grades and health factors (Wahlstrom, 2014).

In research conducted by Lauren Hale, startling statistics were found. They concluded that 75% of children reported the presence of at least one technology device in their bedroom, while 60% have reported use of these devices before bed. (Hale, 2018). Abundant studies come to the same conclusion: there is a direct association between screen time and a reduction of sleep quality in adolescents. While there has been documented studies looking at total screen time per day, a focus on use 1-2 hours before bedtime showed more drastic detrimental effects (Hale, 2018).

Though it is clear that technology use plays a role in the reduction of sleep, there is mixed literature regarding to if the type, size, or interactive level of the screen makes a difference. For example, it is suggested that activities such as video game use led to a reduction in sleep obtainment more so than activities like simply watching television (Hale, 2018).

To best mitigate the current standing issues surrounding the overwhelming use of technology, it is first important for stakeholders to understand the link between the variables. More research in this area should be conducted to determine the appropriate amount, type, and time of use for technology. The growing world of technology use is

not going away any time soon; thus, it is important for both parents and educators to understand and implement positive and effective methods to mitigate the damaging effects currently observed.

The Relationship Between School Attendance and Academic Performance

Many districts across the United States have made attendance a focal point to improve student attendance. This is a significant problem plaguing schools across the country. According to the US Department of Education, about 1 in 5 students are considered chronically absent (*Chronic Absenteeism in the Nation's Schools*, n.d.). To be considered chronically absent, a student must miss at least 15 days of school in a year (*Chronic Absenteeism in the Nation's Schools*, n.d.). It comes as no surprise that school attendance is critical when looking at a student's academic performance. The relationship between a student's academic success and their absenteeism is one that can typically be seen early on in a student's schooling. There is correlation between missing more school and doing poorly in subsequent grades. It has been shown that students who end up dropping out of high school tended to miss more school in first grade than those who graduated. (*Every School Day Counts: The Forum Guide to Collecting and Using Attendance Data*, n.d.). By the time students hit ninth grade, attendance tends to be a key indicator regarding the likelihood of them achieving high school graduation.

While it can be assumed that there is a relation between a student's academic success and their absenteeism, there is mixed data regarding the validity of the evidence found. As such, the "how, when and where student absences affect academic performance has important implications for the design and targeting of interventions, the

consequences of absence-based accountability policies, and the role of student absences in contributing to socio-demographic gaps in educational outcomes" (Liu et al., 2021). Nonetheless, current studies suggest that a reduction in the number of absences a student accumulates is related to their ability to perform better academically, both in the classroom as well as on standardized tests (Aucejo & Romano, 2016).

While there are more plausible causes as to why a student may accumulate chronic absences, they can be summed up into a few main categories. Poor health, limited transportation, and a lack of safety are all detrimental and can cause chronic absenteeism in students of any grade level, though it is most seen in high schools (*Chronic Absenteeism in the Nation's Schools*, n.d.).

Regardless of the reasoning as to why a student is absent, the effect of it is widespread. It is reported that students who miss significant amounts of grade school often read below grade level. Subsequently, this is a predictor for the future of that student, as individuals who are behind by grade three become four times more likely to drop out of high school (*Chronic Absenteeism in the Nation's Schools*, n.d.).

To best succeed in the classroom, one of the most important steps that a student can take is to be present within it. Not only is this important at the high school grade level, but attendance in lower levels is significant in predicting the future of a student's attendance. This is valuable information for educators across the globe, as often there is an assumption behind the reasoning of teenager's absenteeism. The correlation found in chronic absenteeism throughout an individual's lifetime is troublesome and an area in which schools and communities should focus on improving. If the problem with student

absences is solved early on, it can allow for students to be set up better for success in their future endeavors as well.

Summary

The goal of this study was to provide an extensive overview of the theoretical framework and literature relevant to what effects a high school student's sleep habits have on their academic success. Research was conducted with a focus on viewing every aspect and viewpoint related to the importance of sleep in adolescence, how high school can affect a high school student's sleep, technology use and its impact on adolescent sleep quality, and the relationship between school attendance and academic performance. All the research that has been presented in this chapter will contribute to the overall review and analysis of the data collected in this thesis. The objective for this thesis is to not only utilize this knowledge but also contribute to the research on the significant topic of adolescent sleep quality.

CHAPTER III: METHODOLOGY

I. Introduction

This chapter offers an in-depth summary of the methods that are used in this descriptive research study. The researcher aimed to compare several different student characteristics such as gender, race, sleep habits, job status, participation in extra-curricular activities, attendance, and academic success. The research design, setting, participants, instrumentation, procedure, data processing and analysis, limitations, and ethical considerations are thoroughly outlined in this chapter. This chapter further illustrates the reasoning behind the decisions made in crafting the research design, thereby establishing the groundwork for the forthcoming presentation of study outcomes in Chapter four.

II. Review of Primary Research Questions and Hypotheses

Primary Research Questions

This study will investigate the following questions about students in grades 9-12 at Bridgeport High School:

1. Are End-of-Course (EOC) English Language Arts (ELA) scores, use of LED technology, work status, participation in organized sports, sleep habits, and attendance significant predictors of academic performance as measured by cumulative grade point average (GPA)?

2. Are EOC ELA scores, use of LED technology, work status, participation in organized sports, and sleep habits significant predictors of attendance?
3. Are gender, race, and work status significant predictors of sleep habits?

Hypotheses

The hypotheses for the three research questions include:

1. EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance are significant predictors of academic performance as measured by cumulative GPA.
2. EOC ELA scores, LED light usage before bed, work status, participation in organized sports, and sleep habits are significant predictors of attendance.
3. Gender, race, work status, are significant predictors of sleep habits.

III. Participants and Setting

Participants in this study consist of students from the Bridgeport Exempted Village School District (BEVSD) located in Bridgeport, Ohio. Students in grades 9 through 12 at Bridgeport High School, with the consent of their parents, voluntarily chose to participate in the study. BEVSD is a small district settled in rural Belmont County, Ohio, along the Ohio River. The campus-style district has 737 students housed in one building for preschool – twelfth grade. The district is split into three separate schools and as of 2024, the elementary is comprised of 346 students in preschool through fourth grade, 216 students in middle school grades fifth through eighth, and 175 students in the

high school grades ninth through twelfth (Reports Portal, 2024). Bridgeport High School has a 4-year graduation rate of 95.2% (Ohio School Report Cards, 2024).

According to the Ohio Department of Education and Workforce, "an Ohio school district is eligible for the Rural Low-Income School grant if the district has a low-income percentage of 20 percent or higher with children ages 5-17 on the U.S. Census for the geographical area that the school district serves. (2017)" As such, Bridgeport Exempted Village School District fulfills this criterion with 63.5 percent of students who are considered economically disadvantaged across all grade levels. These students reflect Bridgeport Ohio, where 31.76% of the population lives below the poverty line. Bridgeport High School serves a student population of which 10.6% are recognized as gifted and 19.7% are identified as having a disability (Reports Portal, 2024).

The sample for this study is composed of 69 students: 8 ninth graders, 18 tenth graders, 16 eleventh graders, and 27 twelfth graders. The participants' ages range from 14 to 19 years old with only one student who was age 19 at the time of the data collection. Based on participant gender identification, there are 33 female students and 34 male students involved in the study with one student who did not disclose their gender.

IV. Instrumentation

Ohio End-of-Course State Tests

According to the Ohio Department of Education and Workforce, Ohio End-of-Course State Tests are taken by students to analyze how well they are growing in the knowledge

and skills outlined by the Ohio Learning Standards. The tests are used to help strengthen future teaching to ensure students are being prepared for long-term success in school, college, careers, and life. Tests are also used to allow citizens to know how well local schools are performing compared to others around the state (Rural Low-Income School Program | Ohio Department of Education and Workforce, 2017).

Ohio End-of-Course (EOC) state tests in eighth grade English Language Arts (ELA) are used as a baseline measurement for students involved in the study. Participants in grade 12 did not take the Ohio EOC state Tests in the eighth grade due to the COVID-19 pandemic. In this case, scores from seventh grade EOC ELA tests were used for baseline data in place of the standardized eighth grade test. Seven participants transferred into the district after middle school, and therefore neither seventh nor eighth grade End-of-Course results were available.

Teen Sleep Habits Survey

Instrumentation for the study includes the *Teen Sleep Habits Survey* that was originally developed and used in a study conducted by Kayla Wahlstrom to show relationships between school start times, sleep duration, and adolescent behaviors (2014). The survey is a 97-item questionnaire that asks participants to write in their usual bedtime and wake-up time for both school nights and weekends. For this analysis, "sleep duration" for both school nights and weekends are found by calculating the number of hours between the self-reported bedtime and wake-up time. This method of finding a student's sleep duration is supported in a study conducted by Wolfson et al which found that using self-reported sleep and wake times on a survey are sufficiently aligned with sleep duration data that is collected using actigraphy (Wolfson et al., 2003).

Other topics that are included on the *Teen Sleep Habits Survey* include questions about why a student goes to sleep and wakes at the time they do. The survey also includes questions about how often they struggle to stay awake in a day or have actually fallen asleep in different situations such as during class time, while doing homework, taking a test, watching television, etc. Questions also ask participants to self-reflect on their sleep habits by asking how much sleep they feel they need each day and if adequate sleep is being achieved with their daily routine. For students who have a job or participate in extracurriculars, questions are included that gauge how these activities affect their sleep patterns.

Factors associated with a student's mental health were also examined through the *Teen Sleep Habits Survey*. Students were asked in the last two weeks, how often they were bothered or troubled by: arriving late to school due to oversleeping; feeling too tired to do things; having trouble going to sleep or staying asleep; feeling unhappy, sad or depressed; feeling hopeless about the future; feeling nervous or tense; or worrying to much about things. Participants were instructed to respond never, once, twice, several times, or every day/night. Participant's use of substances was assessed through participant self-report. It is important to note that the *Teen Sleep Habits Survey* was not anonymous. Although students were urged to answer all questions honestly and without fear of repercussions, it should be noted that the responses in this section could be skewed due to a fear of being punished or embarrassment due to the sensitive nature of the questions. Students were asked during the last two weeks, how often they had done the following: drank a beverage with caffeine such as Coke, Pepsi, Monster, Mountain Dew, or Red Bull; drank coffee or tea with caffeine; used tobacco; drake alcohol; or used

drugs. Participates were instructed to respond never, once, or twice a week, once a day, or several times a day.

V. Procedure

Data collection took place in January 2024 through April 2024. Students in grades 9 through 12 were asked to participate during their math class. The limited sample of 68 participants were selected based off who returned a parent consent form and student assent form. Students were informed that the survey was completely optional, and the results would be used in a research thesis on sleep habits and academic success. They were informed that the survey was not anonymous for data collection purposes, however they had the right to skip any questions they felt uncomfortable answering, and all answers would be kept confidential. Participants and parents were given a letter and a written document explaining the study and their rights. All documents described above can be found in Appendix B.

Once proper parent consent was received, students completed the *Teen Sleep Habits Survey* during the time frame listed above. Results of the survey were released to the researcher and then placed into a spreadsheet for analysis. With the approval of school administration, the high school guidance counselor provided participant's cumulative grade point average (GPA) and attendance information. These were then matched to the results from the *Teen Sleep Habits Survey*, and all personal identifiers were removed before being released to the researcher for further analysis. The cumulative grade point average reflected all classes taken from the first 9-weeks of the participants ninth grade school year to the end of the third 9-weeks of the 2023-2024

school year. Attendance was taken by calculating the number of hours missed from August 17, 2023, through April 1, 2024 of the 2023-2024 academic school year.

VI. Data Analysis

The statistical analysis for this study is conducted using R (R Core Team, 2020). All hypotheses are tested using multiple regression techniques and are done so at the 95% confidence level, corresponding to an alpha level of .05 (Warner, 2013). Independence and equal variances are tested using an independent samples t-test. The Shaprio-Wilk test is used to check for possible threats to the normality assumption, and Levene's test is used to check if the equal variance assumption is met. G*Power 3.1 software is used to test the appropriateness of sample size for each of the hypotheses being tested. The standard value for small effect size is 0.20, a medium effect size is 0.50, and a large effect size is 0.80 (Warner, 2013). In addition to the hypotheses being tested, a detailed item analysis is conducted and reported for each question on the *Teen Sleep Habits Survey*.

All three hypotheses use variables that are measured in a variety of ways. LED light usage before bed is determined by the participants response to question 2 on the *Teen Sleep Habits Survey*; "There are many reasons for doing things at one time or another. What is the main reason you usually go to bed at this time on school days?" Participants are classified as users of LED light before bed if they responded to question 2 with "My TV shows are over", "I have finished socializing (texting, phone calls, etc.)" or "other" and wrote a response related to LED light usage on the provided line. Otherwise, the participant is classified as a non-user of LED light before bed. Work

status is determined by the participants response to question 30 on the *Teen Sleep Habits Survey*; “During the last week, did you work at a job for pay.” Participation in organized sports was measured using question 32 from the survey; “During the last week, did you engage in organized sports or a regularly scheduled physical activity?” Sleep habits were measured by a self-reflective response, question 20, from the *Teen Sleep Habits Survey*; “How often do you think you get enough sleep during the school week?” The response to this answer is dichotomized by grouping the responses never and rarely together as students with poor sleep habits and grouping the responses sometimes, usually, and always together as good sleep habits.

ELA Scores are measured from the Ohio seventh or eighth grade End-of-Course State tests. Cumulative GPA is measured using a 4.0 scale. It is determined by averaging all GPAs from the first 9-weeks of the student’s ninth grade school year through the third 9-weeks of the 2023-2024 school year. Attendance is measured by the number of hours of school missed during the first, second, and third 9-weeks of the 2023-2024 school year. Attendance does not differentiate for why a student is absent. Gender is determined by the participants self-reporting as male or female. Race is also reported by the participants on question 47 of the *Teen Sleep Habits Survey*.

Hypothesis one aims to assess the impact of EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance on a student’s cumulative GPA. This analysis is done using multiple regression techniques with six predictors. Power was measured using G*Power software an of .80 at an effect size of 0.15 and $\propto$=.05, a sample size of 92 is required. With an achieved sample of

n=54, power is a concern and there is an increased likelihood that a statistically significant finding may represent a false positive result.

Hypothesis two aims to test the impact of EOC ELA scores, LED light usage before bed, work status, participation in organized sports, and sleep habits on attendance. This analysis is done using logistic regression techniques with five predictors. The number of hours absent was dichotomized based on the threshold of a student being considered truant, as set forth by the Oho Revised Code. If a student is absent for more than 72 hours during the school year, they are considered truant (Section 2151.011, 2023). For this analysis, if a student is absent for more than 72 hours, he or she is classified as having poor attendance.

Hypothesis three aims to assess the impact of gender, race, and work status on sleep habits. This analysis is done using logistic regression techniques with three predictors. Sleep habits were dichotomized based off the participant's self-reflective response to question 20 from the Teen Sleep Habits Survey; "How often do you think you get enough sleep during the school week?"

VII. Limitations

Several limitations of the study must be addressed. One limitation is that baseline data for this study was pulled from different Ohio End-of-Course State Tests. This was necessary due to a lack of eighth grade test scores for every grade level due to the Covid-19 pandemic. During the 2019-2020 school year, children across Ohio, including students in the Bridgeport School District, were forced to finish the school year remote due to safety concerns from the pandemic, and state testing for that year were suspended.

Furthermore, the *Teen Sleep Habits Survey* that was given to all participants of this study was not anonymous. Students were required to provide their name on the survey so that the results would be able to be linked to future data collection. This potentially increases the risk of students not answering some of the sensitive questions honestly. To reduce the likelihood of students no answering truthfully, students were encouraged to skip any questions they did not feel comfortable answering. They were also reminded that once all of the data was collected, all personal identifiers would be removed before being analyzed in the study.

Other important considerations are the limited sample size of the study and how students were selected to participate. Because the study deals with participants who are under 18 years of age, parental consent was required. Every student in grades 9 through 12 grades were given letters for their parents outlining valuable information about the study and asking for consent for their child to participate. Out of the 175 letters that went home to parents, only 68 signed consent forms were returned. This could limit the generalizability of the research to the population of the district as a whole. Additionally, since the study relied on voluntary participation from both the student and their parent, selection bias may have been introduced. This could have an impact on the reliability of the findings.

VIII. Ethical Considerations

Confidentiality of the participants was ensured through multiple measures. First, all cumulative grade point averages and attendance information were removed of all identifiers prior to being released to the researcher. Although results from the *Teen*

Sleep Habits Survey were not anonymous, results from the survey were entered into a spreadsheet by the researcher. The school's guidance counselor then paired the attendance and GPA data to the results from the survey and removed the personal identifiers before releasing the spreadsheet back to the researcher.

The researcher submitted an application to the Institutional Review Board (IRB) for a full review, and approval for the study was granted by the board after one of their monthly meetings. The protection of rights for participants that are under 18 years of age was a key part of the IRB review process. With the recommendation of the IRB board, consent forms were required to be signed and returned by all participants legal guardian and assent forms were to be signed by the student prior to any data collection. In addition to requiring consent, information about the study, the rights of the participants and their parents, and the risks associated with the study were all communicated to the parent. Contact information was given to guardians for any questions regarding the study. All forms listed above can be found in Appendix B.

IX. Conclusion

Chapter 3 provided a detailed description of the methodology employed in this study. The research design, participants and setting, instrumentation, procedure, data analysis, limitations, and ethical considerations were each addressed in relation to the research. Limitations have been acknowledged and should be considered when interpreting the findings from this study. Thereby, this chapter has detailed the framework that will serve as a foundation for the analysis and interpretation of the research findings in future chapters.

CHAPTER IV: RESULTS

I. Introduction

The chapter will begin with a brief recap of the study's participants, setting, and the instruments that were used. An item analysis for the *Teen Sleep Habits Survey* and a summary of the results will be broken up by teen sleep patterns, teen sleep quality and daytime sleepiness, and student participation in out-of-school activities. All analysis in this chapter was performed using R (R Core Team, 2022). The chapter will conclude with an analysis of the hypotheses by looking at the impact student sleep habits have on academic success and attendance, as well as if gender, race, or work status affect the amount of sleep a student receives.

II. Participants, Setting, and Instrumentation

Participants in this study consist of students from the Bridgeport Exempted Village School District (BEVSD) located in Bridgeport, Ohio. Students in grades 9 through 12 at Bridgeport High School, with the consent of their parents, voluntarily chose to participate in the study. At the time of this research, Bridgeport High School had 175 students in grades 9^{th} through 12^{th} (Reports Portal, 2024). There were 69 students and parents who gave proper consent to participate in the study (39.4% of the population). **Table 1** shows the academic levels of all the students who participated in the study. In addition, **table 2** shows a breakdown of each race and student identified gender that is represented in this sample.

Table 1: Breakdown of Students in Each Grade Level

Academic Level of Students	Number of Participants
Freshman	8
Sophomore	18
Junior	16
Senior	27
Total	69

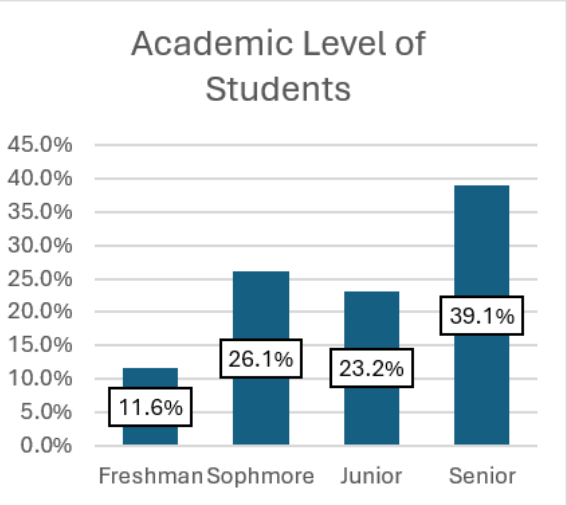


Table 2: Breakdown of Race and Student Identified Gender

Self-Identified Gender	Number of Students	Percent of Sample
Male	33	47.8 %
Female	35	50.7 %
Undisclosed	1	1.4 %

Race	Number of Students	Percent of Sample
White/Caucasian	58	84.1%
Black/African American	4	5.8%
Multi Race/Other	7	10.1%

Instrumentation

Assessment data from the Ohio End-of-Course Tests in seventh and eighth grade English Language Arts was used for baseline data of students prior to entering high school. Attendance was measured for the 2023-2024 school year by calculating the number of hours missed from August 17, 2023, through April 1, 2024. The cumulative grade point average reflected all classes taken from the first 9-weeks of the participants ninth grade school year to the end of the third 9-weeks of the 2023-2024 school year. The *Teen Sleep Habits Survey* that was originally developed and used in a study conducted by Kayla Wahlstrom was used to show relationships between school start times, sleep duration, and adolescent behaviors (2014).

III. Results from the *Teen Sleep Habits Survey*

Part 1: Teen Sleep Patterns

To analyze teen sleep patterns for students who participated in this study, students were asked a variety of questions on the survey related to their bedtimes and wake up times. **Table 3** presents the mean times students reported that they usually go to bed and wake up on school nights/days and weekend nights/days. A school night is classified as any night in which a student has to wake up for school the next morning (Sunday – Thursday), and a weekend night is any night in which a student does not (Friday – Saturday). On average, it was found that students not only go to bed later during the weekends, but also sleep in later as well.

Table 3: Mean Student Reported Bedtime and Wake Up Times

Bedtime School Nights	Wake Up Time School Days	Bedtime Weekend Nights	Wake Up Time Weekend Days
11:50 PM	6:39 AM	1:11 AM	10:05 AM

When subtracting each student's usual wake up time on school days by their corresponding usual bedtime on school nights, it was found that only 20 of the 69 students (29.0%) receive the recommended eight to ten hours of sleep a night and only one student achieved the optimal nine hours and fifteen minutes for teenagers. The other 49 students (71.0%) are unable to sleep of a recommended minimum of eight hours a night during the school week. When performing the same calculation for weekends, 34 of the 69 students (49.3%) receive the recommended eight to ten hours of sleep a night. Twenty of the 69 students (29.0%) still fall below the eight to ten hours of recommended sleep for teenagers, while 15 students (21.7%) sleep for over the recommended 10 hours (Wolfe, P., 2010).

The survey given asked students what time their bodies indicated it was time for bed as shown in **table 4**. The survey also asks students to give the main reason he or she decides to go to sleep. The results to this question can be seen in **table 5.** Based on this data, only 7.2% of students claim to have a bedtime set by a parent on a weekday. That number drops to 0% on weekends. Results from these tables show that teenage students not only have various times they choose to go to sleep, but also various reasons for it.

Table 4: When Students' Bodies Start to Tell Them It Is Time for Bed

Time Period	Percent of Sample
8:00 – 9:00 PM	1.4%
9:00 – 10:00 PM	13.0%
10:00 – 11:00 PM	30.4%
11:00 PM – 12:00 AM	39.1%
After 12:00 AM	15.9%

Table 5: Main Reason Why Students Go to Bed When They Do on School Nights and Weekends

Reason	School Nights	Weekends
My parents have set my bedtime	7.2%	0%
I feel sleepy	49.3%	58.0%
I have finished my homework	5.8%	0%
My TV shows are over	1.4%	1.4%
I have finished socializing (social media) and playing video games	11.6%	26.1%
I get home from my job	2.9%	1.4%
Other	18.8%	10.1%

Results from the survey also indicate that it takes students longer to fall asleep on school nights than it does on weekends nights (**See table 6**). Once asleep, a majority of students (88.2%) are awakened by either an alarm clock or a family member on school days. That number drops dramatically to 19.2% on the weekends. The data shows that most students (61.8%) wake up naturally on the weekend for no particular reason. **Table 6** shows responses as to why students reported waking up when they do.

Table 6: Main Reason Why High School Students Wake Up When They Do on School Days vs. Weekends

Response	School Days	Weekends
Noises or pets wake me up	0%	11.8%
My alarm clock wakes me up	70.6%	11.8%
My parents or other family members wake me up	17.6%	7.4%
I need to go to the bathroom	2.9%	2.9%
I don't know, I just wake up	7.4%	61.8%
Other	1.5%	4.4%

The survey also inquired about students' napping habits. **Table 7** shows how often students report napping both on school days and weekends. This data shows that students are more likely to nap at least sometimes on school days (55%) than on weekends (46.4%).

Table 7: How Often Students Nap on School Days and Weekends

Response	School Days	Weekends
Never	24.6%	40.6%
Only when I'm sick	20.2%	13.0%
Sometimes	39.1%	37.7%
Every Day	15.9%	8.7%

Part 2: Teen Sleep Quality and Daytime Sleepiness

Students were asked to self-report how often they felt they received enough sleep (**see table 8**). Responses generated are used in assessing all three hypotheses later in this chapter. In general, students reported getting enough sleep more frequently on weekends than on school days. The survey showed that on weekdays, 72.1% of students felt they at least sometimes got enough sleep, as compared to 90.1% on weekends.

Table 8: How Often High School Students Think They Get Enough Sleep on School Days and Weekends

Response	School Days	Weekends
Never	9.8%	1.6%
Rarely	18.0%	8.2%
Sometimes	36.1%	26.2%
Usually	26.2%	31.1%
Always	9.8%	32.8%

Students were asked how often they felt sleepy during the daytime and struggled to stay awake (**see table 9**). Only 21.7% of students felt that it was no problem at all, while most students admitted it was at least a little problem. The survey further examined this question by providing a series of daily activities and had students indicate if in the last two weeks they had struggled to stay awake and/or fallen asleep during that activity (**see table 10**). It is important to point out that 43.5% of students reported that they either struggled to stay awake or fell asleep in a class at school.

Table 9: How Much of a Problem Students Have with Sleepiness Overall During the Daytime

Response	Percent
No problem at all	21.7%
A little problem	52.2%
More than a little problem	17.4%
A big problem	5.8%
A very big problem	2.9%

Table 10: How Often Students Struggled to Stay Awake or Fallen Asleep Over the Previous Two Weeks.

Activity	Struggled to stay awake or fallen
In a class at school	43.5%
While doing homework on the computer	27.5%
Reading, studying, or doing homework	40.6%
While taking a test	18.8%
Traveling in a bus, train, plane, or car	44.9%
Attending a performance (movie, concert, play)	18.8%
Watching television or listening to music	58.0%
Playing video games	18.8%
Driving a car	0%
In a face-to-face conversation with another person	10.0%

Part 3: Student Participation in Out-of-School Activities

Students were asked questions about out-of-school activities. Out of all students who were surveyed, 61.7% study and do homework outside of the school day, 49.3% play organized sports, 32.8% participate in an organized activity such as a club or music/band, and 37.7% work a job for pay. The mean number of hours students report they spend participating in these activities outside of the school day are displayed in **table 11**.

Table 11: Mean Number of Hours Students Spend During Out-of-School Activities*

After School Activity	School Days	Weekends
Studying/doing homework	1.9 hours	1.1 hours
Participating in an organized sport	5.4 hours	1.3 hours
Participating in an organized activity such as a club or music/band	2.2 hours	1.3 hours
Working a job for pay	9.9 hours	10.6 hours

*Note: This table only includes data from students who indicated they participated in these out-of-school activities.

Students of after-school activities were also surveyed regarding their sleep habits due to their participation. As shown in **tables 12 and 13**, most students reported that their bedtime and wake-up time would not change if they did not participate in their out-of-school activity. Despite this, **Table 14** shows that during the last two weeks, many of these same students either struggled to stay awake or fell asleep during these activities.

Table 12: Percent of Students That Would Go to Bed Earlier, Later, or The Same Time If They Did Not Participate in The Out-of-School Activity.

Activity	Earlier than you do	Later than you do	Same time as you do
Studying/doing	17.0%	8.5%	74.5%
Participating in an organized sport	14.7%	17.6%	67.6%
Participating in an organized activity such as a club or music/band	13.6%	4.5%	81.8%
Working a job for pay	20.0%	12.0%	68.0%

Table 13: Percent of Students That Would Wake-up Earlier, Later, or The Same Time If They Did Not Participate in The Out-of-School Activity.

Activity	Earlier than you do	Later than you do	Same time as you do
Studying/doing homework	8.7%	10.9%	80.4%
Participating in an organized sport	11.8%	20.6%	67.6%
Participating in an organized activity such as a club or music/band	4.5%	18.2%	77.3%
Working a job for pay	8.3%	25.0%	66.7%

Table 14: The Percentage of Students Who Struggled to Stay Awake/Fell Asleep at An Out-of-School Activity During the Previous Two Weeks.

Activity	Struggled to stay awake or fell asleep	Did not
Studying/doing homework	32.4%	67.6%
Participating in an organized sport	5.9%	94.1%
Participating in an organized activity such as a club or music/band	13.6%	86.4%
Working a job for pay	36.0%	64.0%

IV. Analysis of Research Questions and Hypotheses

This study will investigate the following questions about students in grades 9, 10, 11, and 12 at Bridgeport High School:

RQ 1: Are EOC ELA scores, use of LED technology, work status, participation in organized sports, sleep habits, and attendance significant predictors of academic performance as measured by cumulative GPA?"

RQ 2: Are EOC ELA scores, the use of LED technology, work status, participation in organized sports, and sleep habits significant predictors of attendance?"

RQ 3: Are gender, race, and work status significant predictors of sleep habits?

The descriptive statistics summarizing GPA, hours absent, and End-of-Course ELA test scores are broken down for each categorical variable in **able 15**. These variables are used in both research questions 1 and 2.

Table 15: Descriptive Statistics for LED Technology, Work Status, Participation in Organized Sports, and Student Sleep Habits

Variable	GPA **Mean (sd)**	Hrs. Absent **Mean (sd)**	EOC ELA Score **Mean (sd)**
Not exposed to LED light before bed	3.225 (0.621) $nn = 48$	58.879 (52.568) $nn = 48$	720.070 (21.109) $nn = 42$
Exposed to LED light before bed	3.183 (0.623) $nn = 21$	60.172 (51.169) $nn = 21$	715.722 (25.381) $nn = 20$
Does not work part-time	3.329 (0.701) $nn = 43$	53.546(53.407) $nn = 43$	715.947 (21.078) $nn = 38$
Works part-time	3.018 (0.440) $nn = 26$	68.743 (48.470) $nn = 26$	719.000 (23.228) $nn = 24$
Does not participate in organized sports	3.146 (0.604) $nn = 35$	69.456 (64.662) $nn = 35$	716.767 (24.536) $nn = 30$
Participates in organized sports	3.280 (0.639 $nn = 34$	48.789 (31.500) $nn = 34$	717.469 (19.846) $nn = 32$
Poor Sleeper	3.235 (0.590) $nn = 39$	57.071 (56.801) $nn = 39$	719.294 (21.615) $nn = 34$
Good Sleeper	3.259 (0.703) $nn = 22$	54.397 (34.110) $nn = 22$	717.800 (20.488) $nn = 22$

Hypothesis for RQ 1: EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance are significant predictors of academic performance as measured by cumulative GPA.

A standard multiple regression analysis was performed between GPA (M = 3.212, SD = 0.617) as the dependent variable and EOC ELA scores, use of LED technology,

work status, participation in organized sports, sleep habits, and attendance as the independent variables. A total of 15 cases were removed due to missing data and results were calculated on a sample size of n = 54. Power was measured using G*Power software an of .80 at an effect size of 0.15 and ∝=.05, a sample size of 92 is required. Therefore, power is a concern and there is an increased likelihood that a statistically significant finding may represent a false positive result.

Results of the evaluation of the assumptions indicated no concerns with independence, normality of error terms, equal error variances, or multicollinearity. Independence was verified with the Durbin-Watson test; D-W Statistic = 1.905, p = .598. Shapiro's test for normality revealed no concerns; W = 0.976, p = .352. Additional plots that were used to check the normality and equal variance assumptions are presented in **graph 1**. Multicollinearity was examined using Variance Inflation Factors, which ranged from 1.04 (Hrs. Absent) to 1.28 (Work Status).

Figure 1: Plots for Normality and Equal Variance Assumptions

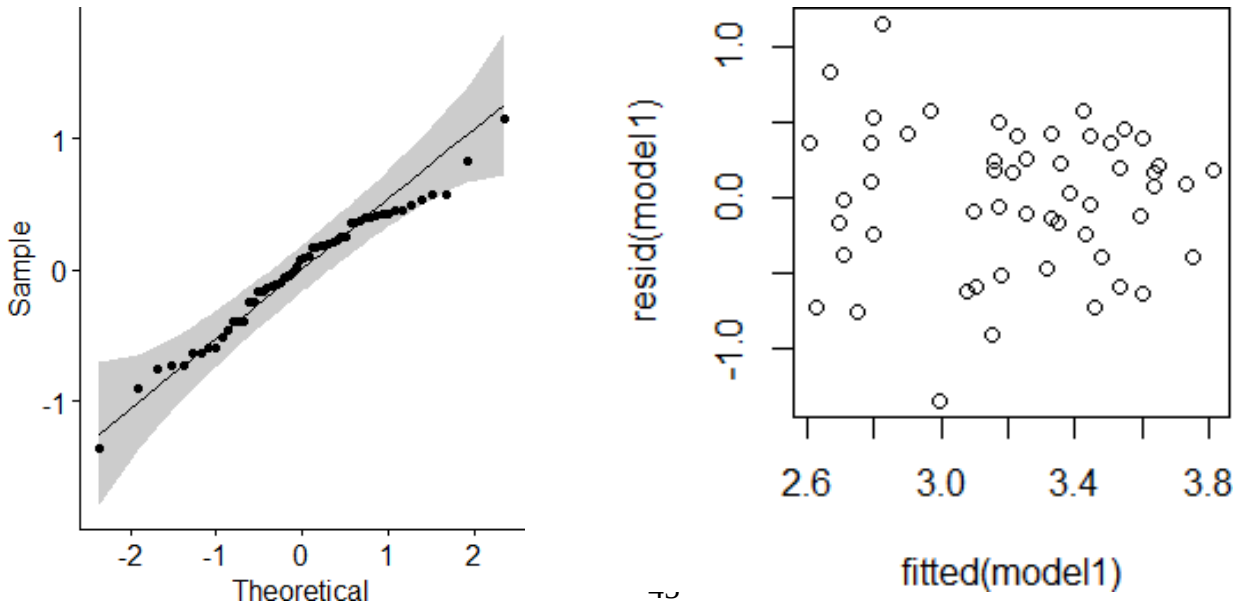


Table 16 displays the correlations between the variables, unstandardized regression coefficients, and the adjusted RR^2 value. A test of the full model against the intercept only model was significant; F (6, 47) = 3.803, p < .01. The set of predictors in combination contributed to approximately 24% of the variance in GPA. The only regression coefficients that emerged significant were EOC ELA scores, work status, and hours absent, therefore, test-statistic values and confidence intervals are presented for each: EOC ELA scores (t = 2.977, (0.003, 0.016)); Work status (t = -2.043, (-.669, -0.005)); Hrs. Absent (t = -2.784, (-0.009, -0.001)). Examination of outlier cases, high standardized residuals, and influential cases led to the deletion of no cases. Despite the data showing a decrease in GPA for students exposed to LED light before bed and categorizing themselves as poor sleepers, neither of these variables were significant predictors of GPA. In addition, participation in organized sports was also not a significant predictor of GPA.

Table 16: Correlations Between Variables, Unstandardized Regression Coefficients, and The Adjusted RR^2

Variables	ELA	Hrs. Absent	LED	WORK	SPORTS	SLEEP	B	SE
GPA	0.471	-0.227						
ELA	--	-0.251					0.010**	0.003
Hrs. Absent	-0.251	--					-0.005**	0.002
LED			--				0.106	0.157
WORK				--			-0.337*	0.165
SPORTS					--		-0.075	0.151
SLEEP						--	0.184	0.147
Intercept							-3.455	2.353
Means	717.13	59.272						
St. dev.	25.704	51.773						
							Adjusted RR^2 = 2222.0000%	
							F (6, 47) = 3.803, p < .01	

Note: *, significant at the .05 level; **, significant at the .01 level; ***, significant at the .001 level.

Hypothesis for RQ 2: EOC ELA scores, LED light usage before bed, work status, participation in organized sports, and sleep habits are significant predictors of attendance.

A direct logistic regression analysis was performed on attendance as the outcome and five predictors: EOC ELA scores, use of LED technology, work status, participation in organized sports, and sleep habits. The number of hours absent was dichotomized based on the threshold of a student being considered truant, as set forth by the Oho Revised Code. If a student is absent for more than 72 hours during the school year, they are considered truant (Section 2151.011, 2023). For this analysis, if a student is absent for more than 72 hours, he or she is classified as having poor attendance. A total of 16 cases were removed due to missing data and results were calculated on a sample size of n = 53 students: 12 (22.6%) students identified as having poor attendance and 41 (77.4%) students identified as having good attendance. ELA scores were also dichotomized based on if a student scored proficient (700 or higher). A total of 44 (83%) students scored proficient or higher and 9 (17%) students scored below proficient.

A test of the full model with five predictors against a constant-only model was statistically reliable, $\chi 2$ (5, N = 53) = 37.713, $p < .001$, indicating that the set of predictors reliably distinguished between poor attendance and good attendance. The variance attendance accounted for is small with McFadden's rho = 0.665, df = 5. AIC for the full model (30.99) was lower than for the constant-only model (58.70), indicating a slightly better fit. Prediction success (using 0.5 as the threshold) was impressive with 50 of 53 cases (94.3%) accurately classified or predicted correctly. Sensitivity and specificity values were 1.00 and 0.75, respectively.

Table 17 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, none of the predictors used were reliable in predicting attendance. Variance Inflation Factors (VIF) values ranged from 1.008 (LED) to 1.586 (ELA and WORK) indicating that multicollinearity is not a problem. Examination of the significance levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 2000) indicates that linearity between each predictor and the logit itself may be assumed.

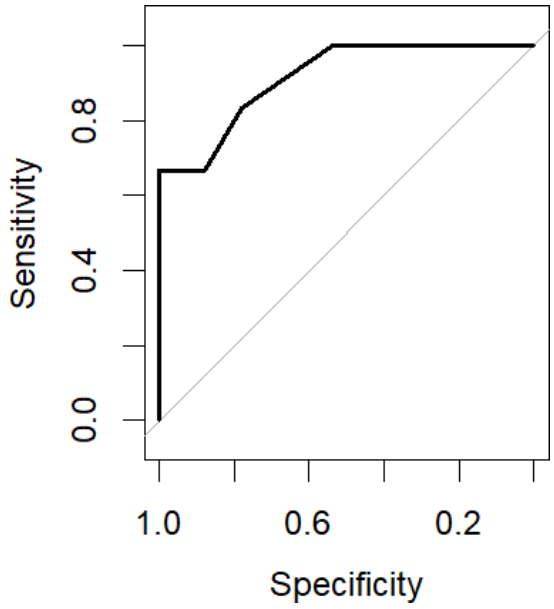
Table 17: **Logistic Regression Analysis of Attendance as a Function of EOC ELA, LED, Work, Sports, and Sleep.**

Variables	*B*	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
ELA	-40.527	-0.006	0.995	2.77e-18	0	1.67e+131
LED	-0.117	-0.923	0.356	.415	.060	2.829
WORK	17.739	0.004	0.997	7.60e+07	0	NA
SPORTS	-0.403	-0.879	0.379	.343	.016	NA
SLEEP	1.095	-0.313	0.754	.728	.082	5.197
(Constant)	20.172	0.004	0.997	2.96e+09	2.16e-119	NA

Note: *, significant at the .05 level; **, significant at the .01 level; ***, significant at the .001 level.

Using the five-predictor model, a receiver operating characteristic curve (ROC) is presented in **graph 2**. ROCs have been shown to be a reliable technique for visualizing, organizing, and selecting classifications. Swets (1988) found that ROC analysis could be extended for use in visualizing and analyzing behavior of diagnostic systems and for determining accuracy of a test using the area under the curve (AUC). The AUC was found to be .915, which is an excellent accuracy classification (Nahm, 2022).

Figure 2: ROC Curve, Attendance



Hypothesis For RQ 3: Gender, race, work status, are significant predictors of sleep habits.

A direct logistic regression analysis was performed on sleep as the outcome and three predictors: gender, race, and work status. Data from n = 60 students were available for analysis: 38 (63.3%) students identified as poor sleepers and 22 (36.7%) students identified as good sleepers.

A test of the full model with three predictors against a constant-only model was statistically reliable, $\chi 2$ (3, N = 60) = 8.46, $p < .05$, indicating that the set of predictors reliably distinguished between poor sleepers and good sleepers. The variance sleep accounted for is small with McFadden's rho = 0.106, df = 3. AIC for the full model (78.86) was lower than for the constant-only model (81.76), indicating a slightly better fit. Prediction success (using 0.5 as the threshold) was unimpressive with 41 of 61 cases

(67.2%) accurately classified or predicted correctly. Sensitivity and specificity values were 0.500 and 0.769, respectively.

Table 18 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, only Gender reliably predicted sleep habits, $z = -2.299$, $p < .05$. A model with Gender omitted was not reliability different from a constant only model, $\chi 2$ (2, N = 60) = 2.803, p = .256; however, the model was reliably different from the full model, $\chi 2$ (1, N = 60) = 5.657, $p < .05$. This confirms that Gender is the only significant predictor of sleep among the predictor variables. Variance Inflation Factors (VIF) values ranged from 1.003 (Race) to 1.008 (Gender) indicating that multicollinearity is not a problem. Examination of the significance levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 2000) indicates that linearity between each predictor and the logit itself may be assumed.

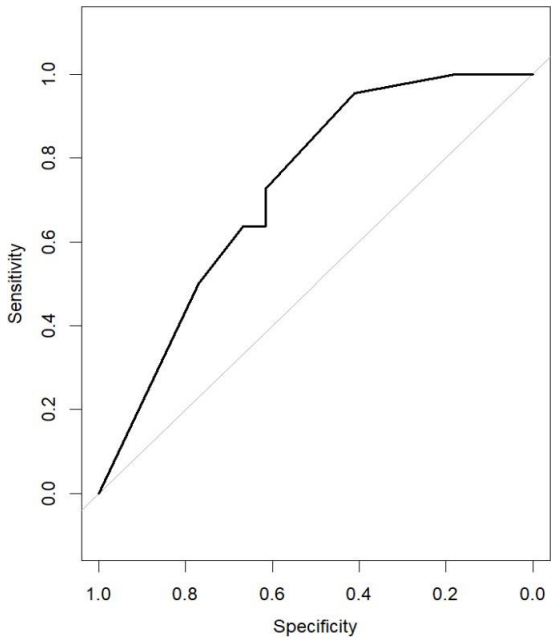
Table 18: Logistic Regression Analysis of Sleep as a Function of Gender, Race, and Work Status.

Variables	*B*	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
GenderF	-1.358	-2.299	.0215 *	0.257	0.076	0.791
Race	-0.922	-1.064	0.2872	0.398	0.054	1.904
Work	-0.360	-0.582	0.5608	0.698	0.198	2.320
(Constant)	0.283	0.653	0.4966	1.327	0.590	3.072

Note: *, significant at the .05 level; **, significant at the .01 level; ***, significant at the .001 level.

Using the three-predictor model, which was found to be statistically reliable, a ROC is presented in Graph 3. The AUC was found to be .726, which is a fair accuracy classification (Nahm, 2022).

Figure 3: ROC Curve, Sleep Habits



V. Conclusion

This study explored student responses to the *Teen Sleep Habits Survey* to gain insight on characteristics students share when it comes to sleep. The responses to the survey were further examined by analyzing the impact student sleep habits have on academic success and attendance, as well as if gender, race, or work status affect the amount of sleep a student receives. This was done through three research questions:

RQ 1: Are EOC ELA scores, use of LED technology, work status, participation in organized sports, sleep habits, and attendance significant predictors of academic performance as measured by cumulative GPA?"

RQ 2: Are EOC ELA scores, the use of LED technology, work status, participation in organized sports, and sleep habits significant predictors of attendance?"

RQ 3: Are gender, race, and work status significant predictors of sleep habits?

The first research question was tested using the following hypothesis: *middle school EOC ELA scores, LED light usage before bed, work status, participation in organized sports, sleep habits, and attendance are all significant predictors of academic performance as measured by cumulative GPA.* The results of the multiple regression analysis showed that EOC ELA scores, work status, and hours absent were all significant predictors of GPA. With a small sample size, power is a concern and there is an increased likelihood that a statistically significant finding represents a false positive result.

The second research question was tested using the following hypothesis: *middle school EOC ELA scores LED light usage before bed, work status, participation in organized sports, and sleep habits are all significant predictors of attendance.* The results of a logistic regression analysis for this hypothesis showed that none of variables in this test were significant predictors of attendance.

The third and final research question was tested using the following hypothesis: *Gender, race, work status, are significant predictors of sleep habits.* The results of a logistic regression analysis for this hypothesis showed that gender was the only statistically significant predictor of sleep habits. Controlling for other predictors, the odds of having good sleep habits are 3.89 higher for Male students than for female students.

The next chapter will discuss these findings and compare them to existing literature on student sleep habits, attendance, and academic performance. Chapter 5 will also disclose the study's limitations and provide suggestions for future research related to this topic.

CHAPTER V: SUMMARY

The primary objective of this study was to determine if there was correlation between in-adequate sleep and poor academic performance. The study aimed to examine the impact student sleep habits have on academic success and attendance, as well as if gender, race, or work status affect the amount of sleep a student receives. Furthermore, an in depth look at the students' sleep habits was reported through the results of the *Teen Sleep Habits Survey.*

Many factors contribute to academic success in high school; some can be controlled by students, while others cannot. This study has two potential implications. First, the study will provide an analysis to determine if sleep has an impact on a student's attendance or GPA. Second, the study gives insight into the potential factors that contribute to a high school student's sleep pattern. The outcomes from these results may bring awareness of the importance of sleep for future students at Bridgeport High School as well as other similar school districts.

This chapter will explore the main findings of the study in connection with existing literature on student sleep patterns and academic achievement. These findings will be discussed within the context of the brain plasticity theory. To conclude, this chapter will discuss the study's limitations and considerations for areas of future research.

Interpretation of the Findings

RQ 1: Are EOC ELA scores, use of LED technology, work status, participation in organized sports, sleep habits, and attendance significant predictors of academic performance as measured by cumulative GPA?"

The results of the multiple linear regression showed that while EOC ELA scores, work status, and hours absent were all significant predictors of GPA while use of LED technology, participation in organized sports and sleep habits were not. Despite these results, average GPA was slightly higher for students who were not exposed to LED light before bed (0.022 points higher) and for students who report being good sleepers (0.024 points higher). Also, the average GPA for student athletes was 0.134 points higher than nonathletes.

The results suggest that students who work part-time are more likely to struggle academically than those who do not. The average GPA was 0.311 points lower for students with jobs than those who are unemployed. Students from the sample reported working an average of 9.9 hours during the school week and 10.6 hours on the weekend. It can be assumed from these results that time spent at a part-time job often interferes with a student's academia.

RQ 2: Are EOC ELA scores, the use of LED technology, work status, participation in organized sports, and sleep habits significant predictors of attendance?"

The results of this linear regression analysis showed that none of the factors measured were found to be significant predictors of attendance. However, a test of the full model with three predictors against a constant-only model was statistically reliable

indicating that the set of predictors reliably distinguished between poor attendance and good attendance. Attendance for student athletes was 1.42 times better than nonathlete students with student who participate in at least one sport missing an average of 48.789 hours of school compared to 69.456 hours of school missed for nonathletes. Students who work part-time jobs missed an average of 15.197 hours more than unemployed students. Also, attendance for students who identify as good sleepers was slightly better than those who identify as poor sleepers.

The results from this analysis suggest that although none of the variables are significant predictors of the number of hours absent, there is a slight improvement in school attendance for student athletes, individuals with no part-time jobs, and those with good sleep habits. Evidence of sleep affecting student performance is apparent with 43.5% of students surveyed reporting that they have either struggled to stay awake or have fallen asleep in class at least once in the two weeks prior to completing the survey. The results for this research question are comparable to those from RQ 1, indicating that school attendance and GPA are related.

RQ 3: Are gender, race, and work status significant predictors of sleep habits?

This final research question was tested using logistic regression techniques and results showed that gender was a significant predictor of sleep habits, however race and work status were not. A test of the full model with three predictors against a constant-only model was statistically reliable, indicating that the set of predictors reliably distinguished between poor sleepers and good sleepers. Controlling for other predictors, the odds of having good sleep habits are 3.89 higher for male students than for female

students. Further, 48.5% of female students reported having poor sleep habits compared to 16.7% for male students. Although it is a much smaller difference, 23.1% of students who work part time reported having poor sleep habits. This number increases to 37.2% for students who are unemployed indicating that students who work part time have slightly better sleep habits than those who do not. Race was insignificant in relation to an individual's sleep.

Connections to Existing Literature

Many connections can be made between the findings of this study and those reported in the Chapter 2 literature review. Eliasson found from his own research that there was no significant association between a student's sleep quality and their academic performance. These results are equivalent to the findings of this study as well. With that being said, research conducted by Curcio, et al. indicates that students who have a better night's sleep tend to have a higher GPA. This result was represented in this study with students who reported being a good sleeper having an average GPA 0.024 points higher than those who reported being a poor sleeper. Research suggests that the teenage brain is often not ready to wake up until well after school begins (Curicio et al., 2006). Students who participated in this study reported an average wake-up time of 10:05 AM on days without school compared to 6:39 AM on school days. With students losing out on an average of 3 hours and 26 minutes of sleep due to school start times, students miss REM sleep and consequently, the connections made during sleep cycles (Wolf, P., 2010).

Results from this study regarding student attendance also have connections to existing literature. The US Department of Education reported that about 20% of students

are considered chronically absent, having missed at least 15 days of school in a year's time. Attendance data for this survey was taken at the end of the third 9-weeks. At this time, 15 of the 69 students surveyed, or 21.7% of the sample population, had missed at least 15 days of school. The results from a logistic regression analysis that showed attendance as a significant predictor of GPA supports research that shows there is a correlation between an increase in school missed and a decrease in student grades (*Every school day counts: The forum guide to collecting and using attendance data*, n.d.). Studies show that a reduction in the number of absences a student accumulates is directly related to their ability to perform better academically, both in the classroom as well as on standardized tests (Aucejo & Romano, 2016). With 43.5% of students surveyed reporting that they have struggled to stay awake or fallen asleep in class at least once in the two weeks prior to completing the survey, it is important to also point out that Curcio, et al. reports that most school achievement difficulties occurred in individuals with reported fatigue (2006).

Research done by Kalenkoski and Pabilonia indicates that a high school student who works for pay in the United States spends significantly less time on other activities such as homework, sleeping, and screen time. They found that an increase in a student's paid work time leads to a reduction of time spent on the previously mentioned activities by up to 84% (Kalenkoski & Pabilonia, 2009). Results from this study indicate that work status is a significant predictor of student GPA. Although much of the results from this study mimic those done by Kalenkoski and Pabilonia, their research found different results when looking at the effect working part-time has on student's sleep. They found

working part-time to not to be a significant predictor of a student's sleep habits which is contradictory to the results obtained in this study.

This study is not only essential for students, parents, and teachers within the Bridgeport School district, but it also fills a gap in the research when it comes to sleep patterns and a student's success in high school. Most research on this topic is centered around collegiate students, therefore indicating a need for similar studies at the high school level. It also provides different results than much of the existing research on the topic of technology use and its impact on adolescent sleep. Although LED light usage before bed did not prove to affect a student's sleep habits, outside research shows a direct correlation between the two. Blue light and LED light before bed are proven to artificially affect adolescents' natural circadian rhythm (Wahlstrom, 2024). Although this study extends current research on the topic of sleep and academic success at the high school level, there is still room for additional studies to further close the gap in understanding the importance of sleep in adolescence.

Implications for Theory Related to Synaptic Homeostasis Hypothesis and Brain Plasticity Theory

This study and research were built on theoretical frameworks of Brain Plasticity Theory and Synaptic Homeostasis Hypothesis. Brain plasticity theory, also known as neuroplasticity, is the study of the brain's ability to modify its connections or rewire itself in response to learning and the various experiences that a person encounters. Brain synapsis occurs when a person learns or memorizes information they encounter such as practicing a sport, meeting new people, or performing well in school or a career. Brain

plasticity theory and the results from this study work together to strengthen the argument that sleep is essential for students to succeed, especially during adolescence. The synaptic homeostasis hypothesis gives a theory that sleep is needed for the brain to disconnect from the environment for hours every day to restore synaptic homeostasis (Tononi & Cirelli, 2020). This study contributes to the understanding of these theories by showing the ramifications that poor sleep habits can have on both a student's GPA and attendance.

Limitations of the Study

For this study, it is assumed that participants put forth the best effort on the *Teen Sleep Habits Survey* by providing truthful responses for each question. Although all personal identifiers were removed from the data once all variables were compiled, the survey was not completely anonymous as names were required to match all the data. Requiring students to put their names on their survey is a potential limitation for this study because may cause students to be less likely to provide truthful responses on sensitive questions.

Sample size is a major limitation for this study. Bridgeport High School is a smaller school district with only 190 students in grades 9-12. For a student to become a participant in the study, they had to return a signed consent form from a parent or guardian. With a return rate of only 36.3%, the sample for this research was set at 69 participants. In addition, some students elected to not answer some of the key questions on the *Teen Sleep Habits Survey* causing them to be excluded in the analysis of the hypothesis. For these reasons, reaching an adequate sample size to perform the needed analysis was difficult. For the first hypothesis, to achieve the desired power of .80 at an

effect size of 0.15 and ∝=.05, a sample size of 92 was required. With a sample size of only 54, power is a large concern and there is an increased likelihood that a statistically significant finding may represent a false positive result. The randomness of sampling students was also hindered due to the low return rate of parental consent forms.

Another limitation for this study is the unequal proportion of students from each grade level with 8 ninth graders, 18 tenth graders, 16 eleventh graders, and 27 twelfth graders. This could potentially have influenced the results, as factors such as work status and GPA may have varied depending on the grade level of the participant. The student's cumulative GPA was calculated from the first 9-weeks of their freshmen year to the third 9-weeks of the 2023-2024 school year. Therefore, an upperclassman's GPA is gathered from a larger sample of classes than a freshman. Also, a junior or senior is more likely to work at a part-time job than an underclassman. For these reasons, the uneven sample from each grade can be a limitation for the study.

The final limitation in this study was that not all students took the EOC ELA exam in the eighth grade due to the COVID-19 pandemic. Scores from seventh grade EOC ELA tests were used for baseline data in place of the standardized eighth grade test when needed. Seven participants transferred into the district after middle school, and therefore neither seventh nor eighth grade End-of-Course results were available. Both seventh and eighth grade EOC ELA exams are measured on the same numerical scale, however they cover a different level of content.

In summary, to remain transparent, this study acknowledges multiple limitations such as potential dishonest answers on sensitive survey questions, inadequate sample size, unequal balance of students from the different grade levels, and the use of EOC

ELA test scores from two different grade levels. These factors may have influenced the results and need to be considered when interpreting the findings. It is also important to stress that this research is limited to a sample population of Bridgeport High School students, and the results from this study should not be generalized for other districts.

Recommendations for Future Research

This study's ability to draw more generalizable conclusions was hindered by its small sample size from a single small school district. Future research may consider conducting this research at multiple districts from diverse backgrounds to increase the sample size and obtain more comprehensive insights with greater statistical power.

To gather more extensive information about students' sleep factors, additional survey questions should be considered. Two possible inquiries could pertain to the average amount of sleep a student gets on a school night with a school day the next morning, compared to a night without a school day the following morning. The survey also did not explicitly ask if a student is exposed to LED light within an hour before they go to bed. Improvements to the survey may make the analysis process provide more meaningful results.

A final suggestion for future research is to implement a similar study at the elementary and middle school level. Some of the factors, such as part-time work status, would need to be altered or removed, however the need for adequate sleep is just as relevant in younger students. Also, results from this study are likely to change through different generations, therefore repeating this study in later years can be significant.

Conclusion and Implications for Practice

The primary goal of this research was to compare a student's sleep habits to their GPA and attendance and determine the factors that contribute to how well a student sleeps. With the *Teen Sleep Habits Survey,* the study aimed to determine whether EOC ELA scores, work status, participation in organized sports, and sleep habits predict a student's attendance, and their relationship with a student's GPA. In addition, the study looked at if gender, race, or work status are significant predictors of sleep habits. It sheds light on why sleep is important to an adolescent student in the academic setting.

The results from several analyses conducted in this study showed that EOC ELA scores, work status, and hours absent are all statistically significant predictors of a student's GPA. This realization suggests that students who work part time and/or consider themselves poor sleepers tend to have a lower GPA in school than those who are unemployed and/or classify themselves as good sleepers. In addition, it was found that male students are 3.89 times more likely to consider themselves as good sleepers than female sleepers.

These findings have implications not only for current and future students and their parents, but also teachers and administrators at Bridgeport High School. With only 7.2% of students who claim to have a bedtime set by a parent on a weekday and 0% on weekends, this study can be used to suggest a consistent bedtime for students that is enforced by a parent or guardian. It can also caution students and parents about the potential negative effect having a part-time job can have on a student's academic performance. Teachers and administrators can use this information to not only inform

students about why the amount of sleep is relevant, but also provide insight for a more successful academic career.

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Appendix A

Teen Sleep Habits Survey

Name _____ **Grade** _____

SURVEY INSTRUCTIONS

Please answer the questions on the following pages as accurately and honestly as you can.

You can skip any question that you do not understand or choose not to answer. Do not spend too much time on any one answer. Your first impression is usually best.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Make solid marks that fill the response completely.
- Make no stray marks on this form.

CORRECT: ● INCORRECT: ✓ ✗ ◒ ◒

1. What time do you usually go to bed on school days? List one time, not a range.

_____ p.m./a.m.

2. There are many reasons for doing things at one time or another. What is the main reason you usually go to bed at this time on school days (Mark only one)

- ○ My parents have set my bedtime
- ○ I feel sleepy
- ○ I have finished my homework
- ○ My TV shows are over
- ○ I have finished socializing (texting, phone calls, etc.)
- ○ I got home from my job
- ○ Other _____

3. On school days, after you go to bed at night, about how long does it usually take you to fall asleep?

- ○ Less than 10 minutes
- ○ 10-20 minutes
- ○ More than 20 minutes

4. What time do you usually wake up on school days? List one time, not a range.

_____ p.m./a.m.

5. What is the main reason you usually wake up at this time on school days? (Mark only one)

- ○ Noises or my pets wake me up
- ○ My alarm clock wakes me up
- ○ My parents or other family members wake me up
- ○ I need to go to the bathroom
- ○ I don't know, I just wake up
- ○ Other _____

6. What time do you usually leave home on school days?

_____ a.m.

7. How do you usually get to school?

- ○ Walk/ride a bike
- ○ Take the bus
- ○ Get a ride with family member
- ○ Get a ride with friend(s)
- ○ Drive my car

8. What time do you usually go to bed on weekends?

_____ p.m./a.m.

9. There are many reasons for doing things at one time or another. What is the main reason you usually go to bed at this time on weekends? (Mark only one.)

- ○ My parents have set my bedtime
- ○ I feel sleepy
- ○ I have finished my homework
- ○ My TV shows are over
- ○ I have finished socializing (texting, phone calls, etc.)
- ○ I got home from my job
- ○ Other _____

10. On weekends, after you go to bed at night, about how long does it usually take you to fall asleep?

- ○ Less than 10 minutes
- ○ 10-20 minutes
- ○ More than 20 minutes

11. What time do you usually wake up on weekends? List one time, not a range.

_____ a.m./p.m.

12. What is the main reason you usually wake up at this time on weekends? (Mark only one.)

- ○ Noises or my pets wake me up
- ○ My alarm clock wakes me up
- ○ My parents or other family members wake me up
- ○ I need to go to the bathroom
- ○ I don't know, I just wake up
- ○ Other _____

13. Some people wake up during the night, others never do. How many times do you usually wake up during the night?

- ○ Never
- ○ Once
- ○ 2 or 3 times
- ○ More than 3 times
- ○ I have no idea

14. People sometimes feel sleepy during the daytime. During your daytime activities, how much of a problem do you have with sleepiness (feeling sleepy, struggling to stay awake)?

- ○ No problem at all
- ○ A little problem
- ○ More than a little problem
- ○ A big problem
- ○ A very big problem

15. How often do you nap on school days?

- ○ Never
- ○ Only when I am sick
- ○ Sometimes
- ○ Every day

16. How often do you nap on weekend days?

- ○ Never
- ○ Only when I am sick
- ○ Sometimes
- ○ Every day

17. How much sleep do you need? Fill out below how much sleep you think you would need each night to feel your best every day. (Remember to mark hours and minutes, even if the minutes are zero.)

_____ **hours** _____ **minutes**

18. In general, do you feel you usually get:

- ○ Too much sleep
- ○ Enough sleep
- ○ Too little sleep

19. Do you consider yourself to be a:

- ○ Good sleeper
- ○ Poor sleeper

20. How often do you think you get enough sleep during the school week?

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Usually
- ○ Always

21. How often do you think you get enough sleep on the weekend?

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Usually
- ○ Always

22. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep in the following situations? (Mark one answer for every item.)

	No	Struggled to stay awake	Fallen asleep	Both struggled to stay awake and fallen asleep
In a class at school	○	○	○	○
While doing homework on the computer	○	○	○	○
Reading, studying or doing homework	○	○	○	○
While taking a test	○	○	○	○
Traveling in a bus, train, plane or car	○	○	○	○
Attending a performance (movie, concert, play)	○	○	○	○
Watching television or listening to music	○	○	○	○
Playing video games	○	○	○	○
Driving a car	○	○	○	○
In a face-to-face conversation with another person	○	○	○	○

23. During the last two weeks, how often have you done the following? (Mark only one answer for every item.)

	Never	Once or twice a week	Once a day	Several times a day
Drank a beverage with caffeine (Coke, Pepsi, Monster, Mountain Dew, Red Bull)	○	○	○	○
Drank coffee or tea with caffeine	○	○	○	○
Used tobacco (cigarettes, cigar, chewing tobacco, etc.)	○	○	○	○
Drank alcohol	○	○	○	○
Used drugs	○	○	○	○

24. In the last two weeks, how often have you done the following? (Mark one answer for every item.)

	Never	Once	Twice	Several Times	Every day/night
Arrived late to class because you overslept	○	○	○	○	○
Fallen asleep in a morning class	○	○	○	○	○
Fallen asleep in an afternoon class	○	○	○	○	○
Awakened too early in the morning and couldn't get back to sleep	○	○	○	○	○
Stayed up until 3 a.m. or later	○	○	○	○	○
Slept later than noon	○	○	○	○	○
Felt tired, dragged out, or sleepy during the day	○	○	○	○	○
Needed to be told more than once to get up in the morning	○	○	○	○	○
Had an extremely hard time falling asleep	○	○	○	○	○
Had nightmares or bad dreams during the night	○	○	○	○	○
Gone to bed because you could not stay awake any longer	○	○	○	○	○
Done dangerous things without thinking	○	○	○	○	○
Had a good night's sleep	○	○	○	○	○

25. During the last two weeks, how often were you bothered or troubled by the following? (Mark one answer for <u>every</u> item.)

	Never	Once	Twice	Several Times	Every day/night
Arrived late to class because you overslept	○	○	○	○	○
Feeling too tired to do things	○	○	○	○	○
Having trouble going to sleep or staying asleep	○	○	○	○	○
Feeling unhappy, sad, or depressed	○	○	○	○	○
Feeling hopeless about the future	○	○	○	○	○
Feeling nervous or tense	○	○	○	○	○
Worrying too much about things	○	○	○	○	○

26. Ideally, when would be the best time for you for school to start?

○ 7:00 am
○ 7:30 am
○ 8:00 am
○ 8:30 am
○ 9:00 am
○ Later than 9:00 a.m.

27. Imagine you have to take a two-hour test, but you can take it when you think you will do your best. What time is that?

○ 8:00-10:00 a.m.
○ 11:00-1:00 p.m.
○ 3:00-5:00 p.m.
○ 7:00-9:00 p.m.

28. When do you usually have the most energy to do your favorite things?

○ 8:00-10:00 a.m.
○ 11:00-1:00 p.m.
○ 3:00-5:00 p.m.
○ 7:00-9:00 p.m.

29. When does your body start to tell you it's time for bed (even if you ignore it)? Between:

○ 8:00-9:00 p.m.
○ 9:00-10:00 p.m.
○ 10:00-11:00 p.m.
○ 11:00-12:00 a.m.
○ After 12:00 a.m.

30. During last week, did you work at a job for pay?

○ No (Skip to question 31)
○ Yes

During the last week, when did you work? (Mark all that apply.)

○ In the morning before school
○ In the afternoon after school
○ In the evening on days that you had school
○ On the weekend

How many hours do you work at your paying job?

During the school week: _____**hours**

During the weekend: _____**hours**

During the last week, did you struggle to stay awake (fight sleep) or fall asleep at your job?

○ No
○ Struggled to stay awake
○ Fell asleep
○ Both struggled to stay awake and fell asleep.

If you did not have your job, would you go to bed:

○ Earlier than you do
○ Later than you do
○ The same as you do

If you did not have your job, would you wake up:

○ Earlier than you do
○ Later than you do
○ The same as you do

31. During last week, did you study/do homework?

○ No (Skip to question 32)
○ Yes

During the last week, when did you study/do homework? (Mark all that apply.)

○ In the morning before school
○ In the afternoon after school
○ In the evening on days that you had school
○ On the weekend

How many hours do you study <u>outside of school</u>?

During the school week: _____**hours**

During the weekend: _____**hours**

During the last week, did you struggle to stay awake (fight sleep) or fall asleep while studying?

○ No
○ Struggled to stay awake
○ Fell asleep
○ Both struggled to stay awake and fell asleep.

If you did not have to study, would you go to bed:

○ Earlier than you do
○ Later than you do
○ The same as you do

If you did not have to study, would you wake up:

○ Earlier than you do
○ Later than you do
○ The same as you do

32. During last week, did you engage in organized sports or a regularly scheduled physical activity?

○ No (Skip to question 33)
○ Yes

During the last week, when did you practice? (Mark all that apply.)

○ In the morning before school
○ In the afternoon after school
○ In the evening on days that you had school
○ On the weekend

How many hours do you practice?

During the school week: _____**hours**

During the weekend: _____**hours**

During the last week, did you struggle to stay awake (fight sleep) or fall asleep during practice?

- ○ No
- ○ Struggled to stay awake
- ○ Fell asleep
- ○ Both struggled to stay awake and fell asleep.

If you did not have your sports activity, would you go to bed:

- ○ Earlier than you do
- ○ Later than you do
- ○ The same as you do

If you did not have your sports activity, would you wake up:

- ○ Earlier than you do
- ○ Later than you do
- ○ The same as you do

33. During last week, did you participate in organized activities (i.e., clubs, music, etc.)?

- ○ No (Skip to question 34)
- ○ Yes

During the last week, when did you participate? (Mark all that apply.)

- ○ In the morning before school
- ○ In the afternoon after school
- ○ In the evening on days that you had school
- ○ On the weekend

Outside of regular school hours, how many hours do you participate?

During the school week: _____**hours**

During the weekend: _____**hours**

During the last week, did you struggle to stay awake (fight sleep) or fall asleep during this participation?

- ○ No
- ○ Struggled to stay awake
- ○ Fell asleep
- ○ Both struggled to stay awake and fell asleep.

If you did not have your extracurricular activity, would you go to bed:

- ○ Earlier than you do
- ○ Later than you do
- ○ The same as you do

If you did not have your extracurricular activity, would you wake up:

- ○ Earlier than you do
- ○ Later than you do
- ○ The same as you do

34. Are your grades in school <u>mostly</u>?

- ○ A's
- ○ A's and B's
- ○ B's
- ○ B's and C's
- ○ C's
- ○ C's and D's
- ○ D's
- ○ D's and F's
- ○ F's

35. Do you drive a car?

- ○ Yes
- ○ No (Skip next question)

36. If yes, have you ever had an accident?

- ○ Yes
- ○ No

37. Do you have any disabilities or chronic illnesses (for example, asthma, diabetes, deafness, physical impairment, etc.)?

- ○ Yes
- ○ No

38. Compared to others your age, would you say that your health is:

- ○ Poor
- ○ Fair
- ○ Good
- ○ Excellent

39. Do you take medication to help with concentration or a learning disability

- ○ Yes
- ○ No

40. During the last two weeks, how many days did you stay home from school because you were:

Sick: ○ 0 days ○ 1 day ○ 2 days ○ 3 days ○ 3+ days

Other: ○ 0 days ○ 1 day ○ 2 days ○ 3 days ○ 3+ days

Why did you stay home? _____

41. Do you have a TV in your bedroom?

- ○ Yes
- ○ No

42. Do you have a computer in your bedroom?

- ○ Yes
- ○ No

43. Do you have a telephone/cell phone in your bedroom?

- ○ Yes
- ○ No

44. Your gender:

- ○ Male
- ○ Female

45. Your age:

- ○ 13
- ○ 14
- ○ 15
- ○ 16
- ○ 17
- ○ 18
- ○ 19

46. Your grade:

- ○ 9
- ○ 10
- ○ 11
- ○ 12

47. What best describes your racial/ethnic background? (Check all that apply)

- ○ White/Caucasian
- ○ Black/African American
- ○ Hispanic/Latino
- ○ Asian/Asian American
- ○ Native Amercian/Pacific Islander
- ○ African
- ○ Other _____

PLEASE DO NOT WRITE IN THIS AREA

[SERIAL]

Appendix B

Letter sent home to parents to inform them of the study as well as the parent/guardian consent form and student assent form.

Bridgeport High School
55707 Industrial Drive
Bridgeport, Ohio 43912
Phone 740-635-0853
Fax 740-635-6008

Jack Fisher, Principal *Vicki Falcone, Guidance*

Dear parent/guardian,

This letter is to inform you of a potential study your child may be asked to participate in. I am currently pursuing a Master's Degree in Mathematics from Shawnee State University, and as such, I am required to conduct a research based thesis study. I am requesting that should your student be selected at random and asked to participate, you give consent for their participation.

The purpose of this study is to compare students' sleep habits with their academic success, as well as the factors that lead to sleep loss in school age students. When completed, the goal of the study is to show the correlation that exists between these variables and inform students of the potential impact of poor sleep habits with their academics.

The only requirement on the student's behalf for the study is to complete a questionnaire regarding his/her sleep habits. The information collected will then be used to look at the factors that are associated with sleep loss in adolescence, as well as look at the impact their sleep habits have on their academic success.

It is important to note that the survey is not anonymous, however, the only reason for this is to be able to accurately compare the students survey results with their specific academic success factors and attendance rates. I will be the only individual with access to their given results, and when all data is submitted to Shawnee State University, students will be assigned a random number and no personal identifiers such as name or school ID will be provided. Likewise, when the results of this study are published, students' individual information is withheld.

I request that you consider giving permission for your child to be involved by signing the attached consent form and returning it with your child. Please note that this is completely optional, and you may decline your consent, or opt out at any later time. Participation has no impact on students' individual grades or merits in any classes.

Please reach out should you have any questions or concerns. I look forward to the opportunity to learn from your child and use that information to inform future students.

Thank you,
Mackenzie Krieger

Mathematics Dept., Bridgeport High School
Mackenzie.krieger@bridgeportschools.net 740-635-0853 ext. 6010

Consent Form for Participation in a Research Study
Shawnee State University

1. Study Title: A Study of the Factors Associated with Sleep Loss in Adolescence, and the Impact of High School Student's Sleep Habits on Their Academic Success and Attendance Rate

2. Location of Study: Shawnee State University

3. Investigators: The following investigator is available for questions about this study: Mackenzie Krieger, (740) 635-1713 Extension 6010, Mackenzie.krieger@bridgeportschools.net

4. Purpose of the Study: The purpose of this research project is to determine whether there is an association between poor sleep habits, academic achievement, and attendance.

5. Population to be Studied: Individuals enrolled in Bridgeport High School

6. Number of subjects: 100

7. Study Procedures: Your child will be asked to complete a questionnaire about his/her sleep habits. The results from this questionnaire will be analyzed along with your child's state test scores, high school GPA, and attendance information.

8. Benefits: This study may yield valuable information about whether there is a relationship between the amount of sleep a student receives and success in the classroom. This information may be beneficial for future students and parents.

9. Risks: The only study risk is the inadvertent release of sensitive information collected during the study. However, this study is anonymous and documents will be labeled with subject numbers, which will not be connected to your child's identifying information in any documentation. All data that will be used for subsequent scientific/academic/educational venues will be non-identifiable.

10. Right to Refuse: You or your child may choose not to participate or to withdraw from the study at any time without penalty or loss of any benefit to which they might otherwise be entitled.

11. Privacy: Results of the study may be published, but no names or identifying information will be included in the publication. Your child's identity will remain confidential unless disclosure is required by law. All documents will be stored at Bridgeport High School for a period of 3 years, at which point the documents will be destroyed.

12. Signatures: I verify that I am 18 years of age or older. The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators listed above. If I have questions about subjects' rights or other concerns, I can contact the Associate Provost, Institutional Review Board, (740) 351-3299. I agree to allow my child to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Signature of Guardian_____ Date_____

Assent Form for Participation in a Research Study
Shawnee State University

1. Study Title: A Study of the Factors Associated with Sleep Loss in Adolescence, and the Impact of High School Student's Sleep Habits on Their Academic Success and Attendance Rate

2. Location of Study: Shawnee State University

3. Investigators: The following investigator is available for questions about this study: Mackenzie Krieger, (740) 635-1713 Extension 6010, Mackenzie.krieger@bridgeportschools.net

4. Purpose of the Study: The purpose of this research project is to determine whether there is an association between poor sleep habits, academic achievement, and attendance.

5. Population to be Studied: Individuals enrolled in Bridgeport High School

6. Number of subjects: 100

7. Study Procedures: You will be asked to complete a questionnaire about your sleep habits and other personal information. The results from the questionnaire will be analyzed along with your state test scores, high school GPA, and attendance information.

8. Benefits: This study may yield valuable information about whether there is a relationship between the amount of sleep a student receives and success in the classroom. This information may be beneficial for future students and parents.

9. Risks: The only study risk is the inadvertent release of sensitive information collected during the study. However, this study is anonymous and documents will be labeled with subject numbers, which will not be connected to your identifying information in any documentation. All data that will be used for subsequent scientific/academic/educational venues will be non-identifiable.

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12. Signatures: The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators listed above. If I have questions about subjects' rights or other concerns, I can contact the Associate Provost, Institutional Review Board, (740) 351-3299. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this assent form.

Signature of Subject_____ Date_____

Appendix C

IRB Approval from Shawnee State University granted 12/7/2023.

DocuSign Envelope ID: CDBAD21F-9486-43A7-A522-D0EC7593509A

SSU IRB Approved BR 12/7/2023 | 9:42 PM

Shawnee State University

Study # 2023-57

In submitting this form and the corresponding documents, I acknowledge that I have completed Human Research Participants training and that I understand and will uphold the rights of human participants. I also verify that all information contained in this form and any other corresponding documentation is correct based on my knowledge. I understand that I may not have contact with any research participants until the Shawnee State University IRB has given me their approval. I also understand that I must file an ***Amendment/Modification Form*** if my project extends beyond a year from my approval date and I must file a ***Final Study Form*** with all consent forms once the study is complete.

DocuSigned by: Douglas Dardaro
Signature of Principal Investigator 1

DocuSigned by: Mackenzie Krieger
Signature of Co-Investigator 2

Signature of Co-Investigator 3

Signature of Co-Investigator 4

Signature of Co-Investigator 5

Signature of Co-Investigator 6

Date of Submission: 12/7/2023 | 12:45 PM EST

Please compile attachments into one document for each category. If any forms below are not applicable, please attach reasons why.

Human Research Training Certificates:

Data Collection Questions and Forms:

Research Summary:

Consent Forms:

Assent Forms:

Advertisements:

Revisions Requested Yes No X IRB Chair Signature

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Please attach revisions requested with changes clearly marked

Changes marked

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BIBLIOGRAPHY

Mackenzie Krieger

Candidate for the Degree of

Master of Science Mathematics

Thesis: WHAT EFFECT DOES A HIGH SCHOOL STUDENT'S SLEEP HABITS HAVE ON HIS/HER ACADEMIC SUCCESS? A STUDY OF THE FACTORS ASSOCIATED WITH SLEEP LOSS IN ADOLESCENCE.

Major Field: Mathematics

Education: Bachelor of Arts in Mathematics

Completed the requirements for the Master of Science in Mathematics, Portsmouth, Ohio in July 2024.

Dr Douglas G Darbro
Dr Douglas G Darbro (Jul 24, 2024 09:30 EDT)

ADVISER'S APPROVAL: Dr. Douglas Darbro