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Exploring the Connection Between Sleep Duration and Life Satisfaction Domains in a Magnet High School

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ABSTRACT

Life satisfaction (LS) domains and its relationship to average sleep duration was investigated in 51 students at Bergen Technical High School High School in Teterboro (BCTHS). This was assessed through an online survey that asked about their sleep duration within a 24 hour period, as well as their self-perceived life satisfaction that was divided into three domains: social, mental health, and school LS. The purpose of this study was to determine whether there is a correlation between sleep duration and LS and if so, which LS is most affected by sleep. The quantitative data collected through the survey were analyzed using a multiple linear regression analysis. The results were not consistent with previous research conducted on college students as the results indicated that the three domains have little to no correlation to BCTHS student's sleep duration.

1. Introduction & Literature Review

1.1: Subject Well Being and Sleep

Sleep deprivation has become increasingly more prevalent among adolescents, to the extent where it is now considered a public health epidemic (Brink et al., 2000). While it is recommended for teenagers to receive 8-10 hours of sleep per day, 72.7% of high schoolers are getting less than the recommended amount of sleep on school nights (CDC, 2020). The demand for an increase in sleep duration is deemed unrealistic often due to early school start times, as well as the shift in circadian rhythms. Circadian rhythms are defined as the cycle of biological functions that repeats around every 24 hours, that determines when you feel drowsy and when you feel alert (Funk & Wagnalls New World Encyclopedia, 2018). Due to this shift that often occurs during the ages of puberty, it makes it difficult for teens to sleep early or wake up early. While circadian rhythms are supposed to promote overall health, due to early school start times within high schools, these natural rhythms are often disrupted. Not only does this take away from the amount of hours teens should be sleeping, but they carry on their days in a fatigued state, which would ultimately lead to negative impacts on well-being.

According to Ed Diener, psychological well-being is a way in which people evaluate their overall lives (Diener, 1984). While the habitual levels of psychological well-being vary widely from person to person, when individuals have a high and stable psychological well-being, they tend to be more fulfilled with many aspects of cognitive functioning, health, and social relationships (Huppert, 2009). Consequently, more attention is being drawn to the importance of sleep, as a substantial amount of research has linked sleep and psychological well-being. For example, Keyu Zhai observed the associations between sleep quality and well-being among a college student sample. Through this, he found that normal sleep quality is associated with lower psychological well-being, while poor sleep quality is associated with high levels of negative psychological well-being (Zhai, 2018). A similar finding was detected in the work of Malin Jakobsson, who found that sleep difficulties, which is a prevalent issue among adolescents, can have negative consequences for people's health and well-being after a narrative interview with 16 adolescents aged 14-15

in a Swedish City (Jakobsson et al., 2022). This indicates that not meeting the sleeping standards set by professionals not only contributes to a fatigued state, but also has consequences on well-being.

Specifically focusing on a prevalent mental well-being issue like depression, Annalijn Conklin investigated the possible correlation between cumulative sleep deprivation and subsequent levels of depressive symptoms from a gender perspective. Through a self-reported questionnaire regarding sleep hours, Centre for Epidemiologic Studies Depression Scale (CESD), as well as statistical analyses of gender-specific associations, the results showed that cumulative sleep deprivation was associated with a monotonic increase in depression, precisely in young women. The study found that 15% of young women were chronically sleep deprived and 29% were depressed. Ultimately, the author concluded that chronic sleep deprivation increases the risk of susceptibility to major depression among young women, which can in turn harm psychological well-being (Conklin, 2018). However, these findings are not fully consistent with previous research as sleep deprivation, in controlled settings, have shown to rapidly reduce symptoms of depression (Gehrman, 2017).

1.2: Life Satisfaction and Sleep

Based on the studies previously discussed, it is evident that the magnitude of the correlation between psychological well-being and sleep is not explicit. One way to measure this correlation is to assess life satisfaction. Life satisfaction (LS) is defined as the cognitive evaluation of one's life, and life satisfaction is stated to be the most stable measure of well-being (Suldo et al., 2006). Therefore, a study regarding life satisfaction and sleep length is needed to improve the understanding of this issue within the field. Contrary to the broad information provided regarding psychological well-being and sleep, the correlational studies between sleep length and life satisfaction are very specific. This exact study regarding the correlation between sleep length and life satisfaction was conducted on a college student sample by William E. Kelly. In this study, 212 college students were required to report their habitual sleep length and complete the Satisfaction with Life Scale (Kelly, 2004). However, first he begins by establishing that individuals who attain less sleep compared to those who attain more sleep, were found to be less psychologically healthy. For example, college students who attain less sleep reported more neuroticism, anxiety, worry, and hallucinations, as well as less creativity and lower grade-point averages (GPA). Furthermore, a clear connection between sleep duration and life satisfaction was established. Individuals who are less satisfied with their lives reported higher levels of anxiety, worry, and neuroticism, which are characteristics of lack of sleep. Through this, it was speculated that sleep length and life satisfaction were positively related. To investigate this, the researchers used a self-reported estimation where participants were asked to report the amount of hours and minutes they sleep habitually within a 24 hour period. Additionally, in order to assess life satisfaction, he utilized a 5 item Satisfaction with Life Scale (SWLS), which is a measure of global life satisfaction. The average sleep duration for these respondents were 6.96 hours with a SWLS score being 5.5% of the variance in sleep-length. They ultimately concluded that college students who attain less sleep on a habitual basis were significantly likely to report lower life satisfaction and tend to be less psychologically healthy (Kelly, 2004).

1.3: Life Satisfaction Domains and Overall Life Satisfaction

Life satisfaction domains are satisfactions in different areas of life that contribute to an individual's overall level of satisfaction (Gonzales, 2019). According to Arthaud-Day, life satisfaction represents a cognitive evaluation of one's life, constituted by components of satisfaction in different domains of life. While the importance of a life satisfaction domain varies based on the individual and their values, it was found that life satisfaction was most strongly associated with social life satisfaction (Arthaud-Day et al., 2005).

1.4: Current Study

The current study aims to extend the study of William E. Kelly by studying the correlation between sleep duration and life satisfaction domains in a high school student sample. Previous studies show that life satisfaction and sleep duration are positively correlated, indicating that an increase in sleep duration would in turn raise life satisfaction levels. However, because there are a lack of studies that address LS through LS domains, the current study examined overall LS through social, mental health, and school life satisfaction, in order to determine which domain correlated the most with sleep duration. These domains were chosen because social and school LS were found to make up two-thirds of overall student LS (Arthaud-Day et al., 2005), and since self-reported mental health has been strongly associated with LS (Lombardo et al., 2018). Furthermore, because past studies have focused solely on college students and adults, this filled a gap in the literature and gave insight on what high school students are dealing with, which may be overlooked at times. This study aimed to answer the research question: "Which Life Satisfaction Domain is Most Affected By Sleep Duration Among High School Students at BCTHS in Teterboro?". This study focused specifically on high school students of grades 9-12 that attend a magnet high school in Teterboro New Jersey, to expand on the findings of William E. Kelly.

2. Methods

2.1: Participants

The goal of this quantitative research was to see if there is a correlation between sleep duration and life satisfaction domains among high school students in a magnet high school. The school that this study was conducted at is Bergen Technical High School in Teterboro New Jersey, a highly ranked school for academic performance. While previous researchers have studied this correlation among a college student sample, this study aims to find the correlation among high school students, who are considered a vulnerable group. A vulnerable group is a group susceptible to coercion or undue influence, such as minors (*Special Subject Population FAQs*, 2023). While the Institutional Review Board (IRB) requires a justification for selecting a vulnerable group as subject to a research project, this helps build on the importance of this current study as this group significantly lacks studies compared to college students or adults. Additionally, due to the lack of studies in this field that measure life satisfaction domains, this study aims to collect first-hand data. Students from this high school participated in this study by completing an online survey that was sent school-wide via school email. Approval from the IRB was obtained before the survey was sent out. This survey assessed the amount of time (in hours and minutes) spent sleeping within a 24-hour period, as well as their life satisfaction using 3 domains: social, mental health, school life satisfaction. The completion of this survey was completely optional, and student school identification numbers (IDs) were the only type of identifying information asked in this survey.

2.2: Measures

The survey sent to all students (grades 9th-12th) was divided into four sections, which consists of sleep duration, social LS, mental health LS, school life LS, respectively. The survey was organized in this format because the list of questions would correspond to each of the LS domains, and the participants would know which part of their life satisfaction is being assessed when reading each statement.

In the beginning of the survey, the students were asked for their student identification numbers (IDs), and a checkbox to confirm that the participant is a student of BCTHS in Teterboro. Their student IDs were asked so that a Student Assistant Counselor could contact them and offer help depending on the nature of their response. Since this study is dealing with life satisfaction levels, if a student shows extreme dissatisfaction (reporting low satisfaction in

two or more areas) with their lives, they may need assistance from a professional who has experience aiding students navigate their mental health. When a student shows extreme dissatisfaction with their lives on the google form, the google sheet (which is automatically linked to the google form) is formatted to turn the responses red, making it easier to find students that may be struggling. This information is thereby forwarded to guidance via school email. While school administrators have access to the information that relates a student to their student IDs, other students do not have access to this information, meaning that the participants were kept anonymous from the researcher. The responses from the survey were destroyed at the close of the data analysis process.

In later sections, the students were asked to state the level of agreement they have with 4 statements per LS domain using a 5-point Likert scale that ranges from 1=Strongly Agree to 5=Strongly Disagree. The statements included in the survey are based off of the Satisfaction with Life Scale (SWLS), a measure of life satisfaction created by Ed Diener, a psychologist known for research regarding subject well-being. However, because I am assessing life satisfaction domains instead of life satisfaction as a whole, I altered the statements to fit the specific domain. For instance, instead of asking for their level of agreement with "I am satisfied with my life" as done in Kelly's study, I expanded on his study by altering it to "I am satisfied with my social life". The 12 statements used to assess social, mental health, and school LS are shown in Table 1.

Table 1 *-Survey Items Per Life Satisfaction Domain*

LS Domains	**Statements**
#1 Social Life Satisfaction	I am satisfied with my social life
	I enjoy spending time with my friends
	I am happy with the number of friends I have
	I do not wish I had different friends
#2 Mental Health Life Satisfaction	I am satisfied with my state of mental health
	I am able to manage my stress well
	I generally do not feel overwhelmed difficulties are piling up
	I generally do not worry about things that are of my control
#3 School/Academic Life Satisfaction	I am satisfied with my academic performance
	I am satisfied with the relationship that I have with my teachers
	I am satisfied with the institution I attend
	I am satisfied with the amount of work my teachers assign me

The possible range of scores on the Likert scale for each LS domain is 4-20 because there are 4 questions per LS domain, where they provide their level of agreement from 1=Strongly Agree to 5=Strongly Disagree. Therefore, for social life, mental health, or school life satisfaction, scores between 16- 20 represent high satisfaction, 9-15 represent medium satisfaction, and 4-8 represent low domain satisfaction. These categories and corresponding numbers were derived from a study previously conducted by Gonzales regarding academic achievement and LS domains (Gonzales, 2019). This determined whether there was a correlation between the amount of sleep they received per day on average and their level of satisfaction with factors that make up their life satisfaction. However, because I asked the participants to reflect on the past week and write an estimation of how many hours they sleep on average within a 24-hour period, this data may not be completely accurate. This is considered a limitation, however, if the participants

were asked to log their sleep duration everyday for the week, many students may not follow up, or may have refrained from participating in the study.

2.3: Data Analysis

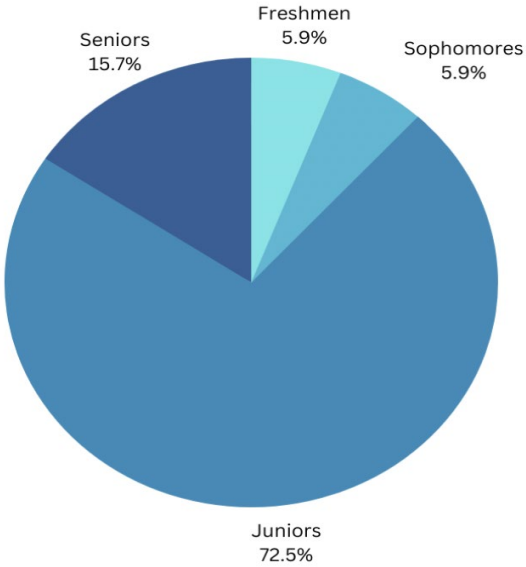
A multiple linear regression analysis was used to analyze the quantitative data gathered from the survey responses. This method was chosen specifically because it can identify the strength of the effect that each variable had on the dependent variable. The three independent variables used in this study were Likert scale scores of social life, mental health, and school life satisfaction. The dependent variable was the average sleep duration. The multiple linear regression was used to see if there was a correlation between each domain and average sleep duration, and if so, which domain was the most strongly affected.

3. Results

3.1 Demographic Data

The purpose of the survey used in the study was to gather information regarding average sleep–length and self-perceived life satisfaction within an academically rigorous, magnet high school. This public magnet high school in New Jersey has around 670 students from 9th to 12th grade. Out of this population, the relationship between sleep duration and life satisfaction were investigated among a sample of 51 high school students from varying grades. In the survey, participants indicated their average sleep duration, as well as 12 questions regarding their LS. While the survey also asked for the participant's student identification number (ID), which can identify their grade, and to confirm that they are a student at BCTHS in Teterboro, no other demographic-based questions were asked. Among the 51 responses that I analyzed, 5.9% were freshmen, 5.9% were sophomores, 72.5% were juniors, and 15.7% were seniors (shown in Graph 1). As represented, the participants were mostly juniors, shedding light onto the limitation of the study as this is not an equal representation of all grades within the school.

Graph 1



3.2 Sleep Duration Statistics

The average sleep duration reported by the sample was 6.14 hours per a 24 hour period, with a standard deviation of 1.1. Because the recommended amount of sleep for a teenager is 8-10 hours, this is almost 2-4 hours less (CDC, 2020). The standard deviation of 1.1 indicates that the average sleep duration at BCTHS is tightly clustered around the mean value. Specifically, a standard deviation of 1.1 signifies that around 68% of the data is plus or minus 1.1 hours from the mean value. While the minimum average sleep duration reported was 3 hours (1 student) and the maximum was 8.5 hours (2 students), the Interquartile Range (IQR) of 1.5 hours indicates that the middle 50% of the data falls within a narrow range of 1.5 hours, meaning that there is relatively low variability in the distribution.

Table 2 *-Survey Statistics for Domain Satisfactions*

LS Domain	High LS (16-20)	Medium LS (9-15)	Low LS (4-8)
Social	64.7%	35.3%	0%
Mental Health	11.8%	66.7%	21.6%
School	21.6%	72.5%	5.90%

3.3 Life Satisfaction Analysis

After collecting raw data from the survey, the total Likert Scale score was added for each LS domain. Then, it was categorized into low LS (4-8), medium LS (9-15), or high LS (16-20). Table 2 reveals the percentage of the participants who scored high, medium, or low LS within the three satisfaction domains. Here, it is important to note that none of the participants reported low social LS, contradicting previous findings that shed light onto the social repulsion that is often activated during sleep loss (Anwar, 2018). The sum of each LS domain was recorded into a spreadsheet along with their average sleep duration. Then, the responses were organized from lowest to highest reported sleep duration. Those who reported the same amount of sleep were grouped into one category, and the mean of each life satisfaction domain was calculated. In order to more accurately represent the population of BCTHS students, the data of those that did not have at least two of the same sleep duration was excluded. Upon reviewing the data, I found that from 4-7.5 hours, the LS scores fluctuated. However, those who received 8.5 hours on average had the highest average of social LS and mental health LS among all of the samples.

3.4 Multiple Linear Regression Analysis

In order to perform a multiple linear regression analysis, 51 responses regarding sleep duration as well as the sum of each LS domain were put into the XLMiner Analysis Toolpak. The Y range stood as the average reported sleep duration, while the X range included the three LS domains (X1=social LS, X2=mental health LS, X3=social LS). This extension was utilized to create a summary output of the regression statistics and performed a multiple linear regression analysis.

Table 3 *-Multiple Linear Regression Analysis*

Regression Statistics		
Multiple R	R Square (R2)	Adjusted R Square
0.2306	0.0532	-0.0072
LS Domains	**Coefficients**	**P-Values**
Intercept	6.1200	0
Social	-0.0136	0.8224
Mental health	0.0760	0.1290
School	-0.0502	0.4154

The data that was recorded in the spreadsheet generated an R-Value of 0.231. In regression statistics, the Multiple R value demonstrates the strength and direction of the association between multiple variables. In a general sense, a R-value of 1 would indicate a perfect positive relationship between each variable while a R-value of 0 would indicate no association at all. Because this study produced an R-value of 0.231 and that is very close to 0, this indicates that there is weak association between sleep and how that affects each of the LS domains. Furthermore, the R squared value of 0.053 that was produced, shows that 5.3% of life satisfaction levels are explained by the amount of sleep that a person receives within a 24-hour period. The R-values that were a part of the regression statistics revealed that there was a weak correlation between sleep duration and life satisfaction. The equation below was generated by the intercept, social LS, mental LS, and school LS coefficients. The model created follows:

Predicted sleep duration= 6.120 - 0.014 (Social LS) + 0.076 (Mental Health LS) - 0.050 (School LS)

The coefficients for each expressed that social LS was -0.0136, mental health LS was 0.0760, and school LS was -0.0502. While the correlation coefficient of mental health LS was positive, social LS and school LS were negative, indicating that mental health LS and sleep duration has a slightly positive correlation while social and school LS has a slight negative correlation with sleep duration. While mental health LS has a positive correlation with sleep, the coefficient is extremely low and very close to 0, which means that there is little to no correlation between sleep duration and these life satisfaction domains. Overall, the results of the study were not consistent with existing research that assessed a college student sample.

4. Discussion

The current study investigated the relationship between BCTHS student's sleep duration in comparison to their self-perceived LS levels. Considering that overall LS is a broad subject and the importance of understanding what areas of LS are most affected by sleep-length, LS was divided into social, mental health, and school LS. Social life was

chosen as one of the focused areas of study due to existing studies that demonstrated an association between sleep deprivation and social isolation (Anwar, 2018). Furthermore, social life and school life satisfaction were two of the three factors that made up a student's overall life satisfaction, the third being family life (Arthaud-Day et al., 2005). Because assessing a high school student's satisfaction with their family life may be a sensitive topic, mental health satisfaction was assessed with a non-clinical test, indicating that it is not used to diagnose any type of mental health diseases. The focus of this was to assess stress management, worry, and feelings of being overwhelmed, which are common symptoms of sleep deprivation (Lichstein et al., 1997). A survey was sent out to all students of BCTHS where students were asked to report their average sleep duration as well as their levels of satisfaction with the three LS domains using a Likert scale. With 51 responses collected, a multiple linear regression analysis was performed in order to assess which LS domain was most affected by sleep duration. The results indicated little to no correlation between average sleep duration and the LS domains.

4.1 Mental Health LS

As presented in Table 3, there is a slightly positive correlation between sleep duration and mental health LS with a correlation coefficient of 0.076. This means that around 7.6% of mental health LS scores were impacted by sleep duration. In linear regression analyses, the correlation coefficient ranges from -1 to 1 where these numbers indicate a perfectly negative or perfectly positive relationship respectively. Because the coefficient for this variable was 0.076, which is very close to 0, this indicates that while there is a slight tendency for mental health satisfaction to increase as people obtain more sleep, this only accounts for a small percentage. However, it is important to note that mental health was the only variable that showed a positive relationship with sleep duration. Taking into consideration that mental health issues such as anxiety and depression have been a growing concern especially post pandemic, it is important to establish modifiable factors that can help improve public mental health, even in the slightest (Shanbehzadeh et al., 2021). This not only demonstrates the importance of maintaining a healthy sleep schedule, but sleep duration can serve as one modifiable factor that can be used to promote better mental health outcomes.

4.2 Social and School LS

In comparison to mental health LS, social and school LS revealed a weak negative correlation coefficient of -0.014 and -0.050 respectively. Generally, in linear regression analyses, a negative correlation coefficient indicates that there is an inverse relationship whereas one variable increases, the other variable tends to decrease. If the coefficient was -1, that would indicate that as sleep duration increases, social and school LS would always decrease. However, because the coefficient is very close to 0, this indicates that there is no strong association between sleep duration and social or school LS.

Previous studies regarding sleep duration and social LS have determined that sleep deprived individuals were viewed as socially unattractive from the outside perspective where even a brief encounter with a sleep deprived person could trigger a sense of loneliness, which would in turn lead to isolation (Anwar, 2018). These findings are corroborated by other studies as it has been found that sleep deprived individuals are perceived as more fatigued, less socially attractive, and less healthy through facial cues, which strongly influence a person's willingness to interact with them (Sundelin et al., 2013). Therefore, students in this study were expected to report low social LS due to their average sleep duration being 6.14 hours. However, out of 51 students, none of them reported low social LS levels. While this is inconsistent with previous studies, this could be attributed to students often sacrificing sleep for social interactions. When school or social demands encroach, people often choose to cut back on sleep for additional time that could be used to prioritize these activities (William D.S. Killgore, 2010). This would explain why there is a slight inverse relationship between sleep duration and school/social LS. In terms of school LS, when students sacrifice sleep to study for exams or complete homework, not only do they experience satisfaction in completing these assignments, but homework is positively correlated with academic achievement (Langberg et al., 2016). Because the survey asks about

a student's satisfaction with academic performance, it would make sense that as students reduce their sleep to devote more time and effort into completing assignments or studying, it would in turn lead to better school LS levels.

4.3 Implications and Limitations

The results of the current study underline the importance of getting a sufficient amount of sleep even though it does not account for a large percentage of student LS. When sleep duration was organized in shortest to longest order, the average LS from 4 to 7.5 hours fluctuated, however, those who got 8.5 hours of sleep had the highest reported social and mental health LS levels across all of the samples. This emphasizes the benefits of getting over the recommended amount of sleep even if only 5.3% of LS levels are explained by sleep duration. Because this study showed little to no correlation between sleep duration and the LS domains, this could be used to dispel common misconceptions regarding this relationship. By establishing that sleep duration is not a major contributing factor to the aforementioned LS domains, parents and guidance counselors could focus on other factors that could have a greater influence on student LS such as family life or physical health.

A limitation of this study is that these findings are not generalizable to other high schools. According to U.S. News & World Report, BCTHS in Teterboro is ranked as #8 in New Jersey High Schools, and is recognized for their academic performance, rigor, and preparation for college. Because students have to apply and get accepted in order to attend this school, it is more likely for them to report higher school LS levels. Additionally, because this was a voluntary survey and students were required to provide their student IDs, this discouraged some students from filling out the form. This also led to an unequal distribution of student responses from each grade, indicating that the sample is not an accurate representation of the whole school. Expanding on that, because 72.5% of the participants were juniors, they have been attending this school for 3 years. It can be speculated that because these students are so used to their academically rigorous schedule and consistent sleep deprivation, their LS levels are no longer affected to a greater extent. Regardless, this information can be useful in recent debates about delaying school start times. While a strong correlation wasn't found, a small percentage of LS levels were explained by sleep duration. This study can be taken into consideration as it provides the perspective of high school students, which is a demographic that lacks studies and is often overlooked.

4.4 Conclusions & Future Directions

Overall, this study found little to no correlation between average sleep duration and the three life satisfaction domains: social LS, mental health LS, and school LS. This adds to existing research surrounding this topic because it was inconsistent with multiple studies conducted in a college student sample. This revealed that sleep duration does not strongly influence a student's self-perceived LS in the three areas aforementioned. In order to revise and expand on the current study, researchers are advised to take other demographics into account. For instance, instead of just looking at what grade the participants are in, gender, ethnicity, and family income should be considered. Furthermore, various other factors such as academic performance, physical health, extracurricular activities, personal goals, cultural background, and economic background could have more significant impacts on LS and could be assessed to determine the underlying factors that contribute to an individual's overall life satisfaction. Taking into consideration that higher sleep quality was found to be the most significant indicator of quality of life (Bækø & Ingvild Saksvik-Lehouillier, 2018), including sleep quality on top of sleep duration could produce more significant results. Especially because recently, sleep quality has been determined as superior to sleep quantity as an index for assessing sleep.

Another way to expand on this literature is to replicate this study in regular high schools rather than a magnet high school in order to determine whether the findings are consistent across diverse groups. Because students get used to their academically rigorous environment and sacrificing sleep on a daily basis more often compared to public high schools, it can be speculated that it becomes a habitual occurrence and a norm that it no longer impacts their life satisfaction on a greater scale. A study conducted on this topic would not only determine whether this experience is

unique to students at a magnet high school or whether it is consistent, but would add to the body of knowledge of high school students. All in all, the current study is one of the very few studies that analyzed the correlation between sleep duration and life satisfaction domains. Given that this study only assessed students of BCTHS, expanding this to a larger sample could not only provide more of a wide range of responses (especially for sleep duration) but could expand the body of knowledge by providing the underlying factors that significantly impact an individual's self-perceived life satisfaction.

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