



Effects Of Sleep Deprivation On Academic Performance

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Abstract:

Introduction: Medical students are exposed to a significant level of pressure because of their academic demands. Thus, they are at increased risk for sleep disorders.

Objectives: The objectives of the study were to determine the effect of sleep deprivation on the academic performance and cognitive functions among the college students.

Materials and Methods: This work is a cross-sectional questionnaire-based study. Participants of this study consisted of first-, second-, and third-year medical students. The Pittsburgh sleep quality index (PSQI) was adopted to identify sleep disorder, and the grade point average of the students was recorded for academic performance.

Results: A total of 177 respondents, with a response rate of 55%, were obtained. According to the PSQI score, 36.6% of participants were considered to have abnormal sleep habits, with a statistically significant increase in female students ($P < 0.05$). Abnormal PSQI scores were associated with lower academic achievement ($P < 0.05$). Marital status, habitat, smoking and physical activity were also associated with PSQI scores.

Conclusions: A high prevalence of sleep disorder was found in this population, specifically among female students. Analysis of the relationship between sleep disorder and academic performance indicates a significant relationship of PSQI scores with marital status, habitat, smoking, physical activity, and academic performance.

Keywords: Academic Performance, Computer Science Students, Sleep Quality Index, Sleep Quality

I. INTRODUCTION

Sleep is a basic necessity of life. It is an important part of our daily routine where we spend about one-third of the 24-hour time doing it. It is a state on which the body and mind of an individual is relatively inactive and its muscles are relaxed. In order for human beings to function properly, sufficient sleep each night is vital. Adults need on average eight hours of sleep. Sleep deprivation occurs when an adequate amount of sleep is not being maintained. Focusing on the college student population, sleep deprivation is extremely prevalent. As computer science student, countless sleepless nights have been experienced due to work schedules, assignment or any other work. It has been found that “up to 60% of all college students suffer from a poor sleep quality” (Scholar et al., 2017, p. 1). Overtime, a lack of sleep can negatively affect a person's

physiological health and cognitive function. Therefore, it is important to investigate how sleep impacts the human body and look into ways to combat the issue of sleep deprivation. A substantial body of biomedical research demonstrated that physiological and cognitive functions that determine our accomplishments vary within 24 h (by circadian rhythms).

The sleep–wake cycle, one of our biological rhythms, is driven by a circadian timing system that is influenced by some factors such as physiological function, school and work schedules, and many others [1]. College life presents many new and stressful challenges, such as increased freedom, self-responsibility, a disorganized lifestyle, variable schedules, repeated deadlines, and social and academic obligations. To meet these demands, students voluntarily alter their sleeping habits.

Consequently, in a study conducted in 2020–2021, more than 70% of college students had some degree of sleep-related concerns. Buboltz et al. [2] found that only 11% of a sample of US college undergraduate students (N = 191) had good sleep quality. College students are invariably sleep deprived. Factors contributing to erratic sleep patterns and poor sleep quality include academic demands (which may require all-night study sessions, especially at examination time), repeated prolonged exposure to light at the wrong time of day because of all-night study sessions and late-night computer work (which can disrupt the biological sleep/wake rhythm regulation) social interaction with peers (which may lead to later bedtimes), and worrying while falling asleep. Students who are more concerned about using their time effectively to meet all of the demands placed on them are more likely to experience sleep problems.

Academic performance is defined as the extent to which a student has achieved their short or long-term educational goals. Cumulative Grade Point Average (GPA) and the results that the students have achieved in their high school or Bachelor degree courses represent their academic performance. A cumulative grade point average is a calculation of the average of all a student's total earned points divided by the possible number of points. Existing evidence does suggest an association between sleep and GPA. Students who obtained more sleep (long sleepers > 8 hours) had higher GPAs than short sleepers (< 6 hours).[3]

Hence, the objectives of the study were to determine the effect of sleep deprivation on the academic performance and cognitive functions among the college students. The objectives of the study was to determine the effect of sleep deprivation on the academic performance and cognitive functions among the college students.

I. Literature review

Sleep deprivation is a critical issue affecting students globally, particularly among university and IT students who often face intense academic pressures and social demands. Extensive research has demonstrated that sleep deprivation significantly impairs both cognitive and physical performance, which in turn negatively impacts academic success.

William C. Shiel Jr. (2017) [3] defines sleep as a vital rest cycle necessary for overall health. However, many students, especially in the 21st-century "next generation" (Gilbert & Weaver, 2014), fail to meet the recommended 7-9 hours of sleep. Studies have consistently shown that insufficient sleep is directly associated with lower academic performance. For instance, **Singleton and Wolfson (2009) [5]** found a strong correlation between unhealthy sleep patterns and reduced GPAs. They observed that alcohol consumption and discrepancies between weekday and weekend sleep patterns are key factors leading to academic underperformance.

Furthermore, the sleep habits of medical students, who are particularly vulnerable to sleep deprivation due to their demanding academic and clinical schedules, were analysed by the **National Sleep Foundation (2019) [6]**. Their research revealed that students with more regular sleep schedules exhibited higher GPAs. Similarly, **Ming et al. (2011) [7]** found that sleep deprivation impairs cognitive function, directly affecting students' academic achievements.

Sleep disorders among full-time university students experiencing high levels of stress because of the demands of academic performance is an important topic for investigation [9–10]. Relatively few studies have investigated sleep habits and patterns among undergraduate medical students as a specific group and the relationship with the students' academic achievement and cognitive functions [11,12]. Some studies have concentrated specifically on postgraduate medical residents [13,14]. Extensive literature review could not reveal any local study that assesses the relationship between sleep disorders and academic achievement.

Additionally, **Peters et al. (2001) [8]** conducted a study that emphasized the importance of consistent sleep patterns. They found that students with regular sleep schedules consistently outperformed those with irregular sleep in terms of GPA. This evidence reinforces the notion that academic success is closely tied to healthy sleep habits.

In general, researchers Xue Ming et. al. (2011) at the Department of Neurosciences and Neurology, sought to understand the effects of sleep deprivation on high school students, whom only 33.7% surveyed had adequate sleep on the weekdays. The results showed that the lack of sleep leads to a superimposed circadian disadvantage, which intensifies the ability of high schoolers to fall back into their normal sleep cycle, ultimately hindering their academic performance as their school grades went down (Ming et. al., 2011). Similarly, research conducted in Taipei supported that claim by reporting that the JEE high school students studying for long hours showed a negative correlation between sleep and performance. In conclusion from the two studies, it is in concordance that students elicited an increase in complaints and sleepiness during daytime and showed a decrease in academic performance (Gau & Soong, 1995; Ming et. al., 2011). Following the effects of sleep deprivation, highlighting the general effects of consumption of caffeine after sleep deprivation on their studies is essential; however, there are no studies found that suggest those direct analysis, so looking at three factors would be necessary in order to deduce and imply to answer the research question.

In conclusion, the relationship between sleep deprivation and academic performance is well-documented. Regular, sufficient sleep is essential not only for maintaining cognitive functions but also for ensuring optimal academic outcomes. Future research should focus on interventions that encourage healthier sleep habits among students to promote academic success and overall well-being.

II. Methodology

Research Design: Cross sectional design

Sample Size: 150 college students

Sampling Design: Convenient sampling

Source of Data: Data was collected from Jain university, Bangalore

Inclusion criteria:

- Normal healthy college students
- Participants with age group 18-24 years
- Students willing to participate in this study

Exclusion criteria:

- Students with any sleeping disorders like insomnia
- Students on medications
- Students with part-time job

III. PROCEDURE

200 healthy subjects (N=200) were included in the study age group 18 to 24 years. Written consent was obtained from all the 200 subjects. Each subject was screened for, and excluded if the subjects had not met the inclusion criteria. Then the purpose of the study was explained to the subjects. An anonymous, voluntary, self-administered questionnaire was given to the subjects. The GPA of every subject was recorded. These average scores were considered as their academic performance in the present study.

IV. Hypothesis

Hypothesis: There is a relationship between sleep deprivation and exam performances.

Sleep deprivation may decrease academic performance during exam.

Sleep deprivation has a negative impact on academic performance.

There is a relationship between general performance achievement (GPA) and sleep pattern habits. Personal characteristics have impact on sleep patterns.

V. Subject And sample size

A cross-sectional questionnaire based on self-reported evaluation was carried out on a randomly selected sample of CS & IT students, from the first to the third academic years, during the academic year 2021–2025 at the school of CS & IT, a self-rated questionnaire that assesses sleep quality over a time interval of one month, was adopted in the survey. Seven proper- ties of sleep were evaluated by this questionnaire:

VI. Questionnary

SECTION 1: PLEASE CIRCLE “TRUE” OR “FALSE”.

- | | |
|---|---------------|
| 1. I had a deep sleep last night. | TRUE OR FALSE |
| 2. I feel that I slept poorly last night. | TRUE OR FALSE |
| 3. It took me more than half an hour to fall asleep last night. | TRUE OR FALSE |
| 4. I woke up several times last night. | TRUE OR FALSE |
| 5. I felt tired after waking up this morning. | TRUE OR FALSE |
| 6. I feel that I didn't get enough sleep last night. | TRUE OR FALSE |
| 7. I got up in the middle of the night. | TRUE OR FALSE |
| 8. I felt rested after waking up this morning. | TRUE OR FALSE |
| 9. I feel that I only had a couple of hours' sleep last night. | TRUE OR FALSE |
| 10. 10. I feel that I slept well last night. | TRUE OR FALSE |
| 11. 11. I didn't sleep a wink last night. | TRUE OR FALSE |
| 12. I didn't have trouble falling asleep last night, | TRUE OR FALSE |
| 13. After I woke up last night, I had trouble falling asleep again. | TRUE OR FALSE |
| 14. I tossed and turned all night last night. | TRUE OR FALSE |
| 15. I didn't get more than 5 hours' sleep last night. | TRUE OR FALSE |

SECTION 2: PLEASE ANSWER EACH QUESTION WITH A WHOLE NUMBER ON THE LINE PROVIDED.

16. In an average week, how many nights do you get less than five hours of sleep? _____
17. In the past week, how many nights did you get less than five hours of sleep? _____
18. In an average night, how many hours of sleep do you get? _____
19. In the past year, how many all-nighters have you pulled? _____

SOME DEMOGRAPHIC INFORMATION PLEASE.

20. Are you male or female? _____
21. What is your age? _____
22. What is your class? (please circle). FRESHMAN SOPHOMORE
23. What is your major? _____
24. Do you live on or off campus? (please circle) ON CAMPUS OFF CAMPUS
25. What is your GPA? (note: this information is confidential) _____

VII. Data Collection and Sampling Technique

An online survey using google form was distributed to all jain university CS & IT student in years 1 - 3. Convenience sampling was adopted, and surveys were circulated to the target population via email and social media accounts (WhatsApp, LinkedIn, and Facebook). The study objectives were explained to the participants, and their consent was obtained prior to participation. Data were auto collected into Google form Sheets and stored privately with access restricted to the authors only. No identification information, such as names or emails, was collected to limit bias in the data collection process. Participation was voluntary, and participants could withdraw at any time by quitting the survey. All questions in the online survey were mandatory. This study was performed upon approval from the Institutional Review Board (IRB) at Jain university. All methods were performed per the relevant IRB guidelines and regulations.

VIII. How to Approach

The scores for each question range from 0 to 3, where 0 indicates the best sleep quality and 3 indicates the worst. The seven scores are then added up to get a total score between 0 and 21. A higher score means poorer sleep quality, and a global score of 5 or more indicates poor sleep quality over the past month. The questionnaire was found to be very valid (94%) and reliable (72%), with a Cronbach's alpha coefficient of 0.77, as assessed by Farrahi Moghaddam et al.

Participants were informed about the goals of the research, the study methods, and how to fill out the questionnaires. Only those who gave consent participated, and their information was used solely for this research. Those who didn't consent were excluded. The participants were followed for a month, and their academic scores (GPA) for that period were recorded. These scores were used to assess academic performance in the study, which is a common method in sleep research.

Academic performance was categorized as follows:

- High (8.5 or higher)
- Good (7.0 - 8.49)
- Normal (4.0 - 6.99)
- Low (less than 4.0)

I will collect a complete history from participants, including their academic year, sleep hours, midday naps, and common causes of sleep disturbances like age, gender, BMI, physical activity, smoking, and marital status. We screened for chronic medical or psychiatric illnesses, and excluded students with known chronic illnesses or those taking medications that could cause sleepiness. After the questionnaires were completed, we collected them and removed any incomplete ones (like those with unanswered or unclear questions).

We will use the SPSS V.19 program to analyse the data. A t-test was used for quantitative data, and a chi-square test for qualitative data. Multivariate analysis was done to determine the effects of sleep quality on academic performance. A two-sided alpha value of 0.05 was considered statistically significant.

IX. Result

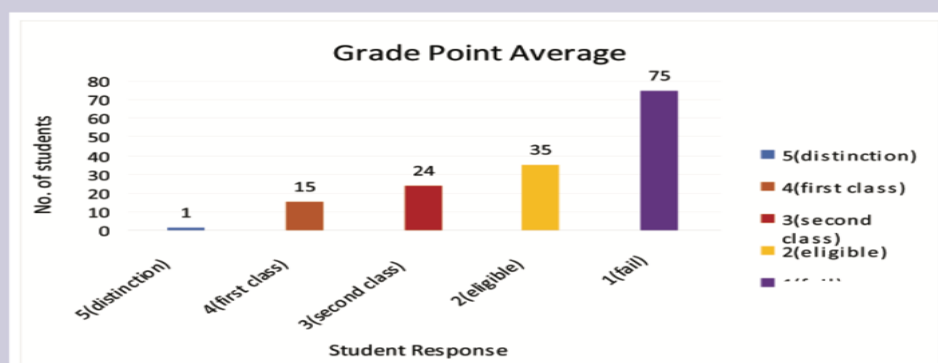
The questionnaire was distributed to 200 students and completed questionnaires were received from 150 students. 79 (52.7%) students feel that their academic performance is hindered due to insufficient sleep. 118(78.7%) students felt that they are sleep deprived as a college student.

Table 1: Demographic information of 150 students

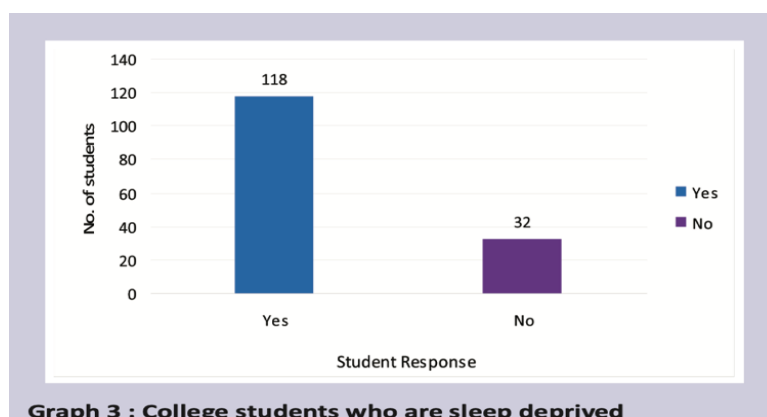
Descriptive Statistics					
Characteristics	N	Minimum	Maximum	Mean	Std.Deviation
Female	73	18.00	24.00	19.8493	1.31942
Male	77	19.00	24.00	20.7922	1.46303

Table 3: Focus on Performance and Cognitive Function

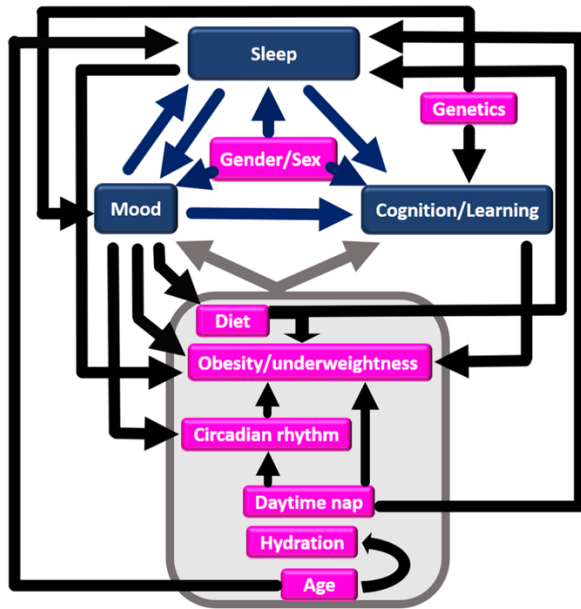
Do not sleep well or lack of sleep	Yes		No	
	Frequency	%	Frequency	%
Unable to stay awake or focused during classes	132	88%	18	12%
Unable to focus during exams	81	54%	69	49%
Feels less energy or motivation	125	83.3%	25	16.7%
Weakened immune system	62	41.3%	88	58.7%
Feels academic performance is hindered	79	52.7%	71	47.3%



Interpretation: This graph shows the students grade that they have scored in the exams. According to the graph, 16 (10.7%) student had GPA > 4, about 24(16%) students had GPA=3, 35 (23.3%) had GPA =2 and about 75 (50%)students had GPA =1.

**Graph 3 : College students who are sleep deprived**

Interpretation: The students were asked that whether they felt that they are sleep deprived as a college student. 78.7%students felt that they were sleep deprived and 21.3%students felt they were not sleep deprived.



Complex relationship between sleep, mood, and learning. Sleep and mood/emotion affect cognition and academic achievement. Their effects can be additionally influenced by other factors like diet, metabolic disorders (e.g., obesity), circadian rhythm, daytime nap, hydration level, age, gender, and genetics. The figure presents the interrelationships and highlights the complexity emerging from the interdependence between factors, action of multiple factors on a single factor or vice-versa and the bidirectional nature of some associations. These associations collectively determine learning and thereby, academic achievement. Direction of the arrow represents effect of a factor on another.

Students were awarded one point for each "false" response on questions 8, 10, and 12, and one point for each "true" response on the remaining 11 questions. A score of zero indicated the highest quality of sleep. Additionally, questions 16–19, which were self-designed, measured students' sleep deprivation through open-ended numerical responses. Their GPAs were also collected using open-ended numerical inputs. To analyze the relationship between academic performance and sleep patterns, correlations were calculated between GPA and five key variables in our study.

Our findings revealed a significant correlation between the average amount of sleep per night and GPA, $r(101) = 0.20$, $p = 0.048$ (see Figure 2). Students who averaged more hours of sleep per night tended to achieve slightly higher grades. Furthermore, the number of days per week that students slept less than five hours showed a weak but statistically significant negative correlation with GPA, $r(101) = -0.29$, $p = 0.003$ (see Figure 1). This suggests that as the frequency of sleep deprivation increased, academic performance tended to decline. Thus, as the average number of days per week a student got less than five hours of sleep increased, GPA decreased. No correlation was found between students' GPA and the number of all-nighters students have experienced in the past year [$r(101) = 0.02$, $p = 0.857$], the number of days students got less than five hours of sleep in the past week [$r(101) = -0.07$, $p = 0.475$], and the students' scores on the Groninger Sleep Quality Questionnaire [$r(101) = 0.01$, $p = 0.993$].

SLEEP QUANTITY AND ACADEMIC PERFORMANCE

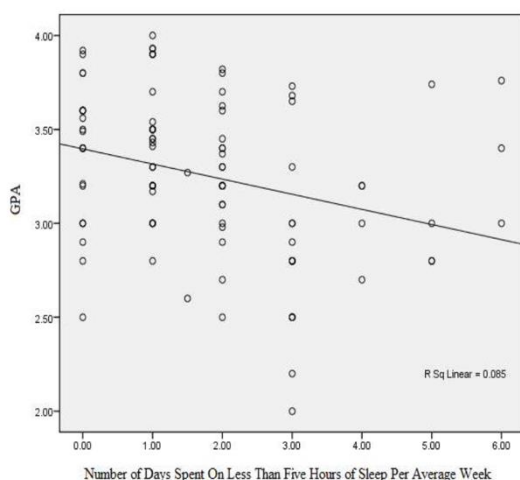


FIGURE 1. Scatter plot of GPA by average number of nights per week.

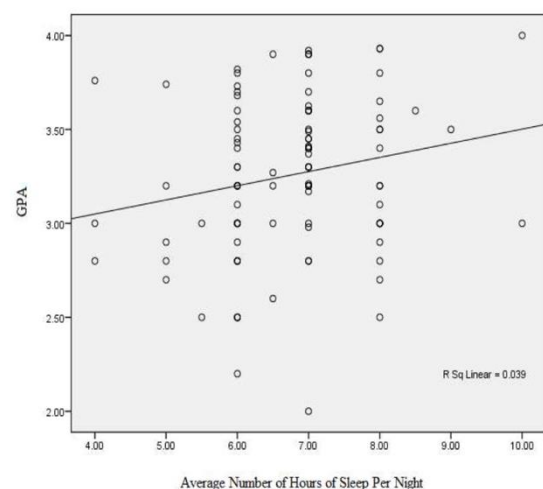


FIGURE 2. Scatter plot of GPA by number of hours slept by the average number of nights per week.

Table 4: Sleep patterns of students in the study sample (n=114)		
Item	Frequency	Percent
Sleep hours at night: Usual week days:		
<6	63	55.3
6+	51	44.7
The midterm eve:		
<6	98	86.0
6+	16	14.0
The final eve:		
<6	109	95.6
6+	5	4.4
Sleep hours needed to be alert:		
<6	33	28.9
6+	81	71.1
Sleep hours at midterm eve:		
Less than usual	84	73.7
Less than needed to be alert	99	86.8
Sleep hours at final eve:		
Less than usual	94	82.5
Less than needed to be alert	107	93.9
Bedtime:		
Before midnight	63	55.3
At or later than midnight	51	44.7

Table (4) mirrors the sleep patterns of the subjects included in the study. More than half 55.3% sleeps in usual week days but less than 6 hours/day. However, at the midterm exam the subjects who sleep also less than 6 increased to 86.0 %. The number of the students increased in the final exam to be 95.6% to get sleep less than 6 hours /day, the table shows the student mentioned that the need hours for sleep to the alert is more than 6 hours/day as mentioned by 71.1 % of them.

Conclusions:

In this study, we examined the effects of sleep deprivation on the academic performance of students across different academic years. Using a cross-sectional questionnaire that gathered self-reported data on sleep habits, insomnia severity, daytime sleepiness, and study habits, we were able to correlate sleep deprivation with various academic challenges.

Our findings suggest that students who experience moderate to severe insomnia or excessive daytime sleepiness tend to report:

- Lower academic performance, as evidenced by difficulty concentrating, reduced study hours, and poor exam results.
- Higher levels of stress and associated symptoms, such as headaches and forgetfulness, further affecting their ability to focus and retain information during study sessions.

Moreover, the prevalence of sleep disorders, such as insomnia and poor sleep quality, was notable across all academic years, with a higher impact observed among senior students, possibly due to increased academic pressure and workload. This research highlights the critical importance of adequate sleep for maintaining optimal academic performance.

In addition, the researcher also recommends the students should value the essence of sleep. Moreover, they must learn to prioritize things and balance their academic activities as well as their sleep. Most importantly, time management should be observed at all times. For the parents, it is suggested that parents should monitor their children. They must look into the sleeping behaviours of their children and supervise them to avoid sleep deprivation. Teachers should help students build optimal sleep habits and will also monitor students' progress in all learning areas. For the school administration, they may also come up with policies and regulation for students who are sleep deprived, to those who have kids and even students who are far from school. The administration may draft policies to support students coming from another municipality. They may also use the findings in addressing diversity of learners towards developing a school culture.

Our findings on sleep deprivation align with previous research. Specifically, our data support Pilcher and Huffcutt's (1996) assertion that sleep deprivation negatively impacts cognitive processes. According to their definition, sleep deprivation refers to functioning with fewer than five hours of sleep from the previous night.

However, contrary to past research, we did not find a correlation between sleep quality and GPA. For instance, Singleton and Wolfson (2009) concluded that alcohol consumption affects sleep quality, which in turn compromises college students' academic performance. The absence of a significant relationship in our study may be due to our survey's narrow focus on sleep quality from only the previous night. Factors such as upcoming tests or assignment deadlines could have disrupted sleep for an entire class, creating a uniform effect on responses.

To enhance the accuracy of our findings, future research should consider incorporating questions about students' average sleep quality over a longer period rather than relying on a single night's data.

Recommendations: It is recommended for the student to improve the sleep habit by:

- Create a nightly routine: that helps prepare your body for a good night's sleep. This should include relaxing activities.
- Avoid doing anything in bed other than sleeping and resting: Like watch TV in bed.
- Avoid caffeine, nicotine four to six hours before you go to sleep.
- Exercise: is an important part of keeping a healthy lifestyle.
- Future research should aim to enhance generalizability by exploring the broader effects of students' sleep duration and patterns on academic performance and cognitive functioning.
- Researchers should incorporate cognitive tasks in future studies, comparing participants' performance with their average sleep duration per night to better understand the impact of sleep on cognitive abilities.
- Further studies should explore effective and practical interventions that promote sleep awareness and encourage healthy sleep habits among college students in a time-efficient and cost-effective manner.

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