Title: Impacts of late-night phone usage on students' effort quality the next day.

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Abstract

As smartphones become increasingly popular among adolescents, concerns regarding their impact on sleep hygiene and academic performance have grown. This study investigates the relationship between late-night phone usage and the subsequent quality of effort and productivity among high school students. It was hypothesized that students who use cellphones before sleep would report higher tiredness and decreased productivity the following day.

Data were collected by a Google Forms survey distributed to students at a high school in Chantilly, Virginia. A total of 15 participants (ages 13–18) reported on their nighttime digital habits, total sleep hours, and perceived levels of tiredness and productivity using a 5-point scale. Results indicated that 93.3% of participants used their phones before bed, primarily for social media. Students using phones for more than one hour averaged only 4–6 hours of sleep, significantly lower than the recommended 8–10 hours. Participants reported a morning tiredness score averaging 3.9 out of 5, while productivity scores averaged 3.2, showing a clear trend: as late-night phone use increased, sleep duration decreased, and daytime productivity declined.

The findings of this study support the hypothesis that pre-sleep screen exposure disrupts sleep quality and diminishes school performance. Although limited by a small sample size, the study highlights the need for "digital hygiene" education in school curricula. Future research should utilize objective sleep-tracking technology to further explore the physiological impacts of specific late-night digital activities on adolescent development.

Introduction

In today's digital age, smartphones play a central role in the daily lives of teenagers. These devices can help with social connections, entertainment, and information. For example, teens use their phones to message peers and family through social media platforms and text, as well as for entertainment through streaming services and apps. Teens use their cellphones throughout the day, in the morning, in the afternoon, and in the evening. The use of phones is especially high in the evening as students get back from school and use their devices for homework, catching up with peers, or just relaxing after a long day.

The usage of phones late at night can interfere with sleep quality. Sleep quality is the length and amount of sleep spent in rapid eye movement (REM) sleep, which is the most restful and restorative stage of sleep. Poor sleep quality has been consistently linked to decreased cognitive performance (lower test scores, ability to complete school and everyday tasks), reduced productivity (how many tasks students can complete for school and other necessary duties), and not being well rested (being tired or not energized throughout the day). Among the cohort of 397 adults 18-69 years of age, 75% report leaving their phones on at night (Saling). Because participants leave their phones on throughout the night, they report being awoken to various notifications, calls, and others' phone use (Saling). Another study showed that over 250,000 children and adolescents use their mobile phones during the night, which was found to be associated with a lower likelihood of obtaining the full 8 hours or more sleep that is needed

across all age groups for proper physical and cognitive development (Correa et al., 2022). This leads to poor sleep as they are not fully rested throughout the entire night, disrupting their needed REM sleep. This is important, especially for teens, as they use their phones in the evening regularly, which has the potential to impact their performance at school.

It is important to consider and pay close attention to the issue of cellphone use impacting productivity, as late-night phone usage can have lasting impacts on teens as they grow older. This could impact their well-being, academic status, and social life, which can overall negatively affect the teens. It is beneficial to be able to understand the short and long-term effects and the impacts of how late-night phone usage has on teens, in order for them to learn and put this understanding to use as they grow older through healthy sleep habits (e.g., limiting cellphone use before bed).

The purpose of this study is to investigate whether late-night phone usage before sleep negatively impacts the quality of teenagers' efforts and productivity the following day, both in school and at home. It was hypothesized that teenagers who use cellphones late at night before sleep will demonstrate lower quality of effort and productivity the following day compared to those who refrain from phone use before bedtime.

Methods

Participants

Participants were recruited through a convenience sampling method at a high school in Chantilly, Virginia, using school-based email. After approval from the high school administrator, a Google Forms survey link was distributed to roughly 200 high school students in grades 9 through 12. All high school students were invited to participate in the survey regardless of demographics, gender, academic status. Study inclusion criteria required participants to be current high school students between the ages of 13 and 18. A total of 15 students completed the survey. The sample consisted of 80% female participants and 20% male participants.

Materials

Surveys were distributed electronically on Google Forms, and all participants gave informed consent prior to completing the survey. The survey included demographic questions (age, grade level, gender) as well as behavioral questions related to nighttime phone use. Questions were developed based on common behaviors identified in prior sleep and technology research, such as duration of phone use, type of activity, and self-reported tiredness. Participants were asked to report whether they used their phones before sleeping with a yes or no question, the duration of phone use (less than 30 minutes, 30-60 minutes, 1-2 hours, or 2+ hours), and the primary activities on their phone, such as social media, texting, gaming, streaming, or other. Participants were then asked to rate their morning tiredness and daily productivity using a 5-point scale, where 1 indicated “not at all tired” or “most productive ”and 5 indicated “very tired” or “not productive”. Productivity was operationalized as the participant’s self-reported ability to stay focused, complete schoolwork, and remain engaged during the day (See table 1 for full survey details).

Table 1. Questions from the survey and the response options.

Question	Response options

Do you give consent for your answers to be used in this research?	Yes
What is your age?	13, 14, 15, 16, 17, 18
Grade in High School	Freshman (9th), Sophomore (10th), Junior (11th), Senior (12th)
Gender	Female, Male, Prefer not to say
Do you use your phone before sleeping?	Yes, No
Do you use your phone 1 hour before going to bed?	Yes, No
How long did you use your phone for before going to bed?	15 minutes, 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, 6 hours, other
How many hours of sleep do you get on average?	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, other
What do you do on your phone before sleeping?	Social Media, Texting, Watching TV/Shows, School Related, other
What time do you wake up on a School Day?	Short Answer
How tired were you when you woke up?	1 not tired, 2, 3, 4, 5 very tired
How tired were you throughout the day?	1 not tired, 2, 3, 4, 5 very tired
How productive were you during school?	1 not productive at all, 2, 3, 4, 5 very productive
How tired were you after school?	1 not tired, 2, 3, 4, 5 very tired

Statistical Analysis

After 15 participants completed the study survey, the Google Form was closed. Google Forms automatically generated the frequency and descriptive statistics of the respondents' answers for each question, which were examined to understand demographic representation, late-night phone usage, and next-day productivity.

Results

Demographics

Amongst the 15 respondents, 80% identified as female and 20% as male (Figure 1). Males reported higher tiredness levels compared to females for both during school and after

school (Figure 2). 7.1% were 15, 71.4% were 16, 14.3% were 17, and 7.1% were 18 (Figure 3). From this, 6.7% were in 10th grade, 66.7% were in 11th grade, and 13.3% were in 12th grade (Figure 4).

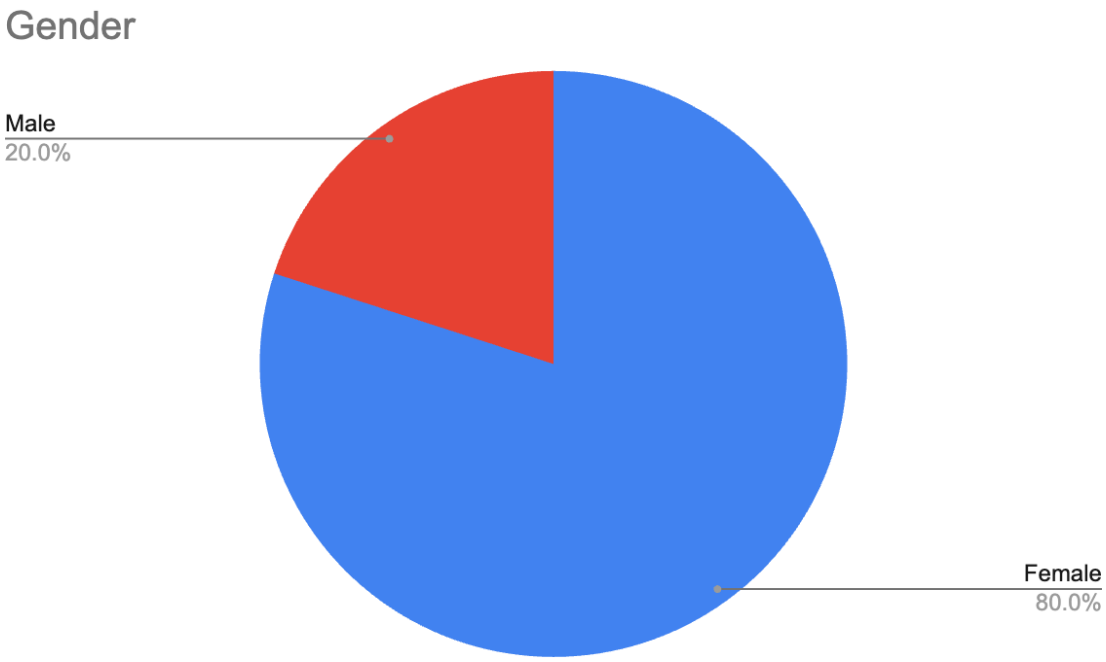

Figure 1: Representation of the gender of participants

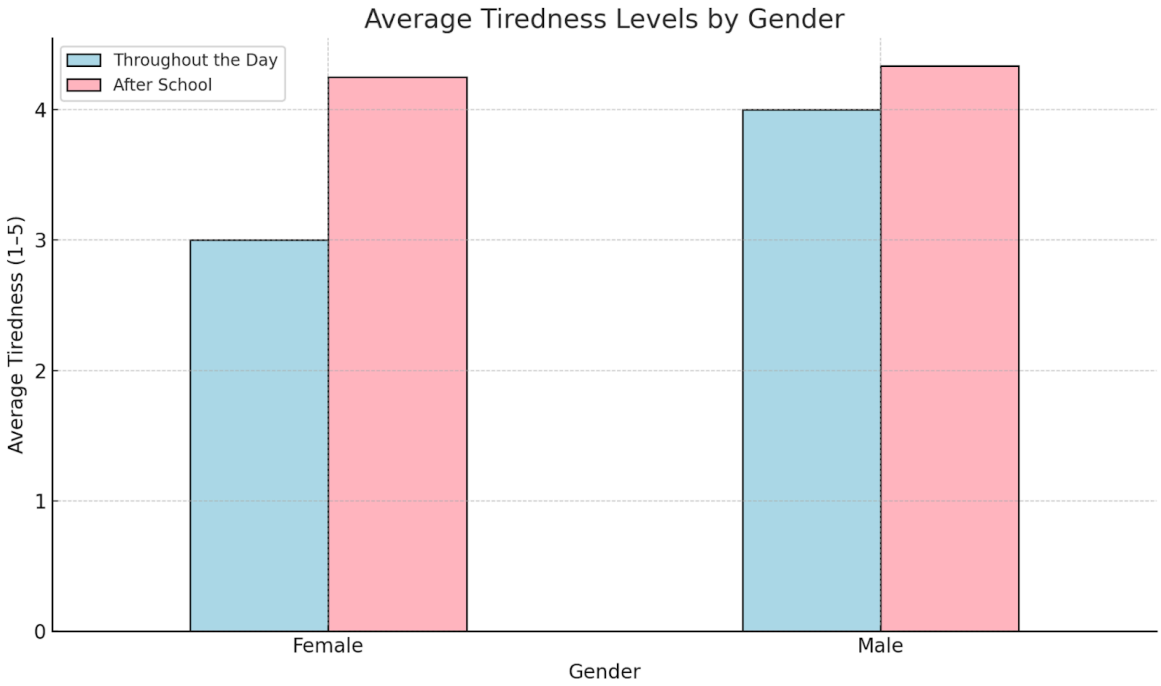

Figure 2: Average tiredness levels by Gender for after school and throughout the day.

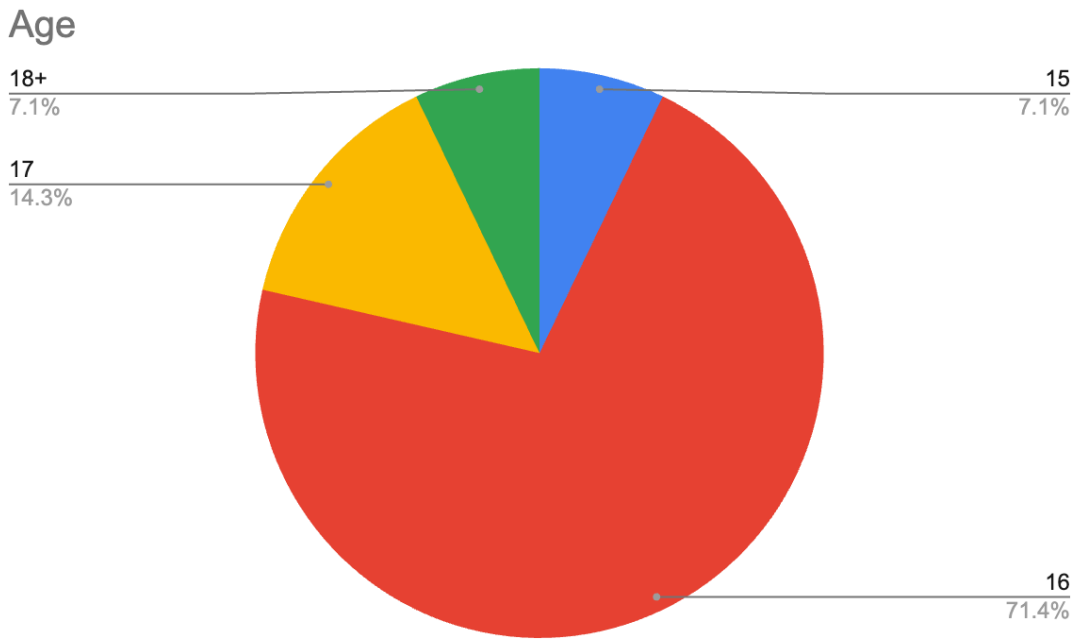

Figure 3: Representation of all the ages of the participants

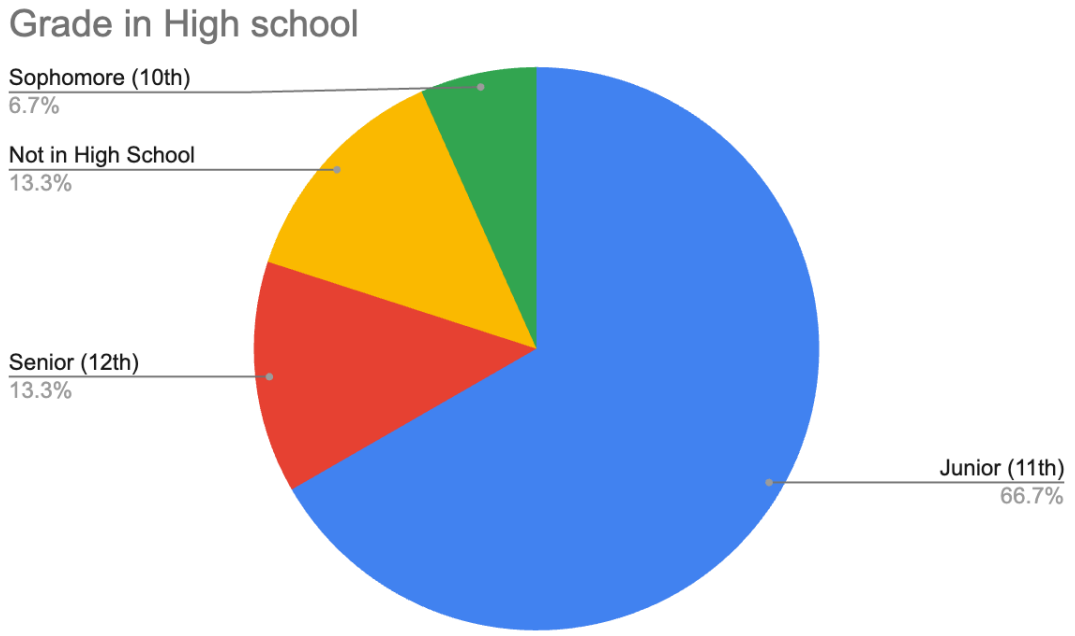

Figure 4: Representation of all the grades of the participants

Cellphone Use Before Bed

The frequency and descriptive statistics showed that nearly all participants (93%) reported using their phones before going to sleep, and only one participant (7%) reported not using their phone before bed. Among those who used their phone before bed, 60% used their phones for 30 minutes to 1 hour, while 33% used their phones for two or more hours (Figure 5). The most common nighttime activity was social media use (80%), followed by calling (7%) and gaming (7%).

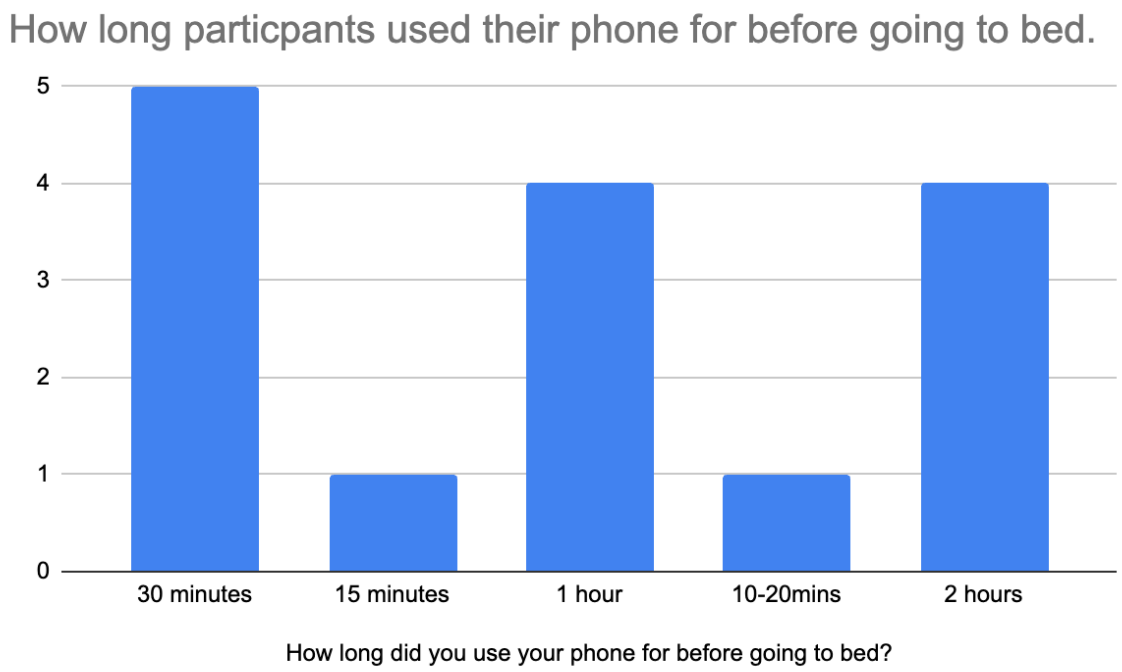

Figure 5: Representation of how long participants used their phones before going to bed

Hours of Sleep Per Night

Participants reported an average of 6.6 hours of sleep per night, with individual responses ranging from 4 to 9 hours. A noticeable trend emerged showing that participants who used their phones for longer durations tended to get less sleep. For instance, those who reported using their phones for over an hour typically slept between 4–6 hours, whereas participants who limited usage to 30 minutes or less averaged 7–8 hours of sleep, as seen in Figure 6.

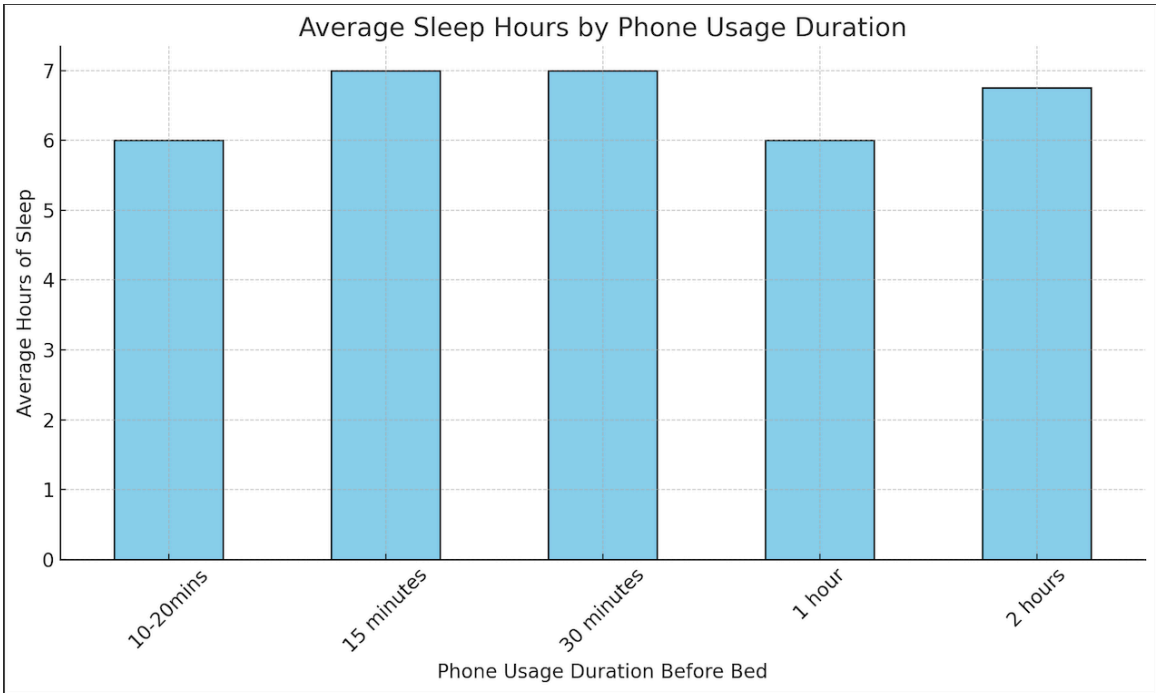

Figure 6: Visual representation of how long participants use their phones before bed and the average hours of sleep they usually get

Tiredness and Productivity

When rating tiredness on a 1–5 scale (1 = not tired, 5 = very tired), the average morning tiredness rating was 3.9 (see Figure 6), while the average tiredness throughout the day was 3.3. Productivity during school had an average score of 3.2, suggesting that higher tiredness was associated with slightly lower productivity, as shown in Figure 7. In general, those who reported using their phones for over an hour before sleeping tended to feel more tired (ratings of 4–5) and rated their productivity lower (2–3) than those who used their phones for shorter periods.

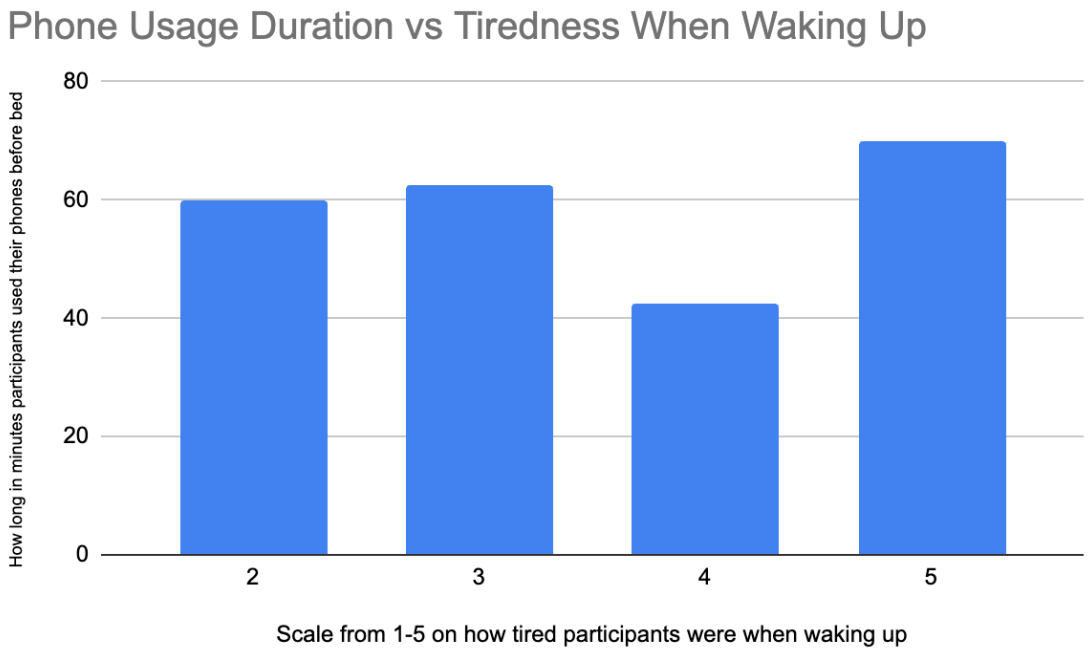

Figure 7: Average for how tired participants were when waking up and how long they used their phones for before going to bed.

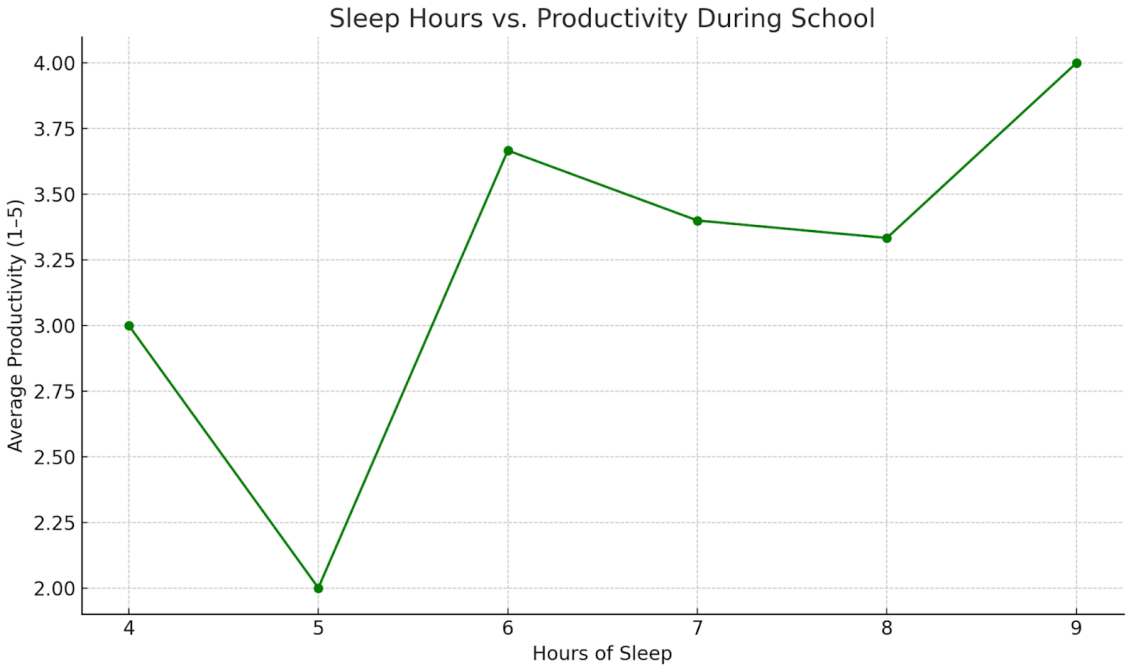

FIGURE 8. Sleep hours and levels of productivity during school

Discussion

Poor sleeping habits can have negative effects on children as they have the potential to impact productivity, sleeping habits, growth, and overall mood. Lack of sleep can have impacts that are not only physical, but also through educational and social environments. The increase in phone usage before bed, as well as other screens are common among adolescents and children, including those included in this study. This phone use is associated with poor sleep throughout the night. From the survey completed in this study, the majority of the respondents were female and 16 years old, which shows that the findings identified here reflect sleep patterns and phone use that are common among female and male adolescents aged 15 to 18 years. The overwhelming majority of respondents (93.3%) report using their phones before going to bed, which contributed to a greater percentage of respondents reporting feeling tired when waking up. Survey responses also demonstrate that phone use is common among these students. Participants averaged 6.6 hours of sleep, which is lower than the recommended 8-10 hours of sleep for adolescents. This suggests that longer phone use before bed is associated with fewer hours of sleep. Higher phone use is also associated with greater tiredness, as the average morning tiredness rating was 3.9 on a 5-point scale. This suggests that the majority of participants woke up feeling moderately to very tired, which may be the result of increased phone use in the evening. Students who used their phones longer before bed were more likely to report a score of between 4 and 5 on the tiredness scale, while shorter phone use participants reported lower tiredness levels. The scores of productivity also showed a clear pattern for participants who used their phones longer before going to bed, as the average rating of productivity was 2-3. These patterns show a relationship in which reduced sleep contributes to lower productivity and effort, making it harder for students to stay focused and engaged in school. Overall, the data demonstrates a clear pattern that greater nighttime phone use leads to fewer hours of sleep and higher levels of tiredness, which overall leads to lower productivity.

Together, the results of this survey assessment support the hypothesis that late-night phone use negatively impacts sleep quality and next-day productivity. Participants who spent more time on their phones before bed slept fewer hours, felt more tired in the morning, and reported lower productivity levels during school. The findings align with existing research. For example, from Harvard Health [1], they indicate that screen exposure before bedtime suppresses melatonin production, delays sleep onset, and decreases restfulness.

The connection between extended nighttime phone use and reduced rest suggests that the blue light, a type of light emitted from screens and LED lighting, and cognitive stimulation, mental activity that makes your brain active and engaged, from phones, may interfere with the body’s natural sleep rhythm. The body's natural sleep rhythm is an internal 24-hour clock in the brain that controls when you feel awake or sleepy based on changes in environmental light. Disruptions to this rhythm are harmful because they have the potential to alter the internal clock in such a way that it becomes out of alignment, leading to poor sleep quality and a higher risk of long-term health problems. Additionally, using phones for social media or communication close to bedtime may increase mental engagement, making it harder to fall asleep.

Implications

The results of this study indicate that late-night phone use is a potentially impactful behavior that can be targeted to improve the sleep patterns and academic performance of students the following day. Most students who participated in this study reported using their phones before bed and reported not getting enough sleep or feeling tired. Therefore, limiting late-night phone use is a potential behavior change that can be targeted to increase the

productivity of students. It is important to educate students on the importance of sleep. For example, health classes in schools should have a mandatory lesson on sleep habits and the importance of sleep to students to make sure all students are informed and understand the importance of healthy sleep habits. Another example could be pediatricians informing parents and children about the importance of sleeping habits and enforcing this through routine well-child visits. This can have a positive consequence on students' academic performance by improving their focus in class, the quality of their work on homework, and their overall mood. It is important to target this behavior at a young age to ensure that they have a good academic performance and a good life.

Limitations

Despite these findings, the study had several limitations that are important to consider. For example, the small sample size and lack of gender diversity are limitations, since the final population was mainly female. Figure 2 shows that tiredness levels differed slightly between male and female participants, though the small number of male respondents limits interpretation. Because the gender and age representation was imbalanced, it cannot be generalized since there were more females than males. This limits the study's generalizability. Additionally, the data relied entirely on self-reported measures, which are subject to recall bias. The students may have inaccurately estimated their exact minutes of phone use or hours of sleep. Finally, the convenience sampling method at a single high school in Chantilly, Virginia, means the results may reflect specific local academic pressures or social norms that are not representative of students in different geographic or socioeconomic environments. However, the consistency of the data trends provides useful insight into how everyday behaviors affect teenagers' well-being and productivity.

Future Directions

Future studies could benefit from more representative samples of participants to increase generalizability across various ages/grade levels, genders, and academic backgrounds. Future research should also consider integrating the use of objective measures of sleep, such as sleep-tracking devices or apps. This approach may offer more reliable information than the self-reported number of hours slept utilized here. Future studies could also explore the effects of different types of cellphone use to assess if specific types of phone use have a greater effect on sleep and productivity. Researchers could also explore interventions such as blue light filters, bedtime routines, or digital wellness tools to examine if any wellness methods work to improve sleep and academic performance.

Conclusion

The use of smartphones prior to going to bed by high school students at night is a common behavior. Among a sample of 15 adolescents, 93.3% reported nighttime cell phone use. The study also identifies that there is a strong relationship between extended periods of time spent on the phone before going to bed and the amount of total sleep time, as well as the amount of daytime tiredness experienced by high school students. All of these factors lead to lower self-reported levels of productivity and effort put forth by the students while in school. While the use of technology is a critical component of education and social interaction in today's world, its uncontrolled use during the night has disrupted natural sleep rhythms and REM sleep. Therefore, to support academic performance and long-term wellness for all students, educators

and parents need to develop digital wellness plans to help students transition to a screen-free period prior to going to sleep in order to minimize sleep deprivation and ensure that they arrive at school rested and able to succeed at the highest possible levels.

Works Cited

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