

THE EFFECT OF SLEEP PATTERNS ON LEARNING CONCENTRATION OF GRADE XII STUDENTS OF AL AZHAR MEDAN OUTSTANDING HIGH SCHOOL

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Abstract

This study aims to determine the tendency of the relationship between sleep patterns and learning concentration of grade XII students of SMA Unggulan Al Azhar Medan. The study used a quantitative approach with a descriptive design and a cross-sectional design. The study respondents were 50 grade XII students selected using a purposive sampling technique. Data were collected through an online questionnaire with a Likert scale and analyzed using descriptive statistics in the form of frequency distribution and percentages. The results showed that 32 respondents (64%) stated that they had sufficient sleep time, while 18 respondents (36%) stated that their sleep time was insufficient. In addition, 21 respondents (42%) reported having irregular sleep times. In terms of learning concentration, 31 respondents (62%) stated that they were able to concentrate well, while 19 respondents (38%) experienced difficulty maintaining concentration. A total of 35 respondents (70%) also gave a positive response that sleep conditions affected their ability to concentrate while studying. Based on these results, there is a tendency that insufficient or irregular sleep patterns are related to difficulties maintaining learning concentration, such as easily feeling sleepy, distracted, and having difficulty understanding the material. However, because the study used descriptive analysis with a limited number of respondents, these findings cannot yet be used to prove causality or generalize to a broader student population. Therefore, managing adequate and regular sleep patterns needs to be considered as part of efforts to support learning readiness and concentration in 12th-grade students.

Keywords: sleep patterns, learning concentration, grade XII students, sleep quality, learning

I. INTRODUCTION

Decreased learning concentration is a critical issue because it affects students' ability to optimally record, remember, and develop learning material (Putri & Sari, 2024). Learning engagement, encompassing both cognitive and behavioral dimensions, relies heavily on stable attentional capacity during classroom instruction (Xu et al., 2025). High academic pressure demands the mastery of complex knowledge in a short duration, which often drains mental energy and reduces students' attention span (Caesaridha, 2024). Changes in adolescent lifestyles today tend to neglect energy recovery, thus directly impacting low focus during learning activities (Kurniawati et al., 2025).

Global empirical data indicates that sleep disorders are a widespread phenomenon, with a prevalence reaching 68.8% in adolescents in the United States (Rivani et al., 2023). A recent international study reported that approximately 80.9% of students in the health sector experience poor sleep quality, which impacts academic achievement (Okur et al., 2026). At the national level, research on college students identified a rate of 80.6% of poor sleep patterns, which is significantly correlated with decreased concentration (Putri & Sari, 2024). Cognitive impairments due to sleep restriction include slowed reaction times and attention deficits, which can cumulatively impair intellectual performance (Ampofo et al., 2025).

Physiologically, sleep functions as a primary regulator of circadian rhythms, maintaining body homeostasis and supporting neuronal plasticity mechanisms (Okur et al., 2026). Memory consolidation occurs intensively during the Rapid Eye Movement (REM) and Slow-Wave Sleep (SWS) phases to stabilize newly learned information (Ampofo et al., 2025). Adequate sleep quality is essential for supporting biological cell regeneration and hemoglobin biosynthesis, ensuring optimal oxygen transport to the brain (Arlinda et al., 2025). Dysregulation of the

hormone melatonin due to disrupted sleep-wake cycles can trigger neurofatigue, which inhibits the central nervous system's ability to maintain focus (Khoiroh et al., 2024). Consequently, disrupted sleep architecture directly reduces executive function performance in the prefrontal cortex, which is responsible for attention control and information processing (Caesaridha, 2024).

The issue of sleep patterns urgently requires research because students with poor sleep quality are 13.6 times more likely to experience poor concentration compared to students with adequate sleep (Rivani et al., 2023). Poor sleep quality has been shown to reduce information processing efficiency and significantly hinder active learning engagement (Xu et al., 2025). While numerous studies highlight the impact of sleep at the university level, there is a paucity of literature on these dynamics in high school students under the pressure of preparing for final exams (Okur et al., 2026). Rationales for long-term impacts include the risk of decreased academic performance and mental health disorders if lifestyles are not promptly evaluated (Kurniawati et al., 2025).

This study aims to analyze in depth the influence of sleep patterns on student learning concentration at the senior high school level. This research approach uses a descriptive quantitative design to precisely identify correlations between variables. Different from previous studies, this study examines the influence of sleep patterns on learning concentration using a quantitative descriptive method in the context of 12th grade students of Al Azhar Medan's flagship high school who are preparing for college selection exams. The results of this study are expected to provide academic contributions to the development of study time management and practical contributions for schools in designing sleep hygiene programs for students.

II. LITERATURE REVIEW

Sleep is a vital physiological state for humans, defined as a recurring state of unconsciousness in which perception and reaction to the environment are reduced, but individuals can still be awakened by sufficiently strong sensory stimuli (Putri & Sari, 2024; Hall & Hall, 2021). Fundamentally, sleep is a key component of the circadian rhythm that maintains physical and psychological homeostasis (Okur et al., 2026). The primary functions of sleep include energy recovery, repair of damaged body cells, strengthening immunity, and reducing stress and anxiety (Putri & Sari, 2024; Sastrawan & Griadhi, 2017).

From a neurobiological perspective, the Rapid Eye Movement (REM) and slow-wave sleep (SWS) phases play crucial roles in stabilizing and consolidating new information received during wakefulness (Ampofo et al., 2025). During this process, the brain clears cellular toxins and regulates neuronal plasticity, supporting memory function and learning abilities (Okur et al., 2026). Disruptions to the sleep cycle can trigger autonomic nervous system dysregulation and neuroendocrine changes, such as increased cortisol levels and decreased melatonin (Sari et al., 2025; Susanti, 2024). Decreased melatonin not only disrupts sleep initiation but also inhibits the regeneration of red blood cells (erythrocytes), which carry hemoglobin for energy metabolism (Arlinda et al., 2025; Khoiroh et al., 2024). In addition, lack of sleep affects the regulation of the hormones leptin and ghrelin which control hunger, thus impacting nutritional status and nervous fatigue which directly reduces concentration (Kurniawati et al., 2025; Putri & Sari, 2024).

PREVIOUS RESEARCH REVIEW

Research on the relationship between sleep patterns and cognitive function has documented a very high prevalence of poor sleep quality among students in various countries. Empirical data shows that as many as 80.9% of health students in Turkey (Okur et al., 2026) and 80.6% of medical students in Jakarta (Putri & Sari, 2024) have low sleep quality. At the high school level, Rivani et al. (2023) reported that 65.2% of students in South Tangerang also experience similar problems, often triggered by academic demands and excessive use of electronic devices before bed (Apipah et al., 2025; Arlinda et al., 2025).

The relationship between sleep quality and learning concentration shows a statistically significant relationship. Students with poor sleep quality were found to have a 13.6 times greater risk of experiencing learning concentration problems compared to students who get enough sleep (Rivani et al., 2023). This is in line with the findings of Putri & Sari (2024) who confirmed a significant relationship between sleep patterns and students' attention levels ($p = 0.028$). In the more specific cognitive domain, Ampofo et al. (2025) found that poor sleep quality scores (high PSQI) were negatively correlated with performance on tests of verbal memory, attention (Stroop Test), and cognitive flexibility (WCST). However, some studies have shown varying results; for example, Apipah et al. (2025) found no significant relationship between fatigue levels and sleep quality in certain students, suggesting that a single factor such as task load is not always the sole determinant of a person's sleep quality. On the other hand, mental health was found to act as a crucial moderator, where students with stable psychological

conditions were able to mitigate the negative impact of sleep disturbances on their learning engagement (Xu et al., 2025).

III. METHOD

This study employed a quantitative approach with a descriptive design that aimed to provide an objective overview of the variables studied without providing special treatment to the research subjects. The applied research design was a cross-sectional study, in which data collection for the variables of sleep patterns and learning concentration was carried out simultaneously at a specific point in time for respondents. The research flow began with a literature review stage to map the phenomenon of sleep and attention disorders in adolescents, followed by the development of valid and reliable research instruments. After the instrument was ethically approved, an online questionnaire was distributed, followed by the data processing stage using statistical techniques to draw credible conclusions in accordance with the research objectives. The operational stages of this research are visually presented in the following flowchart:

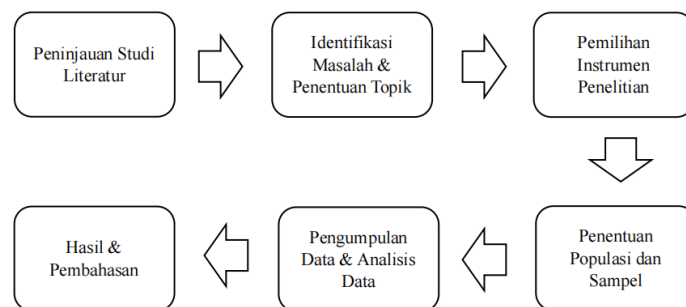


Image 1. Flowchart of Descriptive Quantitative Research Flow

POPULATION, SAMPLE, AND RESEARCH SUBJECTS

The population in this study included all active students of Class XII of Al Azhar Medan's flagship high school, totaling 50 people. The sampling technique used a purposive sampling method, namely the selection of respondents based on certain criteria that are considered capable of representing the characteristics of the problem being studied, especially for students facing high graduation pressure. The inclusion criteria in this study were active students of Class XII, willing to be respondents voluntarily, and not currently undergoing clinical treatment that affects cognitive neurofunction. Conversely, exclusion criteria included students who had a history of congenital clinical sleep disorders or did not complete the questionnaire completely during the data collection period. The sample size was determined through precision calculations that considered a 95% confidence level to ensure the representativeness of the data obtained.

RESEARCH INSTRUMENTS AND MATERIALS

The main instrument used in this study was a structured questionnaire independently developed by the researcher. This questionnaire was designed to measure students' subjective perceptions regarding the correlation between sleep quality and learning concentration levels. Measurements were conducted using a five-point Likert scale, consisting of the following options: Strongly Agree (SS), Agree (S), Neutral (N), Disagree (TS), and Strongly Disagree (STS). The items in the instrument were specifically designed to evaluate aspects of cognitive attention and information processing efficiency (e.g., difficulty understanding material) that are influenced by adequate rest duration. To adapt to the demographic characteristics of respondents and ensure optimal understanding, several items were formulated using a language approach that is more closely related to students' daily lives, without losing the essence of the measured variable indicators.

DATA COLLECTION TECHNIQUE

Primary data collection was carried out efficiently through an online survey method utilizing the Google Forms platform. This approach was chosen to facilitate wider respondent reach in a relatively short time and minimize the potential for human error during data entry. Before completing the instrument, respondents were given a brief explanation of the research objectives. Respondents' informed consent was accommodated

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electronically at the beginning of the form, which emphasized that participation was voluntary and the data collected would be used solely for academic purposes. The researcher also guaranteed strict implementation of the principles of anonymity and confidentiality of respondents' identities .

DATA ANALYSIS TECHNIQUES

Quantitative data obtained from Google Forms data collection was processed using descriptive statistical techniques. The data analysis steps included tabulating , data cleaning , and calculating response percentages. To illustrate the response trends for each indicator item, a relative frequency distribution was calculated using the following percentage formula:

$$P = \frac{f}{N} \times 100\%$$

Information:

- P= Percentage of respondents' answers
- f= Frequency of answers for a particular option (SS, S, N, TS, STS)
- N= Total number of respondents

The calculated data was then visualized in a pie chart to facilitate the reading of the proportions and distribution patterns of responses. Data interpretation was carried out by grouping positive responses (Strongly Agree and Agree) versus negative responses (Disagree and Strongly Disagree) to conclude how sleep patterns generally affect student learning concentration. All numerical calculations and graphical visualizations were processed automatically through a spreadsheet database to maintain data accuracy and validity before final conclusions were drawn.

IV. RESULTS AND DISCUSSION

This study involved 50 12th-grade students at Al Azhar Medan's flagship high school. Data were collected through an online questionnaire using Google Forms to obtain insights into students' sleep patterns and learning concentration.

No	Question	Score				
		1	2	3	4	5
1						
2						
3						
4						

IV. RESULTS AND DISCUSSION

Respondents' Sleep Pattern Characteristics

This study involved 50 12th-grade students at Al Azhar Medan's flagship high school. Data were collected through an online questionnaire using Google Forms and analyzed descriptively based on frequency distribution and percentages. The results showed variations in sleep patterns among the respondents. A total of 32 respondents (64%) stated they received sufficient sleep, while 18 respondents (36%) stated they did not. In addition to sleep duration, 21 respondents (42%) reported irregular sleep times. These findings indicate that although most students feel they receive sufficient sleep, a significant proportion still experience suboptimal sleep patterns, particularly in terms of sleep regularity.

This situation can be attributed to the characteristics of 12th-grade students, who face relatively high academic demands. Preparing for school exams and college selection can force students to allocate study time until late at night. Repeatedly practicing this habit can lead to shorter or inconsistent sleep times. These findings align with those of Rivani et al. (2023), who found that sleep quality issues are quite common among high school students and are linked to academic concentration. Meanwhile, Okur et al. (2026) showed that poor sleep quality is also a significant problem among health students. Although the respondent characteristics differ, both studies demonstrate that sleep problems can be found in groups of students with academic demands. Caesarridha (2024) also explained that sleep quality and duration are aspects related to concentration levels in learning. Therefore, sleep adequacy can be measured not only by the number of hours slept, but also by the regularity and quality of

sleep. In the context of this study, the fact that 42% of respondents had irregular sleep schedules indicates that managing sleep schedules remains an important aspect for 12th-grade students.

Respondents' Level of Learning Concentration

The study results showed that 31 respondents (62%) reported being able to concentrate well during learning, while 19 respondents (38%) experienced difficulty maintaining concentration. These difficulties were evident in several indicators, such as feeling sleepy while studying, being easily distracted, having difficulty understanding the material, and having difficulty maintaining attention for extended periods. The findings indicate that most respondents were able to maintain concentration during learning, but more than a third experienced concentration difficulties. This is important to note because concentration is a crucial part of receiving and processing information during learning.

According to Ampofo et al. (2025), poor sleep quality is associated with a decline in several cognitive functions, including verbal memory, attention, and cognitive flexibility. Disruptions to these functions can make it more difficult for someone to maintain attention and process information optimally. This aligns with research findings that students who experience difficulty concentrating also report problems such as being easily distracted and having difficulty understanding material. Furthermore, research summarized in the MDPI Public Health Editorial Board (2022) shows that sleep restriction can impact sustained attention, or attentional vigilance. The ability to maintain attention over a period of time is crucial in the learning process, especially when students must follow teacher explanations, read material, work on problems, and memorize information over a relatively long period of time. Thus, the concentration difficulties found in 38% of respondents can be understood as a condition possibly related to various factors, one of which is sleep patterns. However, because this study used only descriptive analysis, this condition cannot be used to state that sleep patterns are the direct cause of poor concentration.

The Relationship Between Sleep Patterns and Study Concentration

Based on the distribution of respondents' answers, 35 students (70%) responded positively to the statement that sleep conditions affect their ability to concentrate while studying. Furthermore, the study results showed a tendency for respondents who reported poor sleep patterns to also report difficulty maintaining concentration. These findings suggest a trend toward a relationship between sleep patterns and learning concentration among 12th-grade students at Al Azhar Medan's flagship high school. In other words, students who have insufficient or irregular sleep are more likely to report problems such as drowsiness, distraction, and difficulty understanding the material. These results align with research by Rivani et al. (2023), which found that students with poor sleep quality have a higher risk of experiencing learning difficulties. This research supports the hypothesis that sleep quality is a factor related to students' ability to maintain concentration during learning activities.

This opinion is also supported by Ampofo et al. (2025), who found that sleep quality is associated with various cognitive functions. According to these findings, poorer sleep quality is associated with lower performance in memory, attention, and cognitive flexibility. Theoretically, this condition could explain why students who are sleep-deprived have more difficulty maintaining attention while studying. From a psychological and learning perspective, Xu et al. (2025) demonstrated that sleep quality is related to learning engagement, or students' involvement in learning. This study also suggests that mental health can act as a moderating factor. This means that the impact of sleep quality on learning engagement varies across individuals, as psychological conditions can also influence students' responses to sleep disturbances. This is relevant to the situation of 12th-grade students who face significant academic pressure. The burden of assignments, exam preparation, college entrance exams, and the pressure to achieve academic success can impact both sleep patterns and concentration. Therefore, the relationship between sleep and concentration should not be viewed as a standalone relationship, but as part of an interaction of various factors that influence students' readiness to learn.

The Role of Sleep Patterns in Academic Readiness of Grade XII Students

XIIth-grade students are a unique group, particularly those in the final stages of secondary education. In addition to completing school activities, they also need to prepare for exams and the university selection process. This can increase the need for study and lead some students to extend their study time into the evening. Studying late into the night can be problematic if it leads to a persistent lack of sleep. In the short term, students may feel that reducing sleep frees up more time for studying. However, if sleep deprivation leads to decreased attention and

information processing, the additional study time may not necessarily result in more effective learning. The research findings show that 70% of respondents acknowledged the impact of sleep on concentration. This indicates that most students recognize the importance of sleep for their readiness to participate in learning activities. This opinion aligns with the findings of Okur et al. (2026), which showed a relationship between sleep quality and academic performance in health students. However, the study also showed that sleep is not the sole factor determining academic performance. Therefore, sleep patterns should be considered a component of learning strategy management, not the sole determinant of academic success.

Other Factors That Can Affect Concentration

Although this study found a trend toward a relationship between sleep patterns and learning concentration, various other factors can influence student concentration. These factors include academic load, stress, use of electronic devices before bed, the learning environment, motivation, study habits, psychological state, and general health. Xu et al. (2025) emphasized the importance of mental health conditions in understanding the relationship between sleep quality and learning engagement. Meanwhile, previous studies included in this review suggest that electronic device use and academic demands may also be related to sleep quality. Therefore, the low concentration levels of some respondents cannot be directly attributed solely to sleep patterns. A student may have sufficient sleep but still have difficulty concentrating due to stress, lack of motivation, an unsupportive learning environment, or other factors.

This is also why the results of this study should be understood as descriptive trends. This study did not conduct inferential statistical tests to determine the strength of the relationship or influence between variables. Therefore, the term "influential" in the context of this study is more appropriately understood as perceptions and tendencies based on student responses, rather than as evidence of a causal relationship. Overall, the study results indicate a tendency for better sleep patterns to be associated with more optimal learning concentration among 12th-grade students at Al Azhar Medan's flagship high school. Sixty-four percent of respondents reported getting enough sleep, 42% reported irregular sleep patterns, 62% reported being able to concentrate well, and 70% reported that sleep conditions affected their ability to concentrate.

These findings are consistent with previous studies showing that sleep quality is related to attention, memory, alertness, and learning engagement. Rivani et al. (2023) demonstrated a relationship between sleep quality and learning concentration in high school students, while Ampofo et al. (2025) demonstrated a link between sleep quality and several cognitive functions. Xu et al. (2025) also demonstrated that sleep quality is related to student engagement in the learning process. However, previous research also shows that sleep is not the sole factor determining learning ability and academic achievement. Therefore, sleep patterns should be viewed as a crucial component in supporting students' cognitive readiness, along with time management, psychological well-being, learning motivation, learning environment, and other academic factors. Thus, this study suggests that maintaining adequate and regular sleep patterns can be part of a healthy learning strategy for 12th-grade students. Preparation for exams and college selection should not only focus on increasing study time but also consider the body and brain's need for adequate rest.

V. CONCLUSION

The research results show that sleep patterns are one aspect related to students' ability to maintain concentration in learning. Respondents who reported insufficient sleep or irregular sleep patterns were more likely to experience difficulty concentrating, such as drowsiness, distraction, and less than optimal comprehension of learning materials. These findings align with studies on the impact of sleep deprivation on cognitive function. Sleep deprivation is known to impair attention, alertness, working memory, information processing speed, and executive function. In adolescents, this becomes even more relevant because biological changes in the sleep-wake system can lead to a tendency to sleep later, while school demands still require students to wake up early.

Neurocognitively, sleep plays a crucial role in maintaining attentional function during wakefulness. Reviews of sleep deprivation indicate that sustained attention (vigilant attention) is one function sensitive to sleep deprivation. Attention deficits can also accumulate when sleep deprivation persists for several consecutive days. This may explain why students with poor sleep patterns may have difficulty maintaining focus during learning. The results of this study also align with research on high school students that found a link between sleep quality and academic achievement. Research on high school students showed that poorer sleep quality scores were significantly associated with lower academic performance. (PubMed)

Similar findings have been seen in research on health-related college students. A recent study of 315 college students found that 80.9% of respondents reported poor sleep quality based on the Pittsburgh Sleep Quality

Index (PSQI). The study also found a relationship between sleep duration on exam days and test scores, although the relationship was weak. This suggests that sleep is not always the sole factor determining academic achievement, but it remains an important aspect of learning readiness. (PubMed)

However, previous research has not always shown a consistent relationship. A study of medical students in Kermanshah, for example, found no significant difference in sleep quality between high- and low-achieving students. This study emphasized that other factors can influence academic achievement, so sleep quality cannot be viewed as the sole determinant. (PubMed)

These differences in results are important to consider in this study. Study concentration is not only influenced by sleep patterns, but can also be related to academic load, stress, electronic device use, learning environment conditions, motivation, study habits, and students' psychological state. Therefore, the trend in the relationship between sleep patterns and concentration found in this study needs to be understood as one factor influencing the learning process.

The context of 12th-grade students is also an important aspect in interpreting the research results. Students at this level face relatively high academic demands, having to complete secondary education while preparing for college selection. This situation can encourage students to reduce sleep time to study. However, research in adolescents shows that partial sleep restriction can lead to impairments in sustained attention, processing speed, and alertness. In fact, some neurobehavioral impacts may persist after the recovery period.

Thus, the results of this study reinforce the importance of managing sleep patterns as part of a 12th-grade student's learning strategy. Exam preparation requires not only increased study time but also a balance between study time and rest. A structured study schedule can help students avoid late-night study habits and maintain a healthy sleep schedule.

However, this study has limitations. The study's sample size was limited to 50 students and the use of a self-developed questionnaire means the results should be interpreted with caution. Furthermore, the study used a cross-sectional design, meaning data were collected over a single period and cannot establish a causal relationship. Future research could utilize a larger sample size, validated sleep quality instruments such as the PSQI, and more objective measures of concentration to obtain stronger results.

Overall, the study results indicate a tendency for better sleep patterns to be associated with more optimal learning concentration in 12th-grade students at Al Azhar Medan's flagship high school. These findings support the literature demonstrating that sleep plays a crucial role in attentional function and cognitive abilities, and also suggest that sleep factors need to be considered in learning management strategies for students facing high academic demands.

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