The Impact of Sleep Quality on Academic Performance in Adolescents

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Abstract: In the highly competitive society of modern academic pressure, most middle school students choose to give up sleep to study and achieve higher scores. Therefore, the relationship between academic performance and sleep quality is an important topic for exploring the healthy development of adolescents. This article explores the direct relationship between sleep and academic performance. Low quality sleep such as sleep disorders, insomnia, and daytime sleepiness are examined through the cerebral cortex and cognitive function of adolescents. Lifestyle habits are also a key factor to explore, which is related to the physical fitness of adolescents. The third research perspective starts from the psychological problems of adolescents, such as anxiety and depression as the research subjects associated with sleep quality and academic performance. The article also investigated the relationship between eating at night and watching electronic screens before bedtime leading to insomnia. Whether anxiety acts as a mediator to affect the relationship between sleep quality and academic performance remains to be verified, and data collection methods need to be optimized. Further in-depth exploration is needed in the field of biology, brain, and neurology to obtain different results from different disciplinary classifications.

1 INTRODUCTION

Adolescence is a transitional period in which adolescents gradually develop into adults (Kohyama, 2021). Teenagers may experience significant physical changes and begin to form adolescent self-awareness development. Teenagers begin to explore their roles and positioning in society, preparing for their future integration into society. Academic pressure will increase and promote the improvement of thinking ability. Chinese students have to face the college entrance examination, which is closely related to their future university studies and job hunting. Due to the immense academic pressure, many students overlook the factor of sleep. Staying up late to study for grades leads to a lack of sleep, which has a certain impact on their academic performance. Therefore, the sleep quality of teenagers is worth paying attention to. Some students attribute their poor grades to their lack of effort. However, in reality, they lack sleep, and their brains do not get enough rest, resulting in a decline in their thinking ability. This study can help teenagers recognize the importance of sleep.

As people age, people's sleep intake decreases due to internal factors such as screen time use, extracurricular activities, evening diet, accumulation of daytime stress, and morning shift schedules. Subjective metrics of sleep quality have encompassed aspects such as the profundity of sleep, the state of rest, the presence of non - restorative nocturnal sleep, the experience of drowsiness, and the sensation of requiring additional sleep within a span of three days or less during the previous week. Family lifestyle is positioned as an external factor. A deterioration in sleep quality has the potential to precipitate an array of maladies, a regression in cognitive function, subpar academic achievements, a diminution in emotional self - regulation, an upsurge in behavioral issues, and chronic deleterious impacts on diverse metabolic systems, along with an increased propensity for obesity. Multiple determinants, such as genetic, behavioral, medical, and environmental elements, can exert an influence on an individual's sleep quantity. Thus, prior to assessing the correlation between sleep quantity and other variables, it is imperative to gauge, for each person, the ideal sleep duration as well as the divergence from their personal ideal sleep quantity. Drowsiness is a potential candidate for evaluating executive function better than sleep volume and is considered one of the issues reflecting sleep quality.

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The investigation of sleep quality in adolescents is still limited, and clear standards for evaluating sleep quality have not yet been established. Sleep is related to biology, psychology, and other unknown aspects. To unearth the nuances of adolescent sleep quality, more in - depth and comprehensive research is imperative.

Besides the decline in learning caused by memory impairment, personal emotions are also one of the factors that interfere with learning (Valiente et al., 2012). Personal emotions play an important role, and in the direct correlation between emotions and academic functions, negative emotional reactions and individual differential emotions play a prominent role in many social patterns. It is more arduous to discern and differentiate positive emotions. Moreover, scant evidence exists to imply a link between positive emotions or personality characteristics in children and their academic accomplishments. Emotions such as joy, hope, and pride exhibit a positive correlation with students' academic self - efficacy, academic interest, the exertion of effort, and overall scholastic attainment. It is postulated that positive emotions serve to expedite approach - related activities. These activities, in turn, are apt to bestow academic advantages, especially when the student is progressing towards a coveted objective. There is merit in contemplating the quadratic relationships between high - intensity positive emotions and academic proficiency. Cognition serves as a means by which the correlation between emotions and academic attainment can be modulated. To begin with, negative emotions such as anger have a detrimental impact on academic performance. This is in part due to the fact that they exert an adverse influence on advanced cognitive mechanisms and direct attentional resources towards a restricted range of behavioral alternatives. Students who are prone to anger or anxiety may perform poorly through motivational measures, as these emotions reduce their motivation to participate in classroom activities, which is an important predictor of their academic success. Anxiety can have a negative impact on students' thinking and mentality. In the classroom, students may be unable to concentrate on listening to the content due to anxiety. Their attention span may become shorter, and they may not be able to register what the teacher is saying. It is not the case that all emotions are apt to be connected to achievement in identical manners or due to identical rationales.

Previous studies have explored the negative effects of individual internal factors, including dietary habits, screen use, emotional stress, etc., on adolescents. At the biomedical level, long-term effects such as familial genes and genetic diseases may gradually lead to symptoms of drowsiness and insomnia. The negative emotions and anxiety of adolescent students need to be closely monitored, which is closely related to their academic performance. Whether they maintain interest or concentration in learning, as well as perfect interpersonal relationships and effective social support, all require constant attention. The intermediate relationship between sleep quality and academic performance among adolescents still needs further exploration. With the development of the internet, teenagers have increased the use time of electronic products. There are also psychological disorders caused by internal stress, such as anxiety and depression, which reflect poor sleep and decreased learning. Social time difference is a new definition that explains whether learning is important or giving up learning to maintain sleep is important. These will be worth a more comprehensive summary and interpretation.

2 LIFESTYLE RELATED FACTORS AND THE ASSOCIATION BETWEEN ACADEMIC PERFORMANCE AND SLEEP

2.1 The Overall Link Between Sleep and Academic Performance

Longitudinal studies can comprehensively explore the prospective association between insomnia, daytime sleepiness, and academic performance among Chinese adolescents. Zhang et al. analysed the chronological order of academic difficulties caused by excessive daytime sleepiness (EDS) and insomnia symptoms at different time points (Zhang et al., 2022). It is possible that daytime sleepiness plays an important mediating role between sleep disorders and academic performance.

They used a self-reported academic achievement scale to have students evaluate their overall performance and assess their academic performance. They used the Youth Self Rating Scale to ask sleep related questions (e.g., difficulty initiating sleep, difficulty maintaining sleep, early morning awakening, unrefreshing sleep, and poor sleep quality) to measure the degree of insomnia and drowsiness scale to inquire about the overall feelings

of adolescents over the past month to study daytime sleepiness.

It found that insomnia and EDS have a strong correlation with academic performance. During the first year of follow-up, 15-17% of adolescents had insomnia symptoms, and 21-24% of adolescents experienced daytime sleepiness. One year later, a decrease in math scores was found during follow-up, and the proportion of poor grades increased. Insomnia is significantly associated with overall poor performance. Insufficient sleep, augmented daytime somnolence, and compromised cognitive function can be induced by insomnia. These consequences, in turn, are prone to exert a detrimental influence on academic performance. Not only does insomnia have an adverse effect on academic achievement, but EDS also has a negative impact on it. Moreover, the impact of insomnia on academic performance is conveyed through the medium of excessive daytime sleepiness.

Insomnia can lead to a decrease in learning efficiency. However, in the study of time span, it was found that the impact of sleep on academic performance was not significant. On the contrary, daytime sleepiness plays a strong mediating role between insomnia and academic performance. This study cannot elucidate why EDS has different mediating effects on academic performance in different disciplines. As language is a complex learning process, further longitudinal research on neurobiology is needed.

2.2 Lifestyle, Sleep, and Academic Performance

Lifestyle includes screen time, studying time, moderate to vigorous physical activity practice, time spent on social medias, eating and sleeping habits. If teenagers use screens for too long, it may cause emotional problems and disrupt sleep. It is also possible to ignore time, resulting in staying up late, shortening sleep time, and making it difficult to enter a deep sleep state. In the study by Dubuc et al. studying how students' daily habits affect their academic performance (Dubuc et al., 2020). The reascher collect data on academic performance through the final transcript of students by the school. Students reflect their lifestyle habits by answering a self-report test. They used a software on a computer to observe students' reactions to the changes in arrows on the screen to evaluate inhibitory control.

It found that the academic performance of teenagers declines between grades 1 and 3, during which their work, study, physical activity, and dietary habits remain unchanged. Between 1st and 3rd grade, teenagers' use of television and video games significantly decreases, while by 3rd grade, teenagers begin to spend more time on social media. Students sleep later and have shorter sleep times in third grade. Screen usage time is negatively correlated with academic performance and cognitive control. Teenagers watching TV and using electronic devices for less than an hour will reflect higher academic performance. Good eating habits are related to better academic performance. Academic accomplishment was found to have an inverse relationship with every variable pertaining to screen time. Moreover, among high - school students, there are pronounced associations among lifestyle patterns, cognitive self - regulation, and academic attainment. The deficiencies in students' self-living habits can interfere with sleep and indirectly affect the sleep quality of adolescents.

In addition to the influence of electronic screen usage time, lifestyle habits such as physical activity, dietary habits, and social support that affect self-esteem and academic pressure in adolescents can also be linked to their academic performance, which is reflect through students' grade point average (GPA). In the study by Maniaci at el. the relationship between healthy lifestyle of adolescents and their academic performance (Maniaci et al., 2023). The basic information of the interviewees was elicited through the employment of the questionnaire. The information of age, sex, marital status, occupation, and residential residence, as well as GPA was collected. The survey also investigated diet, views on self-psychological pressure, internet addiction, height and weight, evaluators' support for society and measurement of self-esteem. Assess students' GPA based on written warning records received during the exam period.

It found that Academic performance can be improved by adopting a healthy diet. There is no positive correlation between good dietary habits and students' self-esteem. Unhealthy diet is negatively correlated with sleep duration. Academic performance and sleep habits are negatively affected by internet addiction that survey supports the previous statement that screen usage can have a negative impact on adolescent academic performance and the sleep time of internet addicted patients is significantly shortened Perceived social support is negatively correlated with internet use. Less social support may be a risk factor for adolescent internet addiction. Teenagers may experience poor physical fitness and sleep quality due to unhealthy lifestyle habits, lack of exercise, and unhealthy diet, ultimately affecting academic performance. Students' academic

performance may be detrimentally affected by academic stress. In contrast, academic achievement shows a positive association with a robust sense of social support within the family.

With the development of science and technology, the internet is an important factor for the healthy development of young people. The internet usage may act as an intermediary factor to affect sleep and academic performance. Teenagers who use the internet too much will produce nervous excitement and affect sleep. Or teenagers' infatuation with the internet reduces their motivation for learning. This is an area worth exploring. The evaluation of internet usage duration is primarily accomplished by examining the time dedicated to activities such as television viewing, video - game playing, internet surfing, and mobile - phone utilization.

In the study by Adelantado-Renau and colleagues (Adelantado-Renau et al., 2019). They explored the relationship between sleep quality and academic performance through internet use time as a mediator. Assessing students' sleep status and data through a sleep index survey questionnaire and the duration of daily sleep was measured using an accelerometer. Starting from the first year of high school, students' academic performance is evaluated using a 10-point final grade system. They use a specially designed questionnaire to ask teenagers whether they work on weekdays or weekends

It found that self-reported better sleep quality is associated with higher academic performance. Students with high sleep index have better academic performance than those with poor sleep. Social networks and internet usage can increase physical and emotional arousal, thereby disrupting sleep quality. The bright light emitted by the screen before bedtime may have an acute warning effect. Online time may replace study time, and poor sleep quality may lead to a decline in academic performance. Long term use of the internet will affect the prefrontal cortex to reduce the quality of sleep, and finally lead to cognitive impairment, which is affect attention and reduce academic performance. It proves that internet use time plays a mediating role between sleep quality and academic performance.

3 THE ROLES OF ANXIETY AND DEPRESSION IN THE RELATIONSHIP

In addition to students' lifestyle habits, their own anxiety issues also need to be carefully examined. Anxiety refers to a psychological state characterized by excessive worry, fear, unease, and other emotions. Students may experience anxiety due to concerns about grades, which can affect their sleep quality. Zhang et al. Investigated the relationship between sleep quality, anxiety, and academic performance among Chinese high school students (Zhang et al., 2021). The frequency at which electronic devices are utilized, the timing of their usage, the selection of said devices, as well as the intent behind the screen, and time engagement were used to obtain information on screen usage time among teenagers. They used the self-report to assess the daily anxiety levels of adolescents. They assessed sleep disturbances and also used scales to investigate functions related to sleep impairment such as drowsiness, exhaustion, alertness, and wakefulness.

Research findings indicated that a lengthier sleep duration, in tandem with a higher prevalence of sleep disorders, was associated with a decline in academic standing. Paradoxically, students experiencing more profound sleep-related disruptions yet having longer sleep hours tended to exhibit superior academic performance compared to those with fewer sleep - disorder manifestations or shorter sleep periods. Moreover, it was observed that individuals who engaged with electronic screens prior to bedtime were more prone to encountering significant sleep disorder issues. An increase in anxiety can lead to an increase in sleep disturbances and sleep related impairment. However, the survey results indicate that there is no explicit relationship between students' anxiety symptoms and academic performance. This is contrary to the assumption that anxiety can lead to a decrease in grades. This may be due to the Confucian academic background in China, where students sacrifice their sleep time to learn and demonstrate better academic performance.

Social jetlag refers to the difference in sleep time caused by insufficient sleep among teenagers due to workdays, resulting in delayed wake-up times on weekends. Social jetlag can have a negative impact on the physical and mental health of teenagers, causing irritability. This may be one of the sources of anxiety. In the study by Tamura at el. exploring the correlation between social jet lag and irritability among Japanese adolescents and the relationship between daytime sleepiness, fatigue, and poor academic performance (Tamura et al., 2022). Inquire about bedtime and sleep duration to assess social jet lag (i.e., delays and wake-up time on weekdays and weekends). They used problem assessment to assess students' daytime functional impairment in the previous month.

It found that the higher the level of social time difference reaction among students. Students with a social time difference of equalling to or greater than 1 hour sleep late, wake up late, and sleep longer compared to students with a social time difference of 0 to less than 1 hour. Compared to a reference point of 0, the adverse social jetlag experienced by students is manifested in their late - night bedtimes and tardiness. Those students who endure more pronounced social jetlag are more prone to exhibit an irritable disposition, sleep deprivation, daytime somnolence, and a deterioration in academic achievement. Moreover, students grappling with negative social jetlag display marked fatigue and subpar academic performance. The experiment also found that when the social time difference is greater than 1, it can lead to poor mental state and anxiety. This is related to the increased risk of poor academic performance. This research has shown that students with significant social time differences may experience daytime sleepiness, leading to irritable mood and anxiety, which is related to a decline in academic performance. Contrary to hypothesis, negative social jet lag only leads to fatigue and has a negative impact on academic performance.

In the modern competitive environment, teenagers may choose to give up sleep in order to achieve their academic goals. Depressive symptoms can also become a part of relationship. Assuming that students with poor sleep quality and spending more time on study are more likely to experience depressive symptoms and have poorer health conditions. In the study by Sing et al. the impact of this self-rated was investigated in school (Yeo et al., 2019). Students were asked to evaluate adolescents' sleep behavior on school days and weekends by answering questionnaires reporting their bedtime, wake-up time, and nighttime sleep. Several symptoms related to sleep were also examined, including daytime sleepiness, school day napping, caffeine use, sleep latency period, reasons for waking up on school days, sleep quality, prolonged weekend night sleep, and weekend napping. They distributed self-assessment questionnaires to collect health data and assess the severity of depression.

It found that teenagers with poorer self-evaluation have lower sleep quality. Overweight and depressive symptoms in terms of health can also affect sleep. Late onset of sleep patterns, lower levels of parental supervision before bedtime, spending more time on studying, school hours, and longer travel time can all cause sleep disorders. In addition, socio-cultural differences may lead to sleep deprivation and have a negative impact on the health of adolescents. This confirms that sleep disorders can cause depressive symptoms and interfere with academic performance. After exploring depression as one of the anxiety factors, longitudinal studies are needed to investigate the impact of anxiety, depression, and sleep on academic performance. The duration of sleep and academic performance may also be influenced by various factors.

Evanger et al. explored the relationship between high school students' sleep duration, insomnia, depression, anxiety and school performance (Evanger et al., 2024). They used questionnaires to assess self-reported sleep status of students on school and free day. The Insomnia Scale is a six item self-report questionnaire used to assess the insomnia status of adolescents. They used a health questionnaire to assess symptoms of depression in adolescents. The academic performance data of school participants is collected through their respective school management departments. It found that at longitudinally, the longer the sleep duration, the milder insomnia symptoms are, and the diagnosis of insomnia at the negative baseline of screening both predict better GPA at 2 years. The higher the level of depressive symptoms or above the critical value, the lower the development of GPA is. There is no longitudinal correlation between anxiety symptoms and GPA development. Students who sleep longer tend to perform better academically than those who sleep less. A two-year longitudinal study found that prolonged sleep duration resulted in higher average score points. In contrast, insomnia symptoms have increased within two years, leading to an increase in anxiety and depression. There is no vertical correlation between anxiety and academic performance, but there is a vertical correlation between sleep duration and academic performance.

4 CONCLUSION

Sleep disorders such as daytime sleepiness and insomnia have been found to worsen through longitudinal studies, leading to a decline in academic performance among adolescents. Teenagers' prolonged use of electronic devices in their daily routine can directly interfere with cognitive function and emotional fluctuations, causing negative effects on sleep and loss of interest in learning. The stress caused by other lifestyle habits such as diet, physical exercise, and lack of social support will affect a child's sleep state, and the degree of falling asleep will ultimately have a certain impact on their intelligence. The internet, as a medium, interferes with the nervous

layer, disturbs mood, affects sleep or directly occupies most of the time spent by teenagers in learning. Anxiety can also cause sleep disorders in adolescents. Social jetlag is one of the factors that cause anxiety. Social jetlag affects sleep and academic performance as well. Depression is also a potential factor that can have a negative impact on sleep quality and learning.

However, there are some contradictions in the experimental results of previous investigations. Inconsistent results were found regarding the role of anxiety. The method of obtaining data is using a psychological self-assessment questionnaire to ask students to describe changes in their own mentality. Students may assess their overall psychological changes based on their recent mood. Therefore, more objective approaches should have been taken, such as conducting a questionnaire survey for parents or teachers to reflect students' anxiety status, to improve the accuracy of data. In longitudinal studies, tracking and monitoring the sleep status of adolescents for one year was conducted to discover the significant relationship between sleep quality and academic performance. The data obtained from a one-year longitudinal study is not sufficient, and future studies should be expanded to a three-year longitudinal design in order to obtain a more comprehensive findings regarding the relationship between sleep quality and academic performance.

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