Proceedings of the 4th International Conference on Computing Innovation and Applied Physics
DOI: 10.54254/2753-8818/80/2025.21212

Analysis of the Effect of Bedtime Electronic Product Use on Sleep Quality of College Students

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Abstract: College students are the backbone of the country's future development. However, the phenomenon of college students using electronic devices before bed is becoming more and more common, which has a significant impact on their sleep quality. In this paper, the screen light theory, high arousal theory, and sleep displacement theory are introduced by combining the existing research results. This article explores the influential mechanism of the bedtime screen use on sleep quality. Specifically, the use of electronic products affects sleep in three main ways: one of them is by inhibiting the secretion of melatonin in the human body, the second is to cause cognitive or physiological high arousal before bed, and the third is to occupy the time originally used for sleep or to do activities related to improving sleep quality. The influences of using electronics on the sleep quality of college students were concluded by analyzing the survey results of college students' use of mobile phones before going to bed and the experiments of controlling the content variables of college students; By linking college students' bedtime screen use with sedentary time, the effect of time spent on sleep quality was analyzed. Interventions were proposed to improve the sleep quality of college students in terms of content, mode, duration of electronic product use, and external aspects.

Keywords: College students, electronics, before bed, sleep quality

1. Introduction

Sleep is closely related to human health. It occupies one-third of people's lives, is the central regulator of hormone release, glucose regulation, and cardiovascular function, and is one of the basic indicators to measure the level of health [1]. Studies have shown that sleep problems threaten the health and quality of life of more than 45% of the world's population, having become an important public health problem [2].

With the popularization of electronics such as mobile phones and tablets, while bringing convenience to people, more and more people use electronic products every day. The phenomenon of using electronic products before going to bed is becoming more and more common. A survey done by the National Sleep Foundation shows that more than 90% of Americans use electronics 1 hour before bedtime [3]. Among them, college students are not only the backbone of the country in the future, but also the young people who accept new things very fast. The phenomenon of excessive use of electronic devices and mobile phone addiction is serious. Using electronic products such as mobile phones before sleeping has become a habit for many college students. Research shows that about 99.08% of students in a Chinese university use mobile phones and other electronics before going to

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bed. This can have negative impacts on their sleep quality, which can affect the physical and mental health of college students.

Existing studies have shown that the use of electronic devices before bed has negative impacts on sleep quality. Therefore, it is of great significance to study the factors that interfere with sleep quality, explore the association between the content and duration of using the screen and sleep quality, as well as the specific mechanism of sleep quality. So as to deeply analyze the impact of bedtime electronic product use on the sleep quality of college students, and pay attention to the physical and mental health of college students.

The purpose of this paper is to analyze the impacts of bedtime electronic product use and duration on the sleep quality of college students and the mechanism of the impact by combining the existing studies. The aim of this study is to put forward reasonable suggestions and interventions to improve the sleep quality of college students.

2. The impact mechanism of using electronics before bedtime on the sleep quality of college students

At present, the research on the influence mechanism of the use of electronics before bed on the sleep quality of college students mainly includes the following three theories:

2.1. Screen light theory

Melatonin, a hormone secreted by the pineal gland of the brain, plays an important role in the circadian rhythm and regulation of the sleep/wake cycle in humans [4, 5]. Since melatonin is sensitive to light, the bright light emitted by the screen when using electronic devices such as mobile phones will inhibit the secretion of melatonin in the human body, thus affecting the sleep-wake cycle of college students [6]. For example, Sun Wei et al., in experiments studying the relationship between the use of electronic devices and melatonin levels, found that the use of electronics for a long time before bedtime led to a decrease in urinary melatonin levels [7].

2.2. High arousal theory

Browsing on electronic devices before bed stimulates the retina, leading to excitability in the visual cortex , which in turn affects other areas of the brain that are closely related to mood and cognition [8]. This increases the alertness of college students and improves their physiological arousal levels, which can have an impact on sleep quality. He Jingwen et al. found in their study of the relationship between bedtime use of electronic devices and bedtime high arousal, that bedtime high wakefulness plays a partial mediating role between bedtime use of electronic products and sleep quality, and electronic products such as mobile phones may affect sleep by causing bedtime cognitive or physiological high arousal [9].

2.3. Sleep replacement theory

Procrastination before bed is a form of failed self-regulation. Because there is no fixed start and end point for the use of electronic devices for recreational activities, the use of electronic devices before bed may lead to the use of time for sleep or activities related to improving sleep quality, leading to procrastination before bedtime [10]. Procrastination before bed can lead to shorter sleep duration and lower sleep quality. Studies have shown that procrastination before bed is inversely correlated with sleep quality, i.e., the more frequent bedtime procrastination, the worse sleep quality [11].

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3. The impact of different content of electronic devices used before bedtime on sleep quality

Differences in what you watch before bed can lead to different physiological levels of arousal, which in turn have different effects on sleep quality [6]. Wu Jihui et al.'s survey on college students' use of mobile phones before going to bed showed that among the college students they surveyed, about 12% of the college students who focused on online chatting before going to bed had a bad or very bad sleep, about 38% had average sleep, and about 50% had good or very good sleep; About 12% of students who prefer to watch the news before going to bed have poor or very bad sleep, but 54% have an average sleep and only about 23% have a good or very good sleep [12]. This shows that watching the news has a greater impact on sleep quality. Although there is little difference in the effect of the two on students with poor or very poor sleep conditions, watching the news has a more obvious effect on the reduction of sleep quality of college students [12]. According to research analysis, this may be due to the existence of a sleep supervision mechanism, for example, two or more people chatting to say good night will end the chat while watching the news is completely an individual activity, and the start and end time are completely dependent on the individuals themselves, and there is a lack of sleep supervision mechanism [12]. In a study, Legend and Cui Yupeng divided college students into four groups according to the content of electronic products used before bedtime. The study found that the TV/movie streaming group and the online surfing/social networking group had lower sleep quality, shorter sleep duration, and later sleep time than after the intervention [13]. This suggests that watching TV/movies, and surfing the Internet are associated with decreased sleep quality, shorter sleep duration, and later bedtime [13]. Although this study does not explain the effect of playing video games on sleep quality, other recent studies have shown that playing video games does not necessarily impair sleep quality and may even have a positive effect on physical function and mental state during the day [14]. The effect of video games before bed on sleep quality is not fully understood, and futher follow-up studies are needed.

4. The impact of different screen usage durations on sleep quality

Data studies have shown that the longer the time spent using electronics such as mobile phones before bedtime, the more obvious the dependence on mobile phones, the longer the time to fall asleep, and the lower the sleep efficiency [15]. GRADISAR ET AL. found that the longer you use your phone before bedtime, the worse your sleep quality is [3]. The use of electronics such as mobile phones for activities often does not have a fixed starting point, and it is easy to use it for too long, resulting in a delay in falling asleep. In recent studies, it has been found that screen time, especially playing games, is associated with changes in sleep duration, timing, and quality, which is strongly associated with changes in the time to start sleeping. Hysing et al. found that using mobile phones before bedtime prolonged sleep latency, difficulty falling asleep, and increased risk of insomnia [16]. In addition, longer bedtime screen time is often accompanied by sedentary behavior. Studies have shown that screen-based sedentary behavior has a negative impact on sleep quality, sleep duration, and time to fall asleep [17]. There is a significant positive correlation between screen-based sedentary behavior and the Pittsburgh Sleep Quality Index (PSQI) score, i.e., the longer the screen-front sedentary time, the higher the PSQI score, which means worse sleep quality [17]. In a survey of adolescents, adolescents who spent more time on screens slept for less time [18]. Guerrero et al. found that screen time was significantly positively associated with problem behaviors such as obesity and depression, and screen use to watch TV, watch videos, and play video games was associated with reduced sleep time. At the same time, they noted that longer sleep duration was associated with a reduction in problem behaviors. Thus, sleep duration mediates screen time and problematic behaviors [19].

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5. Intervention

In order to reduce the use of screen before going to bed and improve sleep quality, the following five aspects of intervention are carried out:

5.1. Intervention effect of Autonomous Sensory Meridian Response (ASMR) video on sleep quality

ASMR refers to the stimulation of the human senses, such as sight and smell, to produce a pleasant sensation of stimulation in other parts of the human body [20]. AMSR videos can relax the human body and reduce psychological stress by creating sound and environmental atmosphere such as light touch, and can effectively improve the sleep quality of college students by watching ASMR videos before going to bed [13]. This is because viewers of ASMR videos experience a decrease in heart rate and a subjective increase in chills, which is consistent with changes in the body at the time of sleep [21].

However, due to the different brain and nervous system structure of each individual and the different subjective perception of ASMR, ASMR video sleep aid intervention is not suitable for everyone. At the same time, ASMR videos may reduce the body's sensitivity to sound due to the long-term emitting the same or similar sounds, and become dependent on ASMR videos before bedtime, which makes it more difficult to fall asleep without watching ASMR videos. In view of the limitations of ASMR video, other techniques can be combined to improve sleep, such as creating a comfortable and quiet sleep environment, and wearing auxiliary tools such as ear plugs and eye masks to reduce external interference. Using cognitive behavioral therapy techniques such as sleep restriction, stimulus control, and relaxation training, these methods not only help individuals relax, but also reduce reliance on specific tools such as ASMR videos and promote healthier sleeping habits.

5.2. Intervention of duration

For college students who have the habit of using electronic products before going to bed, the dependence on using electronic products before going to bed can be reduced by reducing the daily use time. For example, before using the mobile phone to browse news, watch movies and TV or chat, you can set an alarm clock to count down, turn off the mobile phone and prepare to sleep when the time is up, and shorten the countdown time every day to gradually reduce the use of mobile phones before going to bed

5.3. Intervention of watching content

For college students who watch streaming media or news before going to bed, they can try to choose a peaceful type of viewing and avoid watching intense content. According to the theory of high arousal, exciting videos can significantly improve the physiological arousal level of college students and make the thinking more active, which is contrary to the changes in the human body entering the sleep state, so it is not conducive to falling asleep. It is also a effective way to try watching ASMR videos or listening to soft music to find your own way to relieve stress and promote sleep.

5.4. Intervention of usage methods

It can set the phone to eye protection mode or night mode to reduce the impact of blue light on melatonin secretion and eye damage. Also try to avoid sedentary behavior in front of a screen at night, which can lead to a delay in falling asleep and a significant increase in electronic device use. Therefore, it is possible to stand up and perform moderate activities in the interval between using electronic products, which helps reduce the screen use time of college students and fall asleep quickly.

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5.5. External intervention

The government or school can carry out activities on campus for publicity and education, such as putting up posters to reduce the use of electronic devices before going to bed, holding lectures on reducing dependence on mobile phones before going to bed, etc., to further improve the sleep quality of college students.

6. Conclusion

This paper analyzes the influence of electronic product use on sep quality of college students from three aspects: influencing mechanism, watching duration and using content. Among them, the longer the bedtime screen use time, the more likely to lead to college students sleep time delay, sleep quality decline. The use of electronic devices to chat, watch news or video streaming can reduce the quality of sleep of college students, and the impact of chatting on sleep quality is less than that of watching news or video. Watching ASMR videos can help college students fall asleep and improve their sleep quality. Existing studies have shown that playing video games before bed has no effect on sleep quality. It is clear that a large number of survey data are needed to further explore the relationship between video games and sleep quality.

In this paper, the analysis of screen use is limited to bedtime and its impact on sleep quality, without considering the impact of daytime electronic product use on sleep quality, the relationship between daytime electronic product use and night use, and the differences among college students based on gender and grade. Future studies may consider the possibility that the reverse effect of sleep quality on bedtime screen use, and further conduct intervention studies to evaluate and compare different assessment and preventive improvement measures, such as anti-blue light glasses, so as to propose intervention measures more suitable for college students and more effectively improve their sleep quality.

References

[1] *Sleep, E. B. (2009). Sleep and society: An epidemiological perspective. Sleep, 10, S3-S6.*
[2] *Wade, A. G., Zisapel, N., & Lemoine, P. (2008). Prolonged-release melatonin for the treatment of insomnia: Targeting quality of sleep and morning alertness. Ageing Health, 4(1), 11-12.*
[3] *Gradisar, M., Wolfson, A. R., Harvey, A. G., Hale, L., Rosenberg, R., & Czeisler, C. A. (2013). The sleep and technology use of Americans: Findings from the National Sleep Foundation's 2011 Sleep in America poll. Journal of Clinical Sleep Medicine, 9, 1291-1299.*
[4] *Li, R., Zhang, S., Lü, H., & Chen, X. (2015). Survey and analysis of college students' mobile phone use before sleep. Science and Education Literature (Upper Monthly Edition), (1), 175-176, 179.*
[5] *Tilden, A. R., Rasmussen, P., Awantag, R. M., et al. (1997). Melatonin cycle in the fiddler crab Uca pugilator and the influence of melatonin on limb regeneration. Journal of Pineal Research, 23(3), 142-147.*
[6] *Hunter, C. M., & Figueiro, M. G. (2017). Measuring light at night and melatonin levels in shift workers: A review of the literature. Biological Research for Nursing, 19(4), 365-374.*
[7] *Sun, W., Gao, W., & Sui, C. (2019). The relationship between college students' use of electronic devices, melatonin levels, and blood pressure. Journal of Qiqihar Medical University, 40(06), 739-740.*
[8] *Münch, M., Nowozin, C., Regente, J., et al. (2016). Blue-enriched morning light as a countermeasure to light at the wrong time: Effects on cognition, sleepiness, sleep, and circadian phase. Neuropsychobiology, 74(4), 207-218.*
[9] *He, J., Tu, Z., Su, T., et al. (2021). Partial mediating effect of pre-sleep wakefulness on the use of mobile phones and subjective sleep quality among military academy students. Journal of Second Military Medical University, 42(08), 945-948.*
[10] *Singh, M., Messiah, S. E., et al. (2016). Effects of radiation emanating from base transceiver stations and mobile phones on sleep, circadian rhythm, and cognition in humans: A review. Biological Rhythm Research, 47(3), 353-388.*
[11] *Li, L., Wu, C., Gan, Y., et al. (2016). Insomnia and the risk of depression: A meta-analysis of prospective cohort studies. BMC Psychiatry, 16(1), 375.*

DOI: 10.54254/2753-8818/80/2025.21212

[12] *Wu, J., & Yang, H. (2016). The impact of playing smartphones before sleep on sleep quality among college students. Management Observation, (15), 85-87.*

[13] *You, L., & Cui, Y. (2024, November 15). The effect of screen content before sleep on the sleep quality of college students at night. Chinese School Health, 1-5.*

[14] *De Rosa, O., Conte, F., D'Onofrio, P., et al. (2023). Habitual videogame playing does not compromise subjective sleep quality and is associated with improved daytime functioning. Brain Sciences, 13(2), 279. https://doi.org/10.3390/brainsci13020279*

[15] *Li, X., & Liu, C. (2023). How do mobile phones disrupt the sleep of adolescents? – An empirical study based on national data. Chinese Youth Studies, (07), 26-33.*

[16] *Hysing, M., Pallesen, S., Stormark, K. M., et al. (2015). Sleep and use of electronic devices in adolescence: Results from a large population-based study. BMJ Open, 5(1), e006748. https://doi.org/10.1136/bmjopen-2014-006748*

[17] *You, L. (2024). The impact of screen-based sedentary behavior on college students' sleep quality and the effectiveness of melatonin intervention. (Unpublished doctoral dissertation). Capital University of Physical Education and Sports.*

[18] *Twenge, J. M., Hisler, G. C., & Krizan, Z. (2019). Associations between screen time and sleep duration are primarily driven by portable electronic devices: Evidence from a population-based study of US children ages 0-17. Sleep Medicine, 56, 211-218.*

[19] *Guerrero, M. D., Barnes, J. D., Chaput, J.-P., & Tremblay, M. S. (2019). Screen time and problem behavior in children: Exploring the mediating role of sleep duration. International Journal of Behavioral Nutrition and Physical Activity, 16(1), 1-10.*

[20] *Tang, Y. C. (2024). Can ASMR help you sleep? Psychology and Health, (06), 62-63.*

[21] *Poerio, G. L., Blakey, E., Hostler, T. J., et al. (2018). More than a feeling: Autonomous sensory meridian response (ASMR) is characterized by reliable changes in affect and physiology. PLoS One, 13(6), e0196645.*