Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN 3006-4651

Print ISSN 3006-466X

Smartphone Use, Cognitive Biases, and Sleep Quality Among University Students: A Dual Process Perspective

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Article Details:`

Received on 14 May, 2026
Accepted on 23 June, 2026
Published on 26 June, 2026

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Abstract

Sleep is crucial for physical well-being, emotional stability, and cognition; however, inadequate sleep quality is widespread among university students. One factor in sleep disruption is late-night smartphone use; however, the fact that people continue to use it even when they know it is harming their sleep suggests that cognitive processes are at play. This research, based on dual-process theory, investigated the effects of smartphone use on sleep quality, with cognitive biases mediating the relationship. It had a quantitative cross-sectional design with 300 university students aged 18 to 30 years. The validated scales were smartphone use, cognitive biases, and sleep quality, such as the Pittsburgh Sleep Quality Index (PSQI). The findings showed that smartphone users had a positive correlation with cognitive biases ($r = .51$, $p < .01$) and poor sleep quality ($r = .55$, $p < .01$), although cognitively biased were also correlated with poor sleep ($r = .49$, $p < .01$). Regression analysis revealed that smartphone use was a significant predictor of sleep quality ($\beta = .55$, $p < .001$) and cognitive biases ($\beta = .51$, $p < .001$), and that cognitive biases were a significant predictor of sleep quality ($\beta = .49$, $p < .001$). The mediation analysis demonstrated that there was a significant indirect effect (95% CI [.170, .332]), suggesting that there was partial mediation. These results imply that both cognitive biases and smartphone use should be considered when working to enhance students' sleep quality.

Keywords: Smartphone use, sleep quality, cognitive bias, dual-process theory, university students, and mediation analysis.

Online ISSN Print ISSN

3006-4651 3006-466X

Introduction

Sleep is a biological process essential for physical health, emotional regulation, and cognitive function. It also helps consolidate memory, make decisions, and promote well-being; however, poor sleep quality has been linked to many adverse outcomes, including poor focus, academic underachievement, and depression(Fang et al., 2021; Yeo et al., 2023). Poor sleep quality is prevalent among university students, who are extremely vulnerable to academic stress, timetables, and lifestyle patterns (Bloomfield et al., 2024; Qanash et al., 2021).

The overuse of smartphones is likely one of the most apparent lifestyle factors contributing to sleep deprivation (Abouelenen et al., 2024; Chaudhry et al., 2024). The rapid advancement of technologies and smartphones has greatly integrated into our lives, especially among the youth. Students also spend some time watching their devices later in the evening for entertainment, fun, and studying. This habit of consumption generally retards the initiation of sleep and reduces sleep (Muhammad et al., 2021; Pillion et al., 2022). Although there is growing recognition of these adverse effects, a significant number of individuals still use their smartphones at night, suggesting that awareness alone may not be sufficient to change behavior.

To clear up the issue at hand, we would examine the role of cognitive processes in behavior. The majority of human judgments cannot be above an inquiry into shortcuts to judgment, which are mostly automatic and intuitive. According to dual-process theory, human beings are equipped with two systems of thought: one system is the fast system, which is automatic and demands the least effort, and the other system is the slower system that involves conscious thinking (Wu et al., 2022). Intuitive decisions aimed at instant gratification (e.g., the necessity to check notifications) and over time (e.g., sleep deprivation) can also influence human behavior in terms of smartphone use (Kanungo et al., 2022). This disequilibrium may result in inconsistent behavior based on knowledge or intentions.

Systematic patterns of failure to make rational decisions are called cognitive biases(Mahajan et al., 2025). Although previous research has substantially examined the relationship between smartphone use and sleep quality (Qanash et al., 2021), little is known about the mechanism of such adverse effects or the mediating role of cognitive biases(Lin & Zhou, 2022). The best idea is that the knowledge of the effects of these biases on behavior will be useful in explaining why people, even after acquiring knowledge on their effects, continue to engage in sleep-disturbing behavior.

Thus, the present study investigates the impact of smartphone use on the sleep of university students and examines how these effects are mediated by the existence of cognitive biases. This research aims to add to the niche of reading in terms of sleep health and provide a more complex understanding of sleep-related behavior as a phenomenon in contemporary digital realities.

Literature Review and Hypotheses Development

Smartphone Use and Sleep Quality

Smartphones have been integrated into the daily lives of numerous individuals in numerous contexts. This is especially true for university students, who represent one of the most digitally enabled user groups. Smartphones are multifaceted devices, and their purposes extend to various modalities, such as communication, information search, academic tasks, leisure, entertainment, and social networking (Ayo et al., 2025).

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

Smartphone use pervades the lives of students to a considerable degree. In particular, late-night smartphone use has become widespread (Sánchez-Fernández & Mas, 2022). Consequently, the typical night-time sleep period has come under increasing threat. Nighttime is when most people are expected to be asleep. However, late-night is correspondingly the time of day when people are expected to be awake. Smartphones are designed to operate and be useful at any time of day or night (Qanash et al., 2021).

Excessive smartphone use is identified as a sleep health hazard. Research now indicates a consistent correlation between late-evening smartphone use and sleep degradation in young people. These research findings highlight the trends of delayed sleep onset, reduced total sleep time, and decreased sleep quality in students. Moreover, the decrease in sleep quality as a result of smartphone use impacts students' perception of sleep as well as their wakefulness, alertness, memory, cognitive function, academic performance, mood regulation, emotional intelligence, and ability to complete daily tasks effectively (Akl & Safwat, 2023; Moscoso et al., 2025).

This hyper-connection is associated with sleep disturbances. From a physiological perspective, short-wavelength (blue light) emitted by smartphones can suppress melatonin production. As Yehia & Abulseoud (2024) stated, "The delay in melatonin release will lead to a delay in the timing of the biological processes that are regulated by the circadian rhythm." From a psychological perspective, the content presented on smartphones can increase cognitive arousal. Smartphone use is often associated with exposure to a multitude of stimuli competing for attention, such as social media, games, and emotionally stimulating content (Qanash et al., 2021). These stimuli activate attention and emotional systems and can make it challenging for individuals to relax and fall asleep (Lindström et al., 2021).

In addition to the above mechanisms, behaviors encouraged by smartphone design also play a crucial role in how they affect sleep. Massar et al. (2021) noted that smartphones contain many features that are intentionally designed to encourage engagement. Some of these features, such as notifications, infinite scrolling, and algorithmic content ordering, create behaviors driven by rewards designed into the app (Stevie & Ammara, 2023; Taylor et al., 2023). This type of design facilitates the development of habits that are difficult to break, even when the user is aware of the negative effects on sleep (Li et al., 2024). Smartphone use can thus be seen as a function of both voluntary behavior and more automatic psychological processes(Deng et al., 2024).

In conclusion, these physiological, psychological, and behavioral factors suggest that excessive smartphone use is a significant predictor of poor sleep quality among university students.

H1: Smartphone use has a significant negative effect on sleep quality in university students.

Cognitive Biases and Sleep Quality

In contrast to the numerous studies on the sleep-disrupting effects of smartphone use, little research has been conducted on the reasons why individuals engage in such practices. Uninformed and irrational human choices frequently precede actions. Individuals often make spontaneous decisions while relying on mental heuristics that determine the quality of the resultant choice. This phenomenon is particularly concerning when considering smartphone use in the evenings, when better sleep quality is necessary for improved cognitive function. The dual-process theory can elucidate smartphone behavior because it articulates fast, automatic thought (System 1) and slow, systematic analysis (System 2).

Online ISSN Print ISSN
3006-4651 3006-466X

In many domains, including health-related behaviors, individuals often rely on System 1 processing, which renders them more vulnerable to certain cognitive biases (Yung et al., 2024). These biases are systematic, observable patterns of deviation from rational judgment that affect how people determine risks and outcomes and consequently make decisions (Kessler et al., 2023). Some of these biases are particularly relevant to the domain of sleep (Torrente et al., 2021).

When it comes to sleep, our biases may affect our health in substantial ways. Our optimism bias makes us feel that bad sleep outcomes are less likely to occur to us than to other people (Bulley & Schacter, 2021). By underestimating our own risk of sleep deprivation and its negative consequences, we are less likely to recognize the need to alter our behavior and make changes (Murage et al., 2023). Our overconfidence bias makes us think we can do just fine, even when we have not gotten enough sleep (Alp et al., 2023). We tell ourselves we can stay up late and still function well tomorrow, or that a few more hours of sleep are not necessary. Finally, our present bias makes us prioritize immediate gratification, such as using our smartphones, over longer-term benefits, such as a full night's sleep (Schuster & Spann, 2024).

Furthermore, dysfunctional beliefs about sleep, such as a feeling of incomplete and unpredictable sleep, can influence a person's reality testing of their reduced sleep duration (Wang et al., 2023). These distorted beliefs about sleep can, in turn, increase an individual's dysfunctional attitudes towards sleep and influence poor sleep-related habits (Shah, 2025).
However, biases do not act alone and interact with typical human behaviors to perpetuate adverse habits (Torrente et al., 2021). For example, individuals with good sleep practices often have bedtime sleep schedules and typically sleep for adequate amounts of time each night. Even with the best intentions, typical biases in cognition prevent sleep practices from translating into adequate sleep quality (McDonagh, 2025).

H2: Cognitive biases significantly negatively affect sleep quality among university students.

Smartphone Use and Cognitive Biases

Smartphone use is linked to cognitive biases in complex ways. First, frequent smartphone use is a cause of cognitive biases. Many smartphone uses—such as frequent app-switching, passive social media scrolling, or reaching for one's phone out of boredom—are automatic, cue-driven behaviors that occur without much conscious deliberation and are instead processed through our intuitive mental systems (System 1; Wu et al., 2022). These habitual smartphone uses, in turn, drive other biases, in that they create opportunities for information to enter our awareness in an automatic, uninformed way, which in turn fosters greater reliance on intuition and less on deliberation (Peters et al., 2024).

Smartphones are an increasingly integrated part of daily life and contain unpredictable sources of psychological reward that may promote habitual use (Taylor et al., 2023). Repeated exposure to rewarding content may result in behavior shaped by reward-learning principles(Lindström et al., 2021). Many people report using their smartphones late at night, which is commonly used for sleep, and perceive their behavior as not causing them significant harm to sleep or health (Jolly et al., 2025).

Excessive smartphone use generates an "addictive" culture and may be "reinforced" by cognition, resulting in a complicated situation in which behavior and cognition mutually influence each other. In this situation, excessive smartphone use causes individuals to generate illogical beliefs that justify their behavior and reduce cognitive

Online ISSN Print ISSN
3006-4651 3006-466X

dissonance. These beliefs further enhance the possibility of the continuation of such behavior.

In line with the findings of Mittone et al. (2023) on the relationship between repeated behaviors and cognitive patterns, we assume that as smartphone use is a repeated behavior, frequent users will be more prone to cognitive biases due to their higher exposure to smartphone-mediated interactions with technology (IT). Therefore, we predict that, on average, frequent smartphone users will show higher levels of fallacy acceptance than occasional smartphone users.

H3: Smartphone use has a significant positive effect on cognitive biases

Mediating Role of Cognitive Biases

Though smartphones are directly related to sleep quality(Massar et al., 2021; Khan et al., 2023), this correlation cannot entirely serve as the explanation for the continued experience of sleep-disturbing activities. The fact that such behaviors continue despite being aware of their negative implications implies that other processes are involved. An important explanatory pathway includes cognitive biases that affect the interpretation of the behavior and individuals' reactions to the outcomes of the behavior (Bielik & Krell, 2024). This decreased behavioral change motivation leads to the maintenance of poor sleep.

In this case, well-being-related strains (i.e., nomophobia and sleep deprivation) can be viewed as mediating factors through which bedtime smartphone use and academic performance are also associated with well-being-related strains (Lin & Zhou, 2022). This mediating role will take the study out of a binary cause-and-effect relationship and provide a more refined view of how sleep behavior occurs. The method is also consistent with current studies suggesting the significance of psychological processes in understanding health-related behaviors(Timm et al., 2024).

Knowledge of the mediation effect of cognitive biases has significant implications for the design of interventions. This implies that measures to enhance sleep quality need to go beyond minimizing the amount of time spent on smartphones and must also target the cognitive distortions that uphold this practice.

H4: Cognitive biases significantly mediate the relationship between smartphone use and sleep quality.

Integrated Theoretical Perspective

The propositions formulated in the present study are based on an integrative theoretical framework that integrates behavioral and cognitive approaches to explain sleep-related outcomes within the framework of contemporary digital lifestyles. Although these methods have offered insights, they can only be considered to offer a partial account of why individuals engage in behaviors that have a known negative impact on sleep. The current study overcomes this drawback by implementing cognitive processes as one of the key explanatory elements.

In this context, smartphone use is theorized as a behavioral determinant that has both direct and indirect effects on sleep quality. On the one hand, it is a direct sleep disruptor, both physiologically and psychologically, that is, by exposure to light and mental activity(Qanash et al., 2021). Conversely, it exists within a larger cognitive framework in which individuals explain, rationalize, and control their actions. Through systematic patterns of thinking, often known as cognitive biases, this mental context is formed that shapes the manner in which people conceptualize risks, assess the outcome, and make choices(Kessler et al., 2023).

Another theory, dual-process theory, allows the integration of such views and assumes that human behavior is controlled through the interaction between intuitively and thoughtfully oriented systems of thinking(Yung et al., 2024). In the case of smartphone use, intuitive processes (System 1) influence behavior towards habits (checking notifications or spending time on digital content) or rewards (seeking rewards), such as checking notifications at night(Taylor et al., 2023; Wu et al., 2022). Although reflective processes (System 2) can provide an understanding of the adverse nature of such conduct, they do not tend to eliminate automatic inclinations (Yung et al., 2024). This imbalance gives rise to cognitive biases, strengthening tendencies in behavior that focus more on immediate satisfaction than on lasting well-being(Schuster & Spann, 2024).

The framework offers a more in-depth explanation of the connection between smartphone use and sleep quality when cognitive biases are used as mediating factors. It is implied that the effects of smartphone use cannot be reduced merely to a direct result of exposure to engagement, but must also be influenced by the ways in which people think about the issue of how they are justified in taking certain actions. For example, people can decrease the risk of behavioral change as a result of diverse cognitive biases(Bulley & Schacter, 2021). This viewpoint emphasizes that knowledge is insufficient to change behavior when it is distorted by biased thinking processes(Boult, 2021).

Moreover, the integrative model makes a contribution to the literature by altering the focus on strictly descriptive relationships, which are being substituted with mechanisms. It not only explains how variables are related but also understands the reasons for and the mechanisms by which these associations occur and are sustained. This strategy aligns with the modern trends in behavioral science, which emphasize the significance of inner psychological processes in explaining health behaviors(Timm et al., 2024).

This framework also has significant implications for intervention design in practice. It recommends that efforts to enhance the quality of sleep should not simply focus on reducing smartphone use but also on modifying the cognitive biases underlying this habit. Awareness of biased thinking intervention, self-regulation, and reflective decision-making may prove to be more effective in generating more sustainable behavioral change.

In conclusion, this unified theoretical perspective, as embraced in this study, offers a comprehensive understanding of sleep-related behavior by unifying behavioral patterns and cognitive processes. It builds upon prior studies by demonstrating that sleep outcomes are not simply due to external behaviors but are also influenced by internal processes that regulate how individuals think, make choices, and behave.

Methodology

Research Design

This quantitative, cross-sectional study design was used to investigate the relationship between smartphone use, mental biases, and sleep quality among university students. This design is suitable because data can be collected at one point in time to determine trends and relationships and predictive correlations among variables. It is the most prevalent design used in studies on behavior and sleep because of its effectiveness and applicability to hypothesis testing. The research was deductive in nature, being based on hypotheses made on the basis of theory and tested statistically. This will provide the research with a strong theoretical base as well as new empirical findings.

Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN 3006-4651

Print ISSN 3006-466X

Participants and Sampling

University students will be the target population of this study because such a group is even more susceptible to sleep disturbances because of academic pressure, inconsistent schedules, and excessive smartphone activity. A sample size of 300 individuals will be chosen, which is believed to be sufficient for the regression and mediation analyses. The participants involved will be between the ages of 18 and 30 years. Convenience sampling will be a non-probability sampling method because it will be easy to access the respondents due to the large and conveniently available population of students. It will be based on both physical and online data collection, that is, the distribution of questionnaires in universities and the use of online tools, such as Google Forms and social media. Although this is an effective and convenient method to use in the context of this study, there is a risk that the findings may not necessarily be applicable to the general population.

Measures / Instruments

Smartphone Use

Smartphone use was measured using a self-report scale comprising five items that focused on how often the phone is used each day, used before sleep, and how often the phone is checked at night. Responses were measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), and a composite score was obtained by averaging the items, where high scores received higher points (greater smartphone use). Some earlier research has indicated a satisfactory level of reliability with Cronbach's alpha values between 0.78 and 0.85. The questionnaire scale was based on the Smartphone Addiction Scale (modified to fit smartphones; Kwon et al., 2013).

Cognitive Biases

A six-item Likert-scale measuring optimism bias, overconfidence, and present bias was used to evaluate cognitive biases as applied to sleep behavior. The options included 1 (strongly disagree) to 5 (strongly agree), and the responses were averaged; the higher the score, the deeper the bias. The scale has good internal consistency, a with Cronbach 's alpha value of > 0.80. The items were designed in accordance with the literature on behavioral decision-making, specifically, the works of Daniel Kahneman and Amos Tversky (Kahneman, 2011; Tversky and Kahneman, 1974).

Sleep Quality

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989), a validated measure with 19 items organized into seven components, such as sleep duration, disturbances, and daytime dysfunction. These items produce a score ranging from 0 to 21 worldwide, and an increase in the score suggests lower sleep quality. The PSQI has been shown to be reliable, with Cronbach 's alpha of approximately 0.83 (Buysse et al., 1989).

Data Collection Procedure

Data will be gathered using both online and offline data collection. Study participants will be made aware of the study purpose, and their responses will be notified that they will be confidential and anonymous. Participation will be voluntary, and informed consent will be obtained before data collection. The questionnaire circulated as part of the data collection process will go hand in hand with the same approach of distributing the questionnaire via both physical and online platforms with a clear explanation of the study objectives to the

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

participants. Once they provide their consent, data will be collected and filtered to verify that they are complete and accurate, and then data will be analyzed.

Ethical Considerations

The research will follow basic ethical principles to protect and guarantee the health of the research participants. Participation will be voluntary, and participants will be allowed to drop out of the study at any point without any repercussions. The data obtained will be maintained in a highly confidential and anonymous manner, such that no information that can be linked to the participants can be obtained. Moreover, there is no physical or mental harm related to the study, and no potential dangers can be anticipated.

Data Analysis Strategy

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean, standard deviation, and frequency, were used to begin the analysis and describe the nature of the data. The reliability analysis will be followed by Cronbach's alpha, which will evaluate the internal consistency of the scales, with a reference level of 0.70 considered acceptable. Subsequently, a correlation analysis was conducted to examine the relationships among the study variables. The direct impact of smartphone use and mind biases on sleep quality, in accordance with Hypotheses H1, H2, and H3, was tested through multiple regression analysis. Finally, Hypothesis H4 was tested for the indirect impact of smartphone use on sleep quality, mediated by cognitive bias, using the PROCESS macro (Model 4) or a hierarchical regression application.

Results

Table 1: ***Demographic Characteristics of Participants (N = 300)***

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	150	50.0
	Female	150	50.0
Age Group	18–20 years	90	30.0
	21–25 years	140	46.7
	26–30 years	70	23.3
Education Level	Undergraduate	200	66.7
	Graduate	100	33.3
Residence	Urban	180	60.0
	Rural	120	40.0

Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

The sample comprised 300 participants, half of whom were male (50%) and the other half female (50%). Most participants were aged 21-25 years (46.7%), followed by those aged 18–20 years (30.0%) and 26–30 years (23.3%). Most participants were pursuing undergraduate degrees (66.7%), with the remainder (33.3 %) in graduate programs. In addition, half of the respondents (60%) lived in cities, and the other half (40%) lived in rural areas.

Table 2: ***Descriptive Statistics of Study Variables (N = 300)***

Variable	Mean	SD	Minimum	Maximum	Cronbach's Alpha
Smartphone Use	3.72	0.71	1.20	5.00	0.83
Cognitive Biases	3.55	0.68	1.40	5.00	0.86
Sleep Quality	2.48	0.79	1.00	4.90	0.81

Note. Note: Higher scores indicate poorer sleep quality.

Table 2 presents the descriptive statistics for the study variables, which provide a summary of their central tendency and variability. The average score of smartphone use (M = 3.72, SD = 0.71) indicates that the respondents engaged with smartphones relatively frequently, specifically at nighttime. The means of cognitive biases were also moderate to high (M = 3.55, SD = 0.68), which implied that the participants displayed evident amounts of biased thoughts in response to sleep behavior. The average sleep quality (M = 2.48, SD = 0.79) shows that the sample had moderate sleep disturbances. The relatively low values of the standard deviation of variables indicate that they are more consistent and not scattered. The spectrum of scores also implies that the responses of the participants were diverse, and there were differences in behavioral and cognitive patterns. Altogether, the results indicate that a high use of smartphones and cognitive biases is associated with poor sleep quality. Such descriptive findings provide preliminary support for considering the relationships between the variables in further analyses.

Table 3: ***Correlation Matrix of Study Variables (N = 300)***

Variable	1	2	3
1. Smartphone Use	—		
2. Cognitive Biases	.51**	—	
3. Sleep Quality	.55**	.49**	—

*Note. **p < .01 (2-tailed). Higher sleep quality scores indicate poorer sleep.*

Pearson's correlation test was used to assess correlations among smartphone use, cognitive biases, and sleep quality. Smartphone use was also strongly and positively related to cognitive biases (r = .51, p < .01; Table 3), indicating that higher smartphone use is

Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

associated with a greater degree of biased thinking. In addition, there was a sizeable positive correlation between smartphone use and sleep quality ($r = .55$, $p < .01$), indicating that more frequent smartphone use correlates with lower sleep quality. Sleep quality was also positively related to cognitive biases ($r = .49$, $p < .01$), indicating that people with more cognitive biases are likely to have more sleep problems. The correlations among all variables were moderate, indicating that the relationships between them were not trivial. The results provide a preliminary representation of the hypothesized and serve as the grounds for additional regression and mediation studies.

Table 4: ***Regression Analysis***

Variable	Sleep Quality (SU)	Sleep Quality (CB)	Cognitive Biases (SU)
Smartphone Use (SU)	.55***	—	.51***
Cognitive Biases (CB)	—	.49***	—
R^2	.42	.42	.26
Adjusted R^2	.41	.41	.25
F	108.34	108.34	82.81

Note. ****p < .001. Higher sleep quality scores indicate poorer sleep.*

Smartphone use, cognitive biases, sleep quality, and predictive relationships; regression analysis was performed to determine predictive relationships among the predictors. Table 5 indicates that smartphone use significantly predicted sleep quality ($\beta = .55$, $p < .001$), indicating that the more one uses their smartphone, the poorer their sleep quality is. Sleep quality was also largely predicted by cognitive bias ($\beta = 0.49$, $p < .001$), indicating that the more biased individuals think, the more likely they are to have sleep disturbances. Moreover, smartphone use was also a strong predictor of cognitive biases ($\beta = .51$, $p < .001$), and higher rates of smartphone use were linked to more cognitive biases. The above models also exhibited high explanatory power, accounting for 42% of the sleep quality variance and 26% of the cognitive bias variance. In general, these results provide solid evidence to support Hypotheses H1, H2, and H3.

Table 5: ***Mediation Analysis Using PROCESS Macro (Model 4)***

Testing Paths	Unstandardized Coefficient	Std. Error	t	Sig.	LLCI	ULCI
SU → CB (a)	0.51	0.06	9.10	.001	0.394	0.626
CB → SQ (b)	0.49	0.05	7.65	.001	0.392	0.588

Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

Testing Paths	Unstandardized Coefficient	Std. Error	t	Sig.	LLCI	ULCI
SU □ CB □ SQ (c□)	0.41	0.06	6.83	.001	0.294	0.526
SU □ SQ (c)	0.55	0.07	8.72	.001	0.412	0.688
Indirect Effects	0.25	0.04	—	—	0.170	0.332

Note. SU= Smartphone Use; CB = Cognitive Biases; SQ = Sleep Quality. The indirect effect is significant if the LLCI and ULCI do not include zeros.

The moderating effect of smartphone use on sleep quality due to cognitive biases was analyzed using mediation analysis through the PROCESS macro (Model 4). As shown in Table 5, smartphone use was a significant predictor of cognitive biases ($\beta = 0.51$, $p = .001$, indicating a strong positive correlation)n. Sleep quality was also highly predicted by cognitive biases ($\beta = 0.49$, $p = .001$), implying that more thinking biases are linked to poorer sleep quality.

The direct effect of smartphone use on sleep quality remained significant ($\beta = 0.41$, $p = .001$) when the mediator was incorporated, suggesting partial mediation. There was also a significant effect of smartphone use on sleep quality ($\beta = 0.55$, $p = .001$). Notably, this indirect effect was statistically significant ($\beta = 0.25$), as the bootstrapped confidence interval (LLCI = 0.170, ULCI = 0.332) did not include zero. These results confirm that cognitive biases partially mediate the correlation between smartphone use and sleep quality, supporting Hypothesis H4.

Discussion

This study explored the relationship between smartphone use and cognitive biases, and sleep quality among university students, as well as the mediating role of cognitive biases in this relationship. The results strongly support all the proposed hypotheses and provide valuable information on the behavioral and psychological processes that contribute to sleep disturbances.

Based on the current literature, the results indicated that smartphone use is a good predictor of poor sleep quality. This finding complements other studies that have also shown that high smartphone use is negatively correlated with sleep outcomes, at least among students (Yin et al., 2025). Earlier studies have mentioned that exposure to screens at night interferes with circadian rhythms and postpones the onset of sleep, resulting in decreased sleep efficiency and duration or quality(Brautsch et al., 2022). Recent findings expand on this stream of evidence, demonstrating that smartphone use continues to be an effective behavioral predictor of sleep disorders and contributing to the problem of increased digital literacy among young adults(Jacquet et al., 2023).

It was also discovered that cognitive biases are a powerful predictor of sleep quality(Rönnlund et al., 2021), which agrees with the findings of the behavioral science community: individuals are more likely to make judgments based on skewed perceptions than on rational ones(Berthet, 2021). Previous literature has shown that when one is influenced by optimism bias and overconfidence, one might disregard the health implications of lost sleep(Avery et al., 2022). The present results confirm this perspective, showing that people with more cognitive bias tend to report lower sleep quality. This indicates the importance of psychological processes to health behaviors.

In addition, the results further showed that smartphone use is a strong predictor of cognitive biases. The emergent research supporting this finding claims that cognitive distortions can be reinforced by repetitive and habitual behaviors over time(Ramakrishnan et al., 2022). By repeatedly choosing rewarding and enriching environments, such as smartphones, such a disposition to present bias may become entrenched, with individuals learning to find satisfaction in the present rather than in healthier long-term outcomes (Robayo-Pinzón et al., 2023). The relationship denotes a dynamic action-thought interaction, as previously theoretically and empirically postulated(Gómez-Marín & Arnau, 2021).

Most importantly, the mediation analysis showed that cognitive biases partly mediate the relationship between smartphone use and sleep quality. This result provides better insight into the underlying mechanism and is consistent with current studies that have highlighted the influence of psychological factors in predicting health behaviors(Hagger, 2024). Unlike previous research, where the emphasis has been on the direct effects of behavior(Roos & Wrzus, 2022), the current study fills the literature gap by demonstrating that cognitive biases serve as an explanatory pathway through which smartphone use has a direct effect on sleep outcomes.

In theory, the findings are decisively in favor of dual-process theory, which posits that human behavior can be affected by both impulsive/automatic mechanisms and conscious thinking. It has been found that System 1 of thought prevails when it comes to the behavior of smartphone use and prompts individuals to seek instant gratification without considering the long-term consequences, which may lead to poor sleep(Gui et al., 2021; Zhu et al., 2025). At this stage, cognitive bias comes into play to enhance maladaptive behaviors and limit self-control(Jorge et al., 2021; Shi & Li, 2023).

Generally, the present research not only substantiates the findings of other scholars but also builds upon past studies through integrating the behavioral and cognitive perspectives. It demonstrates both direct and indirect effects, thus providing a better explanation for sleep disturbances in the modern digital lifestyle. This joint approach can help us understand why individuals continue to engage in sleep-dysregulation behaviors despite being aware of the negative consequences of such behaviors.

Implications

This study addresses sleep behavior from another angle by integrating it with the behavioral and cognitive domains. Many studies have focused on the relationship between sleep and mobile phone use. This study identifies cognitive biases as a psychological factor that drives and explains this relationship. This study also advances the dual-process model of decision-making and suggests that sleep behavior may also be affected by distorted thinking. This study combines behavioral economics and health psychology and attempts to explain the paradox of sleep behavior caused by mobile phone use, which the individual knows is an unhealthy behavior. This study also encourages researchers to account for cognitive biases when creating models of sleep behavior and health-related decision-making.

This study improves sleep quality in young university attendees and young adults. First, smartphone misuse contributes to poor sleep and exacerbates cognitive biases. So, simply warning users of their impacts will not work. Participants have to learn to actively fight these biases. Second, the cultivation of good sleeping practices comes from the combination of sleep education and the digital wellness initiative. Third, the use of consumer technology to monitor and encourage behavioral accountability is a reflection-based initiative. Lastly, this study will inform public health campaigns on sleep and daily-living cognitive processes.

Limitations

Nevertheless, the current study has various limitations that must be mentioned despite its contributions. First, a cross-sectional research design cannot be used to make causal conclusions about the variables. Although considerable relationships have been found, the directionality of the relationships is not well determined. Second, the research relied on self-reported data, which may be prone to response bias, such as social desirability bias or recall errors. The study population might have underreported or overreported smartphone use or sleep patterns. Third, the non-probability convenience sampling technique constrains the generalizability of the results because the sample might not be representative of the overall population of university students. In addition, the experiment concentrated on a small number of variables. It failed to consider other possibly important variables, such as personality traits that can influence sleep quality, as well as resting stress or environmental conditions.

Future Directions

To address these shortcomings, a stronger research design and theories should be employed in current studies. It is recommended to conduct longitudinal studies to establish a causal relationship between smartphone use and cognitive biases related to sleep quality in the future. Experimental studies could also be conducted to test interventions aimed at reducing cognitive biases and improving sleep behavior. Furthermore, objective indicators of sleep (e.g., actigraphy or wearable devices) and smartphone use could be included in future studies to increase accuracy and reduce reliance on self-reported information.

Additionally, researchers should investigate other psychological and behavioral variables, such as self-control, habit strength, and emotional control, to provide a more comprehensive view of sleep-related behavioral factors. Next, it would be helpful to use more diverse groups of people, such as those of various ages, cultures, and types of work, in research to ensure that the results are more generalizable. Finally, the effectiveness of cognitive-behavioral and digital interventions in simultaneously addressing smartphone use and cognitive biases to promote healthier sleep patterns can be further investigated.

Conclusion

Overall, this paper provides an in-depth analysis of the relationship between smartphone use and sleep quality, emphasizing the mediating role of cognitive biases. The results show that lack of sleep is not only an effect of overusing smartphones but also a consequence of processes within the mind that affect decision-making and behavior. Combining behavioral and cognitive perspectives, the paper provides further insight into why people still engage in sleep-disrupting practices despite being aware of the adverse outcomes. To address such behaviors, it is critical to reduce smartphone use and work on the cognitive biases that support them. Finally, to enhance sleep quality in the digital era, a refocus on

Vol. 4 No. 6 (2026)

Journal of Social Signs Review

Online ISSN Print ISSN

3006-4651 3006-466X

behavioral interventions needs to be transformed into a more coherent approach to sleep that examines how people think, make choices, and act.

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