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Scrolling through sleep: Moroccan high school students smartphone uses and sleep quality

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Abstract

In the educational field, sleep is a vital need for students. Recent research has connected smartphone addiction, poor sleep, and academic failure. There is a glaring paucity of information on this subject in Morocco. In order to fill this gap, we conducted this study. This cross-sectional study investigated the effect of smartphone addiction on sleep quality and school outcomes among secondary school students in Marrakesh, Morocco. Following the simple random method, a sample of 389 students was selected. They answered an online questionnaire that included questions about some demographic characteristics, smartphone use, and sleeping habits. The results revealed that 57.8% of the students suffer from smartphone addiction, and 59.9% suffer from poor sleep quality. The study found that there is a moderately positive correlation between smartphone addiction and poor sleep quality. The study not only suggests the need for parents, educators, and health professionals to raise awareness about the negative effects of smartphone addiction on students' sleep quality, but also provides a basis for developing interventions aims at reducing smartphone addiction and improving sleep quality.

Keywords: Academic performance, Adolescents, High school students, Morocco, Public education, Sleep quality, Smartphone addiction.

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1. Introduction

Smartphones have gradually grown in popularity since they were first made available to the general public in 1990. The International Telecommunication Union (ITU) reported that almost three-quarters of people over 10 years old worldwide own a mobile phone, according to their "Facts and Figures for 2022" report [1]. Among children and adolescents, smartphones are identified as the most commonly used device [2]. Thomas and colleagues found that children and adolescents between the ages of 5 and 18 exceed the recommended screen time limit of 2 hours per day, with an average of 3.6 hours per day (ranging from 1.3 to 7.9 hours per day) [3], Smartphone addiction (SA) has become a significant problem, with negative consequences on students' sleep and academic performance [4, 5]. Previous studies have found that SA has a range of negative effects on physical and mental health, social relationships, and daily activities. Furthermore, it has been demonstrated that college students' wellbeing, sleep, and academic performance are all severely impacted by smartphone addiction. [6-8].

1.1. Smartphone Addiction

The overuse of connected devices, namely computers, tablets, and phones can lead to smartphone addiction (SA). Ting and Chen found that "excessive or problematic smartphone use is twice as common in adolescents as in adults," making adolescents vulnerable to SA [9]. SA is an impulse control disorder characterized by exposure to the negative effects of excessive use of social networks and online games for example through cell phones. This has been demonstrated in various studies, including those by Griffiths [10]; Olson, et al. [11]; Kwon, et al. [12] and Sadiq, et al. [13]. They demonstrated that excessive use of connectable devices may lead to behavioral addiction, similar to drug addiction. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), a manual released by the American Psychiatric Association (APA) that provides criteria for the diagnosis and classification of mental disorders, was used to establish the criteria for SA. These symptoms included salience, moodiness, withdrawal, tolerance, and failure of daily life. Numerous studies conducted globally have reported a strong correlation between these symptoms and the total score of the Smartphone Addiction Scale-Short Version [11, 13, 14].

1.1.1. SA Effects on Physical Health

Musculoskeletal disorders are on the rise worldwide owing to the escalated usage of portable digital devices. The excessive and prolonged use of those devices has become a public health concern, given its potential impact on physical health, especially among young people. According to a recent study by Mustafaoglu, et al. [15], a correlation has proven between smartphone addiction and a greater incidence of musculoskeletal pain in areas such as the neck, upper back and hands particularly in the wrists area. This is consistent with earlier studies which showed that prolonged exposure to digital devices can cause musculoskeletal disorders such as carpal tunnel syndrome, tenosynovitis, and neck and back pain. This prolonged use of digital screens is also linked with an increased risk of ocular symptoms such as myopia and ocular surface diseases [16]. This is matter of concern considering the growing amount of time people, including kids and teenagers, spend using computer displays for social, recreational, and educational activities.

1.1.2. Impact of SA on Academic Performance

The literature contains several studies demonstrating a connection between excessive smartphone use and poor academic performance. Kliesener, et al. [17] report that the overuse of smartphones can adversely affect school performance, as the presence of a smartphone often impedes the learning process by encouraging multitasking. Grounded in the construct devised by Kwon, et al. [12], the issue of multitasking - with its potential adverse effects on students' academic endeavors - is prominently featured as the second point of investigation within the instrument known as the Smartphone Addiction Scale-Short Version (SAS-SV) questionnaire [12]. This implies the potential for smartphones to act as catalysts of disruption in work environments and, crucially, as barriers to effective learning processes. The act of multitasking, particularly prevalent among the younger generations, is being progressively perceived as a contributor to cognitive deficits. This is most evident in instances where studying is conducted concurrently with engagement in internet and social networking activities, such as the sharing of messages, videos, and images. Such habits may contribute to diminished concentration, the inefficient use of time, and can, ultimately, precipitate academic underperformance, and in severe cases, dropout [8].

1.2. Sleep Quality

Inadequate sleep, particularly among adolescents, is linked to a higher likelihood of experiencing mental health issues. Teenagers between the ages of 13 and 18 should strive for 8 to 10 hours of sleep every day in order to maintain optimal health, according to the American Academy of Sleep Medicine. [18]. Smartphones that are used at night and around bedtime leads to a significant impact on sleep quality [19]. Sleep quality (SQ) refers to satisfaction with the sleep experience, which includes factors such as falling asleep, staying asleep, the amount of sleep, and the feeling of energy and freshness upon waking (restorative and restful sleep) [20]. Good sleep is often characterized as being able to go asleep within 30 minutes, stay asleep all night without waking up, and, if you do, be able to fall asleep again within 20 minutes [20]. Night-time activities such as networking and online entertainment can interfere with sleep, delaying the onset of sleep and preventing sleep maintenance. Screen- emitted blue light disrupts the body's natural circadian rhythms; it does so through impeding melatonin production and that is a hormone that controls sleep cycles. Consequently, the architecture of sleep undergoes significant modifications, including a reduction in the latency of the first phase of paradoxical sleep, a rise in light slow-wave sleep together with a significant reduction in the deep sleep phase.

1.2.1. Impact of SQ on Academic Performance

Poor quality or inadequate sleep on school nights, defined as less than 8 hours of sleep per night, is associated with poor academic performance due to a significant reduction in working memory performance. In this regard, Mehta [21] shown that getting adequate sleep had a positive impact on the cumulative Grade Point Average (GPA), a crucial indicator of academic accomplishment.

Regular and sufficient sleep is essential for students to maintain optimal cognitive function, emotional well-being, and memory. To achieve these benefits, students need to sleep for 8-10 hours per night. Chronic sleep deprivation can lead to symptoms such as fatigue, clumsiness, and daytime sleepiness. According to Saksvik-Lehouillier, et al. [22], Sleep deprivation over the course of a normal week may drastically affect how well a person thinks and feels in the morning, increasing the likelihood of mistakes and restricting one's capacity to handle stress and unfavorable life events.

Moreover, regular and good-quality sleep has ascertained to have a significant positive impact on one's academic performance [23]. This emphasizes the significance of students cultivating healthy sleeping habits to attain academic accomplishment.

The literature review aforementioned highlights the significance of adopting healthy sleep habits for a positive academic performance, given the impact of sleep on cognitive function, emotional well-being, and memory. Based on this context, the goal of the current study is to determine how much smartphone addiction affects sleep, which in turn affects academic performance in Moroccan high school students. This is achieved through (1) examining the prevalence of smartphone addiction (SA) among secondary school students in public education in Morocco; (2) assessing their sleep quality (SQ); (3) examining whether SA is associated with SQ; (4) surveying the impact of SA and SQ on the academic performance of these students.

Based on the information presented above, the following assumptions were developed.

Hypothesis 1: there is a prevalence of SA among Moroccan high school students.
Hypothesis 2: There is a difference in SA attributed to gender among secondary school students.
Hypothesis 3: Boys and girls in high school suffer from poor sleep quality.
Hypothesis 4: Smartphone addiction affects high school students' sleep quality.
Hypothesis 5: SA affects the academic performance of high school students.
Hypothesis 6: The SQ affects the Academic Performance of secondary school students.

2. Materials and Methods

2.1. Participants, Procedure and Measures

In this cross-sectional study, we used the simple random sampling method to select 389 high school students in public schools in Marrakech, Morocco. The online data was collected through a questionnaire consisting of three sections. The first section concerned the demographic characteristics of the participants (sex, age, educational level and the cumulative average of the "GPA" marks). The second and third sections included two standardized questionnaires: respectively, the Smartphone Addiction Scale - Short Version (SAS-SV) [12] and the Pittsburgh Sleep Quality Index (PSQI).

2.1.1. The Smartphone Addiction Scale-Short Version

2.1.1.1. Smartphone Addiction (SA)

SA was assessed with the Smartphone Addiction Scale - Short Version (SAS-SV), designed for adolescents. This ten-item scale was developed by Kwon, et al. [12], based on the Smartphone Addiction Scale (SAS) which contains thirty-three items assessing six characteristics of smartphone use, namely positive anticipation, overuse, tolerance, withdrawal, the relationship centred on cyberspace and the disruption of everyday life. Each SAS-SV item is rated on a six-point Likert scale (1=strongly disagree, 6=strongly agree). The total score ranges from 10 to 60; scores above 30 indicate a risk of AS: 31 is the threshold value proposed for male and 33 for female [12]. The Cronbach's alpha of SAS-SV is 0.911 [12]. The Cronbach's alpha of SAS-SV is 0.911. As part of our study, an Arabic-English bilingual committee of instructors and inspectors translated the SAS-SV into Arabic. The translated instrument's validity and reliability were substantially excellent; its Cronbach's alpha rating was 0.866.

2.1.2. Sleep Quality (SQ)

We assessed sleep quality using the PSQI. This instrument has 19 questions covering seven domains: sleep duration, disturbance, latency, daytime dysfunction, sleep efficiency, use of sleeping pills, and subjective sleep quality. Each domain is scored from 0 to 3. A total score of 0 to 5 indicates good sleep quality, while a score of 6 to 21 indicates poor sleep quality. The Cronbach alpha of PSQI is 0.83. For our study, we translated the original PSQI version into Arabic within a committee of bilingual teachers and inspectors (Arabic-English). The translated instrument demonstrated satisfactory validity and reliability; Cronbach's Alpha test had a value of 0.645 [24].

The statistical analysis was done using Statistical Package of the Social Science (SPSS) for Windows 2-6.0 software. Descriptive statistics were used to calculate the percentage and frequency values of the demographic data. The normality and homogeneity of our data were inspected using the Kolmogorov-Smirnov test while Student's t-test served as a mean compartor of the variables. The normality and homogeneity of variance in our data set were examined using the Kolmogorov-Smirnov test; Student's t-test, on the other hand was utilized to compare the means of the variables. Given the sample size of 389, and the evidence provided by both the histograms and Q-Q plots, it was determined that the data distribution was sufficiently acceptable. This foundation enabled the execution of analyses, the results of which have proven to be reliable. The correlation between the different variables was assessed through the Chi 2 test. A significance level of less than 5% ($p < 0.05$) was employed in this study.

3. Results

3.1. Demographic and Educational Attributes of Participants

Table 1 resents the frequencies together with percentages of the demographic and educational attributes of the participants. According to the data, 214 of the respondents were females (55.0%) and 175 were males (45.0%). 84.1% of respondents are between the ages of 15 and 17; 13.1% are between the ages of 18 and 19; and 2.8% are above 20. Regarding school levels, 42.7% were in the common core; 37.8% in the first year and 19.5% in the second year of the baccalaureate.

There were students who exceeded the age of 18 in this study. This phenomenon can be attributed to one of the two potential reasons: either they repeated a grade level or they were enrolled late in school. The typical age range for secondary

school students in Morocco is between 15 and 18 years old. When a student surpasses the age of 18 in secondary education, it usually indicates that they have encountered academic difficulties or faced other challenges in their educational path.

Table 1.
Demographic and educational attributes of participants.

Characteristics		n (%)
Sex	Male	175 (45.0)
	Female	214 (55.0)
Age	15-17	327 (84.1)
	18-19	51 (84.1)
	20	11 (2.8)
School level	Com. Core	166 (42.7)
	1st Bac	147 (37.8)
	2nd Bac	76 (19.5)

3.2. Incidence of Smartphone Addiction among High School Students

Table 2 reveals the findings of the prevalence and averages of smartphone addiction among the survey's secondary school participants. A total number of 56.6% of pupils (28.8% of girls and 27.8% of boys) received scores that were higher above the cutoff for safe smartphone use when it came to SA frequencies. Thus, these results confirm hypothesis H1: "There is a prevalence of AS among Moroccan high school students". For the difference in smartphone addiction by gender, the comparison of means did not reveal any significant difference between male and female (M = 34,07, SD = 11.499; M = 33.07, SD =11.721, P > 0.05). These results therefore invalidate hypothesis H2: "In high school pupils, there is a variation in SA that may be attributed to sex. In other words, there is a very slight difference that is not statistically significant, there is a prevalence of AS among the participants that is roughly equal for women and men.

Table 2.
Prevalence of smartphone addiction among high school students.

Gender	Mean	SD	t-test	P
Male	34.07	11.499	0.889	0.402
Female	33.07	11.721		

3.3. The SA Means of the Ten SAS-SV Items

Table 3 presents the SA means of the ten SAS-SV items. The results show that items Q9, Q1, Q4, Q10 and Q2 have the highest values (M = 4.21, SD = 1.665; M = 3.87, SD=1.593; M=3.53, SD= 1.71; M=3.70, SD=1.772). This says a lot about smartphone addiction and at the same time the effects on sleep and school performance. Q1 "Missing scheduled work because of smartphone use", Q2 "Having trouble concentrating in class, doing homework or working because of using smartphone", Q9 "Using my smartphone longer than expected" and Q10 " I've been told by some around me that I use my smartphone excessively" largely explain the SA rate of 56.6% among high school students. Moreover, these items could explain the impact of SA on sleep and school performance: most respondents spend more time than expected on their smartphone (tolerance) insofar as those around them notice it (silence); they exceed the intended use time (loss of control); they find it difficult to do their work on time and to prioritize tasks (disruption of daily life). Overall, this indicates that 56.6% of participants suffer from problematic phone use: they have become accustomed to spending a lot of time on their devices; they find it difficult to put down their displays, and they multitask and put off studying while doing things on their phones.

Table 3.
SA means of the ten SAS-SV items.

Mean and std. deviation	SAS-SV items									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
M	3.87	3.53	2.99	3.80	3.26	2.65	2.99	2.44	4.21	3.70
SD	1.593	1.739	1.822	1.711	1.724	1.706	1.842	1.676	1.665	1.772

3.4. High School Students Sleep Quality

Table 4 presents the sleep quality scores of the students participating in the study. The results showed that only 40.1% of students slept normally and 59.9% slept poorly, and girls slept worse than boys (63.1%; 56.0%, respectively). Thus, these results confirm hypothesis H3: "There is a prevalence of AS among Moroccan high school students". For the difference in sleep quality by sex, the comparison of the means does not reveal any significant difference between boys and girls (M=6.39, SD=2.908; M=6.80, SD=13.102, P > 0, 05). These results therefore do not confirm hypothesis H4: "There is a difference in SA which are attributed to sex in high school students".

In conclusion, the majority of male and female participants had poor quality sleep, with no gender differences given that the means are very close and the p value is higher than 0.05% (0.184); so, there is a very small, statistically insignificant difference between them.

Table 4.
Sleep quality among high school students.

Gender	Mean	SD	t-test	P
Male	6.39	2.908	-1.332-	0.184
Female	6.80	3.102		

3.5. Means and Standard Deviations of PSQI Components

Table 5 presents the results for the scores of the means and standard deviation of the seven components of the PSQI: it has to do with sleep disorders, efficiency, latency, duration, quality, daytime dysfunction and sleep medications. The components 1 "sleep disorders," 3 "sleep latency," 6 "daily dysfunction," and 5 "sleep quality" had the greatest means in terms of relevance (M = 1.55, SD = 0.797; M=1.32, SD=0.664; m=1.13, SD=0.833; m=1.02, SD=0.804). This means that these four components were decisive in affecting the students' sleep patterns. This results in difficulty falling asleep, maintaining sleep, and daytime imbalances that affect life activities. The lowest means for components 5 "Sleep efficiency" and 7 "Sleep medicine" (M = 0.31, SD = 0.647; M = 0.42, SD = 0.741) respectively show that most participants did not utilise sleeping pills to help them fall asleep. It could also imply that minors are still unable to discriminate between good and bad sleep, which is why it's critical to act quickly to protect sensitive individuals and educate them about the negative effects of getting too little sleep. on fitness, happiness, and academic achievement.

Table 5.
Means and standard deviations of PSQI components.

Mean and std. deviation	SQ components						
	Duration of sleep	Sleep disturbance	Sleep latency	Day dysfunction	Efficiency sleep	Sleep quality	Medications to sleep
M	0.87	1.32	1.13	1.55	0.31	1.02	0.42
SD	0.832	0.664	0.833	0.797	0.647	0.804	0.741

3.6. Smartphone Addiction's association to Sleep Quality

The smartphone addiction scores of 44.5% of the students were "normal" and 55.5% were "problematic". The results in the Table 6 show a correlation between smartphone addiction and sleep quality: as the SA level of the students increased, the SQ also deteriorated significantly.

Table 6.
Smartphone addiction's correlation to sleep quality.

Smartphone addiction	Sleep quality		χ^2-value	p
	Good	Poor		
No addicted (%)	99 (57.2)	74 (42.8)	38.028	0.000
Addicted (%)	57 (26.4)	159 (73.6)		

3.7. Smartphone Addiction in relation to Students' Academic Performance

Table 7 illustrates the association between high school students' smartphone addiction and their academic performance. Our results revealed that academic performance as a dependent variable was significantly dependent on the level of smartphone addiction among students ($X^2 = 17.576$, $p < 0.001$). Academic performance increases when smartphone addiction decreases and vice versa.

Table 7.
Smartphone addiction correlated to students' academic performance.

Smartphone addiction	Students' academic performance			X^2	p
	Insufficient	Accepted	Good		
No addicted n (%)	35 (20.2)	62 (35.8)	76 (43.9)		
Addicted n (%)	66 (30.6)	98 (45.4)	52 (24.1)	17.576	0.000

3.8. Sleep Quality and Students' Academic Performance

Table 8 illustrates the correlation between the high school students' Sleep Quality and their Academic Performance. Our results revealed that there was an important association between sleep quality and school performance ($\chi 2 = 6.283$, $p < 0.05$). Concretely, the academic performance of the pupils decreases significantly as the quality of sleep deteriorates.

Table 8.
Sleep quality and students' academic performance.

Sleep quality	Students' academic performance			X^2	p
	Insufficient	Accepted	Good		
Good n (%)	33 (21.2)	61 (39.1)	62 (39.7)	6.283	< 0.05
Poor n (%)	68 (29.2)	99 (42.5)	66 (28.3)		

4. Discussion

4.1. Smartphone Addiction Prevalence

Over the past few years, there has been a substantial surge in research focused on exploring the connection between smartphone addiction, low sleep quality and school performance in the adolescent population. To the best of our knowledge, the current study is one of the first to examine the prevalence of smartphone addiction and its effects on high school students' sleep quality and academic performance in Morocco. Our findings indicate that immoderate use of smartphones can result in addiction, which in turn negatively impacts both the quality of sleep and school performance of high school students. According to the findings shown in the tables above, a sizable majority of participants (56.6%) claimed to have signs of smartphone addiction. The findings of this research align with those of many previous studies [3-29]. The high rate of SA among Moroccan students is concerned and requires immediate interventions. Smartphone addiction partly explains the decline in the overall academic level of high school students. Although the issue of high school students' level is not new, it has always been a difficulty for educators and other stakeholders, it has recently grown to even more alarming dimensions. [30].

4.2. Smartphone Addiction and Its Association to Sleep Quality

The widespread usage of smartphones for activities such as emailing, internet browsing, use of social media and entertainment has led to a significant increase in task switching and multitasking among adolescents during school activities. The attachment of adolescents also leads to the consumption of a lot of time at the expense of rest times and physical activities and affects the quality of sleep. Our results are consistent with findings of several researchers who have found that teens impacted by the Internet and smartphones tend to go to bed later, have shorter sleep durations, and sleep less well [15-25, 27-31]. According to this study, teenagers are more likely to become problem-prone owing to extensive usage of any new kind of media and have a tendency to become more concentrated while using digital media. Indeed, teenagers tend to proactively adopt new media and replace old ones. This makes them more prone to smartphone addiction. In order to minimize hazards, it's critical to identify kids who may be smartphone addicts and take preventive measures to make sure they get the help they need to control their use of technology. Such preventive measures might enhance academic performance and lessen the detrimental effects of excessive smartphone use on kids' quality of sleep and overall health.

4.3. Smartphone Addiction and Academic Performance

Smartphone addiction has emerged as a new disruptive factor that can potentially lead to failure or dropping out of school. The correlation between addiction to smartphones and subpar academic performance is consistent with findings from many previous studies. The underlying reasons for this relationship can be attributed to several factors, including poor time management, multitasking, and nomophobia. Students addicted to screens tend to spend a lot of time on their phones for non-school purposes, such as accessing the internet, social networking sites, games, and music, leading to poor time management. The different capabilities of cellphones can make it challenging for students to focus on educational tasks, which frequently results in procrastination and incomplete work, which eventually lowers academic motivation and accomplishment. Additionally, students may experience anxiety and stress when they are deprived of their smartphones, which can negatively impact their learning abilities. Students must thus be made aware of the negative impact that excessive smartphone use has on both their behaviour and academic achievement. Parents and school administrators should urge kids to balance smartphone use with academics.

4.4. Sleep Quality and Academic Performance

Lately, there has been growing apprehension about the link between smartphone addiction and poor sleep quality. Our results revealed a high incidence of smartphone addiction, which had a negative effect on both sleep quality and school performance. The study also identified poor time management, multitasking and nomophobia as major contributing factors to the adverse effects of smartphone addiction on school performance Evidence suggests a concerning correlation where students who engage excessively with their smartphones tend to experience compromised sleep durations and diminished academic performance. To address this issue effectively, it is vital that the roles of educators and parents expand to include advocacy for adequate sleep and limiting smartphone use, particularly within the bedroom. Moreover, raising students' awareness about the detrimental implications of excessive mobile device usage on their overall well-being and scholastic life emerges as an essential aspect of this endeavor. The results of this study suggest that tackling smartphone addiction is key to improve sleep quality and ensuring overall well-being in high school students.

4.5. Study Limitations

Although this study produced important results about the effects of smartphone addiction on high school students' sleep quality and academic performance, there were several restrictions that needed to be taken into account. Due to time and budget constraints, the sample size was small, consisting of just 389 students from six public high schools. A more diverse and larger sample size including both public and private education institutions may yield more comprehensive results. Additionally, reliance on only one data collection method, namely the questionnaire, raises concerns about potential biases..It could be possible to reduce these potential biases by using several sources of data collecting. Future studies must also take into account the significance of moderating factors, such as family socioeconomic situation and involvement in extracurricular activities, as these might affect smartphone addiction and its impacts. Future research can expand on the current results by taking these constraints into consideration in order to better understand the triangle interaction between smartphone addiction, academic achievement, and sleep quality.

5. Conclusions

All in all, the present study has demonstrated a significant smartphone addiction prevalence and a poor quality of sleep high school students in Morocco endure. The findings also indicate that smartphone addiction is strongly linked to poor sleep quality, which, in turn, can negatively affect academic performance. As such, it is crucial to take proactive measures to prevent and mitigate smartphone addiction. Both parents and educational leaders have a crucial responsibility in restricting and managing the utilization of smartphones by minors.

Future study should concentrate on discovering efficient methods that may turn cellphones into practical teaching aids while minimizing their negative consequences. Specifically, to find effective intervention programmes that may be used to discourage high school kids from excessive smartphone usage, more research should be done on the sociocultural and economic aspects that can affect smartphone addiction. Ultimately, the findings of such research can be used to develop policies and guidelines that can promote healthy smartphone use among students, while simultaneously it is enhancing their academic performance and well-being.

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