

Effects of Electronic Devices and Internet Addiction on Sleep and Academic Performance Among Female Egyptian and Saudi Nursing Students: A Comparative Study

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Abstract

Introduction: The widespread availability of Internet access and increasing rate of electronic device usage has helped enlighten the world community through copious applications, information resources, and other benefits. However, both the lack of controlled behavior and excessive Internet usage have resulted in a variety of difficulties that can hinder user achievement in many areas.

Objectives: This study investigated the prevalence of Internet and electronic device addiction among Egyptian and Saudi nursing students, with the aim of identifying any effects on sleep and academic performance.

Methods: A cross-sectional comparative research design was employed among a systematic random sample comprised of 920 Egyptian and Saudi female nursing students. All participants completed the Young-Internet Addiction Test (IAT), Mobile Phone Involvement Questionnaire (MPIQ), and Epworth Sleepiness Scale (ESS).

Results: Severe Internet Addiction (IA) detected in 42.69% and 10.31% of Saudi and Egyptian participants, respectively. However, Saudi participants were more likely to report high rates of mobile phone usage ($P < 0.001$), while Egyptian participants tended to score higher on the ESS (17.47 ± 3.99 vs. 16.8 ± 3.83 ; $P = 0.024$). For all participants, IAT and MPIQ scores were correlated with ESS results, while IA was specifically associated with poor academic performance. Finally, MPIQ scores were inversely correlated with academic performance for Saudi participants.

Conclusion: Smartphone and Internet addiction were notable problems for the Egyptian and Saudi nursing students investigated in this study. Importantly, these conditions adversely affect academic performance and other activity engagement in addition to inducing excessive daytime sleepiness.

Keywords

electronic device, Egypt, epworth sleepiness scale, internet addiction, mobile phone involvement questionnaire, nursing students, Saudi Arabia

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Introduction

Broad Internet access and increasing electronic device availability have enlightened the world community through a wide variety of applications and benefits, including entertainment, gaming, web surfing, electronic communication, social media applications, instant messaging, streaming content and educational resources. The past few years have witnessed great developments in Internet infrastructure, which have led to increased Internet usage among people of various age groups. However, at the same time, there have been some negative implications associated with increased Internet usage for some individuals. "Internet addiction" (IA) is one such negative consequence of excessive Internet use among users (Dhir et al., 2015a, 2015b, 2015c, 2015d).

On the other hand, overuse can create substantial problems. For example, Internet Addiction (IA) is defined as the extensive and uncontrolled use of the Internet and related electronic devices, which may persist for many hours during activities that are not related to work. In fact, this has become a problem for many Internet users. In general, Internet addiction (IA) is characterized by mood changes and preoccupation, with an inability to limit the time spent using the Internet and associated electronics (Zhang et al., 2014). In turn, this may impact other areas of life, including academic performance, family relations, and employment.

Based on these considerations, this study focused on how Internet and electronic device addiction among Egyptian and Saudi nursing students affected their sleep and academic performance.

Review of Literature

Recent research has shown that an increasing number of Internet users throughout the world are experiencing IA, with notable issues arising among university students (Dehghankar et al., 2019). There are two types of IA, including the generalized and specific. To clarify, generalized IA refers to a multidimensional and general behavioral pattern of smartphone/Internet overuse that is associated with other problems, including impaired family functioning, interactional problems, decreased life satisfaction, poor emotional well-being, and worsening academic performance (Chen et al. (2020b)). On the other hand, specific IA refers to smartphone /internet overuse that is focused on a particular type of activity (e.g., social media, gaming, or gambling) and which shares similar features to generalized IA. Specific IA also associated with poor health outcomes, cyberstalking problems and social media induced jealousy (Chen et al., 2020a; Tandon et al., 2021; Kaur et al. 2020).

In similar regard, smartphones provide many conveniences, but users should also be aware of the negative

effects, the most concerning of which is smartphone addiction (SA), which is a phenomenon in which there is uncontrollable overuse. Individuals with SA may encounter social, psychological, and/or health problems (Cha & Seo, 2018). There may also be other behavioral problems, such as gambling and gaming addictions. Indeed, the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) lists Internet gaming as a specific disorder (American Psychiatric Association, 2013).

Students are some of the most prolific users of virtual applications and social networks. However, Internet usage can have both positive and negative effects on academic, social, and health matters for this demographic. This includes diminished overall grade point averages (GPAs) (e.g., average final grade values ranging from zero to 4, as inversely reflected by the A-F letter-grading scale). In sum, reduced academic performance and less time spent studying are negative consequences of IA. Indeed, research has shown that students who use social networks and the Internet more often than average tend to have poor academic achievement and low concentration levels in the classroom. A study among Qatari students specifically showed lower GPAs for those with IA (Al-Yafi et al., 2018). Internet addiction (IA) is characterized by mood changes and preoccupation, with an inability to limit the time spent using the Internet and associated electronics (Zhang et al., 2014). In turn, this may influence other areas of life, including academic performance and family relations (Dhir et al., 2015a, 2015b, 2015c, 2015d).

A recent systematic review and meta-analysis on the association between Internet addiction and sleep found highly negative effects in cases where adolescents and young adults with IA failed to engage in good sleep hygiene (Alimoradi et al., 2019). This highlights the importance of helping young people develop good sleep hygiene, including the avoidance of Internet and smartphone usage before bedtime or while in bed. This is highly relevant in clinical practice. Internet and electronic device addiction causes difficulty when attempting to control excessive behaviors related to Internet access, which then leads to distress or impairment. Other studies found evidence that internet and electronic device addiction increases the risk of many negative social and health consequences, including poor academic performance, deleterious personality effects, anxiety, and depression (Ting et al., 2019). Smartphone usage just prior to sleep is also significant factor for sleep deprivation in adolescent females. In this regard, excessive smartphone usage has negative impacts on physical health and wellness due to impaired sleep quality and duration. Further, IA is linked to a higher rate of insomnia (up to 3%) and sleep disturbances among individuals who are considered heavy Internet users. Sleep problems are also more likely among students who extensively use the Internet to check social networks and spend substantial amounts of time watching television (Yang et al., 2019; Chen & Gau, 2016). In the context of this study, there is a high potential for

problems related to IA and SA in both investigated countries. Currently, more than 90% of the Saudi population has Internet access, with most students now using electronic devices (Saqub, 2020). As for Egypt, statistical reports showed approximately 36 million Internet users as of 2014 (Statista, 2020a), with 23.6 million smartphone users as of 2017 (Statista, 2020b). These numbers emphasize the need to determine potential areas of risk.

Significance of the Study

Prior studies found a negative impact of internet addiction on students' academic performance (Dhir et al., 2015a; Khayat et al. 2018; Javaeed et al., 2020). While, another study found that there were no significant associations between Internet Addiction Test scores and Cumulative Grade Point Average scores (Hamza et al., 2021). In addition, studies conducted by Khayat et al. (2018) and Lin et al. (2019a, 2019b) investigated the effect of internet addiction on sleep, and found that sleep quality is strongly correlated with Internet addiction level.

To bridge these gaps, the present study investigated the effect of internet and electronic devices addiction among nursing students in Egypt and Saudi Arabia, factors influencing their sleep quality and academic performance, and if there is a difference between these two cultures. In addition, a met analysis study conducted by Alimoradi et al. (2019) concerning IA and its effect on sleep found that most study participant included in the study were school and high school students.

Study objectives. This study investigated the prevalence of Internet and electronic device addiction among Egyptian and Saudi nursing students, with the goal of identifying any effects on sleep and academic performance.

Methods

Study Design

This study adopted a cross-sectional comparative research design.

Setting

The study was conducted among a sample of undergraduate female students from both the Faculty of Nursing at Mansoura University, Egypt ($n = 1,437$ female students in 2018/2019) and the Faculty of Medicine & Nursing at Northern Border University, Kingdom of Saudi Arabia (KSA) ($n = 500$ students 2018/2019). The fieldwork was conducted from January 2018 to April 2019.

Research Questions

We set the following research question prior to our investigation

- How do Internet and electronic device addictions affect sleep and academic performance for Egyptian and Saudi female nursing students?

Research Hypothesis

- Saudi female nursing students had significant problems due to Internet and electronic device addictions compared to female Egyptian nursing students.
- Egyptian and Saudi female nursing students who have higher Internet and electronic device addictions have poor sleep and academic performance.

Sample Inclusion/Exclusion Criteria

Study participants were selected via the systematic random sampling method. Using student lists from the abovementioned universities, we recruited 920 nursing students from Egypt and Saudi Arabia. The estimated sample size for a two-group comparison of proportions was determined using STATA/SE 11.2 for Windows (STATA Corporation, College Station, Texas). The ratio between the Egyptian and Saudi students was two, thus accounting for the higher number of Egyptian students. The amount of type I error (alpha) was 0.05, with a study power of 90% and effect size of 13%. Allowing for a 10% nonresponse rate, the estimated sample size was 264 ($240 + 240 \times 10\%$) for the Saudi students and 528 ($480 + 480 \times 10\%$) for the Egyptian students. The inclusion criteria were set as follows: (1) undergraduate nursing student and (2) female.

Data Collection Tools

Participants submitted data through a survey that divided into four main components, as follows:

Based on the relevant literature, this study developed a self-administered questionnaire designed to collect information on socio-demographic characteristics (age and family income), the presence of chronic disease, medications taken, academic performance (as measured via GPA), sleep hours during study/workdays and vacation, and afternoon napping habits.

The IA was diagnosed using the Internet Addiction Test (IAT) developed by Young (1998). The IAT was previously shown to be reliable and consistent for use in measuring IA among Lebanese medical students (Cronbach's $\alpha = 0.91$) (Samaha et al., 2018). It consists of 20 total items designed to assess the extent of Internet usage and related problems.

Specific sections include productivity at school, work, and home (three items), social life (three items), feelings, reactions, and sleep problems (seven items), and the pattern of Internet usage (seven items). For all items, responses were given on the following 6-point Likert scale: never = zero, rarely = one, occasionally = 2, frequently = 3, very often = 4, and always = 5. The scores from all 20 items were then added to create total scores for each participant, with certain scores reflecting general conditions: 20–49 points (surfs the Web a bit too long at times, but has control over usage, thus classified as average online user), 50–79 points (occasional or frequent problems with Internet overuse), and 80–100 points (significant life problems due to Internet overuse). Daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS) developed by Johns (1991). It consists of eight questions designed to evaluate signs of napping in eight different situations including sitting and reading, watching television, sitting inactively in a public place. In addition to, being a passenger in a car for an hour without stopping, lying down to rest in the afternoon, sitting and talking to someone, sitting after lunch, and sitting in a car while stopped in traffic for a few minutes. Responses given according to the following scale: zero = never, one = sometimes, two = often, and three = always. The sum of all eight responses were then totaled for each participant to result in the following: 0–5 (lower normal daytime sleepiness), 6–10 (higher normal daytime sleepiness), 11–12 (mild excessive daytime sleepiness), and 13–15 (moderate excessive daytime sleepiness), and 16–24 (severe excessive daytime sleepiness). The ESS was previously shown to be valid and reliable among the Arabic population, with few modifications (Cronbach's $\alpha = 0.89$; intra-class correlation coefficient (ICC) = 0.86) (Ahmed et al., 2014). The extent of mobile phone usage was assessed using the Mobile Phone Involvement Questionnaire (MPIQ) developed by Walsh et al. (2010). The MPIQ consists of eight items designed to evaluate the cognitive and behavioral aspects of mobile phone addiction, including cognitive and behavioral salience, interpersonal conflict, conflict with other activities, euphoria, loss of control, withdrawal, and relapse and reinstatement. All items were answered on the following 7-point Likert scale: strongly disagree = one, disagree = two, simple disagree = three, neutral = four, I agree simple = five, agree = six, strongly agree = seven. The MPIQ was deemed to be of satisfactory reliability (Cronbach's $\alpha = 0.78$). For statistical analysis purposes, scores of five or higher were classified as "highly involved," while scores less than three were described as "not involved" (Choudhury et al., 2019).

Pilot study. A pilot study was conducted among 10% of the total participants in order to test the clarity, feasibility, and consistency of the study tools as well as the time needed for data collection. Based on the results, no modifications were needed. The researchers excluded all participants who engaged in the pilot study from the remainder of the study procedures to ensure the stability of the results.

Ethical considerations. This study was approved by the ethical committee at the Faculty of Nursing, Mansoura University. Administrative approval was also obtained from the Dean of the Faculty of Nursing, Northern Border University, Kingdom of Saudi Arabia (KSA). Further, informed consent was obtained from all study participants, who were given adequate information about the study purpose, required data, and expected benefits. They were also informed that all participation was anonymous, confidential, voluntary, and harmless. Finally, all participants were informed that they could withdraw from this study at any time without negative consequences.

Statistical Analyses

Quantitative data described as means \pm SDs, medians, and ranges, while qualitative data summarized as frequencies and percentages. Skewness and Kurtosis normality tests were conducted to examine the distribution of numerical data. Comparisons between the different study groups were conducted via the independent t-test and Mann-Whitney test to assess parametric and nonparametric data. Categorical data was compared using the Chi-square test and Fisher's exact test, as appropriate. Next, the Pearson correlation coefficient (r) was used to examine correlations between IA scores, ESS scores, and academic GPA. Statistical significance was determined $P < 0.05$. All statistical analyses were conducted using STATA/SE version 11.2 for Windows (STATA Corporation, College Station, Texas).

Results

Sample Characteristics

The study sample was comprised of 514 female students from the Faculty of Nursing at EL-Mansoura University in Egypt and 253 students from the Faculty of Medicine & Nursing at the Northern Border University in Saudi Arabia (KSA). Table 1 shows the socio-demographic characteristics for all participants. Egyptian participants ranged from 18–26 years of age (mean of 19.79 ± 0.72), while Saudi participants ranged from 19–22 years of age (mean of 19.95 ± 1.0). Further, Egyptian participants were more likely to have "very good" or "excellent" GPAs than Saudi participants were ($P < 0.001$). On the other hand, Egyptian participants were more likely to have chronic disease or take medications than Saudi participants ($P = 0.005$ and $P = 0.001$, respectively). There were also significant differences between Egyptian and Saudi students regarding the number of hours of sleep taken during work/study/vacation days and afternoon napping habits ($P < 0.001$). Here, Saudi participants were more likely to sleep less than 8 h during study/workdays and more than 8 h during vacation days than Egyptian participants were. Finally, Egyptian participants were more likely to take afternoon naps than Saudi participants (57.98% vs. 17.39%).

Table 1. Demographic Characteristics, Academic Grade Point Average (GPA), Chronic Illnesses, and Sleep Hours of Studied Egyptian and Saudi Student.

Characteristic		Egyptian students (N = 514)		Saudi students (N = 253)		Test	P
		No.	%	No.	%		
Age (years)	Mean \pm SD	19.79	0.72	19.95	1.00	MW = 0.81	0.42
	Median (range)	20	(18–26)	20	(19–22)		
Academic score (GPA)	Failed	65	12.65	0	0.0	X² = 68.99	<0.001
	Accepted	19	3.70	36	14.23		
	Good	129	25.10	91	35.97		
	Very good	262	50.97	115	45.45		
	Excellent	39	7.59	11	4.35		
Suffer from chronic illnesses	No	494	96.11	252	99.60	X² = 7.78	0.005
	Yes	20	3.89	1	0.40		
Take medication for a particular disease	No	481	93.48	250	98.81	X² = 10.38	0.001
	Yes	33	6.42	3	1.19		
Number of hours of sleep during work/study days	>10	14	2.72	4	1.58	X² = 22.82	<0.001
	8 to 10	109	21.21	42	16.6		
	6 to 8	226	43.97	81	32.02		
	4 to 6	165	32.10	126	49.80		
The number of hours of sleep in the vacation	>10	188	36.58	82	32.41	X² = 24.00	<0.001
	8 to 10	195	37.94	133	52.57		
	6 to 8	96	18.68	36	14.23		
	4 to 6	35	6.81	2	0.79		
Taking afternoon nap	No	216	42.02	209	82.61	X² = 113.03	<0.001
	Yes	298	57.98	44	17.39		

MW: Mann-Whitney test; X²: Chi-square test; P: Probability; SD: Standard Deviation.

Research Question and Study Hypothesis Results

There were significant differences between Egyptian and Saudi participants regarding IAT scores, ESS scores, and MPIQ scores (Table 2). More specifically, Saudi participants had higher scores on the IAT (76.94 ± 26.27 vs. 55.91 ± 17.49 for Egyptian participants; $P < 0.001$). Further, a higher proportion of Saudi participants had significant problems due to Internet overuse (42.69% vs. 10.31% for Egyptian participants; $P < 0.001$). While Saudi students also had higher MPIQ scores ($P < 0.001$), Egyptian participants had higher ESS scores (17.47 ± 3.99 vs. 16.8 ± 3.83 for Saudi participants; $P = 0.024$). As shown in Table 3, there was a significant association between severe excessive daytime sleepiness and significant/occasional Internet addiction problems for both the Egyptian ($P = 0.002$) and Saudi ($P < 0.001$) participants. There were also significant variations in GPA based on Internet addiction problems for both the Egyptian ($P = 0.002$) and Saudi ($P < 0.001$) participants. Egyptian participants with significant IA problems had higher rates of failure than those with occasional problems and average Internet users (20.75%, 11.41%, and 12.12%, respectively). Saudi participants with average online usage were more likely to have excellent grades than those with occasional or significant Internet usage (9.3%, 1.69%, and 1.85%, respectively). Referring to Table 4, the majority

of Saudi participants who were involved with mobile phone usage had severe excessive daytime sleepiness when compared to those who were not involved ($P < 0.001$). Further, Saudi participants who had very good or excellent GPAs were more likely to not be involved with mobile phone usage ($P < 0.001$). However, there were no significant associations between GPA and either the MPIQ scores or the ESS scores for Egyptian participants.

Discussion

The Internet and electronic devices such as computers, tablets, and mobile phones are now widely used in areas of communication, education, entertainment, and business throughout the world. While there are many benefits to this, uncontrolled technology usage can lead to problems such as IA, especially for youths and adolescents. In turn, this can result in adverse effects to health, social life, sleep quality, alertness, academic achievement, and work performance. As such, this cross-sectional survey study investigated the prevalence of Internet/electronic device addiction and its impacts on sleep and academic performance among a sample of Egyptian and Saudi female nursing students.

Table 2. Comparison Between Egyptian and Saudi Students in Relation to Internet Addiction Test (IAT), Mobile Phone Involvement Questionnaire (MPIQ) and Epworth Sleepiness Score (ESS).

Scale		Egyptian students (N = 514)		Saudi students (N = 253)		Test	P
		No.	%	No.	%		
Internet Addiction Test (IAT)	Average online user	198	38.52	86	33.99	$\chi^2 = 116.92$	<0.001
	Occasional or frequent problems	263	51.17	59	23.32		
	Significant problems	53	10.31	108	42.69		
	Mean \pm SD Median (range)	55.91 \pm 17.49	55 (20–118)	76.94 \pm 26.27	74 (20–114)	$t = 11.54$	
Mobile Phone Involvement Questionnaire (MPIQ)	Not involved	36	7.00	44	17.11	$\chi^2 = 195.27$	<0.001
	Not highly involved	450	87.55	104	41.11		
	Highly involved	28	5.45	105	41.50		
	Mean \pm SD Median (range)	28.28 \pm 11.11	27 (8–56)	36.82 \pm 13.62	36 (12–55)	$t = 8.65$	
Epworth Sleepiness Score (ESS)	Higher normal daytime sleepiness	10	1.95	1	0.40	$\chi^2 = 39.08$	<0.001
	Mild excessive daytime sleepiness	33	6.42	0	0.0		
	Moderate excessive daytime sleepiness	128	24.90	108	42.69		
	Severe excessive daytime sleepiness	343	66.73	144	56.92		
	Mean \pm SD Median (range)	17.47 \pm 3.99	17 (8–35)	16.80 \pm 3.83	17 (10–30)	$t = 2.27$	

IAT by (Young, 1998); MPIQ by (Walsh et al., 2010); ESS by (Johns, 1991); χ^2 : Chi-square test; t: independent t-test; P: Probability; SD: Standard Deviation. ^aParticipants who scored 5 or higher out of a possible 7 on the MPIQ were classified as being highly involved with their mobile phone, while participants who scored <3 were not involved with their mobile phone. (Choudhury et al., 2019).

In our study, we hypothesize that Saudi female nursing students had significant problems due to Internet and electronic device addictions compared to female Egyptian nursing students. Our results showed that 23.32% and 42.69% of Saudi participants respectively reported occasional and significant problems due to Internet overuse, while Egyptian participants reported 51.17% and 10.31%, respectively. There is also a significant increase in Internet coverage throughout Saudi Arabia over the last decade, thus providing more than 90% of the Saudi population with Internet access. In turn, this has increased the rate of smartphone, tablet, and laptop usage among young people. Further, Saudi Arabia undergoes extensive periods of hot weather and is known as a highly conservative society, which may influence many individuals (especially females) to stay indoors, where they are more likely to overuse electronics and develop IA (Saquib, 2020).

Previous studies in Egypt have reported lower rates of IA than those found in this study. For example, a 45.8% rate of pathological Internet usage found among a sample of 369 students affiliated with the Faculty of Medicine, Menoufia University (Shaheen et al., 2016). A cross-sectional survey of 587 medical students at Sohag University reported that 47.7% engaged in pathological Internet usage based on Young's IAT (Ali et al., 2017). Another study at Sohag

University found that 35.2% of students had problematic IA, including 27.04% and 39.29% ($n = 154$) in applied and theoretical programs (Azab et al., 2019). Further, a clinical study among 60 students at Al-Azhar University found moderate and severe IA in 46.7% and 3.3%, respectively (Mohamed et al., 2019).

In our study, the higher prevalence of IA may be due to the fact that the investigated sample solely consisted of female students, who may be more motivated to engage in Internet usage due to regional sociocultural factors that influence them to remain indoors more often than males. Further, research has shown that females tend to use social media applications (e.g., WhatsApp, Snapchat, and Instagram) for interpersonal communication.

On the other hand, previous studies in Saudi Arabia have found similar rates of IA to those shown in this study. For example, a cross-sectional survey of 2,516 Saudi female university students of Art, Education and Sciences at Imam Abdulrahman Bin Faisal University found that two-thirds had IA or possible IA, according to a 10-question IA tool developed based on Young's IAT (Barayan et al., 2018). More than half of 370 female students at Jouf University were found to engage in problematic Internet usage based on Young's IAT (49.5% and 1.9% had moderate and severe IA, respectively) (Abdel-Salam et al., 2019). A

Table 3. Relationship Between the Internet Addiction Test (IAT) Score and Epworth Sleepiness Score (ESS) and Academic Score/ Grade Point Average (GPA) among Egyptian and Saudi Students.

	Internet Addiction Test (IAT) score												P ^a	
	Egyptian students						Saudi students							
	Average online user (N = 198)		Occasional or frequent problems (N = 263)		Significant problems (N = 53)		Average online user (N = 86)		Occasional or frequent problems (N = 59)		Significant problems (N = 108)			
No	%	No	%	No	%	No	%	No	%	No	%	No	%	
Epworth Sleepiness Score (ESS)														
Higher normal daytime sleepiness	4	2.02	4	1.52	2	3.77	1	1.16	0	0	0	0	0	<0.001
Mild excessive daytime sleepiness	17	8.59	13	4.94	3	5.66	0	0	0	0	0	0	0	
Moderate excessive daytime sleepiness	67	33.84	50	19.01	11	20.75	78	90.70	2	3.39	28	25.93	28	25.93
Severe excessive daytime sleepiness	110	55.56	196	74.52	37	69.81	7	8.14	57	96.61	80	74.07	80	74.07
Academic score (GPA)														
Failed	24	12.12	30	11.41	11	20.75	0	0	0	0	0	0	0	<0.001
Acceptable	14	7.07	5	1.90	0	0.00	29	33.72	3	5.08	4	3.70	4	3.70
Good	48	24.24	67	25.48	14	26.42	10	11.63	22	37.29	59	54.63	59	54.63
Very good	90	45.45	147	55.89	25	47.17	39	45.35	33	55.93	43	39.81	43	39.81
Excellent	22	11.11	14	5.32	3	5.66	8	9.30	1	1.69	2	1.85	2	1.85

IAT by (Young, 1998); ESS by (Johns, 1991); P: Probability.

^aObtained using the Fisher Exact Test.

Table 4. Relationship Between the Mobile Phone Involvement Questionnaire (MPIQ) Score and Epworth Sleepiness Score (ESS) and Academic Score/ Grade Point Average (GPA) among Egyptian and Saudi Students.

	Mobile Phone Involvement Questionnaire (MPIQ) score														P ^a
	Egyptian students						Saudi students								
	Not involved (N=36)		Not highly involved (N=450)		Highly involved (N=28)		Not involved (N=44)		Not highly involved (N=104)		Highly involved (N=105)				
	No	%	No	%	No	%	No	%	No	%	No	%			
Epworth Sleepiness Score (ESS)															
Higher normal daytime sleepiness	0	0.00	9	2.00	1	3.57	0.80	0	0.00	1	0.96	0	0.00	<0.001	
Mild excessive daytime sleepiness	4	11.11	28	6.22	1	3.57		0	0.00	0	0.00	0	0.00		
Moderate excessive daytime sleepiness	8	22.22	113	25.11	7	25.00		44	100.00	36	34.62	28	26.67		
Severe excessive daytime sleepiness	24	66.67	300	66.67	19	67.86		0	0.00	67	64.42	77	73.33		
Academic score (GPA)															
Not passed	1	2.78	61	13.56	3	10.71	0.65	0	0.00	0	0.00	0	0.00	<0.001	
Acceptable	2	5.56	17	3.78	0	0.00		0	0.00	32	30.77	4	3.81		
Good	9	25.00	112	24.89	8	28.57		7	15.91	25	24.04	59	56.19		
Very good	20	55.56	227	50.44	15	53.57		33	75.00	42	40.38	40	38.10		
Excellent	4	11.11	33	7.33	2	7.14		4	9.09	5	4.81	2	1.90		

MPIQ by (Walsh et al., 2010); ESS by (Johns, 1991); P: Probability.

^aObtained using the Fisher Exact Test.

study among 209 medical students at Qassim University found that 12.4% had IA, while 57.9% showed the potential for IA, with higher rates among females ($P=006$) (Taha et al., 2019).

However, this study also found a higher prevalence of IA than that reported by a previous cross-sectional study among male and female nursing students at Imam Abdulrahman bin Faisal University. More specifically, 35.1% of students had occasional problems due to Internet use, with only 0.9% having significant problems (Alamer et al., 2020). Another study among 511 students at King Abdulaziz University, Jeddah found that 29.9% and 1.8% had moderate and severe IA, respectively (Khayat et al., 2018). As with the discrepancies mentioned earlier, the differences in these rates may be due to the higher prevalence of problematic IA generally found among females when compared to males. In this study, 41.5% ($n=105$) of Saudi participants were classified as highly involved in mobile phone usage, compared to only 5.45% ($n=28$) of Egyptian participants. A previous study implemented the short version of the smartphone addiction scale among 420 physical therapy students in Egypt, thus finding smartphone addiction among 62.4%, with a higher prevalence among females (Elserty et al., 2018). A later study among undergraduate students at Ain Shams University found that 32.5% had smartphone addiction, also with higher rates among females ($P=0.003$) (Elkholy et al., 2020).

In Saudi Arabia, 85.3% of Health Sciences Colleges students were found to have mild to severe nomophobia, with

52.5% spending more than 2 h per day using their mobile phones (Al-Shalkh et al., 2019). Even further, about 82% ($n=1,943$) of sampled undergraduate students at King Saud University, Riyadh used their smartphones for more than 3 h per day (Alosaimi et al., 2016). A later study implemented the smartphone addiction scale-short form among medical students at Qassim University, thus finding addiction in 60.3% (Alsalameh et al., 2019). Excessive mobile phone usage was also reported among 129 medical students at a medical college in Oman, where 50% accessed the Internet on their mobile phone for more than 4 h per day; during lectures, 85% kept their phones on, 65% texted, 20% played games, and 7% engaged in phone calls (Siddiqi et al., 2017).

A study conducted by Karki et al. (2020) reported that nomophobia was detected in 57.29% of participants, while 26.82% were at risk of developing the condition. In Nepal, 42% ($n=105$) of medical students self-reported IA, while 60.8% ($n=152$) reported mobile phone overuse, and 25.6% ($n=64$) reported problems concentrating in class, doing assignments, and working due to smartphone use (Karki et al., 2020).

Additionally, our study hypothesis that Egyptian and Saudi female nursing students who have higher Internet and electronic device addictions have poor sleep and academic performance. In this study, IA and mobile phone involvement had negative effects on sleep quality and daytime alertness for both the Egyptian and Saudi participants. Further, two-thirds of the Egyptian participants and more than half of the Saudi participants were found to have

severe excessive daytime sleepiness. In this regard, frequent daytime sleepiness may have been caused by inadequate sleep, where most all participants reported sleeping less than 8 h during work/study days.

A similar study conducted by Alamer et al. (2020) found that more than two-thirds of Saudi nursing students had poor sleep quality. The study also found that IAT and MPIQ scores were positively correlated with ESS scores for all participants. Moreover, severe excessive daytime sleepiness was more likely to occur for participants with occasional or significant problems due to internet use. Severe excessive daytime sleepiness was also significantly associated with mobile phone involvement for the Saudi participants.

Correspondingly, a cross-sectional study on smartphone addiction among 2,367 students at King Saud University, Riyadh found that 28.8% and 15.3% of students agreed and strongly agreed that their sleep hours had decreased due to smartphone use, with 29.5% and 13.9% agreeing and strongly agreeing that they lacked energy as a result (Alosaimi et al., 2016). Similarly, both SA and IA have been strongly associated with longer sleep latency, poor sleep, and daytime hypersomnolence (Gara et al., 2020; Dhir et al., 2015a, 2015b, 2015c, 2015d).

An investigation of sleep quality and IA among 511 students at King Abdulaziz University, Jeddah revealed a significant correlation between IA and poor sleep quality ($P < 0.001$) (Khayat et al., 2018). Another study found that Internet addicts and possible addicts were more likely to neglect adequate sleep in order to remain online ($P = 0.006$) (Taha et al., 2019). In Egypt, IA was more likely associated with poor sleep quality ($P = 0.004$) among students at Al-Azhar University. Similarly, IA was correlated with poor sleep quality among a sample Indian medical students ($P < 0.001$) (Mohamed et al., 2019).

In this study, participants who reported occasional or significant problems due to internet usage were less likely to have excellent GPAs when compared to average Internet users. There was also a negative correlation between mobile phone involvement and GPA among Saudi participants. In Egypt, research among medical students from Menoufia found that pathological Internet usage was negatively correlated ($r = -0.24$; $P < 0.001$) with academic performance (Shaheen et al., 2016).

Research on the consequences of SA among students at King Saud University found that 16.1% and 7.3% agreed and strongly agreed that their academic achievements were adversely affected due to smartphone usage (Alosaimi et al., 2016). In support of this finding, Javaeed et al. (2020) found that academic performance was negatively correlated with IA scores (correlation coefficient = -0.139 ; $P = 0.013$) among 89 undergraduate medical students in Azad Kashmir, Pakistan (Javaeed et al., 2020). Similar findings were reported in Pakistan, where researchers found a negative relationship between smartphone use and academic

performance among students in a higher education setting (Khan et al., 2019).

Implications for Practice

This study has five implications of particular importance. Firstly, the study can guide curriculum designers and teachers since the study revealed a relationship between students Internet Addiction and academic performance in two different countries; to find ways to enhance the academic performance for students especially nowadays virtual learning became very popular and a part of educational system. Secondly, our finding revealed there was a significant association between severe excessive daytime sleepiness and significant IA problem in both groups, educational psychologists and psychotherapists may use these results to develop and apply sleep hygiene protocols for college students with IA. Third, the study implies there was a difference between Saudi and Egyptian college students in relation to mobile-phone usage and daytime sleepiness. This finding can be used by IA researchers to evaluate the effect of culture on the prevalence of IA and develop suitable intervention programs aimed at controlling or reducing internet and electronic device usage among college students like engaging in sports or following a protocol.

Fourth, the present study focused on college students, this can help researchers and contribute to identify if there are differences between Egyptian and Saudi students in factors that could lead to IA and its effect on sleep and academic performance like demographic profiles, socioeconomic status, type of electronic devices, and technology accessibility. Fifth, the present study also raises significant implications for the community represented by parents or family members. There is a need to identify what their role in addressing the IA problem among their children and how to increase their awareness about the consequences of IA academically, socially, psychologically, and physically.

Strengths, Limitations & Future Work

This study had both strengths and limitations. As for the latter, the main limitation was that only female participants were included. Further, the study design did not allow for an investigation of the association between IA and impaired sleep or academic achievement. As such, longitudinal follow-up studies should target this issue.

This study used a cross-sectional design, which limited our understanding of the causal relationship between variables. The study also used the MPIQ, which imposes limitations in that it does not distinguish between mobile phones and smartphones, which may feature substantial differences. Specifically, most mobile phones do not handle apps, which are common points of usage. We therefore recommended that future studies use other validated questionnaires and/or smartphone application-based addiction scales (Lin et al.,

2019a, 2019b; Dhir & Khalil, 2018), thus more precisely targeting SA. In addition, future studies on the relationship between IA and stressful life events may provide a clear explanation for the higher prevalence rate of depression among college students. Future work must be directed to evaluate the effect of practicing sports in reducing IA. We recommend developing an app that helps in detecting and calculating hours spent on Internet and degree of addiction with strategies to help overcome this issue.

Conclusions

In this study, smartphone overuse and IA were found to be significant problems for nursing students in Egypt and Saudi Arabia. More specifically, both conditions had adverse effects on engagement in other activities and academic performance while inducing excessive daytime sleepiness. Future large-scale studies should continue to investigate the underlying risk factors and mechanisms behind these problems.

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Conflict of Interest

The researchers declare no conflicts of interest.

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Contributions

Conceptualizing the Idea of Research: A, SH, R, F & H. Study Design: A. data Collection and Analysis: A, SH & R. Manuscript Writing: A, SH, R, F & H. Manuscript Revision: A, SH, R, F & H.

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Supplemental Material

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