

Smart Phone Use and its Effect on Cognition: A Cross-sectional Study in Undergraduate Medical Students

BAGESHREE N PANDE¹, MITALI KUMBHAR²

ABSTRACT

Introduction: Mobile smartphones have become an integral part of everyone's life. However, concerns have been raised about the various health hazards associated with their use. The presence of smartphones among students reduces their attention span and acts as a distraction in their classes, which could lead to poor academic performance. Medical students, being an important element of society, need to be made aware of the health hazards of excessive smartphone use so that they can spread awareness among others, especially adolescents.

Aim: This study aims to investigate the effect of smartphone use on academic performance and to associate the behavioural aspects of smartphone use with cognitive impairment in medical students.

Materials and Methods: This observational cross-sectional study was conducted in the Physiology Department at Dr. DY Patil Medical College, Hospital and Research Centre, Pune, India, among first MBBS students from March to April 2024. Institute ethics committee clearance was obtained, and written informed consent was acquired from each participant. Participants were selected based on inclusion criteria that included a willingness to participate and a willingness to complete the questionnaire. They were provided with a validated questionnaire that included their personal details, followed by questions related to various aspects of mobile phone use. Their performance was assessed based on the marks (out of 100) in the Physiology theory paper of the first internal assessment examination. Out of a total of 250 first MBBS students, 72 were present on the day of the study. Out of these, eight were unwilling to participate, resulting in a total of 64 participants. The data was tabulated in an Excel sheet, and analysis was performed using SPSS 23. For analysis, participants were divided into three groups based on their theory marks (less than 50, 50-60, and 61 to 80). A chi-

square test was used to find the association between theory marks and mobile phone use, with a p-value of less than 0.05 considered significant.

Results: Eighteen students (28.12%) scored less than 50%, 26 students (40.62%) scored between 50% and 60%, while 20 students (31.25%) scored above 60%. Forty students (62.5%) use either glasses or contact lenses. Twenty-nine students (45.31%) started using mobile phones before 10th standard, 30 students (46.87%) began in 10th to 12th standard, and 5 students (7.81%) started after 12th. Thirty-five students (54.68%) use only 1-2 social media platforms, 27 students (42.18%) use 3-4, and only 2 students (3.12%) use more than 4. Eleven students (17.1%) use mobile phones for less than two hours daily, 37 students (57.81%) use them for 2-4 hours daily, and 16 students (25%) spend more than four hours on them. A total of 32 students, or 50%, use mobile phones just before going to sleep. Twenty-one students (32.81%) admitted that they use their mobiles as soon as they wake up in the morning. More than 50% of students use mobile phones or other electronic gadgets for studying and use them frequently between classes. Overall, mobile phone usage was reported to be higher among students who scored up to 60% compared to those who scored above 60%, although this difference was not statistically significant (p-value >0.05). Statistically, mobile phone use has not affected the academic performance of the students who scored less than 60%.

Conclusion: Since the results of this study are not statistically significant, it can be concluded that mobile phone use has not affected the academic performance of undergraduate medical students. Future studies with a larger sample size and conducted across other professional year MBBS students can provide further insights.

Keywords: Academic, Adolescents, MBBS, Performance

INTRODUCTION

Ever since the widespread adoption of smartphones and the internet, mobile devices have become an integral part of everyone's life; they offer convenience, connectivity, and a wealth of information. However, alongside these benefits, they have also become a source of reliance. The increased use of mobile phones has made us dependent on technology. The ubiquity of mobile phones and their multifaceted applications has revolutionised the way adolescents, especially students, handle their daily tasks.

Studying medicine brings a significant academic burden to a student's life, often compromising aspects of their personal life. The field demands sustained attention, memory retention, critical thinking skills, and the ability to work in a competitive and time-pressured environment. Smartphones have made studying easier through the availability of

online videos and 3-D models. They have alleviated some academic burdens, making it simpler for students to access all the references they need on one platform. However, it is important not to overlook the profound influence of social media on the student population.

Despite the advantages that modern technology provides, as the saying goes, a coin has two sides; excessive use of smartphones increases screen time. A study has linked increased screen time with adverse physiological and psychological outcomes, leading to poorer health habits [1]. Furthermore, excessive screen time has been associated with disturbed sleep outcomes [2] and has a detrimental effect on working memory. Inadequate or disturbed sleep may represent a risk factor for anxiety and depression among students [3]. Good mental and physical health is essential for academic success during medical school and later in their careers.

Emerging research has highlighted the deleterious effects of smartphone usage on cognitive processes, yet the patterns of smartphone usage warrant further study [4]. Even the mere ringing of a phone can lead to distraction. A study by Skowronek J et al., has shown that the presence of smartphones among students reduces their attention span and acts as a distraction in classes, potentially resulting in poorer academic performance [5]. Thus, the literature review suggests that smartphone usage affects the health of individuals.

As medical students are a vital element of society, it is crucial to raise awareness about the health hazards associated with excessive mobile phone use so that they can inform others, especially adolescents. Hence, this study aims to investigate the effect of mobile phone usage on the academic performance of undergraduate medical students and to associate the duration of usage with cognitive impairment. The questionnaire used in this study focused specifically on various aspects of smartphone use, and no separate scale was utilised.

Cognitive abilities were assessed through learning outcomes, specifically in the form of academic performance, which generally provides a good indication of knowledge, memory, and understanding abilities. This study aims to investigate the effect of smartphone use on academic performance and to correlate the behavioural aspects of smartphone use with cognitive impairment in medical students.

The objectives of the study are to determine the various aspects of smartphone use among first MBBS students using a validated questionnaire, to evaluate academic performance by considering scores in the Physiology theory paper of the first internal assessment examination (out of 100), and to assess the association between the duration of smartphone use and academic performance.

MATERIALS AND METHODS

This observational cross-sectional study was conducted in the Physiology Department at Dr. DY Patil Medical College, Hospital and Research Centre, Pune, India, among first MBBS students from March to April 2024. Institute ethics committee clearance (IESC/DPU-STs 2023/27/2023) was obtained prior to the start of the study, and written informed consent was secured from each participant.

Participants were selected based on the following inclusion and exclusion criteria:

Inclusion criteria:

- I MBBS students;
- Willingness to participate in the study.

Exclusion criteria:

- Students who were absent for the examination;
- Students who were absent on the day of the study;
- Incomplete questionnaires (even if a single question was not attempted).

In this time-bound study, out of a total of 250 first MBBS students, 72 were present for the study. Of these, eight were unwilling to participate, resulting in a total sample size of 64. Participants were given a self-prepared, validated questionnaire, with validation conducted by expert faculty from the Department of Physiology. The reliability, measured using Cronbach's alpha, was 0.813, and the content validity index was 0.9. The questionnaire consisted of 10 questions with multiple options, where students were required to select only one response.

Before completing the questionnaire, general information such as age, height, and weight was obtained from each participant. The next section included details regarding various aspects of smartphone use, including whether the student wore glasses, the number of years of smartphone use, daily smartphone usage duration, reasons for smartphone use, smartphone use during bedtime, perceptions

of smartphone use, and academic performance, among others. The performance of these students was assessed based on their marks in the Physiology theory paper of the first internal assessment examination, which was out of 100 marks.

The questionnaire was completed after the examination and was indicative of various aspects of smartphone use only. Cognitive abilities were assessed solely through learning outcomes, represented by academic performance, which generally provides a fair indication of knowledge, memory, and understanding abilities. The authors would like to note the limitation that cognition was assessed only through academic performance, and no other cognitive assessment scale was utilised.

STATISTICAL ANALYSIS

The data was tabulated in an Excel sheet, and results were obtained. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) Version 23 for Windows. A chi-square test was used to determine the association between theory marks and mobile phone usage. A p-value of less than 0.05 was considered significant.

RESULTS

The maximum number of students scored between 50-60 marks (26), followed by those scoring between 61-80 marks (20), and then by those scoring less than 50 marks (18) [Table/Fig-1]. There was no significant difference observed in the marks scored based on whether students wore glasses or contact lenses.

Theory marks (out of 100)	Q1. Wearing glasses/contact lens		Total	χ^2 , p-value
	Yes	No		
<50	10 (15.62%)	8 (12.5%)	18	Chi-square=0.52, p=0.77
50-60	17 (26.56%)	9 (14.06%)	26	
61-80	13 (20.31%)	7 (10.93%)	20	
Total	40 (62.5%)	24 (37.5%)	64	

[Table/Fig-1]: Association of theory marks with the aspect of wearing contact lenses or glasses.

Out of the total participants, 30 (46.87%) started using mobile phones in the 10th to 12th standards, 29 (45.31%) before the 10th standard, and 5 (7.81%) after the 12th standard. There was no significant association observed between theory marks and the standard in which the students began using mobile phones [Table/Fig-2].

Theory marks (out of 100)	Q2. When did you start using a mobile phone			Total	χ^2 , p-value
	Before 10 std	Between 10-12 std	After 12 std		
<50	7 (10.93%)	9 (14.06%)	2 (3.12%)	18	Chi-square=1.80, p=0.77
50-60	14 (21.87%)	11 (17.18%)	1 (1.56%)	26	
61-80	8 (12.5%)	10 (15.62%)	2 (3.12%)	20	
Total	29 (46.87%)	30 (45.31%)	5 (7.81%)	64	

[Table/Fig-2]: Association of theory marks with the start of usage of mobile phone.

[Table/Fig-3] shows that 35 students (54.68%) use only 1-2 social media platforms, 27 (42.18%) use 3-4 platforms, and only 2 (3.12%) use more than four social media platforms. There was no statistically significant difference observed among all three groups.

The comparison of examination performance revealed that daily mobile phone usage was highest among students who scored the highest marks (60% of students), while the least usage was observed among students who scored the lowest marks (55.56% of students), although this difference was not statistically significant [Table/Fig-4].

[Table/Fig-5] shows the number of students who use their mobile phones before going to sleep and the association with examination

Theory marks (out of 100)	Q3. How many social media platforms do you use			Total	χ^2 , p-value
	1-2	3-4	>4		
<50	13 (20.31%)	5 (7.81%)	0	18	Chi-square=7.04, p=0.13
50-60	10 (15.62%)	14 (21.87%)	2 (3.12%)	26	
61-80	12 (18.75%)	8 (12.5%)	0	20	
Total	35 (54.68%)	27 (42.18 %)	2 (3.12%)	64	

[Table/Fig-3]: Association of theory marks with the number of social media platforms in usage.

Theory marks (out of 100)	Q4. What is your daily usage of phones (in hours)			Total	χ^2 , p-value
	<2	2-4	>4		
<50	4 (6.25%)	10 (15.62%)	4 (6.25%)	18	Chi-square=4.19, p=0.3
50-60	2 (3.12%)	15 (23.43%)	9 (14.06%)	26	
61-80	5 (7.81%)	12 (18.75%)	3 (4.68%)	20	
Total	11 (17.18%)	37 (57.81%)	16 (25%)	64	

[Table/Fig-4]: Association of theory marks with the daily usage of phones.

Theory marks (out of 100)	Q.5 Do you use mobile phone before going to sleep			Total	χ^2 , p-value
	Yes	Sometime	No		
<50	9 (14.06%)	7 (10.93%)	2 (3.12%)	18	Chi-square=4.35, p=0.36
50-60	18 (28.12%)	6 (9.37%)	2 (3.12%)	26	
61-80	8 (12.5%)	10 (15.62%)	2 (3.12%)	20	
Total	35 (54.68%)	23 (38.88%)	6 (11.11%)	64	

[Table/Fig-5]: Usage of mobile phone before going to sleep and its association with performance in examination.

performance. Out of the students who scored less than 50% marks, 35 out of 64 (54.68%) admitted that they use their phones before going to sleep, while 23 out of 64 (38.88%) stated that they sometimes use their mobile phones before going to sleep. Only six out of 64 (11.11%) students reported that they do not use their mobile phones at all before going to sleep, although this difference was not statistically significant.

[Table/Fig-6] shows no association between theory marks and the use of mobile phones as the first activity in the morning. Out of a total of 64 students, 30 students (46.87%) stated that they do not use their mobile phones as soon as they get up from bed in the morning, 13 students (20.31%) admitted that they sometimes use their phones in the morning, while 21 students (32.81%) reported that they do not use their mobile phones at all as the first thing in the morning.

Theory marks (out of 100)	Q6. Do you use mobile phone as the first thing in the morning			Total	χ^2 , p-value
	Yes	Sometimes	No		
<50	6 (9.37%)	2 (3.12%)	10 (15.62%)	18	Chi-square=7.26, p=0.12
50-60	12 (18.75%)	4 (6.25%)	10 (15.62%)	26	
61-80	3 (4.68%)	7 (10.93%)	10 (15.62%)	20	
Total	21 (32.81%)	13 (20.31%)	30 (46.87%)	64	

[Table/Fig-6]: Association between theory marks and use of mobile phone as the first thing in the morning.

[Table/Fig-7] shows no association between theory marks and the use of mobile phones or any other electronic gadgets for studying among the students in each group.

[Table/Fig-8] shows no association between theory marks and the frequency of mobile phone use during or between classes.

[Table/Fig-9] shows no association between theory marks and the negative impact of mobile phone use on study span.

[Table/Fig-10] shows no association between theory marks and the effect of mobile phone use on academic performance.

Theory marks (out of 100)	Q7. Do you use mobile phones/any other electronic gadgets to study			Total	χ^2 , p-value
	Yes	Sometimes	No		
<50	14 (21.87%)	4 (6.25%)	0	18	Chi-square=3.96, p=0.41
50-60	21 (32.81%)	2 (3.12%)	3 (4.68%)	26	
61-80	14 (21.87%)	4 (6.25%)	2 (3.12%)	20	
Total	49 (76.56%)	10 (15.62%)	5 (7.81 %)	64	

[Table/Fig-7]: Association between theory marks and use of mobile phones/any other electronic gadgets to study by the students in each group.

Theory marks	Q8. How frequently do you use mobile phone during/between your classes			Total	χ^2 , p-value
	After every class	Sometimes	Not at all		
<50	12 (18.75%)	2 (3.12%)	4 (6.25%)	18	Chi-square=5.06, p=0.2
50-60	15 (23.43%)	3 (4.68%)	8 (12.50%)	26	
61-80	8 (12.50%)	1 (1.56%)	11 (17.18%)	20	
Total	35 (54.68 %)	6 (9.37%)	23 (35.93%)	64	

[Table/Fig-8]: Association between theory marks and frequency of mobile phone use during/between your classes.

Theory marks	Q9. Do you think mobile phone use has affected your study span negatively?			Total	χ^2 , p-value
	Yes	Sometimes	No		
<50	4 (6.25%)	10 (15.62%)	4 (6.25%)	18	Chi-square=7.92, p=0.095
50-60	6 (9.37%)	13 (20.31%)	7 (10.93%)	26	
61-80	11 (17.18%)	8 (12.50%)	1 (1.56%)	20	
Total	21 (32.81%)	31 (48.43%)	12 (18.75%)	64	

[Table/Fig-9]: Association between theory marks and association of mobile phone use on study span negatively.

Theory marks	Q10. Do you believe that excessive mobile device usage has negative impact on your academic performance?			Total	χ^2 , p-value
	Yes	Not sure	No		
<50	6 (9.37%)	6 (9.37%)	6 (9.37%)	18	Chi-square=7.20, p=0.13
50-60	11 (17.18%)	7 (10.93%)	8 (12.50%)	26	
61-80	14 (21.87%)	1 (1.56%)	5 (7.81%)	20	
Total	31 (48.43%)	14 (21.87%)	19 (29.68%)	64	

[Table/Fig-10]: Association between theory marks and effect of mobile phone use on academic performance.

DISCUSSION

In the age of technology, smartphones have become an indispensable part of our lives. With the lowering of costs and the latest features they offer, smartphone usage has increased among young people over the last few years. This has raised concerns related to mobile phone addiction and health hazards associated with vision, obesity, and effects on cognition and behaviour, among others.

Consequently, this study was conducted to investigate the association of mobile phone use with academic performance in exams among undergraduate medical students.

In this study, it was found that out of 64 participants, 40 (62.5%) were using either glasses or contact lenses. The prevalence of visual impairment in medical students is well established in the literature. The findings of this study are consistent with a previous study by Maqbool S et al., which reported the prevalence of refractive error to be 67.7% among medical students [6]. In a similar study conducted on computer vision syndrome [7], it was reported that this syndrome was present in almost 77% of the study group. In the new generation, mobile phones and computers/tablets have replaced traditional books, with most books now available electronically. This shift may be a contributing factor to the high prevalence of refractive errors among young people, as their screen time has increased. However, when the association between mobile

phone use and exam performance was compared, no significant association was found.

Out of the total participants, 30 (46.87%) started using mobile phones between the 10th and 12th standards, 29 (45.31%) before the 10th standard, and 5 (7.81%) after the 12th standard. A previous study on the pattern of mobile phone use among medical students reported that the mean age of internet use ranged from 11 to 20 years, which is similar to the present study [8]. Literature has indicated that mobile phone usage affects the mental health of adolescents, with some evidence suggesting a linear association between deteriorating mental health and the duration of mobile phone use [9]. However, no association was found when comparing the standard in which students started using mobile phones with their cognitive performance as measured by exam scores.

A total of 35 students (54.68%) use only 1-2 social media platforms, 27 (42.18%) use 3-4 platforms, and only 2 (3.12%) use more than four social media platforms. There was no statistically significant difference among the three groups when examining the association between social media usage and exam marks obtained. A previous study reported an increasing trend in social media use among medical students. Social media plays an immense role in educating students and also serves recreational purposes [10].

The comparison of examination performance revealed that daily mobile phone usage was highest among students who scored the highest marks (60% of students), while the least usage was observed among students who scored the lowest marks (55.56%), although this difference was not statistically significant. The maximum mobile phone usage reported by all groups of students was between 2-4 hours. These findings are consistent with previous studies. Yadav JU et al., reported that 65% of participants used mobile phones for around two hours per day [11]. It has been well observed in many studies that people become restless if they do not have access to mobile phones for even a few minutes, a phenomenon known as 'nomophobia' [12,13].

However, the present study indicates that the students were not addicted to smartphone use. Smartphone addiction was reported to be lower by Chen B et al., in China and Ammati R et al., in South India, and these findings align with the results of the present study [14,15]. Additionally, a separate study found that first-year MBBS students were less addicted to mobile phones compared to senior batches [16]. This can be explained by the fact that newly admitted students are adjusting to a new curriculum and environment and may not be overly involved in excessive mobile phone usage.

Out of the students who scored less than 50% marks, 35 out of 64 (54.68%) admitted that they use their phones before going to sleep, while 23 out of 64 (35.94%) reported that they sometimes use their mobile phones before bedtime. Only six out of 64 (9.38%) students said they do not use their mobile phones at all before going to sleep. However, the use of mobile phones before going to bed has not shown any association with examination performance. A previous study indicated that excess screen time in children and adolescents before bedtime can be detrimental [16]. Using mobile phones before sleeping has been shown to negatively impact sleep quality and may lead to mood imbalances. Previous studies on adolescents and children have demonstrated that excessive mobile phone use at bedtime has adverse effects on cognition [17]. Reducing screen time before bed has been associated with improved working memory [18].

Out of a total of 64 students, 30 students (46.87%) reported that they do not use their mobile phones as soon as they get up from bed in the morning, 13 students (20.31%) admitted that they sometimes use them in the morning, while 21 students (32.81%) stated they do not use their mobile phones at all as the first thing in the morning. Although many studies have been conducted in the past to examine the effect of mobile phone use on sleep, the authors could find very little evidence regarding the impact of early morning mobile phone use on cognition. Nevertheless, published data suggest that early

morning use of devices is hazardous to health [19]. It can distract our minds with unwanted information, causing us to lose focus. Furthermore, if we get distracted in the early morning, it can alter brain wave patterns, thereby impairing our learning and memory.

The results of the present study indicate that more than 50% of students use mobile phones or other electronic gadgets for studying and frequently use them between classes; however, overall mobile phone use has not affected their attention span or academic performance. One existing study suggests that mobile phone usage negatively affects academic performance [20]. However, research conducted by Zogheib B et al., did not find any negative impact of mobile phone use on students' academic performance [21].

Limitation(s)

The sample size was small, and results need to be obtained from a larger student population. Academic performance was assessed to evaluate cognition; however, no other cognitive assessment scale was used.

CONCLUSION(S)

The present study indicates that mobile phone use has not affected academic performance among undergraduate medical students. Most students reported starting to use mobile phones between the 10th and 12th standards, and the majority wore either glasses or contact lenses. There was a common trend of using mobile phones regularly before going to sleep, and many of them used their phones as the first thing in the morning. However, the daily hours of mobile phone usage for most students were only between 2-4 hours.

Such studies can certainly assist educators, academicians, and parents in preventing mobile addiction among adolescents. Mobile phones have become an inseparable part of our lives and an integral component of education in universities. They can offer significant benefits if used judiciously by students, which could lead to improved academic performance.

This study suggests that mobile phone use can be restricted in classes, and students should be counselled to engage in yoga and meditation in the early morning rather than using their phones and to avoid using phones before going to bed. Encouraging library visits and the use of books instead of digital media for learning would also be beneficial. Thus, a comprehensive strategy can be developed to enhance student performance and help them excel in their fields.

However, since the results were statistically insignificant, the authors recommend exploring similar studies in the future with a larger sample size.

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PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Physiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India.
2. Medical Student, Department of Physiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Mitali Kumbhar,
Medical Student, Department of Physiology, Dr. D. Y. Patil Medical College,
Hospital and Research Centre, Pimpri, Pune, Maharashtra, India.
E-mail: mitaimk04@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Aug 17, 2024
- Manual Googling: Feb 22, 2025
- iThenticate Software: Feb 25, 2025 (13%)

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