

# Rethinking Screen Time During COVID-19: Impact on Sleep and Academic Performance in Physiotherapy Students

Isha Akulwar-Tajane<sup>1\*</sup>, Ayushi V Shah<sup>2</sup>, Palak H Naik<sup>2</sup>, Kashish K Parmar<sup>2</sup>

<sup>1</sup> Neuro Physiotherapy Department, K. J. Somaiya College of Physiotherapy, Mumbai, India

<sup>2</sup> III BPTH Student, K. J. Somaiya College of Physiotherapy, Mumbai, India

## Email Address

drishasa@yahoo.co.in (Isha Akulwar-Tajane)

\*Correspondence: drishasa@yahoo.co.in

**Received:** 20 June 2021; **Accepted:** 15 July 2021; **Published:** 28 July 2021

## Abstract:

**Background:** Technology has advanced significantly within the past decade and along with that has come the ability to use a variety of devices for academic purposes. While this can make accessing information much easier and allow for new organizational methods, it can also provide the opportunity for more distractions. Sleep is fundamental to optimal functioning including health and behaviour. This paper describes the interrelations between screen use, sleep and academic performance. The purpose of this study was to explore technology use and its impact on sleep and academics in physiotherapy students in This novel pandemic lockdown and how the increased screen media usage and the uncertainty of the situation has an impact on their academic performance. We examined how this distraction potential can play a role in studying experiences and academic performance. A representative sample of 150 Physiotherapy students were surveyed to quantify technology use, sleep pattern, mental health and academic performance. Results: 73.3% of the population agreed that screen time did affect their sleeping pattern in the lockdown, 84.7% of the students conveyed that they could not perform study related activities optimally as per their academic capacity. 56.7% of the population also agreed that excessive screen time hindered their ability to perform academically well. Conclusion: This study provides preliminary insights into excessive screen time and its association with academic performance in Physiotherapy students.

## Keywords:

COVID-19 Pandemic, Screen Use, Sleep, Academic Performance, Physiotherapy Students

## 1. Introduction

The 21st century has been called the era of science and technology (and now data), especially with the new technology developments and advancements over the last few decades. In the world today, people cannot live without technologies such as

televisions, mobile phones, computers and others. The internet has proved to be a boon in this era of technology whereas the evolution of cellular phones has been one of the fastest in the history of innovation. [1] The legacy of these noteworthy milestones is captured by the popularization of the “smartphone” with > 950 million smartphone users in India alone. Internet use has increased with the prevalence of mobile devices and internet-based applications in education, health, social networking, entertainment, etc. For students it has made learning easier with the information available on the net and smartphones can be seen as a learning aid.

Technological advancements have impacted every one of us and can give us an edge in our personal and professional lives. During the past couple of decades, numerous studies in educational research have examined the role of technology in medical students. [2,3,4] It is observed that the scope of technology has been expanded with the innovative potential of digital devices in medical education, patient care, communication, and research. Use of mobile devices is widely adopted by the medical professionals, especially the young trainees with perceived benefits in education and health.

However, given the benefits of technology, there exist a number of negative effects too. [5,6] The increasing use of and dependence on the Internet brought to the surface a new public health concern near the start of the century “Internet Addiction Disorder,” which was eventually included in the Diagnostic and Statistical Manual of diseases (DSM-5) under conditions for further study. On the heels of this, [7] the close association between the internet and the smartphone led to the introduction of a new condition called “Smartphone Addiction,” and has become a more serious problem [7]. Reported in other terms like “Problematic Smartphone Use” and “Smartphone Use Disorder”, this is a behavioral addiction characterized by the presence of symptoms of tolerance, salience, mood changes, and dependence on smartphones.

In the academic realm, smartphone abuse to addiction is becoming a rapidly emerging issue because most students whether higher learning students or low-level students are addicted to applications found on smartphones. [8,9,10,11] Recent studies have revealed a high prevalence of smartphone addiction in university students, ranging from 34% to 40% in medical students across different states of India. With regards to impact of smartphone use on academics, research has been controversial as some studies report positive results, whereas others find use of smartphone addiction as a hindrance to academic activities and overall growth and performance. Explicitly the debate in the literature is operationalized by the particular patterns of smartphone-related behavior concerning the relationship between amount of screen time or amount of smartphone use with academic performance. Despite some apparent benefits, [12,13,14,15,16,17] the majority of the research has shown that smartphone use interferes with academic activities, such as studying and reading books, hence having negative consequences on academic performance. It is yet to be proven that screen time can significantly enhance academic performance, but it is known that increased use in screen time distracts students from focusing on study activities. Excessive smartphone and internet use can lead to anxiety, attention deficits, poor quality of life, and poor academic growth. In addition, sleep, learning capacity and mental well-being can be postulated to be affected by media use and can in turn lead to poor academics.

Problematic screen time refers to online consumption patterns which are accompanied by symptoms of excessive exposure to screen. A core component of problematic use of any screen media is that use must cause dysfunction in a person's life. [18] For university students, a key area of functioning is their academic performance. [19,20,21,22] In our nascent understanding from the literature of the way technology and mobile devices may be affecting students, focus has been mostly directed toward social media use (controlling for specific applications) and psychological outcomes. Currently, less is known about how addictive use of phones in general (cell phone use outside of the college environment, and beyond the use of specific applications such as social media apps), may affect academic outcomes in university students.

In order to further understand the extent and method of protrusion into academic functioning that mobile device usage has, it is important to understand the effect that these devices may be having beyond specific contextual circumstances (i.e. smartphone use during the college day) and app usage. The ubiquity of media multitasking among today's students raises concerns about its consequences and outcomes in relation to student learning and cognition. Although statistics surrounding screen time during the COVID-19 pandemic have yet to be published, more people are confined to their home and using technology to proceed with life. [23] Some preliminary reports indicate that there has been a drastic increase in the screen time usage during the lockdown which can be predicted to be over and above the impact of college day social media use as focused in the previous studies. Additional information in this area may be helpful for educators who are looking to determine the appropriate course of action for students.

Also due to significant disruption in routine, nocturnal media use has been increased. Screen time at night keeps adults from falling asleep and sleeping well due to cognitive stimulation and sleep deprivation. High amounts of screen time can significantly affect a person's mental health. [24,25,26] This time spent sitting and viewing a screen has been linked to mental health effects such as anxiety and depression. With this added risk, lack of sleep plays a major role in a healthy mindset, but without proper rest, mental health can degrade at a higher risk. Over the last 3 months of the COVID-19 pandemic sleep changes are just one of the innumerable daily activities that have been impacted by the virus. [27] Anxiety spurred on by the pandemic, seeping into dreams, and messing up sleep patterns is a common occurrence for millions of adults globally, according to the preliminary surveillance reports. This is of concern, since sufficient sleep is crucial for healthy somatic, cognitive and psychological well-being.

Confined in homes during COVID-19 lock down, we are living through a period where technology is in many regards the only connection to normalcy. It means using technology to move forward when life seems to be on pause. After all, screens are the reason why students can still pursue their education, continue study work, and keep in touch with friends and family when they can't leave their homes. While some forms of technology may have made positive changes in the world; mainstream media and researchers alike have raised the possibility that people can become addicted to smartphone use. This is worth drawing attention to, though, considering the widely established consequences excessive screen time can have on someone's sleep, mental and physical health.

The explosion of technology and excessive screenification in this unprecedented situation has many apprehensions about the pandemic's negative impact on this vulnerable population of young adults. Given the recency of the pandemic, academic studies related to this technological infiltration do not yet exist. From the educator's perspective, this study aims to investigate the effects of excessive mobile-phone use and screen time on learning capacity of students during COVID-19 pandemic lockdown. The purpose of this study is to research how access to screens, such as smartphones, tablets and computers, can act as a distraction potential and play a role in studying experiences. Taking into consideration the mediating effect of sleep pattern and mental health of students on learning abilities, these factors are also analyzed for a comprehensive assessment. The specific objectives outlined in this study are:

- a. To analyze the pattern of digital device use during lockdown
- b. To analyze the impact of technology use on learning capacity

## 2. Methods

It was a cross-sectional qualitative study conducted during COVID-19 lockdown period (April to June 2020). Ethical clearance was obtained from the institutional review board of K.J. Somaiya college of Physiotherapy, India. All the undergraduate (I –IV year) Physiotherapy students, interns, postgraduate students enrolled at the academic institute - K J Somaiya College of Physiotherapy, Mumbai, India were invited to participate in an online survey. The participants were also informed about the voluntary nature of participation and that non-participation would not bear any academic consequences. An electronic consent was obtained from the students for participation. Participants were excluded if (a) had any health problem that temporarily or permanently prevented participation in physical activity; (b) used any type of medication that could induce changes in the study variables (e.g., opioids or antidepressants). The target population was recruited by a non-randomized convenient sampling method and is representative of students available on social media platforms. Sample size was not estimated prior to the study; however, a maximum number of participants was desirable as well as anticipated in view of relevance of this topic to students in the current situation; and the beneficial use of social media as a method of data collection.

A questionnaire was developed de-novo as a part of this study. The questionnaire includes student's academic profile details and other sociodemographic and behavioral characteristics including age, gender, etc. Students self-reported their usage pattern of any screen-based mobile device (mobile phone, tablet, laptop, television, etc.). The questionnaire also sought to obtain perspectives of students on the impact of screen use on their sleep pattern and mental well-being. Sleep variables were derived from self-reported sleep patterns pertaining to sleep latency, sleep duration, use of sleeping medication, daytime dysfunction, and quality of sleep. Status of mental well-being was inferred from various mental and physical health symptoms reported by the participants.

The questionnaire is self-administered and in English language. It is semi-structured with a combination of open and close ended-questions (includes multiple choice and ranking Likert-scale style questions). Content validity of the questionnaire was established from two experienced Physiotherapy faculty. The questionnaire was distributed to the participants as Google forms via social media on Whatsapp; and was

emailed, if requested by them. Link to the forms was available to them for a period of one week. Reminders were sent to ensure maximum participation. Data thus collected was subjected to analysis.

Data reported in this study are a part of a wider project designed with multiple purposes regarding the impact of screen time in Physiotherapy students; and other data with different purposes will be presented elsewhere.

### 3. Data Analysis and Results

All the responses obtained via Google-forms were screened. Inaccurate or incomplete responses were discarded from the analysis. The close-ended data was analyzed automatically using Google spread- sheet and descriptive statistics using percentage and frequency distribution was performed. The open-ended questions were analyzed using categorization and thematic analysis.

Approximately one third of the invited participants completed the survey. A total number of 150 completed forms were analyzed. This study sample is representative of students from all academic years from I BPT<sub>h</sub> to IV BPT<sub>h</sub> and interns and postgraduate students with majority being from the II BPT<sub>h</sub>. The age of the participants was  $20.15 \pm 1.46$  years (mean  $\pm$ SD) and 92% were females.

Screen time is the amount of time that is spent using a device such as a smartphone, computer, television, tablet, iPhone, laptop, or video game console. [28] Table 1 and accompanying pie charts (Figure 1 and Figure 2) show the usage pattern of digital devices during the lockdown by study participants.

*Table 1. Usage pattern of digital devices in the lockdown by the participants.*

Mobile phone	Tablet	Laptop	Computer	Video game console	Television
98%	7.3%	28%	3.3%	1.3%	48.7%

All the participants reported using at least one screen based mobile device, smartphone being the commonest device followed by television and other portable digital devices. It can be seen that with the evolution of mobile phones to smartphones and by encompassing all of the internet features and mobile applications, the technological usage discussed above have been shifting gradually to smartphones. Multiple device use in varied combinations is also reported by the participants.

For 94.7% students screen time use had increased during the lockdown, the extent of increase being moderate (51-75%) or high (>75%) for nearly two thirds of the population. 43.3% of student participants spent more than 6 hours on digital devices on a daily basis. Due to significant disruption in routine during lock down, nocturnal media use has also been increased. The vast majority of students have access to the internet, and many have social media profiles. Participants reported using screen time for many activities ranging from entertainment (40%), educational purposes (34%) and social networking and communication (30.6%).

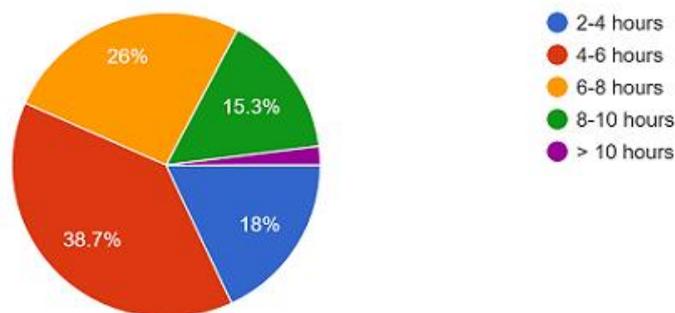
These findings are in accordance with some preliminary reports suggesting that during the pandemic Tech use has increased tremendously among the younger generation and students. With more people having to stay at home, people's use of the internet for entertainment and social networking accelerate globally as evident from the statistical metrics published by various commercial media agencies such as YouTube, Zoom, Amazon, Netflix, Facebook, digital game distributors, etc. and other national broadband networks and mobile applications.[29,30,31] In the current

situation of social distancing, we can harness our capacity to interact socially online to enable social support and social connectedness, and tackle loneliness, whilst physically distancing ourselves from others. Research shows that social media and video games provide temporary escape from real life and offer valuable social engagement.

Strict nationwide lockdown for the COVID-19 closed educational institutions which adopted online classes to continue learning. Logged out of the classroom, embrace of technology for digital education and the internet in particular has been a savior for the students. As per the previous academic schedule, most of the aspirants have gone through the complete syllabus and are in revision mode. It is an unusual situation for university students to have some free time in hand. Students can utilize this time to prepare for the exams and for the further academic process. Under the extended COVID-19 lockdown, while there is anxiety in the atmosphere, there is also potentially a quiet time for contemplation and for a focus on personal growth. Students can find themselves staring at an opportunity to work on themselves, to work on a self-development plan. Students are using technology to proceed for their educational goals and learning activities such as note-taking, studying and researching. Use of screen time for personal and professional skill development activities as reported by 34% of the students is a promising behavior reflecting adult learning characteristics. Adding to its positive side, students also reported that they became more tech savvy.

2. How many hours in a day do you spend actively on your digital device?

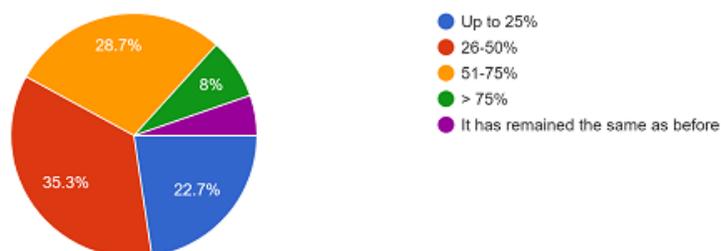
150 responses



**Figure 1.** The following pie chart depicts the number of hours spent on the digital devices by the participants.

3. During lock down by how much percentage has your average screen time increased than before?

150 responses



**Figure 2.** The following pie chart shows by how much the screen time has increased during the lockdown.

This recent emergence of electronic based learning activities provides novel learning opportunities, but may also have unintended consequences on concentration, motivation, attention, sleep and overall physical and mental health of students.

According to the study 84.7% of the students were unable to perform academic activities to their optimal capacity in the COVID-19 lockdown period. The factors enlisted by them were lack of concentration and focus (60.7%) and lack of motivation to study along with some other factors as discussed below. 56.7% of the students opined that smartphone use was problematic as screen usage has affected their academic performance.

Mobile phone multitasking is widely considered to be a major source of distraction in academic performance [32]. Multitasking may impair learning through rapid use of the limited capacity of learners' information processing channels, especially attention processes, leaving insufficient space for meaningful learning. This is based in information processing theory, the scattered attention hypothesis, and bottleneck theory in which attention is a limited resource [33,34].

The adverse effect of smartphone multitasking on academic performance may be explained by the cognitive overload concept [35] whereby non-academic multitasking in learning contexts aggravates the problem [36] but does not reduce the cognitive load [35]. Another possible explanation is that smartphone multitasking while studying inhibits metacognition and self-regulation and hinders the implementation of an appropriate learning strategy [37], which is essential to learning in general and to distinctive academic performance in particular [38]. It is evident that smartphone multitasking that is not related to learning while in the process of learning impedes cognitive processes required for learning [37,39], thus causing academic performance to decline [40,41], even for distinguished students [42]. Students who are in a state of accepting interruptions by smartphone notifications while learning and responding to them by switching tasks interrupt their learning processes and shift their mental resources to Non-academic tasks [43], which results in a loss in learning flow. During the study concentration of mobile phone learners is continuously interjected by the different notifications from different applications actively working in their phones and thus may affect students' learning commitment.

Although not extensively researched in adults, an increase in screen time has been associated with negative cognitive outcomes for children between 0 and 4 years. Previous studies have reported slower brain development, poor connectivity between language, visual and cognitive control regions of the brain, and skills like imagery, mental control and self-regulation. [44] Cognitive imaging studies have found that spending too much screen time will lead to less efficient information processing and thus overall impaired cognitive function. Recently, attention has been given to academic self-efficacy in educational psychology as an influential factor to enhance academic performance. [45,46,47] Previous studies have examined academic performance by tests or learning outcomes with objective evaluation methods such as grade point average. In this study, it is observed from students' narratives that self-efficacy, achievement motivation and goal-directed efforts have been affected by excessive screen time.

Prior research on excessive screen media or smartphone use typically employs the amount of time spent on smartphones or apps as the sole indicator of excessive use. [48] However, recent conceptualizations of excessive use are based on symptoms of addiction to or dependence on screen media and problems in functioning; and offer an

alternative way to quantify problematic phone use. Specifically, the inclusion of Internet Gaming Disorder (IGD) in the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5; American Psychiatric Association [APA], 2013) [49] provides a set of nine symptoms that captures disordered gaming (video game addiction) and other screen-media addictions such as Social Media Dependence. [50,51] Smartphone addiction is measured with these nine symptoms: tolerance (needing to use Smartphone for longer amounts of time to get same effect), withdrawal, preoccupation, loss of interest in other activities, difficulty controlling use, conflict over use, using smartphone to escape problems or negative affect, deception, psychosocial problems due to use, and substantial conflicts with others (impacting one's relationships) due to use. In view of the recent upsurge in technology use in the pandemic situation, sociologists, media theorists and technology experts have argued that digital technology is distracting us, resulting in negative social and emotional consequences.

The majority of the participants admitted that they developed media addiction during this lockdown phase. Stated below are some of the quotes from the participants which indicate a trend towards media addiction and lack of self-control:

P16: *"I feel the urge to constantly check my social networking apps, keep messaging."*

P71: *"I have become addicted to my Phone. I feel the need to check it in a while."*

P98: *"I reflect on what I have seen continuously."*

P103: *"Due to stress of studies I tend to check phone often as an escape"*

As more students enjoy exploring their smartphones in their free hour, an increasing reliance on cell-phones among young adults and college students may signal the evolution of cell-phone use from a habit to an addiction in this lockdown situation. Though we did not employ any smartphone addiction scale, this compulsive nature of checking smartphones frequently indicates a trend towards smartphone addiction. Smartphone users also reported feelings of extreme anxiety and cognitive delays on separation from their smartphones. Similar to other addictions (substance and behavioral), excessive and addictive smartphone use has been linked to life stress, lower self-efficacy, higher perceived stress, high internal locus of control, materialism, and internet addiction. [52]

Participants were aware that they were wasting their time in using digital devices and compromising their study time at the expense of mobile use for other activities instead and resulting in lack of energy at the end for studies. They opined that mobile usage for entertainment such as watching movies, TV serials, playing games was more attractive than studying and also that their social media use has increased during lockdown. Thus, it can be stated that smart phone use inadvertently steals away students' time which affects their academic performance adversely.

P43: *"After being continuously engaged in doing other activities which is more easier and attractive than studies, there is less motivation to study"*

P27: *"I very easily get distracted. While studying I keep checking my phone or tablet which breaks the consistency. Also, the brain cannot function optimally as it feels exhausted."*

From these observations it is evident that students have low-level of self-regulated learning as well as low level of flow when studying. Lack of self-control and motivation, lack of seriousness to studies and increased procrastination with displacement of study related activities was identified by participants as a significant barrier to their studies. These findings are in accordance with the previous literature in university students. [53,54,55,56,57,58,59] Students are constantly interrupted by other applications on the phones when they are studying, and do not have enough control over their smartphone learning plan and its process. [37] An Africa-based study showed that excessive use of the smartphone in graduate students was associated with excessive procrastination, distraction, poor academic scores, and worsened grammatical and linguistic accuracy. [60] It is observed that screen media usage interferes with academic activities, such as studying and reading books, hence having negative consequences on academic performance.

With respect to the use of digital devices for study purposes, some participants found that online learning mode was difficult for them. Few other problems reported are:

P89: *“Due to use of digital devices for learning, my writing speed and concentration has been affected, I can't sit for studies for more than 3 hours.”*

P92: *“Major study materials are on the phone and interest to read from books has reduced.”*

P78: *“I use phone for PDFs of some subject books but get distracted by notifications”*

Only two participants reported that digital device use was helpful for studies as they mentioned *‘it made different learning options available’* and *‘gave a positive mindset during this uncertain situation’*.

It is yet to be proven that screen time can significantly enhance academic performance, but it is known that increased use of screen time, social media and other random applications distract students from focusing on study activities. Few studies have attempted to determine the effect of use of screen time for social communication platforms and academic performance in students. Grosbeck et al, in their study found that the majority of students spend significant time on Facebook more for social uses and less for academic purposes. [61] A research on university students found that Facebook users had lower Grade Point Averages and they were online most of the time and utilized very less time for their studies in comparison with students who did not use Social Networking Services (SNS). Only 26% of students reported that SNS impacted positively and helped to grow in their lives and 74% said that it had adverse impacts like procrastination, lack of concentration or distraction and poor time management. [62] Paul et al reported a statistically significant negative relationship between time spent by students on online social networking and their academic performance. The time spent on SNS was found to be heavily influenced by the attention span of the students. [63] Among college students, research has shown that certain behaviors such as instant messaging does predict poor academic performance, per student self-report. [64] Contradictory results emerge concerning different device use such as smartphone versus computer use or use of portable devices versus television. What appears to need further exploration is how different behaviors related to screen usage can impact academic performance both negatively and positively, and how students attempt to overcome the negative consequences to be more successful.

When asked about *if and how they regulate screen time use*, only 18 % reported that they keep a track of screen use every day, some of them use mobile based applications such as *digital well-being* for the same. Good technology behavior was practiced by few as they replaced some of the unnecessary usage with physical activity (35.3%) or with family get-together (52.7%) and did not use it while studying (0.7%).

In addition to distracting the students from study related tasks, excessive hours spent in front of the screen also has a major effect on one's sleep and can affect one's physical and mental well-being. [65] These additional factors operating simultaneously in a dynamic way can be postulated to affect students' learning abilities as discussed below in the subsequent paragraphs.

Majority of the student participants reported a change in their sleeping pattern and quality and also encountered various sleeping problems as summarized in Table 2.

**Table 2.** Sleep problems reported by the participants.

Sleep problems	Percentage of Participants
Sleep more	53.3%
Sleep less	4.7%
Altered sleep-wake cycle	56.7%
Irregular sleep-wake cycle	30.7%
Problems to fall asleep	31.3%
Restless sleep	16.7%
Involuntary awakenings during night	12%
Too early morning awakenings	8.7%
Awake from sleep with palpitations in chest feeling heart pound or beat irregularly	4.7%
Need to take medication for sleeping	1.3%

Sleep is a biological imperative critical to the maintenance of mental and physical health. It is a state of lessened consciousness and decreased physical activity during which the organism slows down and repairs itself. [66] Good sleep hygiene is crucial for cognitive processes, including sustained attention and memory. Among adolescents, poor sleep hygiene is associated with poor academic performance. [67] More agreement is found in literature regarding the direct topographical link between sleep time and academic achievement. [68,69] Since sleep plays a significant role in the cognitive processes as well as physical and mental health, [70,71,72] sleep deprivation can affect the academic performance of medical students. Many studies in the United States, Australia, India and other countries have found that students with a poor sleep quality have poor marks on their examinations and were more depressed than their colleagues. [73,74,75] Present study also contributes to confirming this international trend, by informing new profiles unknown so far in the physiotherapy student population. Around 52% people admitted that excessive screen use has affected their sleep quality and linked it to sleeping problems such as reduced sleep durations with mobile phone use-awakenings.

As well as negatively impacting the adult sleep cycle, using screens can also affect one's physical health. 87.3% participants reported one or more health symptoms as shown in Table 3.

**Table 3.** General health problems reported by the participants.

Symptom	Percentage of participants
Lack of concentration	60.7%

Tiredness	44%
Lack of energy	42%
Eye strain	32%
Headache	31.3%
Weight gain	29.3%
Exhaustion	26%
Body pain	22.7%
None	12.7%

Feeling of daytime tiredness (44%), more exhaustibility (26%), lack of energy (42%) along with less motivation (65.3%) could be interfering not only with their normal daily activities but with academic performance as well. 48% of the students believe that excessive hours spent in front of the screen has affected their physical well-being. (Effect of screen time use on mental and physical health of physiotherapy students is conducted along with this study, results of which are presented elsewhere). [76] A Saudi Arabian study found that 44.4% of the medical student participants attributed their headaches, decreased concentration, memory loss, hearing loss, and fatigue to the use of their mobile phones. With regard to their academic performance, 13.3% considered that use of a smartphone had a bad effect (according to their grade-point average), 15.8% a good effect and 70.8% no effect.

Digital eye strain is the most frequent symptom linked to technology addiction which includes dry eyes, headaches, blurred vision, burning, itching, difficulty focusing and pain in the neck and shoulders. [77] In the present survey, 32% participants reported eyestrain and headaches and implicated it to be affecting their learning capacity. Reading the smaller fonts on a smartphone and tablet devices, as employed by the survey participants can cause significantly more eye strain as compared to larger Screen-based devices such as laptops and computers. A few key considerations around technology use can help to counteract the side effects caused by its overuse. Apart from limiting screen time, some other recommendations include adjusting lighting, display settings, using screen filter, taking a “20-20-20” break and focusing on distant object, etc. In this study, only 22.7% participants practiced intermittently focusing on distant objects, 28.7 % reported use of mobile app that filters out blue light, whereas 42.7% used it in a dark room. Predominant use of small screen devices, nocturnal use, and inadequate precautionary measures could be the contributing factors to eye strain in this sample.

An alarming number of participants reported to have experienced various mental health issues during lockdown (Table 4). Restlessness, uncertainty of the whole situation, COVID-19 crisis, uncertainty of exams, emotional imbalance, overthinking, etc. were their subjective feelings. There are some studies in medical students which found an association between psychological distress, mental illness and academic performance. [78,79]

**Table 4.** Mental health issues reported by the participants.

Symptom	Percentage of Participants
Mood swings	67.3%
Less motivation	65.3%
Frustration	53.3%
Mental breakdown due no specific reason	38.7%
Anxiety	38.7%
Social isolation	22%
Depression	15.3%

None	8.7%
Scared/panic	0.7%

#### 4. Discussion

This is one of the few cross-sectional studies on electronic media use and sleep which included smartphone use. As an asset of this design, we were able to explore different exposure-response relationships to draw inferences from electronic media use to sleep problems, mental well-being and academics. The present study contributes to the growing literature highlighting the negative effects of excessive screen use, in particular its association with sleep outcomes and mental health. In addition, this study sheds some light on the effect of screen use on cognitive and educational aspects. An important highlight of this study is that it addressed academic performance which is relevant for the student population. To our knowledge, this is the first study which has explored the impact of digital device use on Physiotherapy students in the context of this pandemic lockdown.

Though this study did not assert causation between the high risk of smartphone addiction and academic performance, some points emerged from the study's context and the data that suggest causation. Building on the findings of previous studies, our findings highlight as to how students perceive screen usage negatively impacts their academic performance. They reported it as a distraction and an obsessive habit, and something that contributes to poor sleep hygiene and mental and physical health. In particular, it was noted that a click access to the internet including messaging, more than the devices themselves, was a big factor in becoming distracted.

One of the strengths of this study is that it explored the effect that these devices may be having beyond specific contextual circumstances (i.e., smartphone use during the college day) and app usage. In the current pandemic situation of home quarantine and more free time available with the students, these findings provide a pattern of screen use that could be considerably different than at other situations as studied previously in the literature.

Owing to the mixed opinions of the study participants it is difficult to determine whether this shift in technology use will have beneficial or harmful consequences on academic performance. This question is particularly poignant in graduate or postgraduate physiotherapy students where the cognitive and educational outcomes of technology use are not well studied. At present, this study analysis conducted during a limited period of lockdown does not permit to predict future academic performance in regular curriculum settings. We recommend future longitudinal studies to determine its long-term effect. Nonetheless, our study suggests that addictive phone use is a distinct risk factor for poorer academic performance in Physiotherapy students.

We acknowledge several limitations of the study. Particularly, the lack of objective screen time data is of concern. Students self-reported information on media use and sleep variables and health might generally be biased by recall and subjectivity. A promising approach for future epidemiological research might be the objective assessment of sleep and health variables, as well as mobile phone use via mobile applications. Also, uncertainty due to various psychosocial factors during the pandemic situation has resulted in various mental health issues in the general population. Owing to the complex interaction of the multiple factors viz. screen time, sleep, mental health and physical health we cannot separate the individual contribution of each factor. Excessive screen time as a contributor to sleep problems,

academics and other issues thus needs to be interpreted in a broader context. Loss in the mental and physical health, in turn, might have affected the quality of sleep and academic efficiency. Also, cross sectional nature of the study precludes causal inferences on the associations among their screen media use, sleep time, academic performance and some socio-demographic variables and limits the possibility to determine changes over time in all these variables. Also, other studies have found consequences that differ according to the type of media used. We recommend future longitudinal studies to further explore this dynamic relationship and consider the multiple factors. Some students also reported to have developed poor self-control over media use. Thus, identifying predisposing individual traits and characteristics of the technology use may help discern students whose technology habits most likely indicate problematic use. In addition, age, gender and socioeconomic status are associated to screen media usage and academic performance. These demographic and other factors need to be considered in future studies on Physiotherapy students.

## 5. Conclusions

This study provides preliminary insights into excessive screen time and its association with academic performance in Physiotherapy students. These findings are useful, not only for exploratory purposes, but also for information on behavior patterns that may contribute to establishing recommendations about the timing and duration of the screen media usage in physiotherapy students and the appropriate sleep time needed to meet academic demands successfully. In addition, these findings may contribute to improving interventions targeted to affect behavior change and increase academic performance.

## 6. Implications

While screen usage can be productive in students' lives, positively influencing studying and academic performance, it can also be a distraction and become an unhealthy and damaging habit. Strategy to overcome the negative aspects of screen usage is overwhelmingly the need for self-control. As internet access continues to have a bigger role in students' lives, striking a balance that optimizes academic usefulness while minimizing the drawbacks will be imperative for student success. Helping students to become more self-aware of the need for a balance and self-control provides a unique opportunity for collaboration among student leaders, instructors and administrators. These study findings provide a starting point to overcome this growing challenge.

Students obligated to view screens for a means of studies may not be able to use screen time less than recommended, but there are other recommendations that help mitigate negative health effects. Instead, we encourage smart use of technology that takes advantage of its conveniences and counteracts the side effects caused by overuse. Through this study, we aim to implement better and healthier practices by sensitizing students about the negative effects, encouraging better bedtime routines, and limiting the device use for academic purposes with alternative sources and strategies.

We would like to conclude with a statement by a participant

P35: *“Some entertainment with learning should be promoted for being mentally healthy and studying at the same time, especially during this crisis”.*

We recommend students to utilize the screen time productively!

## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

## Author Contributions

All the authors have nearly equal contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work; drafting the work, revising it critically for important intellectual content; and final approval of the version to be published. Specific contribution of Isha Akulwar-Tajane is in data analysis and interpretation. Other three authors contributed to the acquisition of data. All authors have read and approved the manuscript.

## Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

## Acknowledgments

The authors acknowledge the valuable contribution of student participants; and support of the principal and research committee of the institute in the conduct of the study.

## References

- [1] Telecom Regulatory Authority of India, Telecom Subscription Data as on 30th April, 2016, Ministry of Telecommunication, Government of India, 2016. Available online: <https://www.trai.gov.in/notifications/press-release/press-release-telecom-subscription-data-30th-april-2016> (accessed on 27 June 2021).
- [2] Greenhalgh, T. Computer assisted learning in undergraduate medical education. *BMJ*, 2001, 322 (7277), 40-44.
- [3] Bridge, P.D.; Jackson, M.; Robinson, L. The effectiveness of streaming video on medical student learning: a case study. *Med Educ Online*, 2009, 14, 11.
- [4] Wong, G.; Greenhalgh, T.; Pawson, R.; Internet-based medical education: a realistic review of what works, for whom and in what circumstances. *BMC Med Educ*, 2010, 12, DOI: <https://doi.org/10.1186/1472-6920-10-12>.
- [5] American Psychiatric Association, Diagnostic and statistical manual of mental disorders. Available online: [https://www.psychiatry.org/psychiatrists/practice/dsm\\_](https://www.psychiatry.org/psychiatrists/practice/dsm_) (accessed on 27 June 2021).
- [6] Young, K.S. Internet addiction: The emergence of a new clinical disorder. *Cyberpsychology and Behavior*, 1998, 1, 237-44.
- [7] Griffiths, M. A 'components' model of addiction within a biopsychosocial framework. *J Subst Use*, 2005, 10, 191-7.
- [8] Mangot, A.G.; Murthy, V.S.; Kshirsagar, S.V.; Deshmukh, A.H.; Tembe, D.V. Prevalence and Pattern of Phantom Ringing and Phantom Vibration among Medical Interns and their Relationship with Smartphone Use and Perceived Stress. *Indian J Psychol Med*, 2018, 40(5), 440-445.

- [9] Nikhita, C.S.; Jadhav, P.R.; Ajinkya, S.A. Prevalence of mobile phone dependence in secondary school adolescents. *J Clin Diagn Res*, 2015, 9, VC06.
- [10] Jamir, L.; Duggal, M.; Nehra, R.; Singh, P. Grover S, Epidemiology of technology addiction among school students in rural India. *Asian J Psychiatr*, 2019, 40, 30-8.
- [11] Nowreen, N.; Ahad, F. Effect of smartphone usage on quality of sleep in medical students. *Natl J Physiol Pharm Pharmacol*, 2018, 8, 1366-70.
- [12] Elhai, J.D.; Dvorak, R.D.; Levine, J.C.; Hall, B.J. Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of affective disorders*, 2017, 207, 251-9.
- [13] Kardefelt-Winther, D. A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior*, 2014, 31, 351-4.
- [14] Boumosleh, J.; Jaalouk, D. Smartphone Addiction among University Students and Its Relationship with Academic Performance. *Global Journal of Health Science*, 2018, 10(1), 48-59.
- [15] Duke, É.; Montag, C. Smartphone addiction, daily interruptions and self-reported productivity. *Addictive Behaviors Reports*, 2017, 6, 90-5.
- [16] Misra, S.; Cheng, L.; Genevie, J.; Yuan, M. The iPhone Effect: The Quality of In-Person Social Interactions in the Presence of Mobile Devices. *Environment and Behavior*, 2014, 48(2), 275-98.
- [17] Rotondi, V.; Stanca, L.; Tomasuolo, M. Connecting alone: Smartphone use, quality of social interactions and well-being. *Journal of Economic Psychology*, 2017, 63, 17-26.
- [18] Domoff, S.E.; Borgen, A.L.; Foley, R.P.; Maffett, A. Excessive use of mobile devices and children's physical health. *Human Behavior and Emerging Technologies*, 2019, 2, 169-175.
- [19] Felisoni, D.D.; Godoi, A.S. Cell phone usage and academic performance: An experiment. *Computers & Education*, 2018, 117, 175-187.
- [20] Giunchiglia, F.; Zeni, M.; Gobbi, E.; Bignotti, E.; Bison, I. Mobile social media usage and academic performance. *Computers in Human Behavior*, 2018, 82, 177-185.
- [21] Paul, J.A.; Baker, H.M.; Cochran, J.D. Effect of online social networking on student academic performance. *Computers in Human Behavior*, 2012, 28, 2117-2127.
- [22] Wentworth, D.K.; Middleton, J.H. Technology use and academic performance. *Computers & Education*, 2014, 78, 306-311.
- [23] Sebire, K. The coronavirus lockdown is forcing us to view 'screen time' differently. That's a good thing The Conversation April 13, 2020. Available online: <https://theconversation.com/the-coronavirus-lockdown-is-forcing-us-to-view-screen-time-differently-thats-a-good-thing-135641> (accessed on 27 June 2021).
- [24] Cao, H.; Qian, Q.; Weng, T.; Yuan, C.; Sun, Y.; Wang, H. Tao F Screen time, physical activity and mental health among urban adolescents in China. *Journal of Preventive Medicine*, 2011, 53(4-5), 316-320.

- [25]Babic, M.; Smith, J.; Morgan, P.; Eather, N.; Plotnikoff, R.; Lubans, D. Longitudinal associations between changes in screen-time and mental health outcomes in adolescents. *Journal of Mental Health and Physical Activity*, 2017, 12, 124-131.
- [26]Maras, D.; Flament, M.; Murray, M.; Buchholz, A.; Henderson, K.; Obeid, N.; Goldfield, G. Screen time is associated with depression and anxiety in Canadian youth. *Journal of Preventive Medicine*, 2015, 73, 133-138.
- [27]Morin, C.; Carrier, J. The acute effects of the COVID-19 pandemic on insomnia and psychological symptoms. *Elsevier Public Health Emergency Collection*, 2021, 77, 346-347.
- [28]Definition of Screen Time. Available online: <https://www.merriam-webster.com/dictionary/screen%20time> (accessed on 9 November 2019).
- [29]Winther, D.; Byrne, J. Rethinking screen-time in the time of COVID-19. Available online: <https://www.unicef.org/globalinsight/stories/rethinking-screen-time-time-covid-19> (accessed on 7 April 2020).
- [30]Chanchani, M.; Mishra, D. Mobile apps' usage spikes in lockdown. The times of India Business. Available online: <https://timesofindia.indiatimes.com/business/india-business/mobile-apps-usage-spikes-in-lockdown/articleshow/75148768.cms> (accessed on 15 April 2020).
- [31]Brand Wagon Online Amazon and Netflix witnessed more than 60% growth in subscriber base during lockdown: Velocity MR Study, Financial Express. Available online: <https://www.financialexpress.com/brandwagon/amazon-and-netflix-witnessed-more-than-60-growth-in-subscriber-base-during-lockdown-velocity-mr-study/1965362/> (accessed on 20 May 2020).
- [32]Chen, Q.; Yan, Z. Does multitasking with mobile phones affect learning? A review. *Computers in Human Behavior*, 2016, 54, 34-42.
- [33]Maslovat, D.; Chua, R.; Spencer, H.C.; Forgaard, C.J.; Carlsen, A.N.; Franks, I.M. Evidence for a response preparation bottleneck during dual-task performance: Effect of a startling acoustic stimulus on the psychological refractory period. *Acta Psychologica*, 2013, 144(3), 481-487.
- [34]Van der Schuur, W.A.; Baumgartner, S.E.; Sumter, S.R.; Valkenburg, P.M. The consequences of media multitasking for youth: A review. *Computers in Human Behavior*, 2015, 53, 204-215.
- [35]Mayer, R.E.; Moreno, R. Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist* 2003, 38(1), 43-52.
- [36]Foehr, U.G. Media multitasking among American youth: Prevalence, predictors and pairings. Available online: <https://www.kff.org/other/media-multitasking-among-american-youth-prevalence-predictors/> (accessed on 20 May 2020).
- [37]Lee, J.; Cho, B.; Kim, Y.; Noh, J. Smartphone Addiction in University Students and Its Implication for Learning. DOI: 10.1007/978-3-662-44188-6\_40. Emerging issues in smart learning, 2015; pp. 297-305. Available online: [https://www.researchgate.net/publication/300020494\\_Smartphone\\_Addiction\\_in\\_University\\_Students\\_and\\_Its\\_Implication\\_for\\_Learning](https://www.researchgate.net/publication/300020494_Smartphone_Addiction_in_University_Students_and_Its_Implication_for_Learning) (accessed on 20 May 2020).

- [38]Hawi, N.; Samaha, M. To excel or not to excel: Strong evidence on the adverse effect of smartphone addiction on academic performance. *Computers & Education*, 2016, 98, 81-89.
- [39]Judd, T. Making sense of multitasking: The role of Facebook. *Computers & Education*, 2014, 70, 194–202
- [40]Ellis, Y.; Daniels, B.; Jauregui, A. The effect of multitasking on the grade performance of business students. *Research in Higher Education Journal*, 2010, 8, 1-10.
- [41]Karpinski, A.C.; Kirschner, P.A.; Ozer, I.; Mellott, J.A.; Ochwo, P. An exploration of social networking site use, multitasking, and academic performance among United States and European university students. *Computers in Human Behavior*, 2013, 29, 1182–1192.
- [42]Junco, R.; Cotten, S.R. No a 4 U: The relationship between multitasking and academic performance. *Computers & Education*, 2012, 59(2), 505–514.
- [43]Just, M. A.; Carpenter, P.A.; Keller, T.A.; Emery, L.; Zajac, H.; Thulborn, K.R. Interdependence of nonoverlapping cortical systems in dual cognitive tasks. *NeuroImage*, 2001, 14(2), 417e426.
- [44]Loh, K.; Kanai, R. How Has the Internet Reshaped Human Cognition? *Neuroscientist*. 2016, 22(5), 506-20.
- [45]Richardson, M.; Abraham, C.; Bond, R. Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychol. Bull*, 2012, 138, 353-387.
- [46]Robbins, S.B.; Lauver, K.; Le, H.; David, D.; Langley, R. Do psychosocial and study skill factors predict college outcomes? a meta-analysis. *Psychol. Bull*. 2004, 130, 261-288.
- [47]Honicke, T.; Broadbent, J. The influence of academic self-efficacy on academic performance: a systematic review. *Educ. Res. Rev*. 2016, 17, 63-84.
- [48]Domoff, S.E.; Borgen, A.L.; Foley, R.P.; Maffett, A. Excessive use of mobile devices and children's physical health. *Human Behavior and Emerging Technologies*, 2019, 2, 169-175.
- [49]American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (DSM-5). Arlington, VA: American Psychiatric Association. Available online: <https://www.psychiatry.org/psychiatrists/practice/dsm> (accessed on 20 May 2020).
- [50]Lemmens et al., 2015 J.S. Lemmens, P.M. Valkenburg, D.A. Gentile The internet gaming disorder scale. *Psychological Assessment*, 2015, 72, 567-582.
- [51]Van den Eijnden, R.J.J.M.; Lemmens, J.S.; Valkenburg, P.M. The Social Media Disorder Scale. *Computers in Human Behavior*, 2016, 61, 478-487.
- [52]Cheever, N.A.; Rosen, L.D.; Carrier, L.M.; Chavez, A. Out of sight is not out of mind: The impact of restricting wireless mobile device use on anxiety levels among low, moderate and high users. *Comput Hum Behav*. 2014, 37, 290-97.
- [53]Chiu, S.I. The relationship between life stresses and smartphone addiction on Taiwanese university students: A mediation model of learning self-efficacy and social self-efficacy. *Comput Hum Behav*. 2014, 34, 49-57.

- [54] Wang, J.L.; Wang, H.Z.; Gaskin, J.; Wang, L.H. The role of stress and motivation in problematic smartphone use among college students. *Comput Hum Behav*, 2015, 53, 81-8.
- [55] Samaha, M.; Hawi, N.S. Relationships among smartphone addiction, stress, academic performance and satisfaction with life. *Comput Hum Behav*, 2016, 57, 321-25.
- [56] Park, N.; Kim, Y.C.; Shon, H.Y.; Shim, H. Factors influencing smartphone use and dependency in South Korea. *Comput Hum Behav*, 2013, 29, 1763-70.
- [57] Lee, Y.K.; Chang, C.T.; Lin, Y.; Cheng, Z.H.; The dark side of smartphone usage: psychological traits, compulsive behavior and techno stress. *Comput Hum Behav*, 2014, 31, 373-83.
- [58] Sharma, A.; Sahu, R.; Kasar, P.K.; Sharma, R. Internet addiction among professional courses students: A study from central India. *Int J Med Sci Public Health*, 2014, 3, 1069-73.
- [59] Chittaranjan, G.; Blom, J.; Gatica-Perez, D. Proceedings of the 2015 ACM International Symposium on Wearable Computers, UbiComp '15: The 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing Osaka Japan September 7-11, 2015.  
Available online: <https://dl.acm.org/doi/proceedings/10.1145/2802083> (accessed on accessed on 20 May 2020).
- [60] Yeboah, J.; Ewur, G.D. The impact of Whatsapp messenger usage on students performance in tertiary institutions in Ghana. *J Educ Pract*, 2014, 5, 157-64.
- [61] Grosseck, G.; Bran, R.; Tiru, L. Dear teacher, what should I write on my wall? A case study on academic uses of Facebook. *Procedia - Social and Behavioral Sciences*, 2011, 15, 1425-1430.
- [62] Paul, J; Baker, H.; Cochran, J. Effect of Online Social Networking on Student Academic Performance. *Computers in Human Behavior*, 2012, 28, 2117-2127.
- [63] Junco, R.; Cotten, S. Perceived academic effects of instant messaging use, *Computers & Education*, 2011, 56, 370-378.
- [64] Brasel, S.A.; Gips, J. Media Multitasking Behavior: Concurrent Television and Computer Usage Cyberpsychology. *Behavior, and Social Networking*, 2011, 14(9), 14.
- [65] Al-Khani, A.M.; Sarhandi, M.I.; Zaghoul, M.S. et al, A cross-sectional survey on sleep quality, mental health, and academic performance among medical students in Saudi Arabia. *BMC Res Notes*, 2019, 12, 665.
- [66] Julian, L.; David F. Dinges A Meta-Analysis of the Impact of Short-Term Sleep Deprivation on Cognitive Variables. *Psychol Bull*, 2012, 136(3), 375-389.
- [67] Dewald, J.; Meijer, A.; Oort, F.J.; Kerkhof, G.A.; Bogels, S. The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents. *A meta-analytic review Sleep Medicine Reviews*, 2010, 14, 179-189.
- [68] Ratcliff, R.; H.P. Van Dongen. Sleep deprivation affects multiple distinct cognitive processes. *Psychon Bull Rev*, 2009, 16, 742-751.
- [69] Giri, P.; Baviskar, M.; Phalke, D. Study of sleep habits and sleep problems among medical students of pravara institute of medical sciences loni, Western maharashtra. *India Ann Med Health Sci Res*, 2013, 3, 51-54.

- [70] Alalageri, K.M.; Sobagaih, R.T. A cross sectional study to determine the sleep pattern and impact of sleep deprivation on the health and academics of medical students of BMCRI Bengaluru. *Int J Community Med Public Health*, 2017, 4, 3731-3734.
- [71] Abdulghani, H.M.; Alrowais, N.A.; Bin-Saad, N.S.; Al-Subaie, N.M.; Haji, A.M.; Alhaqwi, A.I. Sleep disorder among medical students: relationship to their academic performance. *Med Teach*. 2012, 3437-41.
- [72] Ahrberg, K.; Dresler, M.; Niedermaier, S.; Steiger, A.; Genzel, L. The interaction between sleep quality and academic performance *J Psychiatr Res*, 2012, 46, 1618-1622.
- [73] Vanderlind, W.M.; Beevers, C.G.; Sherman, S.M.; Trujillo, L.T.; McGeary, J.E.; Matthews, M.D. et al, Sleep and sadness: exploring the relation among sleep, cognitive control, and depressive symptoms in young adults. *Sleep Med*, 2014, 15, 144-149.
- [74] Short, M.A.; Gradisar, M.; Lack, L.C.; Wright, H.R. The impact of sleep on adolescent depressed mood, alertness and academic performance. *J Adolesc*, 2013, 36, 1025-1033.
- [75] Menon, B.; Karishma, H.P.; Mamatha, I.V. Sleep quality and health complaints among nursing students. *Ann Indian Acad Neurol*, 2015, 18, 363-364.
- [76] Al-Khlaiwi, T.; Meo, S.A. Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population. *Saudi Med J*, 2004, 25, 732-736.
- [77] Yan, Z.; Hu, L.; Chen, H.; Lu, F. Computer Vision Syndrome: A widely spreading but largely unknown epidemic among computer users. *Journal Computers in Human Behaviour*, 2008, 24(5), 2026-2042.
- [78] BaHammam, A.S.; Alaseem, A.M.; Alzakri, A.A. et al, The relationship between sleep and wake habits and academic performance in medical students: a cross-sectional study. *BMC Med Educ*, 2012, 12, 61.
- [79] Abdullah, I.; Almojalía, Sami, A. Almalkia.; Ali, S. Alothmana.; Emad, M. Masuadib.; Meshal, K. Alaqeel. The prevalence and association of stress with sleep quality among medical students. *Journal of Epidemiology and Global Health*, 2017, 7(3), 169-174.



© 2021 by the author(s); licensee International Technology and Science Publications (ITS), this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (<http://creativecommons.org/licenses/by/4.0/>)