

## Health Issue: Excessive Smartphone Usage among Students in Public University in Selangor, Malaysia from an Ergonomic Perspective

Rohaizahtulamni Radzlan<sup>2</sup>, Irwan Syah Mohd Yusoff<sup>1,3</sup> & Muhammad Shaifudin Abd Halim<sup>1</sup>

<sup>1</sup>Faculty of Human Ecology, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor,

<sup>2</sup>Department of Social Science and Management, Faculty of Humanities, Management and Sciences, Universiti Putra Malaysia Bintulu Sarawak Campus, 97008 Bintulu, Sarawak,

<sup>3</sup>MyAgeing, Universiti Putra Malaysia, 43400 Serdang, Malaysia. Universiti Putra Malaysia, 43400 UPM Serdang, Selangor

Corresponding Author Email: irwansyah@upm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v13-i18/19955> DOI:10.6007/IJARBSS/v13-i18/19955

**Published Date:** 10 December 2023

### Abstract

The number of smartphone users in Malaysia is expected to reach 29 million by 2021. The objective of this research is to examine the effects of excessive smartphone usage on the health of public university students in Selangor, Malaysia, from an ergonomic perspective. A cross-sectional study was involving a sample of 200 students enrolled in public universities located in the Klang Valley region. Purposive sampling was used, and data was collected through self-administered. The data was analysed using SPSS software and the Chi-square statistical test was employed. The majority of respondents were in the age range of 22 to 23. The findings indicated a noteworthy correlation between health issues related to musculoskeletal disorders ( $r = 0.000$ ,  $p = 0.330$ ). Research has demonstrated that the excessive utilisation of smartphones can exert detrimental effects on human well-being, encompassing both physical and emotional dimensions. The advent of smartphone has had a profound impact on cultural norms and human conduct, with discernible effects in both good and negative domains. The extent to which smartphone exert detrimental influence on society is largely contingent upon the agency and efforts of individuals to regulate and mitigate such effects.

**Keywords:** Smartphone, Ergonomic, Health Problem, Musculoskeletal Disorder, Student

### Introduction

According to Statista (2022), the number of smartphone users in Malaysia is expected to reach 29 million by 2021. With an increasing population, Malaysia's smartphone user base is predicted to expand by 1.74 million more until 2025. The telecommunications industry is

widely regarded as a fundamental catalyst for the overall development of a nation. This sector significantly contributes to the holistic welfare of society. Al-Barashdi et al (2015) assert that university students constitute a significant and influential consumer demographic, characterised by their extensive utilisation of smartphones. According to a study by Alfawareh and Jusoh (2014), the use of smartphones and other electronic devices, such as laptops, has nearly reached full saturation, with a penetration rate of about 100% during the COVID-19 pandemic.

Despite the widespread availability of smartphones, the impact of internet misuse has notably increased, particularly in the context of the COVID-19 pandemic. According to a study by Saadeh et al (2021), a sizable portion of participants (85%) saw an increase or significant increase in their smartphone usage during the quarantine period. Specifically, the percentage of individuals who reported increased smartphone usage rose from 26.7% to 57.2%. Furthermore, the study revealed that 42% of participants utilised their smartphones for more than 6 hours per day.

According to Milenkovic's (2020) study, individuals devoted an average of 4.5 hours per day to their mobile devices, with smartphone usage further escalating on weekends. In addition to the prolonged duration, individuals frequently engage in tasks on a compact mobile phone screen, which involves repetitive movements that ultimately contribute to the development of musculoskeletal disorders (MSD) over time (Damodaran et al., 2019; Korhan & Elghomati, 2019). The presence of static and repeated activity among smartphone users leads to impaired blood circulation and nutrition supply to muscles, resulting in frequent symptoms of Musculoskeletal Disorders (MSD) such as fatigue and soreness (Kim & Kim, 2015). Additionally, a prior investigation revealed that 77.66% of the surveyed individuals, who were users of smartphones, reported experiencing musculoskeletal problems in various regions of their bodies (Tantawy et al., 2017).

The overuse of smartphones has been associated with a range of adverse consequences, notably heightened levels of social isolation and depressive symptoms. The association between depression and anxiety and the extent of social media usage during high school was identified in a 2014 research study conducted by the University of Alabama. Toh et al (2019) assert that social media platforms provide a means to access a wide array of items and gain knowledge about diverse news stories. In fact, in the life of someone who is wealthy and lives in luxury, those who are born into poor households may feel inferior, leading to depression. Depression is one of the top ten mental health problems that Malaysian students face. Aside from that, Shoukat et al (2019) discovered that students who spend excessive time on social media acquire a bad characteristic identified as narcissism. Narcotics addicts constantly believe that their life, personality, and appearance are far superior to others, and they frequently snap or flee at the smallest criticism or disagreement. Taking frequent selfies and sharing all of one's own opinions or facts about one's own life can lead to an unhealthy feeling of self-centeredness, isolate oneself from real-life connections, and make stress more difficult to handle.

The aforementioned addictions are mostly characterised by an excessive or inadequately regulated fixation, desires, or actions related to the use of smartphones, to the point that individuals disregard other aspects of their lives (Ching et al., 2015). Several prior study papers have indicated that students enrolled in three distinct public universities in Malaysia are very susceptible to developing smartphone addiction (Azlina Wati et al., 2018; Ithnain et al., 2018;

Lei et al., 2020). Therefore, this observation serves as a strong indication of the significant prevalence of smartphone addiction among Malaysian individuals, particularly among young adults. Consequently, further investigation is warranted to delve deeper into this subject matter.

The majority of prior studies have focused on university students who are addicted to smartphones and have psychosocial issues, including anxiety, depression, psychological distress, loneliness, and the impact on their academic performance (Suki, 2013; Wong et al., 2015; Samaha & Hawi, 2016; Elhai et al., 2017; Ithnain et al., 2018; Lei et al., 2020). In recent years, scholars have undertaken investigations into the global correlation between musculoskeletal disorders (MSD) and smartphone addiction, especially in ergonomic perspective. This research has been conducted by various researchers, including (Balakrishnan et al., 2016; Xie et al., 2016; Qasim et al., 2017; Namwongsa et al., 2018; Shah and Sheth, 2018; Baabdullah et al., 2020). However, there is still limited studies done about health problems of excessive smartphone use (ESU) among students based on ergonomic perspective.

According to a study conducted in 2016 by Balakrishnan et al., it was shown that a significant proportion of students, specifically 72.5%, enrolled at a private institution reported experiencing mild to moderate pain in their upper body as a result of utilising handheld devices. The limitation of the study is that it is done on a small scale and focuses on the students of one institution only. Therefore, a larger sample size was selected for this study to better look at the health problems of excessive smartphone use (ESU) among Malaysian university students and their associations. Therefore, the general purpose of this study is to investigate the level of health problems associated with excessive smartphone use (ESU) and ergonomic perspectives among university students in Malaysia. In addition, this study also tries to determine the factors that influence the health problems of excessive smartphone use (ESU).

### **Methodology**

This research is being conducted in Klang Valley, Selangor. The Klang Valley, being the geographical region where Malaysia's capital, Selangor, is situated, serves as the site for numerous public universities. This study encompasses six public universities located in the Klang Valley region, namely Universiti Malay (UM), Universiti Putra Malaysia (UPM), Universiti Kebangsaan Malaysia (UKM), International Islamic University of Malaysia (UIAM), National Defense University of Malaysia (UPNM), and Universiti Teknologi Mara (UITM).

Purposive sampling was used in this cross-sectional study, with 200 students participating in the survey. The sampling strategy used in this study was chosen to investigate specific subsets or populations that exhibit specific characteristics. Purposive sampling is used to increase the representativeness of the sample with respect to the target group. The specific characteristics of the sample include individuals who are at least 19 years old, enrolled in a public university located in the Klang Valley region of Selangor, engaged in full-time studies, have a period of study between one and four years, use smartphones longer than four hours per day, and have at least one year of experience. This study chose the sampling method for the purpose of studying a specific subgroup or population with certain characteristics. Purposive sampling helps ensure that the sample accurately represents this target group. Exclusion criteria were applied to students who lacked ownership of a smartphone or tablet, were enrolled in private

universities located outside of the Klang Valley region, had a smartphone usage duration of less than one year, and did not engage in online distance learning activities.

Prior to administering the questionnaire, participants were presented with a letter of consent, which they were obliged to acknowledge by checking a designated box, thereby providing evidence of their voluntary agreement to partake in the research. Each survey can be completed in a short amount of time, typically only a few minutes. The survey instrument comprises four distinct sections: demographic data, general smartphone information, a Nordic questionnaire, and a lifestyle assessment. This study also has a good level of validity and reliability through a test-retest correlation of +.80, which is considered to show good reliability. The confidentiality of the respondent's personal information is rigorously maintained, ensuring that it will not be divulged to the public. The data and information obtained from the survey form were analysed using IBM Statistical Package for Social Sciences (SPSS) version 20, a widely used statistical software. Descriptive statistics were computed for all variables in the study, and the Chi-square was utilised.

## **Results and Discussion**

### ***Characteristic of Smartphone Usage***

According to Table 3, 40% of students use their smartphones for 5–6 hours every day, compared to 17.5% who only use them for 3–4 hours. According to the findings, 21.0% of smartphone users spend between five and six hours and 19.0% spend between seven and eight hours per week using their device. The remaining 45.0% of smartphone users spend more than eight hours per week using their device. This finding is similar to that of Alfawareh and Jusoh (2014), who discovered that 27% of students only use their smartphones for less than two hours per day, while 77% of students use them for more than five hours per day.

The majority of students (64.5%) agree that using their smartphones for social networking, watching movies, and other types of amusement is the main reason they use them. As a result, over half (49.5%) of respondents said that they use their smartphones mostly for online shopping. However, the main use of smartphones is not a priority for students, such as the function of playing mobile games (41.0%) as well as sending messages and making calls (44.0%). Only 9.0% of people agree to use their smartphones consistently throughout the day, while 38.5% use the smartphone inconsistently on a daily basis. According to respondents, WhatsApp is the most used app overall (63.0%), followed by Instagram (59.0%), YouTube (55.0%), and PUBG Mobile (17.5%). This outcome is consistent with the findings of (Kibona and Mgaya, 2015). They discovered that the majority of respondents (48%) use their smartphones for social purposes for an average of 5-7 hours each day, which is a lot longer than they do for academic pursuits. Thus, the use of smartphones may pose a challenge to students enrolled in higher education institutions.

The issues faced by students related to smartphones are related to their academic achievement. Abdullah et al (2012) pointed out that university students frequently use their smartphones mainly for personal communication rather than for educational objectives. The prevalence of smartphone applications serves as an important source of distraction for students, distracting them from their primary objective of learning. In initial observations, the use of smartphones was initially viewed positively. However, subsequent scholarly investigations revealed that students increasingly regarded smartphones as detrimental to their academic pursuits (Tossell et al., 2015). Al-Barashdi et al (2015) reported that students

were found to allocate a greater amount of time towards engaging in recreational activities, such as playing games on their smartphones, as well as other leisure pursuits, as compared to their participation in classroom activities. The utilization of smartphones in educational settings has encountered challenges stemming from technical, psychological, and physical barriers.

Katz and Aakhus's 2002 study found that "the proliferation of mobile phones is affecting people's lives and relationships and how they interact face-to-face, or, rather, face-to-face-to-mobile-phone-face, since people are more likely to include the mobile phone in what would otherwise be a face-to-face dyad." In addition, 32.0% of non-students and 66.5% of students both use their smartphones in the dark. According to Chen et al. (2012), the emission of light directly from digital screens leads to increased strain on the human eye. There has been a notable increase in the amount of time that young adults and children dedicate to the use of electronic devices. Consequently, there has been a corresponding rise in the prevalence of sleep deficit among teenagers, which has emerged as a significant issue within the realm of public health (Hysing et al., 2015). According to a study conducted by Nick (2012), about 90% of individuals in the younger demographic choose to keep their smartphone in close proximity to their sleeping area, with some even placing them directly on their beds. Consequently, these individuals frequently awaken during the night to engage with their smartphones, a behaviour that exposes them to the unpleasant effects of glare and eye strain.

The majority of respondents use their smartphones when lying down (70.5%) and 40.0% with their legs crossed. Furthermore, a research study conducted by Lemola et al (2015) examined the mobile phone usage patterns of adolescents and discovered that individuals who possess a smartphone are inclined to engage with electronic media when in a supine position. Previous research has indicated a correlation between the utilisation of mobile devices while in bed and diminished sleep quality as well as the manifestation of symptoms related to insomnia (Fossum et al., 2013; White et al., 2010). In light of the correlation between the practise of utilising mobile devices while in bed and the occurrence of sleep-related issues, it is imperative to examine the potential impact of postural changes that occur during the use of mobile devices while in a supine position.

According to Kibona and Mgaya (2015), college students are unable to live without their smartphones because they have conditioned their minds to anticipate calls, texts, and emails from their classmates. The use of smartphones in a problematic manner has the potential to disrupt daily routines and negatively impact mental health (Gligor & Mozos, 2019). The phenomenon of problematic smartphone usage encompasses instances such as phantom cell phone ringing, which occurs when individuals experience the perception of incoming phone notifications despite the absence of any actual alerts. This occurrence is often attributed to feelings of anxiety. Additionally, individuals may engage in constant phone checking as a means to maintain social connections through various social media platforms, driven by the fear of losing these connections, commonly referred to as the fear of missing out (FOMO) (Kruger & Djerf, 2016).

Table 3

*Characteristic of smartphone usage*

<b>Items</b>	<b>N</b>	<b>Percentage (%)</b>
<b>Average time usage smartphone daily</b>		
1-2 hour	23	11.5
3-4 hours	35	17.5
5-6 hours	80	40.0
7-8 hours	36	18.0
8> Hours	26	13.0
<b>The time usage smartphone on a WEEKLY basis</b>		
1-2 hour	7	3.5
3-4 hours	22	11.0
5-6 hours	42	21.0
7-8 hours	38	19.0
8 > hours	91	45.5
<b>Main purpose of using smartphone</b>		
Entertainment (social media, movie etc.)	129	64.5
Studying	129	64.4
Online shopping	99	49.5
Playing mobile games	82	41.0
Texting & calling	85	43.0
<b>The time of the day usually use smartphone</b>		
Whole Day	18	9.0
Afternoon	16	8.0
Evening	26	13.0
Night	37	18.5
Midnight	26	13.0
Inconsistent	77	38.5
<b>Type of application use frequently</b>		
YouTube	111	55.5
Instagram	118	59.0
Facebook	96	48.0
WhatsApp	126	63.0
Mobile legend	69	34.5
PUBG Mobile	35	17.5
Twitter	42	21.0
<b>How many days use smartphone in a week</b>		
1 – 2 Days	10	5.0
3 – 4 Days	30	15.0
5 – 6 Days	46	23.0
Whole a week	114	57.0
<b>Use smartphone before sleep</b>		
Yes	64	32.0
No	136	68.0
<b>Use smartphone in dark before going to sleep</b>		
Yes	67	33.5
No	133	66.5

**State how many an hour use smartphone in dark**

1-2 hour	102	51.0
3-4 hours	43	21.5
5-6 hours	28	14.0
7-8 hours	16	8.0
8> Hours	11	5.5

**Position in body posture when using a smartphone**

Lying down	141	70.5
crossed- leg	80	40.0
Squatting	49	24.5
Sitting	62	31.0

**Feeling pain while using smartphone**

Neck Pain	91	45.5
Shoulder Pain	65	32.5
Headache	94	47.0
Double vision	58	29.0
Back pain	63	31.5
Numbness in finger	54	27.0
Trouble sleeping	57	28.5
Dry eyes	39	19.5

**Always adjust the brightness of smartphone.**

Yes	60	30.0
No	140	70.0

**In years, experience using a smartphone.**

1 years	6	3.0
2 years	20	10.0
3 years	52	26.0
4 years	39	19.5
>5 years	83	41.5

(N=200)

**Factors of the Excessive Smartphone Usage (ESU)**

Table 4 shows the findings of the association between the adverse effects of excessive smartphone use and health problems. The previous table indicates a significant relationship ( $X^2: 5.036, P: 0.025$ ) between smartphone usage characteristics and increasing the brightness on your smartphone. This is consistent with Nath and Mukherjee's (2015) finding that using a smartphone or tablet right before bed can substantially interrupt sleep because the type of light coming from the screen has a detrimental effect on the sleep cycle. This is due to the fact that blue light emissions from smartphones have been linked to a variety of visual issues, including eye discomfort, blurred vision, and conjunctivitis (Ma'azer et al., 2017).

The 3–4 hours per day that students spend on social media, however, have a significant association with it ( $X^2: 14.383, P: 0.006$ ). These results are consistent with a 2012 study by White & Mills, which revealed that students were increasingly using smartphones for personal usage rather than for acquiring new material. ( $X^2: 4.269, P: 0.039$ ) Healthy eating practises are not practised. Contrarily, engaging in social activities has little to do with what occurs when people use their phones excessively. Health analysis also shows a connection

between using a smartphone and symptoms like fatigue, joint and vein pain, numbness, and tingling (X2: 4.352, P = 0.037), visual or cognitive discomfort while using a smartphone (X2: 5.850, P = 0.016), and feeling any pain, numbness, or discomfort in your fingers after using a smartphone for hours (X2: 7.990, P = 0.005).

Furthermore, excessive smartphone use has been linked to obesity, headaches, and visual issues (Fawareh & Jusoh, 2017). Some individuals use their smartphones while eating, which can lead to obesity, high blood pressure, and cardiac issues if not addressed appropriately. Coleman (2018), they discovered that using a smartphone for five or more hours a day increased the risk of obesity by approximately 43%. Students who participated in the research had a "twice as probable" tendency to eat more unhealthy foods, sweets, and snacks, as well as to be less active. Addiction to smartphones might reduce social contact. This is due to the fact that those who are smartphone addicts frequently prioritize their phones over other things. Long-term problematic smartphone usage has been associated with an increase in sleep interruptions and mental suffering, both of which were reduced when the device was switched off (Shoukat et al., 2019).

All of the people who used handheld devices, according to Sharan et al (2014), reported suffering from discomfort in the thumb and forearm as well as burning, numbness, and tingling near the eminence of the hand. The detrimental consequences of excessive smartphone use among students at public institutions in the Klang Valley were unaffected by additional factors, including pain when using a smartphone, insomnia before bed, having a high-risk illness, or smoking. The results are in line with a recent study that found consistent evidence connecting excessive smartphone use to various mental health issues such as Internet addiction, depression, anxiety, and OCD (Weinstein, 2014). This serves as another piece of evidence that utilising a smartphone for an extended period of time is bad for one's health.



Tables 4

*Factors for association between Excessive Smartphone Usage (ESU) on Health Problem*

<b>Variables</b>	<b>excessive smartphone usage and health problems</b>		<b>Chi Square value (X<sup>2</sup>)</b>	<b>P value</b>
	No (%)	Yes (%)		
<b>Smoking Status</b>			0.008	0.928
No	50	36		
Yes	67	47		
<b>Experienced symptoms such as fatigue, joint and vein pain, numbness, tingling and related problems due of smartphone usage</b>			4.352	<b>0.037**</b>
No	42	44		
Yes	39	75		
<b>Have insomnia after using smartphone before going to bed</b>			3.271	0.70
No	45	41		
Yes	45	69		
<b>have any visual or cognitive discomfort while using the smartphone</b>			5.850	<b>0.016**</b>
No	48	38		
Yes	44	70		
<b>feel any pain/numbness/discomfort at your fingers after using smartphone for hours</b>			7.990	<b>0.005**</b>
No	40	46		
Yes	31	83		
<b>Use smartphone before going to sleep</b>			0.025	0.873
No	27	59		
Yes	37	77		
<b>Use smartphone in dark before going to sleep</b>			0.130	0.719
No	30	56		
Yes	37	77		
<b>Always adjust the brightness of your smartphone.</b>			5.036	<b>0.025**</b>
No	33	53		
Yes	27	87		
<b>Average hours spend on social media per-day</b>			14.989	<b>0.006**</b>
1-2 hour	21	10		
3-4 hours	19	36		
5-6 hours	19	42		
7-8 hours	13	14		
8> Hours	14	12		
<b>Practice healthy eating habit</b>			4.269	<b>0.039**</b>
No	37	49		
Yes	33	81		
<b>Use social media</b>			5.052	<b>0.025**</b>
Yes	43	43		
No	39	75		

N=200

**Conclusion**

In summary, this study provides a robust foundation for evaluating the interaction and correlation between health concerns and the harmful effects of excessive smartphone use. The predominant smartphone activities encompass messaging, telecommunication, social media engagement, and internet browsing. The findings of prior studies conducted by Hossain and Ahmed (2016) as well as the Mobile Ecosystem Forum demonstrate similar results. The mean duration of smartphone usage among university students is 3.25 years. Multiple surveys have indicated that a significant proportion of university students possess and regularly use mobile devices. The aforementioned observation aligns with the research conducted by Kim, Briley, and Ocepek (2015), wherein they discovered a positive correlation between individuals who are younger, possess higher levels of education, and have greater financial resources and their propensity to utilise smartphones and associated applications. The impact of excessive smartphone usage on the human body has been demonstrated to encompass both physical and mental consequences. According to Martin-Gutiérrez et al (2017), it is crucial to highlight the detrimental physical and psychological effects of smartphone addiction on individuals. It has been found that there is a correlation between the use of smartphones and various negative psychological outcomes, including sleep deprivation, anxiety, stress, and sadness. All of the aforementioned issues can be identified within the scope of this research, with insomnia constituting a significant portion thereof. This issue impacts a significant proportion of the participants, specifically 50.0% of the respondents.

The report raises concerns about the significant frequency of smartphone addiction among university students. The prolonged use of mobile led to both psychological and physical dysfunction in certain body parts. Therefore, Hwang et al (2012) recommend early screening for all smartphone users in relation to this matter. The excessive utilisation of smartphone necessitates assessment to facilitate the development of addiction prevention initiatives including recommendations for maintaining proper posture, strategies for managing stress, fostering good mental well-being, and cultivating meaningful interpersonal connections beyond online communication (Hwang et al., 2012). Further research is required to enhance the comprehension of the impacts of smartphone usage within the university student demographic. This research aims to identify both the risk and protective factors associated with smartphone usage, thereby providing valuable insights for policymakers, educators, clinicians, parents, and young adults. Ultimately, this knowledge will contribute to the optimisation of technology utilisation and its associated benefits.

It is recommended that future studies incorporate a wider geographical scope to gather a more diverse range of viewpoints. Additionally, it is suggested that a long-term research approach be implemented throughout the entire year to obtain more accurate and current findings. This is because the impact of excessive smartphone usage among students in public universities may evolve over time, or new issues may arise as a consequence of technological advancements. Therefore, it is imperative to analyse the impacts of excessive smartphone usage across different phases of the decision-making process. Furthermore, it is suggested that further investigation be conducted in order to comprehensively comprehend the impacts and exercise caution when developing any novel effects. This approach aims to facilitate further investigation in this field across various nations, thereby enhancing the precision and validity of the collected data and outcomes.

### Acknowledgments

This article was financially funded by the Fundamental Research Grant Scheme (FRGS) cycle 1/2021 (Grant No.:5540507) with KPT Reference file No.: FRGS/1/2021/SS0/UPM/02/14, the Ministry of Higher Education (MOE) Malaysia. The contents of this paper are solely the responsibility of the authors and do not necessarily represent the official views of the sponsor.

### References

- Abdullah, Y., Sedek, M., Mahat, J., & Zainal, N. (2012). Individual characteristic in online gaming and mobile application use among students in higher education institution: A confirmatory factor analysis. In *Prosiding Seminar Institusi Pendidikan Tinggi* (Vol. 1, No. 1, pp. 345-360).
- Alfawareh, H. M. & Jusoh, S. (2014). Smartphones usage among university students: Najran University case. *International Journal of Academic Research*, 6(2), 321-326.
- Al-Barashdi, H., Bouazza, A., & Jabur, N. (2015). Smartphone addiction among university undergraduates: A literature review, *Journal of Scientific Research and Reports*, vol. 4, no. 3, pp. 210–225.
- Azlina Wati, N., Nurul Azreen, H., Muhammad Farid, S., Nur Suhailah, M. Z., Nur Nabihah, H. S., & Nur Basyariah, A. (2018). The use and addiction to smart phones among medical students and staffs in a public university in Malaysia. *ASEAN Journal of Psychiatry*, 19(1).
- Baabdullah, A., Bokhary, D., Kabli, Y., Saggaf, O., Daiwali, M., & Hamdi, A. (2020). The association between smartphone addiction and thumb/wrist pain. *Medicine*, 99(10), e19124.
- Balakrishnan, R., Chinnavan, E., & Feii, T. (2016). An extensive usage of hand held devices will lead to musculoskeletal disorder of upper extremity among student in AMU: A survey method. *International Journal of Physical Education, Sports and Health*, 368(2), 368–372.
- Ching, S. M., Yee, A., Ramachandran, V., Lim, S. M. S., Sulaiman, W. A. W., Foo, Y. L., & Hoo, F. K. (2015). Validation of a Malay version of the smartphone addiction scale among medical students in Malaysia. *PLoS ONE*, 10(10), e0139337.
- Chen, J., Cranton, W., & Fihn, M. (2012). *Handbook of visual display technology*. Springer.
- Coleman, B., Coarsey, C., Kabir, M. A., & Asghar, W. (2019). Point-of-care colorimetric analysis through smartphone video. *Sensors and Actuators B: Chemical*, 282, 225-231.
- Damodaran, K. K., Sharma, V., & Purushothaman, S. (2019). Relationship between the hand discomfort with the dimensions of hand and touch screen mobiles. In *Drug Invention Today |* (Vol. 12).
- Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders*, 207, 251–259.
- Fossum, I. N., Nordness, L. T., Storemark, S. S., Bjorvatn, B., & Pallesen, S. (2014). *Behavioral Sleep Medicine*, 12(5), 343-357.
- Gligor, S., & Mozos, I. (2019). Indicators of smartphone addiction and stress score in university students. *Wien Klin Wochenschr*, 131(5-6), 120-125.
- Hossain, M. E., & Ahmed, S. Z. (2016). Academic use of smartphones by university students: a developing country perspective. *The Electronic Library*.
- Hwang, K.-H., Yoo, Y.-S., & Cho, O.-H. (2012). Smartphone Overuse and Upper Extremity Pain, Anxiety, Depression, and Interpersonal Relationships among College Students. *The Journal of the Korea Contents Association*, 12(10), 365– 375.

- Hysing, M., Pallesen, S., Stormark, K., Jakobsen, R., Lundervold, A., Sivertsen, B., 2015. Sleep and use of electronic devices in adolescence: results from a large populationbased study. *BMJ Open* 5, e006748.
- Ithnain, N., Ghazali, S. E., & Jaafar, N. (2018). Relationship between Smartphone Addiction with Anxiety and Depression among Undergraduate Students in Malaysia. *International Journal of Health Sciences and Research*, 1(1), 10.
- Katz, J. E., & Aakhus, M. (Eds.). (2002). *Perpetual contact: Mobile communication, private talk, public performance*. Cambridge University Press.
- Kim, Y., Briley, D. A., & Ocepek, M. G. (2015). Differential innovation of smartphone and application use by sociodemographics and personality. *Computers in Human Behavior*, 44, 141-147.
- Kibona, L., & Mgya, G. (2015). Smartphones' effects on academic performance of higher learning students. *Journal of Multidisciplinary Engineering Science and Technology*, 2(4), 777-784.
- Kim, H.-J., & Kim, J.-S. (2015). The relationship between smartphone uses and subjective musculoskeletal symptoms and university students. *Journal of Physical Therapy Science*, 27(3), 575–579.
- Korhan, O., & Elghomati, A. (2019). MOBİLDokunmatik EkranCihazı Kullaniminin KasiskeleSistemi RahatsızlıklarınEtkisi: Literatür Araştırması. *Ergonomi*, 2(3), 3–4.
- Kruger, D. J., & Djerf, J. M. (2016). High ringxiety: Attachment anxiety predicts experiences of phantom cell phone ringing. *Cyberpsychology, behavior, and social networking*, 19(1), 56-59.
- Lei, L. Y. C., Ismail, M. A. A., Mohammad, J. A. M., & Yusoff, M. S. B. (2020). The relationship of smartphone addiction with psychological distress and neuroticism among university medical students. *BMC Psychology*, 8(1), 97.
- Lemola, S., Perkinson-Gloor, N., Brand, S., DewaldKaufmann, J. F., & Grob, A. (2015). Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *Journal of Youth and Adolescence*, 44(2), 405-418.
- Ma'azer Al Fawareh, H., & Jusoh, S. (2017). The use and effects of smartphones in higher education. *Ijim*, 11, 103.
- Martín-Gutiérrez, J., Mora, C. E., Añorbe-Díaz, B., & González-Marrero, A. (2017). Virtual technologies trends in education. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(2), 469-486.
- Milenkovic, J. (2020, February 11). How Much Time Does the Average Person Spend on Their Phone? <https://kommandotech.com/statistics/how-muchtime-does-the-average-person-spend-on-their-phone/>
- Namwongsa, S., Puntumetakul, R., Neubert, M. S., & Boucaut, R. (2018). Factors associated with neck disorders among university student smartphone users. *Work*, 61, 367–378.
- Nath, A., & Mukherjee, S. (2015). Impact of Mobile Phone/Smartphone: A pilot study on positive and negative effects. *International Journal*, 3(5), 294-302.
- Nick, T. (2012). Using Your Smartphone before Bedtime Isn't a Good Idea, and Here's Why. Phone arena.
- Qasim, T., Obeidat, M., & Al-Sharairi, S. (2017). The Effect of Smartphones on Human Health Relative to User's Addiction: A Study on a Wide Range of Audiences in Jordan. *International Journal of Medical and Health Sciences*, 11(5), 300–303.
- Saadeh, H., Saadeh, M., Almobaideen, W., Al Refaei, A., Shewaikani, N., Al Fayez, R. Q., ... & Al-Hussaini, M. (2021). Effect of COVID-19 quarantine on the sleep quality and the depressive symptom levels of university students in Jordan during the spring of 2020.

*Frontiers in Psychiatry*, 12, 605676.

- Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, 57, 321–325.
- Statista. (2022). *Number of smartphone users in Malaysia from 2010 to 2020 and a forecast up to 2025*. Statista Research Department.
- Shah, P. P., & Sheth, M. S. (2018). Correlation of smartphone use addiction with text neck syndrome and SMS thumb in physiotherapy students. *International Journal of Community Medicine*, 5(6), 2512–2516.
- Sharan, D., Mohandoss, M., Ranganathan, R., & Jose, J. (2014). Musculoskeletal disorders of the upper extremities due to extensive usage of handheld devices. *Annals of Occupational and Environmental Medicine*, 26(1).
- Shoukat, S. (2019). Cell phone addiction and psychological and physiological health in adolescents. *EXCLI journal*, 18, 47.
- Suki, N. M. (2013). Students' dependence on smart phones: The influence of social needs, social influences and convenience. *Campus-Wide Information Systems*, 30(2), 124–134.
- Tantawy, S. A., Rahman, A. A., & Ameer, M. A. (2017). The relationship between the development of musculoskeletal disorders, body mass index, and academic stress in Bahraini University students. *Korean Journal of Pain*, 30(2), 126–133.
- Toh, S. H., Howie, E. K., Coenen, P., & Straker, L. M. (2019). "From the moment I wake up I will use it... every day, very hour": a qualitative study on the patterns of adolescents' mobile touch screen device use from adolescent and parent perspectives. *BMC pediatrics*, 19(1), 1-16.
- Tossell, C. C., Kortum, P., Shepard, C., Rahmati, A., & Zhong, L. (2015). You can lead a horse to water but you cannot make him learn: Smartphone use in higher education. *British Journal of Educational Technology*, 46(4), 713-724.
- Weinstein, L. (2014). *The durable slum: Dharavi and the right to stay put in globalizing Mumbai* (Vol. 23). U of Minnesota Press.
- White, A., Buboltz, W., Igou, F. (2011). Mobile phone use and sleep quality and length in college students. *International Journal of Humanities and Social Science*, 1(18), 51-58.
- Wong, K. C., Tho, F. L., & Sin, H. N. (2015). A study of the relationship between smartphone addiction and loneliness among male and female undergraduates in utar. *In Comput. Human Behav.* (Vol. 5, Issue January).
- Xie, Y., Szeto, G. P. Y., Dai, J., & Madeleine, P. (2016). A comparison of muscle activity in using touchscreen smartphone among young people with and without chronic neck–shoulder pain. *Ergonomics*, 59(1), 61–72.