Egyptian Journal of Community Medicine

# Effects of Using Smartphones as an Educational Tool Among King Faisal University Students During the COVID-19 Pandemic

Zahra Wasel Alismail[1]; Mohammed Albarqi[2]; Abdullah Almulhim[2]; Abdullah Almaqhawi[2]

[1]College of Medicine, King Faisal University, Saudi Arabia
[2]Department of Family Medicine and Community, College of Medicine, King Faisal University, Saudi Arabia

## ABSTRACT

**Background:** Experts suggested that the best approach for preventing the spread of COVID-19 is to limit face-to-face interaction. Therefore, education is a critical area that has been severely affected by the current COVID-19 outbreak. **Objective**: This study aimed to assess the effects of smartphones' use as an educational tool during the COVID-19 pandemic among the students at King Faisal University (KFU). **Method:** A cross-sectional study was conducted using online questionnaires among students. Data were analysed using IBM SPSS version 22; $P$-value less than 0.05 was considered statistically significant. **Results:** A total of 498 participants were enrolled in this study, with a mean age of 22.6 years, and 83.3% were female. About 95.2% of participants agreed that smartphones would help them with the current situation for education, and 93.6% stated that they used a smartphone to study. Furthermore, 81.3% of participants preferred to use a smartphone for research rather than a library. This study found that 75.9%, 77.9%, and 48.6% of participants thought that using smartphones would develop a headache, dry eye disease, and depression and anxiety, respectively. **Conclusion:** This study found that most students preferred e-learning using smartphones over the traditional learning processes, perceiving higher negative effects of smartphones on health and lower negative impacts on learning process. Using e-learning is effective during the pandemic; however, more investigations should be conducted to assess smartphones' effectiveness on learning.

## INTRODUCTION

It revealed that the new virus a new member of the Coronaviruses family, which are well-known viruses that cause a wide range of illnesses, from the common cold to more serious illnesses.[1] A smartphone is a newer cell phone class with integrated computer technology features. Additionally, smartphones can provide extensive information at a touch.[2] Smartphones have been used for academic purposes among students, and they help teachers to provide remote teaching services during the COVID-19 lockdown.[3] Researchers reported that mobile learning plays a vital role in improving the educational process and

affecting education quality because it covers the gap that occurred during coronavirus quarantine and closing of the educational institutions.[4] Smartphones provide advanced communication through internet access, high-quality cameras, and feature-rich applications; furthermore, they can connect to computers and have high memories. Thus, smartphones can replace other devices, such as calculators, alarm clocks, GPS navigators, and laptops.[5] Incorporating smartphones into the educational process helps perform certain activities, such as discussion sessions between students and their teachers, accessing course content, and retrieving information students' performance. Therefore, using smartphones boosts teaching and improves the learning experience by enhancing the students' performance.[6] Moreover, a study showed

**Table 1: Students use and preference of smartphone King Faisal University, Saudi Arabia during the COVID-19 pandemic**

| Students use and preference | Yes | |
|---|---|---|
| | **n** | **%** |
| Do you think the smartphone help you with current situation for education purpose? | 474 | 95.2 |
| Do you search for your study material on internet using your smartphones? | 466 | 93.6 |
| Do you share or takes notes you're your classmates using your smartphones? | 387 | 77.7 |
| Do you download any apps associated with education? | 435 | 87.3 |
| After using smartphones, do you prefer it for research activities and study purposes more than using the library? | 405 | 81.3 |
| **Causes of preference (n=405)** | | |
| Because of lack of time to visit library? | 206 | 41.4 |
| It is convenient | 339 | 68.1 |
| Using smartphone is faster | 390 | 78.3 |

that extended use of a smartphone increased the rate of eye dryness and fatigue after one to four hours of usage.[7] Thus, the usage of smartphones in a pandemic situation is seen as a beneficial instrument in the distance learning system; however, excessive handling of mobile phones may cause negative effects on the learners. Students are the most affected groups during the pandemic as they used e-learning. There is a gap in the literature as there is no study about the impact of using the smartphone as an educational tool during the COVID-19 pandemic among Saudi students in Eastern Region. Therefore, the current study aims to assess this impact among the students at King Faisal University (KFU).

**METHOD**

This is a cross-sectional study conducted at KFU, Saudi Arabia. Inclusion criteria include all female and male students at KFU who used smartphones as an education tool during the COVID-19 pandemic. In addition, this study includes participants who did not have any chronic diseases that might influence them in choosing e-learning. Exclusion criteria include students who were younger than 18 or who had graduated from the university, along with university employees. A non-probability convenience sampling technique was used, and data were collected using an electronic questionnaire distributed through several social media programs. A valid and reliable questionnaire from a previous study has been used.[8] The questionnaire included questions regarding demographic characteristics. The questionnaire also included other questions about the effects of smartphones on the education process among students and teachers during COVID-19. Furthermore, some questions about the effectiveness of smartphones on the learning process during this pandemic were also asked. Moreover, some questions about the negative effects of using a smartphone were also included in the questionnaire.

**Data Analysis:** After extraction, data were revised, coded, and fed to the statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two-tailed tests. *P*-value less than 0.05 was statistically significant. Regarding the student's perception of smartphone usage during the COVID-19 pandemic, a 5-point Likert scale was used for assessment. The overall composite mean score was calculated from different discrete items, ranging from 1 to 5. A student with a composite mean score of less than 3 was considered to have a poor perception, a mean score of 3 to less than 4 was considered average perception while good perception was considered if the student had a composite mean score of 4 to 5. Descriptive analysis, based on frequency and percent distribution, was done for all variables, including the students' socio-demographic data, perception, and satisfaction regarding smartphone usage and the negative effects of using smartphones in learning during the COVID-19 pandemic. Cross-tabulation was used to assess the distribution of students' overall perception level by their data and smartphone use. Pearson's chi-square test was used to assess the significance of study relations.

**RESULTS**

A total of 498 students fulfilling the inclusion criteria

**Table 2: Students' perception toward using smartphones during a the COVID-19 pandemic at King Faisal University, Saudi Arabia**

| Domain | Items | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| Intera | Using smartphone help you to keep your social relationships | 80 | 16.1 | 169 | 33.9 | 249 | 50.0 |
| | You can interact with others regardless of where they are | 45 | 9.0 | 63 | 12.7 | 390 | 78.3 |
| Smartphon | Using smartphone facilitates taking tests | 95 | 19.1 | 128 | 25.7 | 275 | 55.2 |
| | Using smartphone facilitates registration for courses | 39 | 7.8 | 47 | 9.4 | 412 | 82.7 |
| | Using smartphone ease working on presentation and assignment | 60 | 12.0 | 70 | 14.1 | 368 | 73.9 |
| Perception on Mobile | Using smartphone in learning is effective to reduce the gap during the COVID-19 pandemic time | 61 | 12.2 | 72 | 14.5 | 365 | 73.3 |
| | Using smartphone motivated you to finish your study during the COVID-19 period | 79 | 15.9 | 99 | 19.9 | 320 | 64.3 |
| | Using social media applications help in educational fulfilment during the COVID-19 period | 115 | 23.1 | 121 | 24.3 | 262 | 52.6 |
| | Your learning doesn't influence by the screen size of your mobile | 210 | 42.2 | 133 | 26.7 | 155 | 31.1 |

**Table 3: Negative impact of smartphones as an educational tool reported by students at King Faisal University, Saudi Arabia during the COVID-19 pandemic**

| Negative impact items | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| At this pandemic time, high internet charge of mobile network can affect my learning | 88 | 17.7 | 101 | 20.3 | 309 | 62.0 |
| Using smartphone for long time will developed headache | 51 | 10.2 | 69 | 13.9 | 378 | 75.9 |
| Using smartphone for long time will developed dry eye disease | 46 | 9.2 | 64 | 12.9 | 388 | 77.9 |
| Using smartphone for long time will developed depression and anxiety | 103 | 20.7 | 153 | 30.7 | 242 | 48.6 |
| Development of smartphone use from a habit to an addiction | 74 | 14.9 | 78 | 15.7 | 346 | 69.5 |
| I use smartphone more on social media rather than learning purpose | 87 | 17.5 | 149 | 29.9 | 262 | 52.6 |
| Using smartphone impair my concentration and make me do fewer schoolwork | 135 | 27.1 | 122 | 24.5 | 241 | 48.4 |
| Smartphone deprive me from getting enough sleep | 169 | 33.9 | 111 | 22.3 | 218 | 43.8 |
| Smartphone ring and end up disturbing me during the lecture | 114 | 22.9 | 107 | 21.5 | 277 | 55.6 |
| I will be busy in replying to text messages on my smartphone while I am in the lecture | 125 | 25.1 | 127 | 25.5 | 246 | 49.4 |

completed the study questionnaire. The students' ages ranged from 18 to 35 years as some students are post-graduate students, with a mean age of 22.6±3.9 years. Among the 498 students uncompleted survey answers were excluded from this study, 410 (83.3%) were females, and 324 (65.5%) were married. Urban residence was reported by 400 (80.8%) students, and 377 (76.2%) possessed an Apple iPhone with the Apple operating system (iOS). Furthermore, 449 (90.7%) had a Wi-Fi network at home. Moreover, 432 (87.3%) students had a SIM card that allowed them to gain access to a 4G network. 342 (69.1%) students used their smartphones for more than five hours a day (Table 1).

Table 2 shows the students' usage and preference of smartphone use at King Faisal University, Saudi Arabia. 474 (95.2%) students believe that

**Table 4: Distribution of students' perception toward smartphones usage during the COVID-19 pandemic according to their socio-demographic data**

| Socio-demographic data | Student perception toward smartphones using during a covid-19 pandemic | | | | | | p-value |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Poor | | Average | | Good | | |
| | n | % | n | % | n | % | |
| **Age in years** | | | | | | | |
| 18-19 | 22 | 21.8 | 52 | 51.5 | 27 | 26.7 | .048* |
| 20-24 | 37 | 12.3 | 164 | 54.7 | 99 | 33.0 | |
| 25+ | 14 | 14.4 | 45 | 46.4 | 38 | 39.2 | |
| **Gender** | | | | | | | |
| Male | 19 | 23.2 | 40 | 48.8 | 23 | 28.0 | .037* |
| Female | 51 | 12.4 | 218 | 53.2 | 141 | 34.4 | |
| **Marital status** | | | | | | | |
| Single | 52 | 16.0 | 167 | 51.5 | 105 | 32.4 | .328 |
| Married | 19 | 11.1 | 94 | 55.0 | 58 | 33.9 | |
| **Residence** | | | | | | | |
| Urban | 54 | 13.5 | 213 | 53.3 | 133 | 33.3 | .397 |
| Rural | 18 | 18.9 | 48 | 50.5 | 29 | 30.5 | |
| **Type of smartphone you have** | | | | | | | |
| Apple | 52 | 13.8 | 202 | 53.6 | 123 | 32.6 | .673 |
| Android | 19 | 16.1 | 58 | 49.2 | 41 | 34.7 | |
| **Do you have Wi-Fi network at home?** | | | | | | | |
| Yes | 65 | 14.5 | 232 | 51.7 | 152 | 33.9 | .379 |
| No | 7 | 15.2 | 28 | 60.9 | 11 | 23.9 | |
| **Does your SIM card allows using a 4G network?** | | | | | | | |
| Yes | 58 | 13.4 | 227 | 52.5 | 147 | 34.0 | .245 |
| No | 13 | 20.6 | 33 | 52.4 | 17 | 27.0 | |
| **How much time do you use your smartphone every day** | | | | | | | |
| One Hour | 2 | 40.0 | 1 | 20.0 | 2 | 40.0 | |
| Three hours | 6 | 15.0 | 23 | 57.5 | 11 | 27.5 | .399 |
| Five hours | 20 | 18.5 | 52 | 48.1 | 36 | 33.3 | |
| > five hours | 44 | 12.9 | 184 | 53.8 | 114 | 33.3 | |

*P: Pearson X² test, * P < 0.05 (significant)*

smartphones help educationally. Searching for study materials on the internet using smartphones was reported among 466 participants (93.6%), and 387 participants (77.7%) shared or took notes using their smartphones. Furthermore, 435 (87.3%) students used a smartphone to download applications associated with education, and 405 (81.3%) students preferred using smartphones for research activities and study purposes more than using the library. When participants asked for the main reasons why they prefer using a smartphone rather than a library, 78.3% of the students believed that using a smartphone is faster, 68.1% thought that using a smartphone is convenient, and 41.4% of the students did not have the time to visit a library. Table 3 illustrates students' perception regarding smartphone usage during the COVID-19 pandemic at King Faisal University, Saudi Arabia. As for interaction competency, 78.3% of the students agreed that they can interact with others regardless of their locations, and 50% agreed that using smartphones help them in maintaining their social relationships. Considering smartphones' self-efficiency, 82.7% of the students agreed that using smartphones facilitate registration for courses, 73.9% agreed that using smartphones ease working on presentations and assignments, and 55.2% reported that using smartphones facilitate taking tests. Regarding the perception of mobile learning, 73.3% of the students believed that using mobiles in learning are effective in reducing the gap during the COVID-19 pandemic, 64.3% agreed that using mobiles motivated them to finish their study during the COVID-19 pandemic, and 52.6% agreed that using social media applications help them in educational fulfilment during the COVID-19 period;

**Table 5: Distribution of students' perception toward smartphones usage during the COVID-19 pandemic by their phone usage and preference**

| Students use and preference | Student perception toward smartphones usage during the COVID-19 pandemic | | | | | | p-value |
|---|---|---|---|---|---|---|---|
| | Poor | | Average | | Good | | |
| | n | % | n | % | n | % | |
| **Do you think the smartphone help you with current situation for education purpose?** | | | | | | | |
| *Yes* | 63 | 13.3 | 248 | 52.3 | 163 | 34.4 | 0.001* |
| *No* | 10 | 41.7 | 13 | 54.2 | 1 | 4.2 | |
| **Do you search for your study material on internet using your smartphones?** | | | | | | | |
| *Yes* | 64 | 13.7 | 240 | 51.5 | 162 | 34.8 | 0.002* |
| *No* | 9 | 28.1 | 21 | 65.6 | 2 | 6.3 | |
| **Do you share or take notes with your classmates using your smartphones?** | | | | | | | |
| *Yes* | 47 | 12.1 | 207 | 53.5 | 133 | 34.4 | 0.011* |
| *No* | 26 | 23.4 | 54 | 48.6 | 31 | 27.9 | |
| **Do you download any applications associated with education?** | | | | | | | |
| *Yes* | 57 | 13.1 | 227 | 52.2 | 151 | 34.7 | 0.011* |
| *No* | 16 | 25.4 | 34 | 54.0 | 13 | 20.6 | |
| **After using smartphones, do you prefer it for research activities and study purposes more than using the library?** | | | | | | | |
| *Yes* | 47 | 11.6 | 211 | 52.1 | 147 | 36.3 | 0.001* |
| *No* | 26 | 28.0 | 50 | 53.8 | 17 | 18.3 | |

*P: Pearson X² test, * P < 0.05 (significant)*

**Table 6: Multiple stepwise logistic regression model to identify the independent predictors of good perception**

| Predictors | a OR | 95% CI | p-value |
|---|---|---|---|
| Older students | 2.2 | 1.2-4.6 | 0.024* |
| Female | 2.5 | 1.4-5.6 | 0.022 |
| Smartphone help you with current situation for education purpose | 10.5 | 4.1-18.7 | 0.002* |
| Search for your study material on internet using your smartphones | 9.8 | 4.0-19.4 | 0.002* |
| Prefer smartphones for research activities and study purposes more than using the library | 4.2 | 2.1-6.7 | 0.001* |

*a OR: Adjusted Odd ratio, CI: Confidence interval, * P < 0.05 (significant)*

while only 31.1% reported that learning is not influenced by the screen size of their mobile.

Figure 1 shows overall students' perceptions regarding smartphone usage during the COVID-19 pandemic at King Faisal University, Saudi Arabia. 164 (32.9%) of the students had good perception regarding smartphone usage during the COVID-19 pandemic, while 73 (14.7%) had poor perception levels and 261 (52.4%) had average perception.

Table 4 reveals the negative impact of using smartphones as an educational tool reported by students at King Faisal University, Saudi Arabia. The majority, of the students (77.9%) agreed that using smartphones for a long time will develop dry eye diseases, 75.9% thought that using smartphones for a long time will lead to headaches, 69.5% perceived that smartphones usage may turn from a habit into an addiction, 62% agreed that during the pandemic, high internet charges of mobiles networks may affect their learning, and 55.6% reported that smartphones ringed and disturbed them during the lectures. Furthermore, 43.8% agreed that smartphones deprive of adequate sleep.

Table 5 shows the distribution of students' perception regarding smartphones usage during the COVID-19 pandemic by their socio-demographic data. A good perception was detected among 39.2% of older students (25 years old or above) in

comparison to 26.7% of those who were aged 18-20 years with reported statistically significance ($p$=0.048). Moreover, 34.4% of female students had a good perception compared to 28% of males ($p$=0.037). This study showed that smartphones help with current situation for education purpose (OR=10.5). Also, using smartphones help in searching for study materials with OR=9.8. In addition, students preferred using smartphones for research activities and study purposes more than using the library (OR=4.2). Moreover, based on OR, female and older students are independent predictors of good perception with value of 2.5 and 2.2, respectively (Table 6).

**DISCUSSION**

The COVID-19 pandemic poses immense challenges about maintaining the continuity of educational services across Saudi Arabia. This challenge is most evident in the health education sector due to the absence of a standard and unified e-learning method. Also, educational methods are mainly dependent on patient interactions.[9] The current study aimed to assess the positive and negative effects of smartphones' use as an educational tool during the COVID-19 pandemic among the students at KFU.

This study showed that all participants possessed smartphones. The rate of possessing smartphones in our study is higher than in another study conducted in Nigeria in 2014, which found that 70% of students had smartphones (10). It is also higher than a study conducted in Saudi Arabia, which reported usage of smartphones by 40.5% of participants.[11] However, it is comparable to a study conducted in Bangladesh, which reported that 96.2% of the participants possessed smartphones.[3] The higher rate of using smartphones in our study may be due to the dire need for these devices for remote e-learning and the good socio-economic situation in Saudi Arabia, making it easier to provide the students with better tools for education.

Moreover, 69.1% of students reported using smartphones for more than five hours daily. This is higher than another study conducted in Pakistan which reported a lower rate with only 26.8% of students using smartphones for more than four hours.[12] Moreover, this study found that 95.2% of students believed that smartphones would help them with the current situation for education, while 93.6% indicated that they used smartphones to study. Similar results were provided by other studies

in Malaysia and Bangladesh as they reported that 82% and 86% of students, respectively preferred to use smartphones for the educational process.[13,3] On the other hand, another study conducted in Pakistan showed that 77% of students preferred face to face teaching as they were not ready for e-learning. The main reason for that is the limitation of e-learning especially in practical courses as these students were from a medical college.[14] This was supported by a Poland study which conducted on medical students who preferred face to face learning especially for clinical skills as it will lack the interaction with patients.[15] The preference of e-learning will depend on availability of gadgets, students' majors, and types of courses.

About 81.3% of participants of the current study indicated that they prefer to use smartphones for research activities rather than a library. This percentage is higher than that stated by Almaiah (2014), which reported that only 31% of students preferred to use e-learning over traditional education[13] and another study that showed that majority of the students found using smartphones to be more flexible and easier to access information.[12] Due to the COVID-19 pandemic, e-learning is the safest learning method for controlling the spread of the virus.

Moreover, the current study found that 55.2 % of students agreed that smartphones made taking their tests easier; this percentage is lower than those of two studies conducted in Ghana and India where 76.2% and 60.3% of the students, respectively.[11,13] Furthermore, the present results showed that 82.7% of the samples thought that smartphones facilitate registration for courses and 73.9 % thought that smartphones make working on presentations and assignments easier, which is similar to previous results as 60% and 71.2% of students thought that smartphones provide easy access to courses materials.[13,3] Libraries in universities have provided access to different databases for years now, and many students have used these database engines for their research activities especially, so it was not surprising that students prefer to use smartphones for their research activities especially as it is more convenient and more flexible than traditional methods which used textbooks, books, and periodicals.

In addition, this study showed that 73.3% of participants agreed that using smartphones is effective in reducing the gap because of the COVID-19 pandemic, which is similar to another reported

study with 82.7% of students who supported e-learning during the pandemic as it provides a safe environment.[16] In comparison, 64.3% of the current sample reported that smartphones motivated them to finish their studies, which is similar to a previous study that reported a percentage of 66.1%.[3] During COVID-19 pandemic, there is no safer way of teaching students than e-learning as it will reduce the exposure to infection. For that reason, students have selected this method of learning as other methods are not safe to protect them.

In this study, it was found that large percentages of students believe that using smartphones may have negative effects on their health; (75.9% headaches, 77.9% for dry eye disease, and 48.6% depression or anxiety). This percentage is lower than that of another study, which showed that 90% of students thought that using smartphones would lead to depression and anxiety.[11] Another study indicated that using smartphones for a long time would increase the risk of developing headaches and dry eye because of harmful radiation from these devices.[13] Several studies have reported that a large number of students spent too much time on their smartphones to send text messages; hence, they ignored their sessions and got lower scores as they were not able to focus on the lecture, as compared to students who did not use a smartphone.[18,19] Another study reported that most students use their mobile phones to make calls, browse the internet, and take pictures instead of utilising their phones to learn.[20] Additionally, using smartphones for an extended period of time as well as frequent calls and messages adversely impact students' health as they interrupt their concentration; moreover, the students experience headaches and an increased inability to complete their coursework.[21] Addiction to smartphones results in harmed life satisfaction, perceived stress, and academic performance.[22]

Finally, some demographic factors that affected the students' perception of the negative and positive impacts of using smartphones were found, including gender, as females have a more positive perception about the importance of smartphones in increasing interaction with others and increasing self-efficacy; however, they also had a higher negative perception about the negative effect of smartphones on health than males. It might be due to preference of males to attend classes in the universities and using smartphones for their social networks, so they do not prefer to use smartphones for learning. In addition, females are more cautious about their health than male. Notably, older participants thought that smartphones had a good effect on the learning process. This could be justified as older participants are more likely to be post-graduate students, and for that reason they will prefer to use smartphones for their learning and research activities as it is easier to access to online information such as databases.

This study has some limitations, such as depending on the self-reported questionnaire in the collection of data. Furthermore, its effectiveness in collecting data may lead to some personal bias, where some participants may answer some questions wrongly or randomly to satisfy the authors. Also, the online method to distribute the questionnaire leads to some bias as we did not include participants who were not able to buy smartphones, are not familiar with smartphones' techniques, or refused to use smartphones in learning. Additionally, limited time also became a hurdle during this research.

## CONCLUSION

As the world is still facing the COVID-19 pandemic, e-learning has become the most convenient mode of education. As supported by this study, e-learning is more flexible, more convenient, and faster than the traditional methods of teaching and learning. However, e-learning poses some health risks, such as headache, dry eye, depression, and anxiety, which need to be addressed. Moreover, more courses that provide online materials need to be created to enhance the e-learning experiment. Department of Continuing Training in King Faisal University is recommended to provide training courses for students on the negative effects of smartphones on health. These courses aim to encourage students to reduce their usage of smartphones for useless purposes. We also suggest providing exploratory programmes for some diseases known to be caused by smartphones, such as depression and dry eyes, by periodically distributing some known questionnaires to students, thereby measuring their vulnerability. This will help in providing medical assistance to those who need it either as therapeutic or psychologic. Regular investigations should be conducted to assess smartphones' effectiveness on learning, including more data, such as the GPA and clinical outcomes of some students, to assess the negative impact of smartphones. Other recommendations include using larger sample size from different colleges (both literature and

practical). In addition, this questionnaire should also be distributed to faculties staff to provide their feedbacks regarding e-learning. Finally, a recommendation to evaluate e-learning should be made.

### *Ethical Considerations*

The research followed all the ethical considerations, and the approval was obtained from King Faisal University, Saudi Arabia. The committee's reference number is 2020 - 12 - 40. All students were informed, and consent was obtained from all participants after explaining the study's aim.

### REFERENCES

1.  CDC. Human Coronavirus. 2020. Available at: https://www.cdc.gov/-coronavirus/types.html
2.  Iyengar K, Upadhyaya GK, Vaishya R, Jain V. COVID-19 and applications of smartphone technology in the current pandemic. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2020 Sep 1;14(5):733-7.
3.  Biswas B, Roy SK, Roy F. Students Perception of Mobile Learning during COVID-19 in Bangladesh: University Student Perspective.
4.  Usak M, Masalimova AR, Cherdymova EI, Shaidullina AR. New playmaker in science education: Covid-19. Journal of Baltic Science Education. 2020;19(2):180.
5.  Miller G. The smartphone psychology manifesto. Perspectives on psychological science. 2012 May;7(3):221-37.
6.  Cochrane TD. Beyond the Yellow Brick Road: mobile Web 2.0 informing a new institutional e-learning strategy. Australasian Journal of Educational Technology. 2010 Dec 31;26(8).
7.  Choi JH, Li Y, Kim SH, Jin R, Kim YH, Choi W, You IC, Yoon KC. The influences of smartphone use on the status of the tear film and ocular surface. PloS one. 2018 Oct 31;13(10):e0206541.
8.  Hassounah M, Raheel H, Alhefzi M. Digital response during the COVID-19 pandemic in Saudi Arabia. Journal of Medical Internet Research. 2020;22(9):e19338.
9.  Anyor JW, Abah JA. Students' perception of mobile learning in a blended collaborative learning framework in mathematics. Benue Journal of Mathematics and Mathematics Education. 2014;1(3):20-7.
10. Eltayeb LB, Alharthi NS, Elmosaad YM, Waggiallah HA. Students' perception on E. Learning and Remote Exams during COVID 19 Outbreak 2020. International Journal of Pharmaceutical and Phytopharmacological Research (eIJPPR). 2020 Oct;10(5):142-8.
11. Chukhare M, Jadhav S. Awareness of Students Regarding the Effect of Mobile Phone Usage on Health at an Indian University. Indian Journal of Public Health Research & Development. 2019 Jul 1;10(7).
12. Azam M, Naeem SB, Bhatti R. University Students' Readiness towards Mobile Learning: The Stages of Change Model. Pakistan Journal of Information Management and Libraries. 2021 Feb 19;22:37-59.
13. Almaiah MA, Masita Masita Abdul Jalil. Investigating Students' Perceptions on Mobile Learning Services. Int. J. Interact. Mob. Technol.. 2014 Oct;8(4):31-6.
14. Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding E-learning during Covid-19 at a private medical college. Pakistan Journal of Medical Sciences. 2020 May;36(COVID19-S4):S57.
15. Bączek M, Zagańczyk-Bączek M, Szpringer M, Jaroszyński A, Wożakowska-Kapłon B. Students' perception of online learning during the COVID-19 pandemic: a survey study of Polish medical students. Medicine. 2021 Feb 19;100(7).
16. Oumar BS, Aziz SA, Wok S. The Impact of Emergency Remote Teaching and Learning (ERTL) during COVID-19 Pandemic on Students. 2021 1;1:23-38.
17. Tindell DR, Bohlander RW. The use and abuse of cell phones and text messaging in the classroom: A survey of college students. College Teaching. 2012 Jan 1;60(1):1-9.
18. Elder A. College students' cell phone use, beliefs, and effects on their learning. College Student Journal. 2013 Dec 1;47(4):585-92.
19. Alfawareh HM, Jusoh S. Smartphones usage among university students: Najran University case. International Journal of Academic Research. 2014 Mar 1;6(2).
20. Abu-Shanab E, Haddad E. The influence of smart phones on human health and behavior: jordanians' Perceptions. International Journal of Computer Networks and Applications. 2015 Mar;2(2):52-6.
21. Samaha M, Hawi NS. Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. Computers in human behavior. 2016 Apr 1;57:321-5.
22. Singh MK, Samah NA. Impact of smartphone: A review on positive and negative effects on students. Asian Social Science. 2018 Oct;14(11):83-9