

KNOWLEDGE, ATTITUDE, AND BARRIERS IN DISTANCE EDUCATION USING SMARTPHONES AMONG PEDIATRIC DENTISTRY MASTER DEGREE STUDENTS DURING COVID-19 PANDEMIC IN EGYPT: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: To assess the knowledge, attitude, and barriers in distance education using smartphones among Pediatric Dentistry Master Degree students during COVID-19 Pandemic in Egypt.

Methods: A cross-sectional survey was performed by the distribution of a validated well-constructed online questionnaire consisting of five sections (21 questions). The five sections gathered information about demographic characteristics of the participants, the rate of smartphone utilization, the extent of smartphones utilization for knowledge purposes, the participants' attitudes toward smartphone utilization and barriers to smartphones utilization in distance education.

Results: The results revealed that all the respondents had smartphones. 73.8% of the respondents used the internet more than 4 hours daily. 93.4% of the respondents preferred using their smartphone for study and research activities rather than using the library. 67.2% strongly agreed that the use of mobile tools is beneficial. 60.7% of the respondents disagreed that wireless access is available in all their locations.

Conclusion: Smartphones provided an additional mean for dental education and knowledge acquisition during COVID-19 pandemic. Postgraduate dental students have adequate knowledge about dental mobile applications that can be used in dental education. Lack of internet availability in the different premises can be considered a possible barrier to smartphone technology utilization.

KEYWORDS: Smartphones, COVID-19, knowledge, attitude, barrier

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INTRODUCTION

The COVID-19 pandemic has a dramatic world-wide effect on social lifestyle^[1]. This highly infectious and widely spreading virus has changed the concepts of life during this COVID-19 outbreak^[2].

The educational institutions play an important role in the development, building, and progress of any society^[3]. The pandemic lockdown has deleterious effects on the education process, due to the closure of all institutions that provide educational services^[4]. The governments faced a new challenge to overcome the existed situation of the COVID-19 pandemic, consequently the implementation a new education process was inevitable^[5,6].

The paradigm shift in institutional educational system had been achieved in many countries with the increased use of e-learning and diminished use of the traditional teaching methods so as to limit the spread of SARS-CoV-2^[4,7-10]. Accordingly, dental universities shifted from face-to-face learning to distance learning. Thus, asynchronous and synchronous learning had become important strategies for remote education in this pandemic crisis^[7,11,12].

Currently, the use of smartphones in educational purposes has gained growing attention. Smartphones played a significant role in enhancing the teaching and learning processes; they facilitated the students' access to their learning resources, and they also improved the communication and information-sharing between tutors and students^[13,14]. Accordingly, the utilization of smartphones in dental education has acquired particular interest^[15].

Therefore, this study was conducted to assess the knowledge, attitude, and barriers in distance education using smartphones among Pediatric Dentistry Master Degree students during COVID-19 Pandemic in Egypt.

METHOD

Study design

A cross-sectional study was carried out in Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University. This study aims to assess the knowledge, attitude, and Barriers in distance education using smartphones among Pediatric Dentistry Master Degree students during COVID-19 Pandemic in Egypt.

Sample size calculation

Convenient consecutive sampling was applied; it included all Pediatric Dentistry Master Degree students from the Faculty of Dentistry, Cairo University, during the academic year 2020-2021.

Administrative and ethical considerations

The study was reviewed and approved by the Dental Research Ethics Committee Faculty of Dentistry, Cairo University on September 2021 with registration number: 32921

The questionnaire included electronic consent, which was a preliminary step to be approved by volunteered Pediatric Dentistry Master Degree students before participation in this survey. The participants' anonymity was protected as they were not obligated to state their names.

Participants

- The study participants were all Pediatric Dentistry Master Degree students registered in postgraduate program during the academic year 2020-2021 at the Faculty of Dentistry, Cairo University
- A total number of 106 Master Degree students, who were registered in postgraduate program in the Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University were enrolled in this research work.

- **Inclusion criteria:**

- 1- Pediatric Dentistry Master Degree students who volunteered to participate in the study from the Faculty of Dentistry, Cairo University.
- 2- All age groups included
- 3- Both sexes included.
- 4- All nationalities were included.

- **Exclusion criteria**

1. Students who did not complete the questionnaire.

Study settings**Questionnaire**

An observational cross-sectional web-based survey was conducted by using a structured, validated, questionnaire among dental students based on a previous study (Appendix 1) [16]. Google Forms based structured, self-administered questionnaire written in English was employed in this study.

The questionnaire distributed for the Pediatric Dentistry Master Degree students was divided into five sections and containing 21 questions. The first section gathered information about demographic characteristics of the Pediatric Dentistry Master Degree students like gender, age, and nationality. The second section consisted of 6 questions, which assess the rate of smartphone utilization. The third section collected details about the extent of smartphones utilization for knowledge purposes. The fourth section consisted of five questions and asked about students' attitudes toward smartphone utilization. The fifth section is concerned about barriers to smartphones utilization in distance education.

The questions submitted were open-closed ended, Yes/no questions, multiple-choice, and probability type. The attitude questions' responses were collected on a three-point Likert scale, which is, strongly agree, neutral, and strongly disagree.

Questionnaire distribution and data collection

The online questionnaire link was distributed through different networking websites (Pediatric Dentistry Master Degree students' official emails of Faculty of Dentistry, Cairo University, and WhatsApp groups). All responded questionnaires were collected electronically via Google Form and were subjected to statistical analysis. Data collection was terminated one month after the questionnaire distribution.

Bias

Selection bias: avoided by including all questionnaires that fulfilling the inclusion criteria.

Reporting bias: avoided by reporting all data assessed.

Statistical analysis

Categorical data were presented as frequency and percentage values and were analyzed using Fisher's exact test followed by multiple pairwise comparisons utilizing z-test with Bonferroni correction. The significance level was set at $p < 0.05$ within all tests. Statistical analysis was performed with R statistical analysis software version 4.1.2 for Windows^[17].

RESULTS**Demographic data**

The questionnaire was answered by 61 respondents out of 106 participants, representing 57.5% response rate. The results revealed that 10 respondents were males while 51 were females representing 16.4% and 83.6% of the study population respectively. As regard the age, 30 (49.2%) respondents were 30 years old or younger and 31 respondents (50.8%) were older than 30 years. Concerning the nationality, 53 (86.9%) respondents were Egyptians whereas 8 (13.1%) respondents were non-Egyptians.

Utilization of Smartphone

The results revealed that all the 61 respondents had smartphones. 57.4 % of the respondents utilized android as operating system, while 42.6 % used apple as operating system and none of them use windows or blackberry. 96.7% of the respondents had *Wi-Fi* internet at home, whilst 3.3% did not have, this difference was statistically significant (P -value < 0.001). All the respondents' phone contracts allowed internet data use through a 3G/4G network. A significantly high percentage of the respondents (73.8%) used the internet more than 4 hours daily. The respondents used their smartphones for various purposes; 31.8% perform online shopping/ mobile banking using their smartphones, 39.0% utilize their phones to access social networks and 29.2% used their smartphones to watch videos and listen to music. Additionally, all the participants used their smartphones to take pictures (Table 1).

Smartphone utilization for knowledge purposes

Almost all the respondents 98.4% (60 out of 61) utilized their smartphones to watch lectures/ instructional videos or to read scientific articles, and they also believed that their phones helped in improving their knowledge or skills. The most commonly surfed sites for knowledge purposes were Google scholar (41.0%), and PubMed (45.9%), on the other hand, Wikipedia (1.6%), Research Gate (3.3%) and others (8.2%) were the least accessed sites. 68.9% of the respondents were aware of mobile phone apps in dentistry that are used for training or teaching purposes while

31.1% were not. This difference was statistically significant (P -value < 0.003). A significantly high percentage of the respondents (88.5%) believed that academic application of smartphones should be followed in our syllabus. Most of the respondents

(93.4%) preferred using their smartphone for study and research activities rather than using the library as a result of its faster use. Moreover, the majority (93.0%) believed that smartphones' provided information is satisfactory and reliable (Table 2).

Attitude towards Smartphone utilization

A significantly high percentage of the respondents (67.2%) strongly agreed that the use of mobile tools is beneficial. Moreover, 77% of the study population strongly agreed that the utilization of smartphones provided better access to their courses and learning material. 63.9% of the respondents strongly agreed that the use of smartphones helped them to study independently. Consequently, 72.1% of the respondents believed that usage of smartphones should be encouraged by university and staff. In addition, 29.5% of the respondents strongly agreed that smartphones distract them, 57.4% were neutral, whereas 13.1% of the respondents strongly disagreed that smartphones distract them (Table 3).

Barriers to Smartphone utilization

The results showed that 39.3% of the respondents agreed that wireless access is available in all their locations such as hospital /clinic/ hostel/ rooms, while 60.7% of the respondents disagreed. This difference was not statistically significant. Additionally, 63.9% were aware of the various resources available (platforms providing dental education). A significantly higher percentage of the respondents (90.2%) agreed that they use their smartphones due to lack of time. Finally, 59.0% thought that the small screen of the smartphone limited their access, on the contrary 41.0% did not think so. This difference was not statistically significant (Table 4).

TABLE (1): Distribution of the respondents according to the utilization of Smartphone

Question	Choices	n	%	p-value
1- Do you have a smartphone?	Yes	61	100.0%	NA
	No	0	0.0%	
a) If Yes, what kind of smartphone operating system are you using?	Android	35	57.4%	0.249
	Apple	26	42.6%	
	Windows	0	0.0%	
	Blackberry	0	0.0%	
2. Do you have Wi-Fi internet at home?	Yes	59	96.7%	<0.001*
	No	2	3.3%	
3. Does your phone contract allow internet data use through a 3G/4G network?	Yes	61	100.0%	NA
	No	0	0.0%	
4. What is your average internet usage time?	2 h	4 ^B	6.6%	<0.001*
	4 h	12 ^B	19.7%	
	More than 4 h	45 ^A	73.8%	
5. Do you use your smartphone for any of the following purposes?	Online shopping/ mobile banking	49	31.8%	0.309
	Social network (WhatsApp, Facebook, Twitter, email)	60	39.0%	
	Videos & Music	45	29.2%	
6. Do you use your smartphone to take pictures?	Yes	61	100.0%	NA
	No	0	0.0%	

NA: Not Applicable, Values with different superscript letters within the same horizontal row are significantly different *; significant ($p \leq 0.05$)

TABLE (2): Distribution of the respondents according to smartphone utilization for knowledge purposes

Question	Choices	n	%	p-value
7. Do you use your smartphone to watch lectures/ instructional videos or to read scientific articles (e.g., how to make impressions, etc.)?	Yes	60	98.4%	<0.001*
	No	1	1.6%	
a) If Yes, does it help in improving your knowledge or skills?	Yes	60	98.4%	<0.001*
	No	1	1.6%	
8. Most common site for surfing for knowledge	Google scholar	25 ^A	41.0%	<0.001*
	PubMed	28 ^A	45.9%	
	Wikipedia	1 ^B	1.6%	
	ResearchGate	2 ^B	3.3%	
	Others	5 ^B	8.2%	
9. Are you aware of any mobile phone apps in dentistry that are used for training or teaching purpose?	Yes	42	68.9%	0.003*
	No	19	31.1%	

Question	Choices	n	%	p-value
10. Do you think that academic application of smartphones should be followed in our syllabus?	Yes	54	88.5%	<0.001*
	No	7	11.5%	
11. Do you have any dental apps in your phone?	Yes	38	62.3%	0.055
	No	23	37.7%	
a) If yes, why do you use it?	Illustrations	19	50.0%	0.118
	Clinical procedures	11	28.9%	
	Seminar or journal presentation	8	21.1%	
	Conference poster	0	0.0%	
12. Do you prefer using your smartphone for study and research activities rather than using the library?	Yes	57	93.4%	<0.001*
	No	4	6.6%	
a) If yes, what is your reason?	Lack of time to visit library	5 ^B	8.8%	<0.001*
	It is convenient	7 ^B	12.3%	
	It is faster to use a smartphone	45 ^A	78.9%	
b) If yes, is the information you find on your smartphone satisfactory and reliable?	Yes	53 ^A	93.0%	<0.001*
	No	1 ^B	1.8%	
	Don't know	3 ^B	5.3%	

Values with different superscript letters within the same horizontal row are significantly different *; significant ($p \leq 0.05$)

TABLE (3): Distribution of the respondents according to attitude towards Smartphone utilization

Question	Choices	n	%	p-value
13. Use of mobile tools is beneficial.	Strongly agree	41 ^A	67.2%	<0.001*
	Neutral	19 ^B	31.1%	
	Strongly disagree	1 ^C	1.6%	
14. Improve access to my courses and learning material	Strongly agree	47 ^A	77.0%	<0.001*
	Neutral	14 ^B	23.0%	
	Strongly disagree	0	0.0%	
15. Help study independently	Strongly agree	39 ^A	63.9%	<0.001*
	Neutral	19 ^B	31.1%	
	Strongly disagree	3 ^C	4.9%	
16. Usage should be encouraged by university & staff	Strongly agree	44 ^A	72.1%	<0.001*
	Neutral	15 ^B	24.6%	
	Strongly disagree	2 ^C	3.3%	
17. Smartphone distracts you	Strongly agree	18 ^{AB}	29.5%	<0.001*
	Neutral	35 ^A	57.4%	
	Strongly disagree	8 ^B	13.1%	

Values with different superscript letters within the same horizontal row are significantly different *; significant ($p \leq 0.05$)

TABLE (4): Distribution of the respondents according to barriers to smartphone utilization

Question	Choices	n	%	p-value
18. Is wireless access available in all of your locations such as hospital /clinic/ hostel/ rooms?	Yes	24	39.3%	0.096
	No	37	60.7%	
19. Are you aware of the various resources available?	Yes	39	63.9%	0.030*
	No	22	36.1%	
20. Do you use your smartphone due to lack of time (For e.g.: like going to library or browsing center etc.)?	Yes	55	90.2%	<0.001*
	No	6	9.8%	
21. Do you think that the small screen of the smartphone limits your access?	Yes	36	59.0%	0.159
	No	25	41.0%	

Values with different superscript letters within the same horizontal row are significantly different *; significant ($p \leq 0.05$)

DISCUSSION

The worldwide health crisis caused by breakthrough of COVID-19 pandemic dictated the closure of educational institutions in an attempt to limit the virus dissemination. Accordingly, there was a dramatic transition from face-to-face teaching to different online modalities [18,19].

In Egypt, most universities adopted synchronous approach in teaching using various platforms, where the attendance of virtual classes was the most employed mode to maintain the teaching process [18,20].

Thus, this study was conducted to assess the knowledge, attitude, and Barriers in distance education using smartphones among Pediatric Dentistry Master Degree students during COVID-19 Pandemic in Egypt.

In this research, data collection was performed using an electronic questionnaire as it suits the current condition of the pandemic so as to reduce the possibility of cross-infection [21]. The questionnaire was terminated one month after being distributed, this is similar to a questionnaire conducted by Singh et al [22], who gave a chance for the participants to reply for three weeks as it is assumed that there is a diminished value in further extension of the survey after the fourth week of distribution.

In the present study, the response rate was 57.5%,

which is harmony with the response rates reported by Bhuvaneshwari et al (64 % response rate) [16] and Shrivastava et al (53.3% response rate) [21]. On the other side, Priya, et al [23] and Khatoun et al [24] reported 100% response rate. This discrepancy may be related to the difference in questionnaire nature, as Priya, et al and Khatoun et al used written questionnaires which they distributed by themselves to their students, who may feel embarrassed not to participate, but in this research work an electronic questionnaire was employed which depends mainly on the volunteers' will to participate.

Regarding smartphones utilization, the results revealed that all the respondents had mobile phones, these findings come in accordance with the results of Bhuvaneshwari et al [16]. Moreover, the results showed that participants mainly used android or apple as operating systems, this comes in line with findings of Nisar [25] and Manakil and George [26] who also reported that android or iphone technology were the preferred operating systems. In the present study, more than half of the respondents (57.4%) used android operated smartphones, this may be attributed to their cheaper price and ease of use.

The results also threw light that 73.8% of the respondents used the internet more than four hours daily, this percentage is not far away from that reported by Tuncay [13], who found that 84 % of the participants used smartphones more than four hours

on daily basis. Additionally, the results revealed that 39 % of the respondents utilized their phones to access social networks, this percentage was also close to that reported by Tuncay^[13] who found that 37% of the respondents used their smartphones to access Facebook, WhatsApp and Instagram.

In the current study, all the participants used their smartphones to take pictures, this percentage is higher than that reported by Rung et al (65.3%)^[14] and Bikumalla et al (86%)^[27]. In Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo university, the majority of post graduate students use their mobile phones to take photos to document their cases as a part of their clinical requirements, this may be the reason why all the participants in this research used their smartphones to take photos.

Concerning the utilization of smartphones for knowledge purposes, almost all the respondents 98.4% utilized their smartphones to watch lectures/instructional videos or to read scientific articles, and they also believed that their phones helped in improving their knowledge or skills. These findings are in accordance with those reported by Suner et al [28], where high percentage of their participants (86.9%) replied that the use of smartphones in their dentistry study was found to be useful, or very useful.

The results revealed that the most commonly surfed sites for knowledge purposes were Google scholar and PubMed, these sites were also the most accessed sites for knowledge seeking as reported by Saxena et al^[3].

In the present study, a significantly high percentage of the respondents (68.9%) were aware of mobile phone apps in dentistry that are used for training or teaching purposes. On the contrary, Manakil and George [26] and Suner et al [28] reported that only 25% and 34.56% of their respondents respectively, used software applications on their smartphones that are helpful in dental education. This difference may

be related to the scientific degree of the respondents as the participants in the current questionnaire were post graduate students who are more likely to be acquainted by the different applications that can help them in their clinical practice, while the participants in the other studies were under graduate students who may be less aware of these applications.

In agreement with the results of the present study, Priya, et al^[23] reported that using the internet was preferred rather than going to the library for obtaining dental information. This preference is attributed to the rapid and simple access to internet.

As regards the attitude towards smartphone utilization, the results emphasized that high percentage of the respondents strongly agreed that the use of mobile tools is beneficial. These findings coincide with those reported by Suner et al^[28] and Mergany et al [29], whose respondents also had positive attitude towards efficiency of smartphone learning.

The results of the current study highlighted that 72.1% of the respondents believed that usage of smartphones should be encouraged by university and staff. These findings are supported by the results of Bikumalla, et al^[27], whose participants agreed that staff members and students should be motivated about smartphones utilization for study purposes.

Referring to the barriers to Smartphone utilization, more than half of the respondents disagreed that that wireless access is available in all their locations, additionally they believed that the small screen of the smartphone limited their access. These findings are in agreement with those reported by Bhuvaneshwari et al^[16].

CONCLUSION

The vast student possession of smartphones should motivate universities to consider mobile learning as an adjunctive tool for dental education.

Smartphones provided an additional mean for dental education and knowledge acquisition during COVID-19 pandemic. Postgraduate dental students utilized smartphones for learning purposes although this technology is not officially included in their syllabus. Postgraduate dental students have adequate knowledge about dental mobile applications that can be used in dental education. This study reflects the positive attitude of post graduate dental students towards the implementation of smartphone technology in dental education. Lack of internet availability in the different premises can be considered a possible barrier to smartphone technology utilization.

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