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Evaluation of the Use of Mobile Devices for M-Learning among Dental Students at Taif University

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Abstract This study aimed to evaluate mobile usage and mobile learning (m-learning) amongst dental students for dental education at Taif University. The study comprised 51 dental students from the 1st, 2nd, 5th, and 6th years. Data were collected through an online google survey form and analyzed using Excel 2016 and SPSS 17.0. The questions were both quantitative and qualitative. The chi-square test was also applied to non-parametric questions for two independent variables, study year and gender, to evaluate mobile usage for m-learning. We found a significant association between the time duration of mobile usage and study year (P=.00) and gender (P=.00). There was also a significant association between the purposes of mobile usage with study year (P=.00) and gender (P=.02). Moreover, we found a significant association between preferences for mobile usage and study year (P=.00) and gender (P=.00). A total of 29% of the students use mobile devices for m-learning for more than 7 hours. A total of 78% of the students trust the reliability of mobile devices for m-learning. Most students use mobile devices (37%) more often than computers (6%). A total of 96% of dental students consider mobile devices as a medium for m-learning. Considering the results mentioned above, it was concluded that students have adapted to m-learning quickly as it is fast, convenient, and reliable. Mobile devices can also be used for numerous tasks and different purposes.

Keywords: *mobile learning, dental education, mobile usage, m-learning*

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1. Introduction

Smartphones obtained considerable consumer acceptability in the late 1990s and the early 2000s, first in Japan and then worldwide [1]. In the last decade, both the popularity of smartphones and the capabilities they provide have increased meteorically. As mobile phone use has expanded in daily life, so has its use in education. It has been shown that mobile technologies, such as smartphones, tablets, and laptops, may enhance learning environments [2]. Mobile learning, sometimes referred to as m-learning, incorporates mobile devices into the educational process [3,4,5]. Research focused on m-learning has shown that students learn more from classroom activities when materials are adapted to their specific interests or needs, and access to information whenever and wherever makes mobile learning feasible [6].

According to data, most mobile phone consumers are between 18 and 34 years of age [1]. Millions of students have access to smartphones and tablets, making this a powerful learning tool that could significantly influence classrooms if all devices' potential is utilized. However, uncertainty surrounding the present condition of m-learning in institutions has been reported, despite a number of key advantages identified thus far. The cause of such uncertainties is as follows: a need for a strategic plan; an m-learning strategy; insufficient finance and infrastructure; a lack of digital skills; and a local internet connection. Although a wide range of solutions are presented with internet-based educational programs and despite m-learning having gained popularity due to the increased use of mobile in recent years, not all students have the same access to mobile technology, and their usage varies widely. Due to the prevalence of 'Bring Your Own Device' policies at universities, m-learning projects must rely on students' electronic devices [7,8].

Moreover, the efficacy of educational programs suffers greatly when students' workload increases in terms of the amount of time and material they need to study for each class [9]. Secondly, students may likely handle high-intensity course material delivery in a limited time. This kind of teaching method also hinders their ability to acquire anything of substance [10]. A possible solution to the mentioned problems is providing equal educational opportunities, partly by identifying pupils' technological capabilities or habits and then adapting lessons appropriately [11]. Ultimately, students' perceptions of educational activities using such technology may also significantly impact their learning perspectives [12].

Likewise, health sciences, including pharmacology, nursing, and medicine, increasingly favor mobiles for various purposes, including teaching students, communicating for consultation purposes, and accessing scientific research to support patient care [13,14,15]. Most dental students nowadays belong to Generation Z. The capacity to study with and on a mobile device is independent of a person's interest in this 'digital native' generation [16]. Given this, it is essential to investigate how dentistry students feel about m-learning. Although dentistry students have a generally positive view towards e-learning, the same cannot be said for m-learning [17]. The previous study did include college and medical school students with a goal of exploring variations in m-learning perspectives and attitudes based on various demographic characteristics, such as age, location of residence, gender, and smartphone ownership [13,18]. Despite the increased dentistry-related mobile applications [16], dental students' m-learning practices, viewpoints, and adaptation strategies to new technology have yet to be discovered. Therefore, the researcher of the present study believes that evaluating dental students' attitudes and perspectives about m-learning and their usage patterns for mobile technology might be useful for creating educational programs that support m-learning. For this purpose, this study aims to examine the way in which dental students perceive and engage with mobile learning from multiple angles amongst Taif University dental students of 1st, 2nd, 5th, and 6th year students. This study specifically seeks to: describe how dentistry students utilize mobile devices; explore students' attitudes towards mobile learning; and contrast the function of students' demographic data and the goal of using mobile technology.

2. Methodology

2.1. Procedure

A pilot study was carried out for dental students of the faculty of dentistry at Taif University in Saudi Arabia. The inclusion criteria for participation were all students enrolled in the faculty of the dentistry academic year 2022-2023 (1st, 2nd, 5th, and 6th year). The sample included male and female students from different academic years. All of them actively participated in the study. The exclusion criterion for this study was that the number of intern participants was so small that it was considered an outlier and needed to be excluded. For this study, the researcher only investigated undergraduate and graduate students from different study years in a single university.

2.2. Materials

A questionnaire was designed using google surveys, followed the Likert scale for a few questions, and included open-ended questions. Open-ended questions were adopted from a previous similar study [19]. These questions were coded manually, as the sample size was manageable. The study was based on two independent variables; study year and gender.

2.3. Statistical Analysis

Microsoft Excel Plus 2016 and the Statistical Package for the Social Sciences database (SPSS 17) were used to examine the data once the Google survey form generated the Excel spreadsheet. For non-parametric categorical data, the chi-square test was applied, with the level of significance difference set as a p-value of <0.05.

3. Findings

Section 1:

The first section included the population's descriptive statistics, as demographic data of dental students were also collected.

Table 1. Descriptive statistics of the population

Variable	Descriptions	Frequency	Percentage
Age in years	18-23	48	94%
	24-30	3	6%
Gender	Male	31	61%
	Female	20	39%
Study year	First-year	15	29%
	Second Year	9	18%
	Fifth Year	20	39%
	Sixth	7	14%

Findings from the frequency distribution Table 1 show that, in this study, there was a total of 51 participants. Of these, 94% of the students were aged 18–24 years, whilst 6% of students were aged 24–30 years. Furthermore, whilst 61% of the students were male, the remaining 39% of the students were female. On the other hand, students were from different years of study: 29% of the students were from the 1st year; 18% were from the 2nd year; 30% were from the 5th year; and 14% were from the 6th year. In the last two years, no students were enrolled in the university's 3rd and 4th years. Moreover, a student from the internship also participated in the study, but the student sample size was small.

Thus, it was an outlier and was therefore not included in the study.

Section 2:

This section included general questions pertaining to owning a mobile device, and the type of device dental students at Taif University have for accessing the internet. Of the 51 students, 98.04% were found to have mobile devices, whilst 1.96% did not own a mobile phone. The students without a mobile device were found to be in the 5th year and were all males. Additionally, the type of devices dental students was found to have for accessing the internet for m-learning are summarized in Table 2 below, which reflects responses from the most common to the least commonly used devices for accessing the internet for m-learning. All 51 participants responded to the question.

Table 2. Devices used by dental students for learning

Devices	Percentages (%)
Smartphone	78%
Laptop	71%
Tablet Computer	57%
Desktop Computer	31%
Standard Mobile Phone	8%
Netbook	6%
MP3 Player	4%
E-book reader	2%

N = 51

Section 3:

This section covers the evaluation of the use of mobiles for m-learning. It has three parts: evaluation of time duration; purposes; and preferences of mobile usage. The chi-square test was applied to all three non-parametric categorical data to evaluate the results.

Table 3. Evaluation of m-learning

Parts	Variables	Pearson Chi-Square	p-value
Time duration of	Study year	55.956[a]	.000*
mobile usage	gender	20.673[a]	.002*
Purposes of	Study year	53.486[a]	.000*
Mobile usage	gender	9.788[a]	.020*
Preferences for mobile	Study year	37.752[a]	.000*
Mobile usage	gender	15.030[a]	.005*

N=51

The results from Table 3 show a significant association of time duration, purpose, and preferences of mobile usage for m-learning with study year and gender, as every part of the evaluation has a p-value<0.05. We found a significant association between the time duration of mobile usage for m-learning and study year (P=.00) and gender (P=.00). We also found a significant association between the purposes of mobile usage and study year (P.00) and gender (P=.02). Moreover, we also found a significant association between preferences for mobile usage and study year (P=.00) and gender (P=.00). Dental students use mobile devices for m-learning for different purposes, as mentioned in Figure 1. There is a study year and gender-wise description also.

Dental students use mobile devices for different purposes. Different questions were asked to evaluate the purpose of mobile usage for m-learning. Almost all the students (98%) use mobile phones to access blackboards. Of students who were found to use mobile phones to access blackboards, the figures were as follows: in the 1st year, 29%; in the 2nd year, 16%; in the 5th year, 39%; and in the 6th year, 14%. Of these figures, 61% were male and 37% female. Only 2% of the female students in 2nd year were found not to use mobile phones to access blackboards. Moreover, 96% of the students use mobiles for educational purposes, with figures as follows: 29% from the 1st year, 18% from the 2nd year, 35% from the 5th year, and 14% from the 6th year. Of these, 57% were male and 39% female. Only 4% of females from the 5th year do not use mobile phones for educational purposes. Additionally, 94% of the students use mobile phones to share notes; the data pertaining to those are 27% from the 1st year, 35% from the 2nd year, 18% from the 5th year, and 14% from the 6th year. Of these, 57% were male whilst 37% were female. Notably, only 2% of females of 1st year and 4% of males in 2nd year were found to not use a mobile device for sharing notes. Furthermore, 92% of the students use mobile devices to use applications for dentistry. Of these, 25% are from the 1st year, 35% are from the 2nd year, 18% are from the 5th year, and 14% are from the 6th year. These are broken down by gender as follows: 57% male and 35% female. Furthermore, 4% of the 1st year and 4% of the 2nd year students do not use applications for dentistry. These equate to 4% males and 4% females. Moreover, 92% of the students use mobile devices to watch lectures. Of these, 27% are from the 1st year, 14% are from the 2nd year, 37% are from the 5th year, and 14% are from the 6th year. These are broken down by gender as follows: 59% male and 33% female. In contrast, 2% of the 1st year, 4% from the 2nd year, and 2% from the 5th year do not use mobile devices to watch lectures. These can be seen to be 2% males and 6% females. Finally, the 1st year had 25%, the 2nd year had 18%, the 5th year had 27%, and the 6th year had 14% who take photos of work consisting of 49% of males and 35% of females Only 4% and 12% of students from the 1st and 5th years, respectively, do not use mobile phones to take photos of work, notably consisting of 12% males and 4% females.

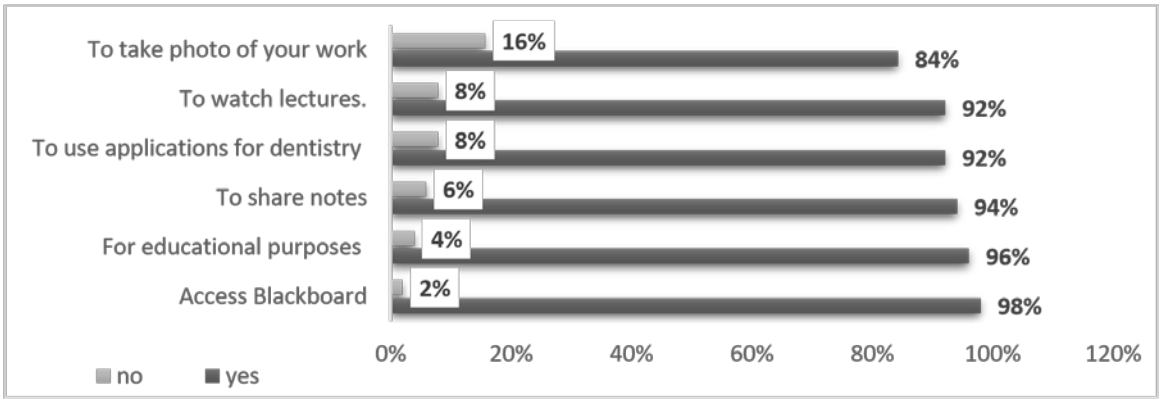

Figure 1. Purposes of mobile usage

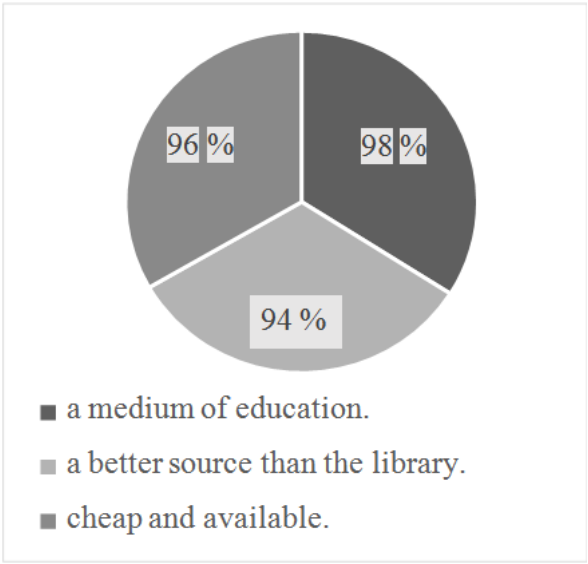

Figure 2. Preferences for mobile usage

We also evaluated m-learning by asking the dental students about their preferences for using mobile devices in Figure 2. A total of 98% of the dental students from Taif University consider mobile devices a medium of education. Of these, 29% were from the 1st year, 37% from the 2nd year, 18% from the 5th year, and 14% from the 6th year, comprising 59% males and 39% females. On the contrary, 2% of the males in the 2nd year do not consider mobile devices as a medium of education. Moreover, 96% of dental students consider mobile devices as a better source than the library, with 27% from the 1st year, 18% from the 2nd year, 35% from the 5th year, and 14% from the 6th year, of which 57% are male and 37% are female, with these proportions considering mobile devices as a better source than the library. On the contrary, 2% of the 1st year and 4% from the 5th year, notably 4% of males and 2% of females don't consider mobile devices better than the library. Additionally, 94% of dental students believe mobile devices are cheaper and more readily available, of which 27% are from the 1st year, 37% from the 2nd year, 18% from the 5th year, and 14% from the 6th year, with 59% of these individuals male and 37% female. On the contrary, 2% of the 1st year and 2% from the 2nd year hold the view that mobiles are not cheaper or more available, with the students broken down by gender as 2% male and 2% female.

Section 4:

Mobile usage for different types of Mobile learning.

Table 4.1. Feature used by dental students on the university website for m-learning

Feature on the university website	Percentages (%)
Looking at course information/materials	78%
E-mail	67%
Quizzes	63%
Handing in assignments	61%
Discussion boards	51%
Links for Students	41%
Others	16%

N=51

Table 4.1 describes that most dental students use mobile devices for looking at the course information/materials, and only a few uses them for other purposes.

Table 4.2. Activities experienced in the course by dental students for m-learning

Activities in a course	Percentages (%)
Virtual Classrooms, e.g. (Blackboards)	67%
Discussion forums	61%
Self-making quizzes	57%
Pre-recorded lectures with PowerPoint slides	55%
Multimedia presentations/mini-recorded lectures	43%
Access to course material	35%
Live lecture capture	22%
Wikis, Podcasts, instant messages	20%
Blogs	14%

N=51

Table 4.2 summarizes that dental student mostly use virtual classrooms, e.g., Blackboards. On the contrary, only some of them use it for blogging.

Table 4.3. Sites accessed by dental students for m-learning

Sites to access data	Percentages (%)
Google	69%
Wikipedia, Google Scholar	61%
PubMed	43%
University sites	24%
Science Direct, Search engines	18%
Personal sites	8%
Medline, Organizations, E-courses	6%
YouTube	4%

N =51

Table 4.3 summarizes the use of sites accessed by dental students. The most used site by students is google, and the least number of students use it to visit YouTube.

4. Summary of Findings

The study revealed that students use their mobile devices for various tasks. It concluded that almost every dental student owns a mobile device. Furthermore, students also have other devices besides mobile devices from which they can access the internet for m-learning purposes. At the same time, most of them use smartphones, laptops, tablets, or desktop computers to access the internet for m-learning. Our findings relate to the results of Payne *et al.* (2012), who concludes that medical students and young physicians use and possess smartphones at significant rates. Both encourage the creation of new applications to aid in their clinical work and educational endeavors [20]. Our study concluded that most students use smartphones and laptops to access the internet for learning. A moderate number of students use other devices such as tablets or desktop computers, whereas only a few students use standard mobile phones, netbooks, MP3 players, and eBook readers to access the internet for learning. The findings relate to the study of Rung *et al.* (2014), which shows that most students use

smartphones or mobile devices to access the internet [21]. On the other hand, this study also evaluated the use of mobile devices and proved the significant relationship between the time duration of mobile students and study year as 1st- and 2nd-year students spend less time on mobile devices for m-learning than students of the 5th year and 6th years. A total of 29% of the students use mobile devices for m-learning for more than 7 hours. At the same time, 24% of the students use it for 4–5 hours. On the contrary, those students who use it for 6–7 hours have the lowest percentage at 6% of the students. There is also a significant association between the time duration of mobile usage and gender, as more males (24%) males and fewer females (6%) use mobile devices for m-learning for more than 7 hours. The results are in alignment with a study carried out in Iran, which shows males use mobile devices more so than females [22]. In contrast, studies by Tavakolizadeh *et al*. (2014) and Dasgupta *et al*. (2017) suggest that females use mobile devices more so than males [23,24]. The difference in results is due to the different sample sizes of males and females in the studies.

The study also concludes that most dental students use mobile devices to look for course information. The results concord with Payne *et al*. (2012), which states that most students use mobiles for timetables and lecture apps [20]. The study also concludes that dental students use mobile devices (37%) more often than computers (6%). At the same time, 27% of the students are continuously on mobile devices when compared with always being on the computer (4%). The results are in agreement with an African study suggesting that m–learning is more portable than e-learning [25]. On the contrary, 25% of the students use mobile devices and computers evenly. Moreover, it was also concluded that 77% of the students prefer mobile devices over the library because it is considered to be both fast and convenient. Moreover, 23% of the students prefer using mobile devices over the library because they have no time to visit the library. These results correlate with those garnered by Georgas (2013), who suggests that students prefer learning online as they have skills searching the data online [26].

Furthermore, upon asking students about the information's reliability on mobile devices for m-learning, 78% of the students trust the reliability of the information, whereas 18% do not know about the reliability of the information on mobile devices for m-learning. On the contrary, 4% of the students do not trust the reliability of mobile devices for mobile learning. Students' mobile usage during lectures was also evaluated. These results suggest that students know the difference between reliable and unreliable data for their learning, which contrasts with the study of Khatoon *et al*. (2019), which notably concludes that, when looking for, analyzing, and synthesizing evidence-based material online, students require instruction and additional support [27]. It reveals that 35% of the students use mobile devices for learning and personal use, and 25% do not even use mobile devices during their lectures. Whilst 18% of the students mostly use it for school learning purposes, 16% use it only for school learning purposes. Similar to the results garnered in this work, Roberts & Rees (2014) conclude that most students use it for tasks related to the lecture [28]. Upon examining all the conclusions mentioned above, students were also asked to comment on the use of mobile devices, of which 88% of students provided no comments. At the same time, 8% of the students commented that mobile devices are easier to use, whilst 4% of the students stated that books are better but complicated. These results relate to the study of Bal & Bicen (2017), which concludes that m-learning is very easy [29].

5. Limitations

The study has obtained a random sample of the population for the pilot study from a single university, including a different number of students from different study years. It would be better if the student sample size for all the study years were the same rather than a different number of students from different years. Moreover, the study should have the same sample size for both males and females. Furthermore, as there was no admission in the 3rd and 4th years of Taif University, the study therefore compromised only those students from the 1st, 2nd, 5th and 6th years. Moreover, the small size of the students is a limitation.

6. Conclusion

M-learning has huge scope in the current world of learning and education and has replaced books. Every dental student owns mobile devices to access information. Furthermore, these students have access to more than one IT gadget for m-learning. They have adapted to m-learning quickly as it is fast, convenient, and reliable. Moreover, dental students can use mobile devices for numerous tasks and different purposes for m-learning.

Lastly, the study also concludes that males use mobile devices more than females.

Declaration and statements

Authors' Contributions

The authors have contributed to the designing, executing, analyzing, and writing this article.

Conflicts of Interest Statement

The authors have no conflicts of interest to declare.

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Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article.

Ethical Approval

Not applicable

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