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Medical students' acceptance and perceptions of e-learning during the Covid-19 closure time in King Abdulaziz University, Jeddah



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ABSTRACT

Background: Nowadays, there is a paradigm shift in medical education. This shift occurred following the Covid-19 crisis. The world uses digital e-learning to support the public health response to this pandemic. The study's objective was to determine the medical students' acceptance and perceptions of e-learning during the Covid-19 closure time in Jeddah.

Methods: A cross-sectional, web-based study was done among 340 medical students from King Abdulaziz University, 2020. A standardized, electronic, self-administered, Google Form data collection sheet was distributed. It included the E-learning acceptance measure (EIAM) containing three constructs, namely: tutor quality (TQ), perceived usefulness (PU), and facilitating conditions (FC). The sheet also inquired about the students' perceptions of the benefits, enablers, and barriers to e-learning. Descriptive, inferential statistics and multiple linear regression analyses were applied.

Results: Blackboard and Zoom were the most preferred Learning Management Systems (LMS) by our medical students. The mean score of EIAM was 102.82 ± 24.102 . Better achievers obtained significantly ($P < 0.001$) higher scores in all EIAM constructs. About three-fifths of the students confirmed that e-learning substituted classical on-campus learning and was an adaptable, and less time-consuming method. The educator's good e-learning skills, the subject, instructional design, interaction, motivation, and good LMS were agreed as enablers of e-learning. However, most students accepted that clinical teaching is the most challenging learning outcome and that exams could be affected by low internet quality.

Conclusion: Medical students moderately accepted e-learning during the Covid-19 Pandemic closure time. More training of the students and tutors, better designing e-courses, more interaction, motivation, and blended learning are recommended.

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Introduction

Nowadays, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), causing Covid-19, is one of the most aggressive and deadly infectious diseases [1]. SARS-CoV-2 was classified as a pathogen with Risk Group 3 as it carries considerable risk to the community due to its effect on life, health, and the global economy [2]. Covid-19 has been declared as a pandemic disease by the WHO on March 11th, 2020 [2,3]. The rapidly evolving global pandemic has affected almost all systems during this crisis [4]. It

presented undue challenges on all stakeholders to go online in such time constraints and resource restraint circumstances [5].

Since the beginning of the Covid-19 pandemic, approximately two billion learners have been affected due to school closures. The UNESCO reported that 192 countries had implemented nationwide closures, impacting about 99.9% of the world student populations [6]. Public health officials' advice on social distancing could flatten the epidemic curve and reduce total deaths from Covid-19. So, emergency e-learning is one of the security measures proposed to protect the community [7]. In a short time, the whole globe was dealing with the challenges of maintaining high-quality education. Designing home schools exaggerated during the pandemic [4]. No previous time in the history had such a vast sudden shift to e-learning [8]. This paradigm shift in education had grave implica-

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tions for all institutions, and it raised particular questions for the medical schools [9].

Information and communication technologies (ICTs) in higher education are subjected to continual debate worldwide [10]. Distance e-learning is defined as “using computer technology to deliver training, including technology-supported learning either online, offline, or both” [3]. Acceptance of online learning denotes the user’s willingness to adapt and utilize technology for the tasks that are intended to support [11].

A study from Thailand, 2016, revealed that undergraduate students’ acceptance level of e-learning was slightly higher than neutral [12]. Costa, et al. conducted a study to explore the e-learning perception of 229 participants from the laboratory animal science who were enrolled in 15 courses from Portugal between 2012 and 2015. They used two online training formats; the flipped classroom and full online theoretical training. They reported high acceptance levels of both methods [13]. Nesterowicz, et al. conducted another study to determine if e-learning can increase knowledge in continuing pharmacy education and if pharmacists can accept the e-courses or not. Their research revealed the effectiveness of e-learning in improving both the knowledge and acceptance of such a learning way [14]. Al-Balas, et al. conducted a recent study, 2020, among medical students from Jordan during the Covid-19 closure time. Their results revealed that the overall students’ satisfaction rate in the e-learning was low [3].

Despite the increasing evidence that e-learning is effective as classical on-campus learning, there is very little evidence about what already works. There is a lack of adequate studies about medical students’ acceptance and perception of e-learning in Jeddah. So, such research is needed.

The study’s objective was to determine medical students’ acceptance and perceptions of the benefits, enablers, and barriers to e-learning during the Covid-19 closure time, King Abdulaziz University, Jeddah.

Methods

A cross-sectional design was conducted targeting medical students who utilized e-learning during the Covid-19 pandemic closure time. Students in King Abdulaziz University (KAU) registries were contacted through their leaders using what’s App and e-mails. The sample size was calculated using the formula for the calculation of samples from the cross-sectional study [14]. At 95% Confidence interval, Z equals 1.96, and 0.053 margins of error was used. As there are no previous similar studies done in Jeddah, “P” was set as 0.5 as the most conservative sample. The total number of the calculated sample was 340 students.

Ethical approval was obtained from the Unit of Biomedical Ethics of King Abdulaziz University with a “Reference Number of 258–20”. An online written consent was taken from each participant through the invitation to participate in the study.

An electronic, self-administered data collection sheet using a Google Form was used. Two experts assessed the face and content validity of the data collection sheet. The internal consistency reliability was assessed by Cronbach’s α and found to be 0.82.

The data collection sheet included the following sections:

- Personal and socio-demographic data: age, gender, academic year, grade-point average (GPA), etc.
- Preferred learning management system (LMS): Zoom, blackboard, Hangout, Microsoft Team, etc.
- E-learning acceptance measure (EIAM): It was used for assessing the degree to which students are willing to use e-learning. It is a standardized 21-item instrument with a 7-point Likert-type scale: 1 = strongly disagree and, 7 = strongly agree. It contains

three constructs for measuring tutor quality (TQ), perceived usefulness (PU), and facilitating conditions (FC). These constructs have a high composite reliability; $\alpha = 0.987, 0.976, \text{ and } 0.996$ for the three constructs, respectively. EIAM also has good validity (11).

- The students were also asked about their perceptions regarding the benefits, enablers, and barriers to e-learning by answering on specific questions using a 5- Point-Likert scale.
- A question asked the student to rate their whole experience with e-learning during Covid-19 closure time. The students answered this question using a five-point Likert scale, and the answers were either very bad experience, bad, fair, good, and excellent experience. Their answers were then dichotomized into 0 = bad experience and 1 = not a bad experience (fair, good, and excellent experience).
- Another question asked the students to rate their experience with the last e-learning course compared to their previous on-class face to face learning. The students answered this question also using a five-point Likert scale, and the answers were either much lower than on-class education, lower, at the same level, better or much better than it. Then their responses were dichotomized into 0=lower than on-class education and 1= not lower than on class learning.

Statistical methods

The data was analyzed using SPSS version 22. Descriptive statistics were done. For inferential statistics, the Student’s t-test was used for comparing two means. Multiple-linear regression analysis was constructed to model the linear relationship between different independent variables and the outcome (dependent) variable of EIMS total score. Other models were also constructed to determine the predictors of the three different EIMS constructs (TQ, PU, and FC). The level of significance was set at $P\text{-value} \leq 0.05$.

Results

The study recruited 340 medical students who agreed to participate. Their mean age was 21.91 ± 1.9 years. Concerning the preferred LMS, to the easiness of use, 48.2%, 47.1%, 1.5%, 0.9%, and 2.3% of them chose the Blackboard, Zoom, Team, Hangouts, and other programs, respectively. Regarding rating of students to their distance e-learning experience (comparing to on-campus learning, 18.2%, 31.8%, 17.4%, 18.5%, and 14.1% of them rated it to be much lower, lower, at the same level, better, and much better than on-class teaching, respectively.

Table 1 shows that the overall score of EIAM ranged from 21 to 147, with a mean of 102.82 ± 24.102 . The TQ total mean score was 39.34 ± 10.14 , the total PU was 44.11 ± 11.52 , and FC was 19.36 ± 5.85 . The lowest value was for FC-3, while the highest level was for PU-2.

Table 2 indicates that females obtained a better mean score of FC (19.84 ± 5.86) compared to males (18.52 ± 5.76), with a statistically significant difference (Student’s t-test = 2.01, $P \leq 0.05$). However, there is no gender difference in the other constructs. Students in the clinical-years obtained a better score on the TQ construct than others ($P < 0.05$). On the other hand, there are no significant associations between age and EIAM. Better achievers obtained significantly ($P < 0.001$) higher scores in all domains of EIAM compared to others. Those who gave a better or equal rating score to e-learning compared to on-class learning had significantly higher total EIAM and higher three construct scores ($P < 0.001$). Similar findings are also revealed regarding the students who rated the e-learning as not being a bad experience.

Table 1
Descriptive statistics of the 21-item e-learning acceptance measure among medical students at King Abdulaziz University Hospital, Jeddah.

Item of ELAM	Mean score	SD
TQ1 - My tutor could explain the concepts clearly through e-learning	5.21	1.41
TQ2 - My tutor was knowledgeable in Information and Communication Technologies	4.62	1.62
TQ3- I was satisfied with the answers given by my tutor	4.93	1.69
TQ4- My tutor was focused on helping me to learn	5.03	1.62
TQ5- The tutorial activities were well-manage	4.64	1.68
TQ6- My tutor was accessible when I need him for consultation	4.8	1.689
TQ7- My tutor was patient when they interacted with me and the class on e-learning	5.03	1.65
TQ8- The group sessions were well facilitated	5.11	1.66
Total tutor Quality	39.34	10.14
Perceived Usefulness		
PU1- I am able to apply the course contents in my work	4.89	1.69
PU2- What I had learned from the course is useful to my work	5.23	1.57
PU3- I am able to use the knowledge from the course to help my colleagues	5.11	1.61
PU4- I can contribute to my workplace more	4.55	2.01
PU5- I can integrate Information and Communication Technologies in my work creatively	4.70	1.64
PU6- I can integrate Information and Communication Technologies in my work with minimal help	4.88	1.48
PU7- I know how to search, evaluate, and select appropriate IT resources to support my work	4.99	1.62
PU8- I am able to adapt Information and Communication Technologies resources in my work	4.93	1.56
PU9- I can manage Information and Communication Technologies resources more effectively at my workplace	4.84	1.73
Total Perceived Usefulness	44.11	11.52
Facilitating condition		
FC1- When I need help to use the e-learning system, guidance is available to me	5.05	1.619
FC2- When I need help to use the e-learning system, specialized instruction is available to help me	4.85	1.62
FC3- When I need help to use the e-learning system, a specific person is available to provide assistance	4.47	1.82
FC4- When I need help to use the e-learning system, I know where to find it	4.99	1.77
Total Facilitating condition	19.36	5.85
Total Scale EIAM	102.82	24.10

Table 2
Mean scores of e-learning acceptance measure according to study variables among medical students at King Abdulaziz University Hospital, Jeddah.

Variables	EIAM scale							
	Tutor quality		Perceived usefulness		Facilitating condition		Total scale EIAM	
	M	SD	M	SD	M	SD	M	SD
Gender:								
Male (N = 123)	40.0 ± 9.78		44.83 ± 11.36		18.52 ± 5.76		103.34 ± 24.12	
Female (N = 217)	38.97 ± 10.35		43.71 ± 11.62		19.84 ± 5.86		102.51 ± 24.14	
Student's t test, p	0.9	0.37	0.86	0.39	-2.01	0.05	0.31	0.76
Age:								
≤ 22 (N = 245)	38.69 ± 9.96		43.74 ± 11.79		19.51 ± 5.95		101.93 ± 24.20	
>22 (N = 95)	41.04 ± 10.51		45.06 ± 10.86		19.03 ± 5.62		105.13 ± 23.96	
Student's t test, p	-1.92	0.06	-0.94	0.35	0.67	0.51	-1.09	0.28
Level								
Basic years (N = 146)	38.03 ± 10.34		43.91 ± 12		19.53 ± 6.32		101.47 ± 25.29	
Clinical years (N = 194)	40.68 ± 9.42		44.59 ± 10.98		19.43 ± 5.42		104.69 ± 22.58	
Student's t test, p	-2.43	0.01	-0.54	0.59	0.15	0.88	-1.23	0.22
GPA:								
≥ 80 % (B and above) (N = 305)	39.81 ± 9.47		44.65 ± 10.78		19.61 ± 5.67		104.06 ± 22.23	
< 80 % (less than B) (N = 35)	35.26 ± 14.33		39.43 ± 16.10		17.26 ± 6.97		91.94 ± 35.20	
Student's t test, p	2.54	0.01	2.56	0.01	2.26	0.02	2.85	0.01
Rating whole e-learning experience:								
Bad (N = 81)	31.14 ± 9.83		33.67 ± 10.59		15.85 ± 5.71		80.65 ± 22.08	
Not bad (N = 259)	41.91 ± 8.81		47.38 ± 9.73		20.46 ± 5.46		109.74 ± 20.24	
Student's t test, p	-9.34	0.000	-10.83	0.00	-6.56	0.00	-11.05	0.00
Comparing e-learning to on-class:								
Lower (N = 170)	35.95 ± 9.92		38.79 ± 10.53		17.52 ± 5.57		92.26 ± 21.74	
Better or equal (N = 170)	42.73 ± 9.22		49.43 ± 9.93		21.21 ± 5.55		113.37 ± 21.65	
Student's t test, p	-6.53	0.000	-9.58	0.00	-6.13	0.00	-8.97	0.00

Table 3
Multiple linear regression analyses of the predictors of total EIAM score and its three constructs among medical students at King Abdulaziz University Hospital, Jeddah.

Construct	Tutor quality		Perceived usefulness		Facilitating condition		Total EIMS	
	B	CI	B	CI	B	CI	B	CI
Rate e-learning experience (not bad)	8.955	0.9, 16.07	10.075	7.408, 12.742	3.296	1.772, -4.819	3.304	1.779, 4.830
GPA (B & Above)	3.586	0.473, 6.698	-	-	-	-	1.917	0.016, 3.817
Rate e-learning class comparing to the in campus class	3.152	1.021, 5.284	6.501	4.225, 8.777	2.267	0.966, 3.568	2.313	1.011, 3.615
Academic year (clinical)	2.258	0.351, 4.165	-	-	-	-	-	-
Constant	8.487	.900, 16.073	9.092	1.556, 16.629	5.447	.937- 9.958	6.438	2.127, 10.749

B: Standardized regression coefficient; CI: Confidence Interval.

Table 4
Perceptions of medical students of the benefits of e-learning during Covid-19 pandemic.

Degree of agreement	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	No	%	No	%	No	%	No	%	No	%
The course materials were always delivered on time	17	5.0	22	6.5	75	22.1	103	30.3	123	36.1
I am motivated to learn online	46	13.5	35	10.3	75	22.1	89	26.2	95	27.9
E-learning substitutes the classical learning process during the Covid-19 pandemic closure	24	7.1	34	10.0	79	23.2	99	29.1	104	30.6
For me, e-learning is adaptable and less time consuming than the traditional classroom learning	29	8.5	39	11.5	71	20.9	76	22.4	125	36.8
There was an interaction between the tutor and students	10	2.9	19	5.6	51	15.0	112	32.9	148	43.5
The tutor paid sufficient attention to each student	13	3.8	16	4.7	96	28.2	101	29.7	114	33.5
Our faculty benefits from distant learning opportunities for addressing large numbers of students	24	7.1	27	7.9	90	26.5	94	27.6	105	30.9
The online assessment was fair for me	41	12.1	46	13.5	86	25.3	84	24.7	83	24.4

Table 5
Opinions of medical students regarding the enablers of e-learning during Covid-19 pandemic.

Degree of agreement	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	No	%	No	%	No	%	No	%	No	%
Enablers of online learning										
Good educator's skills in e-learning	10	2.9	13	3.8	47	13.8	98	28.8	172	50.6
Attractive & interactive learning contents	16	4.7	13	3.8	79	23.2	100	29.4	132	38.8
The subject of the course	13	3.8	8	2.4	51	15.0	89	26.2	179	52.6
Learner background in the subject	18	5.3	17	5.0	78	22.9	83	24.4	144	42.4
An interaction between tutor & students	10	2.9	19	5.6	51	15.0	112	32.9	148	43.5
Motivations from the university, department, and tutor	18	5.3	17	5.0	51	15.0	83	24.4	171	50.3
Expectations and needs of the learner	6	1.8	11	3.2	87	25.6	114	33.5	122	35.9
Friendly learning management system (user-friendly technology)	14	4.1	14	4.1	67	19.7	81	23.8	164	48.2
Improvement E-learning process (as good Information Technology)	10	2.9	15	4.4	67	19.7	98	28.8	150	44.1
More engagement of me as a learner in the learning process (more interactive e-learning)	12	3.5	22	6.5	80	23.5	110	32.4	116	34.1
Provision of more training for the learner and the tutors on e-learning process	10	2.9	16	4.7	75	22.1	109	32.1	130	38.2
Make e-learning an integral part of the learning process (blended learning)	27	7.9	17	5.0	68	20.0	80	23.5	148	43.5
Sound instructional design of the e-learning course	9	2.6	13	3.8	54	15.9	90	26.5	174	51.2
Absence of factors disturbing the learning process	13	3.8	22	6.5	87	25.6	86	25.3	132	38.8
The convenience of the system as a friendly interface, simple use, necessary functionality can improve the process	15	4.4	17	5.0	70	20.6	88	25.9	150	44.1
The efficiency of IT communication can improve the e-learning process	11	3.2	13	3.8	67	19.7	83	24.4	166	48.8
More frequent communication between student and tutor can improve the e-learning process	11	3.2	15	4.4	74	21.8	98	28.8	142	41.8

After controlling confounding factors in multiple-linear regression analyses, Table 3 displays the predictors of the EIMS and its three constructs (TQ, PU & FC). Regarding the total EIMS, the good students rating of their overall e-learning experience during the closure time (B = 3.304; 95% CI: 1.779, 4.830), higher GPA, and the better or equal rating of their e-learning experience compared to on-class learning were the significant predictors. The table also showed that the same predictors and the academic year (B = 2.258; 95% CI: 0.351, 4.165) were the TQ's predictors.

Table 4 shows that about two-thirds (66.2%) strongly agreed and agreed that course material was always delivered on time. Furthermore, about three-fifths (59.7%) of the participants confirmed that e-learning substituted the classical on-campus learning during the Covid-19 pandemic. A similar percentage (59.2%) also agreed that online learning was adaptable and less time consuming than classroom learning. More than three-fourths (76.4%) of medical students agreed that interaction was present between the medical tutor and students during their last online course. Furthermore, 54.1% and 49.1% of the participants agreed that they were motivated to e-learning and that assessment was fair to them, respectively.

Table 5 shows that about four-fifths (79.4 %) of the students strongly agreed and agreed that the educator's good e-learning skills could enable the learning process. Similarly, 78.8%, 77.7%,

74.7%, 73.2%, and 72.0% agreed that the subject of the e-course, sound instructional design of e-learning course, motivation, the efficiency of communication, and a friendly LMS were enablers of e-learning. About two-thirds (67.0%) agreed that the provision of e-learning as an integral part of the learning process (blended learning) is an essential enabler of the future e-learning.

Regarding barriers, Table 6 illustrates that the majority of the medical students (84.2%) agreed that some disciplines or contents (as clinical teaching) are not suitable for e-learning and that the clinical skill is the most challenging learning outcome (76.8%). Similarly, 72.1% of them agreed that their exams could be affected by low internet quality. Furthermore, 57% agreed that limited resources (as weak internet connection) and the lacking of personal preference (negative attitude) to online learning (41.8%) were barriers. One-third of the participants agreed that lacking adequate computer skills was an obstacle for them. About one-third of them accepted that lacking adequate training (32.2%) is another barrier.

Discussion

Up to the best of our knowledge, the current study may be the first research to assess medical students' acceptance & perceptions of e-learning during Covid-19 closure time in Jeddah. The experiences with full-time virtual class e-learning may consider

Table 6
Opinions of medical students regarding the barriers to e-learning during Covid-19 pandemic.

Degree of agreement	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	No	%	No	%	No	%	No	%	No	%
My inadequate computer skills is a barrier to me.	122	35.9	52	15.3	53	15.6	59	17.4	54	15.9
Inadequate training for me on using LMS is a barrier.	104	30.6	48	14.1	75	22.1	43	12.6	70	20.6
Lacking personal preference (negative attitude) to online learning is a barrier.	88	25.9	48	14.1	62	18.2	66	19.4	76	22.4
Lacking self-discipline from my side to e-learning is a barrier.	66	19.4	51	15.0	90	26.5	68	20.0	65	19.1
Poor motivation and expectation from me regarding e-learning is a barrier.	83	24.4	51	15.0	83	24.4	65	19.1	58	17.1
Limited resources as weak internet connections are a barrier to learning.	81	23.8	37	10.9	42	12.3	58	17.1	122	35.9
The weak internet connection is a barrier or good quality of the exam.	21	6.2	15	4.4	59	17.4	72	21.2	173	50.9
Some disciplines or contents are not suitable for e-learning (as clinical teaching).	15	4.4	11	3.2	28	8.2	51	15.0	235	69.2
The cost of accessing the internet is a barrier.	47	13.8	70	20.6	67	19.7	80	23.5	76	22.4
The most challenging learning outcome for me through distance learning is the learning skills (clinical skills)	6	1.8	20	5.9	53	15.6	59	17.4	202	59.4
Student (my) e-learning is constrained by limited options of face-to-face learning.	32	9.4	41	12.1	72	21.2	79	23.2	116	34.1

a newly adopted learning modality among medical students in KAU. E-learning has appeared as a unique learning approach to preserve medical education continuity during the pandemic. We also explored students' opinions toward the significant challenges they faced during such a unique learning experience, limitations, and their future perspectives. The present study may also be the first to use the EIAM to assess e-learning acceptance among Jeddah medical students.

Gaining a better understanding of medical students' acceptance of e-learning can improve our knowledge of their computer-related behaviours and obstacles. Such information could have wide-reaching implications for the educational stakeholders [15].

The e-learning system's easiness to use encouraged the learners to concentrate on learning the content rather than spending efforts on understanding the system [16]. Most of our students preferred Blackboard and Zoom platforms for the easiness to use.

There are three generations of distance education pedagogy. These generations are cognitive-behaviorism, constructivism, and connectivism. These generations have developed in concordance with available technologies [3]. The normalization of emergency e-learning would mean the standardization of such education that can continue in the post-pandemic period [7]. The mean score of EIAM obtained by our medical students was 102.8 ± 24.10 . This score is lower than those reported from Thailand (111.36) and from the combined Singapore samples (130.05) [11]. The lower level of acceptance from the current study may be due to the sudden emergency suspension of education, which poses many challenges. It did not provide adequate times for enough training for the full-time virtual learning, or for accepting and adapting the complete paradigm shift to e-learning. Medical tutors and students found themselves required to use virtual classes to continue [7]. Al-Shehri recommended the importance of preparing the e-learners, understanding their characteristics, and motivations before embarking on significant e-learning programs [17].

Half of our students rated distance e-learning as better or similar to the on-class learning. Students' rating e-learning as not a bad experience, and their rating it as better or similar to on-campus learning were among the predictor of the total EIMS score. Al-Balas's study, 2020, reported that the satisfaction rate in e-learning was only 26.8% among medical students from Jordan [3]. Compared to the Jordanian research, our study's higher rate may be due to the previous application and training on using the blackboard program for years in KAU, Jeddah, before the pandemic (downloading the course materials, giving course instructions, downloading assign-

ments, chatting, and quizzes). However, in the Jordanian's research, there was a new application of e-learning during the Covid-19 crisis. On the other hand, results from a recent meta-analysis, 2019, found that none of the sixteen studies included in their analysis reported that online learning was less effective than offline methods [18]. Similarly, the study of Costa, et al. from Portugal revealed high levels of acceptance of e-learning [13]. The discrepancy between our research and the previous studies may also be due to the faculties' sudden closure during the pandemic with the complete shift to the full-time virtual learning.

The present study revealed the absence of significant associations between students' age with the total EIAM score and all its three facets (TQ, PU & FC). These results are in line with the results of Costa, et al. [13]. On the other hand, this finding disagrees with the results of Teo, et al. and Ngampornchai, et al. from Thailand [11,12]. They found that younger students had a higher level of e-learning acceptance. Toe, et al. also reported that age was negatively associated with all facets in EIAM. Such discrepancy between our findings and the previous studies may be due to the differences in the sample sizes, target populations, or the studies' conduction times. Nowadays, digital information becomes universally and accessible to every person of all ages [18].

Regarding the TQ facet of EIAM, findings of our study revealed that females had a lower level of perception than males (but without a statistically significant difference). Toe, et al. also reported that females had a lower level of perception [11]. On the other hand, in the current study, females obtained a better FC construct level than males ($P \leq 0.05$). This finding may be because females usually communicate better, have more splendid social activities, and are more satisfied with online courses. This result coincides with a study done among university students from Chile and Spain [19]. On the other hand, our findings reported the absence of significant associations between gender and other EIAM constructs (TQ, PU). This result is in line with the results of Teo et al. [11].

Better achievers in our study had significantly higher mean levels of all EIAM facets compared to others (and a higher GPA is one of the predictors of high EIMS and TQ facet). These findings may be because good achievers may need to save time by studying through e-learning (instead of going to the faculty) or having better internet skills. This result agrees with the findings from Indonesia [20].

E-learning has been reported to provide more comfortable and more effective access to a broader variety and greater quantity of information, as well, learning delivery permits a personalized method in learning. So, students have more control over the learn-

ing content and time [3]. Concerning the perceptions of medical students regarding the benefits of e-learning, the results of the current study found that about 60% of the participants agreed that e-learning substituted on-class learning during the closure time. A similar percentage accepted it as an adaptable and less time-consuming method. Similarly, the Jordanian study reported that the main advantage of e-learning, from the perspective of their students, was saving time [3]. Bediang, et al. found that most of their students perceived the potential effect of e-learning [21]. Similarly, Gaikwad, et al., [22] reported that their students well-perceived interactive e-learning in the pharmacology module. Nesterowicz, et al., 2014, notified the acceptance of e-learning by pharmacists from Poland during their continuous pharmacy education [23]. Barteit, et al. conducted a mixed-methods study by introducing e-learning through a blended approach and showed a high agreement (>75%) with such a method [24]. Their higher findings than the current study may be due to their practical training and application of blended learning.

Regarding the enablers of e-learning, most of our medical students agreed that educator's good e-learning skills, subject of the course, sound instructional design, interaction, motivation and good LMS are the essential enablers. Similarly, Regmi and Jones conducted a systematic review of the articles (1980–2019) and found that online learning's main enablers were motivation, interaction, and user-friendly technology [25]. An integrative review (ten studies) reported that improving educators' e-learning skills and incentives were among the e-learning enablers [26].

More than three-fourths of our medical students agreed that interaction was present between the medical tutors and students during their last online course. Such a high interaction rate may be because the tutors in KAU always receive training courses on medical education and on providing interactive and efficient learning. Some of the staff in our medical college also had degrees in medical education. They may also applied such previous experiences for making interaction virtual learning.

About two-thirds of our participants agreed that using blended learning is essential for improving the future online process. Similarly, students from the UK acknowledged the application of it [27]. These findings also agree with the conclusions from Gardner, et al. [28].

Concerning the barriers, a previous study reported that inadequate infrastructure, weak internet, and low computer skills were some barriers to e-learning [8]. In the current study, 57% of our participants agreed that a weak internet connection was a barrier. Furthermore, one-third of the students decided that the lack of adequate personal computer skills was an obstacle, which goes in line with Gaikwad, et al. [22]. In the present work, lack of personal preference (negative attitude) to the e-learning and a lack of adequate training were another reported barriers. The previous integrative review concluded that poor technical skills, inadequate infrastructure, and negative students' attitudes were the main barriers [26]. Similarly, the study of Barteit, et al. reported that technical support to the e-learning platform was perceived by the students to be insufficient [24]. Fransen, et al. noted a few barriers that were related to technological matters [29].

About 40% of our students agreed that lack of self-discipline to e-learning is another barrier, concurs with Regmi and Jones [25]. Lakbala reported that lack of proper training on e-learning and the limited communication with the instructor were the most critical barriers. In contrast, the lack of comfort with technology was the least important factor [30]. Gardner, et al. reported that among the obstacles of e-learning is the need to be personally motivated to complete learning modules, which is in line with our results [28].

The clinical encounter is the central part of learning clinical skills. Eventually, students may need to transfer their skills from the simulated environment to the patient's bedside [27]. The growth

of student needs to clinical encounter over the years was apparent [10]. In the present study, most students agreed that clinical skill is the most challenging learning outcome and might be not suitable for e-learning. This result agrees with the results of Regmi and Jones [25] and Gardner, et al. [28]. On the other hand, a study from the School of Medicine and Dentistry in the UK, 2009, reported that overall second-year students felt that e-learning had a positive impact on their necessary clinical skills, and it was comparable to on-campus clinical teaching [24]. Such discrepancy may be due to differences between students' academic year or due to application of the blended learning in the UK.

Conclusion

With advances in technologies, e-learning is a quickly growing educational approach that represents an optimal solution to continue the learning process in exceptional circumstances and emergencies such as the current global COVID-19 pandemic, which also faced our medical students in Jeddah. Blackboard and Zoom were the most preferred LMS platforms by our medical students. Half of the students rated e-learning to be lower than on-campus learning. The students had a moderate e-learning acceptance level. Females obtained a significantly better mean score of FC compared to males. Students enrolled in the clinical years obtained a better level on the TQ. Better achievers got significantly higher levels in all EIAM constructs than others. The majority of the students agreed that the educator's e-learning skills, the subject of the course, sound instructional design, interaction, motivation, and good LMS are among the enablers of e-learning. Most medical students agreed that clinical teaching is challenging through e-learning. Besides, the majority of them agreed that exams could be affected by low internet quality.

Limited resources and the lacking student's personal preference for online learning were among the reported barriers. One-third of the participants agreed that lacking adequate computer skills and deficiency of proper training were other barriers.

High stakes, educators, and policy-makers should develop continuous training of the medical educators and students on virtual classes to improve their skills and acceptance. Good instructional designs of the e-learning courses, motivation, interaction, and support are needed. Customized blended learning is urgently needed as a post-pandemic pedagogy.

Developers of curricula for clinical skills need to confirm that e-learning environments employ channels that encourage more in-depth learning approaches.

Limitation of the study

The small sample size may be a limitation of the study.

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Competing interests

No competing interests.

Ethical approval

Ethical approval was obtained from the Unit of Biomedical Ethics of King Abdulaziz University with a "Reference Number of 258–20". An online written consent was taken from each participant through the invitation to participate in the study.

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