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Assessment of acceptance, barriers, and facilitators of e-learning among trainees of Saudi board of preventive medicine during covid-19 pandemic

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ABSTRACT

Introduction: When the COVID-19 emerged, and lockdowns were imposed, e-learning was adopted as an alternative teaching method. Our study aimed to assess e-learning acceptance facilitators and barriers among trainees of the Saudi Board of Preventive Medicine (SBPM) during the COVID-19 pandemic. *Methods:* A Cross-sectional study used an electronic questionnaire as Google Form, which included the E-learning acceptance measure (ElAM) with its three constructs and inquired about attitude, barriers, advantages, and disadvantages of e-Learning. Data analysis was done with descriptive statistics, the student's t-test and multiple linear regressions. *Results:* The studies showed an 83% response rate, and most (75%) of the trainees were satisfied with the e-learning experience. Around 65.6% of the trainees did not report any challenges securing the internet during the online learning period. The ElAM mean score was 111.97±23.04. Trainees with difficulty securing the internet for learning had a significantly reduced total ElAM score and its three constructs ($p<0.001$). Of respondents, 72.6% preferred a combination of e-learning with traditional classrooms as unsuitability for some courses to be online was reported. *Conclusion:* Three-quarters of trainees welcomed the new learning method because of its flexibility and cost reduction. Around a half preferred the e-learning coupled with physical training because of limitations line internet issues.

Keywords: e-Learning, acceptance, Barriers, Facilitators, Preventive Medicine, Saudi Arabia

1. INTRODUCTION

In the past two decades, the teaching and learning methods have considerably changed with increasing priority for the electronic (E) learning methods (Xu &

Xu, 2019). Many students and teachers have adopted the online learning method (also known as e-learning) as new teaching and learning model (Hanafy et al., 2021; Li Cathy, 2020; Yaseen & Salah, 2021). This shift has been even faster with the COVID-19 pandemic that was declared in March 2020 by the World Health Organization (WHO) (Christian et al., 2020; Cucinotta, 2020; Ibrahim et al., 2021). COVID-19 prevention measures led to disruptions to the education systems; educational institutions either shut down or had to find an alternative study method that respected the different country measures against COVID-19 (Balhareth et al., 2020; Ibrahim et al., 2021) hence, the sudden adoption of e-learning methods. The teaching process can be real-time, or the students access a pre-recorded teaching material at their own convenient time. E-learning makes learning reliable, efficient, and less stressful with easy access to experts (Butnaru et al., 2021) because students can study from anywhere at any time (Purdy et al., 2015; Yaseen & Salah, 2021).

Medical education primarily involves in-person didactic lectures and in-person clinical exposure/experience (Gismalla et al., 2021). Given this learning model, the COVID-19 pandemic greatly affected medical education. Hence, the need to empower and enforce e-learning in medical education was evident. As e-learning gets adopted by an increasing number of academic institutions, studies use the e-learning acceptance measure (ElAM) to measure the attitudes of students and the teachers that determine the intention and actual use of the e-learning technology (Iyer, 2008; Teo, 2010).

Studies worldwide assessing medical students' perceptions regarding online education have shown positive and optimal results (Purdy et al., 2015). Studies have indicated that students support the e-learning approach over the traditional methods (Ansar et al., 2020; Hanafy et al., 2021). An online survey done on students in residency and fellowships during the pandemic showed that 94% reported that COVID-19 had affected their surgical and clinical training. In comparison, 71.6% had problems continuing their dissertations due to increasing hospital work, especially in COVID-19 wards, supporting their training and learning shift to online (Balhareth et al., 2020). However, some studies suggested that e-learning lacks interactivity and is costly in terms of equipment/materials needed, like the internet, laptops/smartphones, tablets (Butnaru et al., 2021) and technical problems (Zalat et al., 2021).

A study conducted by Ansar et al., (2020) surveyed undergraduate medical students in Pakistan. They found out that 78% of the students were dissatisfied with the methods of assessment and the fairness of the examinations. Kattan et al., (2021) conducted a study involving Saudi plastic surgery residents and attendings of e-learning during the COVID-19 pandemic, and found that 62.3% of the participants suggested that online learning supplements the traditional teaching methods preferring both methods to be used together. Similarly, other studies found that medical residents preferred e-learning to the conventional learning methods as a mitigation measure to Covid-19 contraction (Hanafy et al., 2021; Ibrahim et al., 2021). No study has discussed the current situation of e-learning among trainees of the SBPM.

The SBPM was formed initially as the board of Community medicine in 2009. Then its name changed in 2018 into Preventive Medicine (Saudi Commission for Health Specialties, 2017). Preventive medicine consisted of four levels, two junior (R1 and R2) levels and two senior (R3 and R4) levels. The SBPM has approved training centers in nine cities, namely: Abha, Al-Ahs, Jazan, Jeddah, Madinah, Makkah, Riyadh, Tabouk and Taif, where physicians are trained in public health and clinical medicine. The SBPM also introduced e-learning via the ZOOM platform for the theoretical part of training in all training centers after the COVID-19 pandemic. No studies were conducted before adopting the new learning method. Therefore, during this study, we assessed SBPM trainee's e-Learning acceptance during the COVID-19 pandemic 2020-2021.

2. METHODS

Study design and site

This was a cross-sectional study, administering a questionnaire by electronic link the Google Form. It involved trainees from all SBPM training centers in Saud Arabia and was conducted from 1st October 2021 to 30th November 2021.

Participation and study population

The questionnaire was sent to all 300 trainees from the SBPM registries and the electronic link form was distributed via emails. Reminders were sent via WhatsApp to the leaders in all SBPM centers. The electronic link form included a summary of the research concept and objectives and a request for permission to participate in the study.

A pre-designed questionnaire was with 3 sections used for data collection. The first section collected socio-demographic data such as age, gender, training center, level of training. The second part was the ElAM, a standardized 21 items instrument with a 7-point Likert scale to assess whether trainees would be willing to use e-learning (Teo, 2010). These items fall into three categories: tutor quality (TQ), perceived usefulness (PU), and facilitating conditions (FC). The third part of this tool evaluated the trainees'

acceptance of e-learning during the pandemic year by exploring attitude, barriers, improvement (Ibrahim et al., 2021), advantages, and disadvantages (Dost et al., 2020). The trainees who were already enrolled in the SBPM 2020-2021 training program during our study period were eligible to participate in our study.

Data Analysis

All the collected data were analyzed using R statistics software 3.6.2. Descriptive statistics were conducted on each variable to generate frequencies, percentages, mean, and standard deviation. We also compared the mean total ElAM score and its three constructs based on the trainee's gender and level of training using the student's t-test. We used multiple-linear regression to determine relationship between predictors and the outcome of ElAM total score and its constructs. We constructed other models to determine the predictors TQ, PU, and FC. The statistical significance was considered at P-value ≤ 0.05. The dependent variable included e-learning acceptance measures (such as satisfaction), enablers and barriers (such as lack of adequate training), attitude, and ways for improvement, while independent variables were socio-demographic variables such as age, gender, academic years.

3. RESULTS

Three hundred trainees received the survey, and out of them, 249 (83%) responded. Five trainees were excluded from this study because they were not enrolled in the SBPM program during the study period. Among the respondents, 132 (54.1%) were males, and the mean age of all respondents was 30.2 ± 3.6 years. Fifty-nine per cent of our study participants were junior, and the training center with the most respondents was from Jeddah (50%), followed by Madinah Al Munawarah (30%) (Table 1).

Table 1 Characteristics of the trainees of the SBPM who responded to the survey

Item	Frequency (%)
Gender	
Male	132 (54.1%)
Female	112 (45.9%)
Training level	
Junior	144 (59%)
Senior	100 (41%)
Age	
Mean	30.20
SD	3.59
Training centers	
Abha	24 (9.8%)
Al-ahsa	20 (8.2%)
Jazan	23 (9.4%)
Jeddah	50 (20.5%)
Madinah al munawarah	30 (12.3%)
Makkah al mukarramah	24 (9.8%)
Riyadh	25 (10.2%)
Tabouk	20 (8.2%)
Taif	28 (11.5%)
Main device used	
Laptop	146 (59.8%)
Smart phone	34 (13.9%)
Desktop	18 (7.4%)
Tablet	44 (18%)
Other gadgets	2 (0.8%)
Had e-learning experience before covid-19	
Yes	118 (48.4%)
No	126 (51.6%)
Difficulty securing internet for learning	

No	160 (65.6%)
Sometimes	58 (23.8%)
Yes	26 (10.7%)

Most trainees used personal laptops as the primary devices to access the e-learning tool (59.8%), and 48.8% had e-learning experience before the COVID-19 pandemic. Around 65.6% of the trainees did not report any challenges securing the internet during the online learning period. We found that the ElAM mean score and standard deviation was 111.97±23.04, while that for TQ, PU, and FC were 43.61±9.19, 48.71±10.36, 19.65±6.15, respectively (Figure 1).

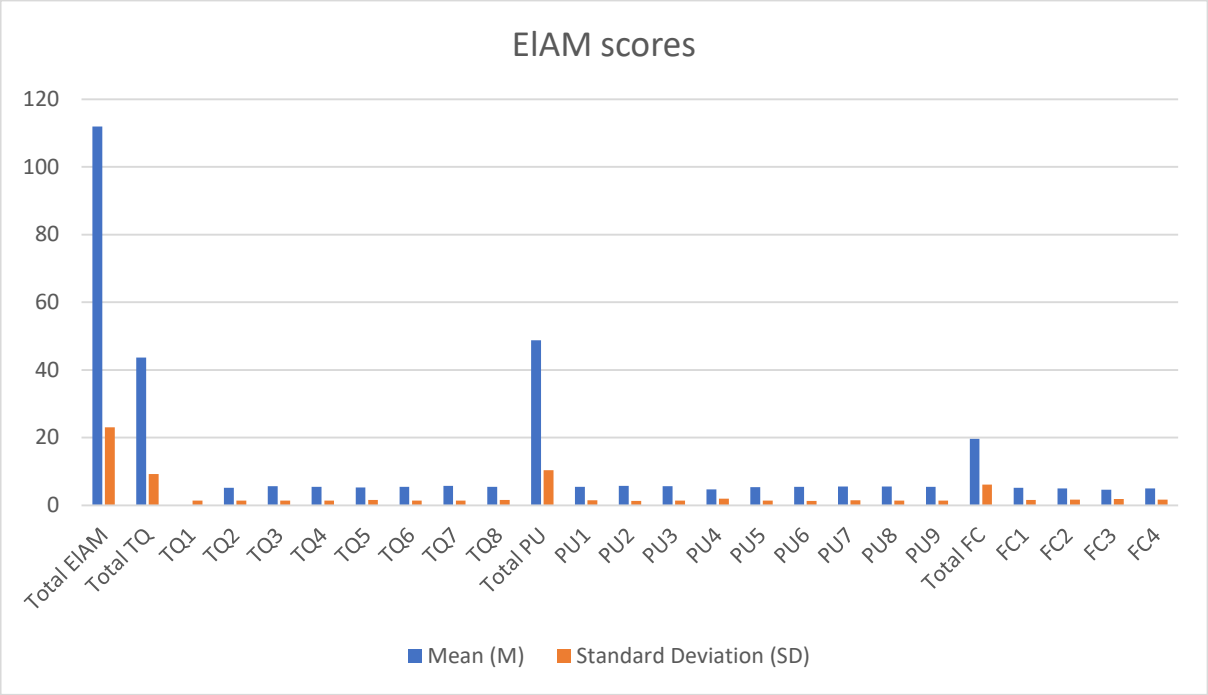

Figure 1 ElAM scores among the trainees of the SBPM who responded to the survey

The comparisons in the mean scores of ElAM, TQ, PU and FC did not show any significant difference between male and female trainees as well as between juniors and seniors (Table 2). As shown in Supplement 1, three-quarters of the trainees were satisfied with the e-learning experience, and 64.4% preferred e-learning over the physical classroom. However, 53.7% indicated that some course contents were unsuitable for e-learning. Although most of the trainees had a positive attitude towards e-learning, 43.5% preferred the face-to-face experience. The good skills of the trainer in e-learning and using a blended model that combine e-learning with traditional classroom were favored by 84.4% and 72.2% of the respondents, respectively. The most-reported advantages of e-learning were reducing the cost of commute (88.9%) and offering better flexibility in terms of time and place (85.3%).

Table 2 Participants' ElAM scores according to gender and training level

Variables	Total ElAM Mean (SD)	Total TQ Mean (SD)	Total PU Mean (SD)	Total FC Mean (SD))
Gender				
Male (n=112)	110.86 (22.90)	42.97 (9.19)	48.37 (10.06)	19.52 (6.05)
Female (n=132)	113.27 (23.24	44.37 (9.16)	49.11 (10.73)	19.79 (6.29)
p-value	0.418	0.237	0.581	0.732
Training level				
Junior (n=144)	112.03 (25.58)	43.82 (10.00)	48.14 (11.43)	20.08 (6.48)
Senior (n=100)	111.87 (18.92)	43.31 (7.91)	49.53 (8.58)	19.03 (5.62)
p-value	0.956	0.671	0.303	0.956

ElAM: e-Learning acceptance measure; TQ: Tutor Quality; PU: Perceived Usefulness; FC: Facilitating Condition; SD: Standard deviation

The multiple-linear regression analyses showed that trainees who reported total difficulty or some difficulty in securing the internet for e-learning significantly scored lower (p<0.001) (Table 3).

Table 3 The relationship between predictors and the outcome of the ElAM total score and its constructs among SBPM trainees (Multiple linear regression analyses)

Predictors	Total ElAM Mean (SD)		Total TQ Mean (SD)		Total PU Mean (SD)		Total FC Mean (SD)	
	estimate (SE)	p-value	estimate (SE)	p-value	estimate (SE)	p-value	estimate (SE)	p-value
Age	0.28 (0.38)	0.461	0.12 (0.15)	0.425	0.23 (0.18)	0.195	-0.07 (0.11)	0.532
Having e-learning experience before covid-19								
No	REF.		REF.		REF.		REF.	
Yes	1.86 (2.76)	0.503	0.22 (1.10)	0.843	1.24 (1.26)	0.327	0.40 (0.76)	0.60
Difficulty securing internet for learning								
No	REF.		REF.		REF.		REF.	
sometimes	-10.27 (3.31)	<0.01	-4.02 (1.32)	<0.01	-4.06 (1.51)	<0.01	-2.19 (0.91)	0.017
Yes	-28.35 (4.55)	<0.001	-11.13	<0.001	-11.64 (2.07)	<0.001	-5.57 (1.26)	<0.001

ElAM: e-Learning acceptance measure; TQ: Tutor Quality; PU: Perceived Usefulness; FC: Facilitating Condition; SD: Standard deviation; SE: Standard Error; REF.: Reference

4. DISCUSSION

Our study was the first one to be conducted in the SBPM training centers, which train physicians. This is helpful as it can show how training was affected and what to improve based on trainees' perceptions. In our study, around 65.6% of the trainees did not report any challenges during the e-learning period. The reason might be that the majority (59.8%) of them used their own laptops they are familiar with, and some (48.8%) had experienced e-learning before. This is similar to what Kattan et al., (2021) found, that most (78.7%) respondents e-learning convenient, and another study which reported 78% satisfaction from online learning by undergraduate students in Pakistan (Ansar et al., 2020). However, another study found that the overall medical students' early experience in e-learning was unsatisfactory, while higher satisfaction was among students who had previous experience in e-learning (Gismalla et al., 2021).

The ElAM mean score for our trainees was 111.97±23.04, and it is higher than what was reported in the study done in Jeddah, on medical students (102.8 ± 24.10) (Ibrahim et al., 2021). The higher level of acceptance in our respondents may be from the fact that they are physicians who already have the means to good computers and stable internet necessary for e-learning. In addition, the trainings about preventive medicine do not primarily require personal physical exercises and exposure that medical students should get in their clinical studies. Unlike Syed et al., (2021) who found that male participants had significantly higher odds of availing e-learning platforms (OR: 1.52; 95%CI: 1.23–1.87, p < 0.001), our study did not show any significant difference between male and female trainees.

Our study showed that trainees (64%) preferred it over physical classrooms. Trainees reported cost reduction and flexibility as e-learning advantages probably because of the ability to access the courses anywhere, removing travel requirements and the ability to record or download materials and replay later when necessary. Similarly, the study done by Gismalla et al., (2021) found that the majority (64 %) of medical students consider e-learning as the best option during COVID 19 lockdown. The survey on orthopedic surgery residents showed overall positive perception towards different e-learning methods, with webinars being rated the highest at 8.1 out of 10. Residents preferred to continue learning all non-practical medical education exclusively online (Figueroa et al., 2020). However, our study's findings disagree with the study done by Syed et al., who found that their participants considered traditional classroom training to be more effective (73.77%) and more convenient (68.74%) (Syed et al., 2021). This disagreement may be because our study's participants had no difficulties getting computers and had digital skills to use e-learning platforms and no significant difference between women's and men's perceptions. Inadequate digital skills, poor infrastructure and significant difference (p<0.001) in perception between male and female participants were reported by Syed et al., (2021).

Good skills of the trainers in e-learning courses were one of the major factors to improve e-learning. Similar findings were reported in the study at King Abdulaziz University. They found that skilled trainers skills, well prepared course subjects, adequate infrastructure and incentives were a key to successful e-learning (Ibrahim et al., 2021). This may be because skilled trainer keeps

trainees engaged and interested in a course, and that improve interaction and infrastructure, and incentives act as motivations. We found that 53% of trainees preferred traditional learning in some course contents that need physical practice, and the majority (72%) preferred a blended model combining e-learning with the traditional classroom. This might be because e-learning was abruptly introduced in the SBPM centers without proper preparations to make the environment favorable to learn and put all online tools in place for all courses. This makes it necessary to have physical trainings on some subjects not designed to be effectively covered online.

The study reported similar findings on medical students that showed some clinical skills to be unachievable through e-learning (Dost et al., 2020). In another study, a lack of face-to-face interaction was reported as the barrier to effective e-learning (Gismalla et al., 2021). This finding is similar to our study, where 43.5% of trainees preferred the face-to-face experience. Our study revealed that d 70.6% of respondents agreed that e-Learning is adaptable and 76.9 % agreed that e-learning has successfully substituted the conventional education method during quarantine time. Similar findings were reported in another study in Jordan, where 59.2% of medical students reported that e-learning is adaptable and 59.7% agreed that it successfully substituted the classical learning process (Khamis et al., 2020). As barriers, 53.7% of trainees reported that some courses were inapt for online education, and 54.4% reported that limitations of suitable devices like good internet, computers, and headsets are barriers to good e-learning. These findings agree with other studies that found a weak internet connection to be a barrier for 57% of students. More than one-third of the trainees agreed that inadequate computer skills were a barrier, which aligns with other studies (Ansar et al., 2020; Hanafy et al., 2021).

Trainees who reported difficulties in e-Learning mostly were challenged to get a good internet connection (Table 5) and had a significant reduction in the total ElAM score. Having experienced internet connection difficulties, their perceptions were negatively affected, leading to decreased total ElAM score. Similar findings were reported in Sudan, where a poor internet connection and lack of electricity were the main challenges (Gismalla et al., 2021). The poor internet quality was also reported by students in 40 UK medical schools (Dost et al., 2020) and by Jordanian medical students (Al-Balas et al., 2020) to be the barrier to e-learning.

5. CONCLUSION

E-learning became the only way to keep trainings going at the SBPM centers after lockdowns and social distancing were introduced to fight against the COVID-19 pandemic. The majority of trainees welcomed the new learning method preferring it over traditional physical trainings. Despite being abruptly introduced and new to most of the trainees, most of them didn't have challenges; they adapted. Flexibility and cost reduction were advantages of e-learning reported by trainees, but the majority preferred to combine e-learning with physical trainings. Challenges like poor internet, some course content being unsuitable for e-learning and lack of face-to-face experiences were among limitations of e-learning. Good skills of the trainers in e-learning courses were one of the major factors to improve the e-learning experience.

Limitations

This study was conducted entirely online. In-person interview could allow more in-depth data collection and minimize bias. Our sample size was small because the number of preventive medicine trainees is limited to 300.

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Author Contributions

Osama M. Almutairi designed the study's conceptual framework and drafted the research proposal. He also did data collection and analysis. Then he wrote the manuscript draft.

Marwan A. Bakarman revised and contributed to the research proposal and manuscript writing and supervised the research conduction.

Hani A. Alghamdi contributed to designing the study's conceptual framework and supervised the research conduction.

Ethical considerations

The study was approved by the Medical Ethics Committee of the Saudi Ministry of Health (ethical approval code: A01275) Jeddah, Saudi Arabia.

Supplement

Supplement 1: Perceptions and Opinions of trainees of the SBPM who responded to the survey regarding the use of the e-learning method

Variables	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	N	%	N	%	N	%	N	%	N	%
Satisfaction										
Overall, I am satisfied with the SBPM online lectures experience	11	4.5%	15	6.1%	35	14.3%	59	24.2%	124	50.8%
Overall, the SBPM online lectures experience was superior to that of the physical classroom.	25	10.2%	21	8.6%	41	16.8%	60	24.6%	97	39.8%
Barriers Factors										
Lack of adequate individual training on the use of e-learning programs such as zoom was a barrier for good e-learning.	42	17.2%	59	24.2%	65	26.6%	47	19.3%	31	12.7%
Limitation of personal resources (headphone, computers, internet connections) was a barrier to achieving good e-learning.	61	25.0%	47	19.3%	52	21.3%	50	20.5%	34	13.9%
Some course contents were not suitable for e-learning.	33	13.5%	34	13.9%	46	18.9%	63	25.8%	68	27.9%
The attitude towards e-learning										
Course materials have always been delivered on time.	7	2.9%	23	9.4%	52	21.3%	77	31.6%	85	34.8%
e-learning have "successfully" substituted the classical learning process during the COVID-19 pandemic.	8	3.3%	5	2.0%	44	18.0%	80	32.8%	107	43.9%
I was able to ask the questions I wanted to ask.	5	2.0%	6	2.5%	40	16.4%	75	30.7%	118	48.4%
e-learning was adaptable and less time consuming than traditional classrooms.	12	4.9%	14	5.7%	41	16.8%	59	24.2%	118	48.4%
I prefer face-to-face lectures more than e-learning ones.	50	20.5%	29	11.9%	59	24.2%	47	19.3%	59	24.2%
Improvement										

Good skills of the educators in e-learning courses can improve the experience of e-learning.	5	2.0%	6	2.5%	27	11.1%	85	34.8%	121	49.6%
Making e-learning part of the usual learning process (blended learning using both classroom and e-learning) can improve the e-learning process.	9	3.7%	7	2.9%	52	21.3%	69	28.3%	107	43.9%
Advantages										
Utilizing Online lectures lead to standardization of material taught across all training centers.	5	2.0%	4	1.6%	37	15.2%	59	24.2%	139	57.0%
Online lectures improved the teaching quality of most of the appointed faculties/experts.	9	3.7%	7	2.9%	48	19.7%	65	26.6%	115	47.1%
Online lectures offered better flexibility in terms of time and place.	4	1.6%	4	1.6%	28	11.5%	50	20.5%	158	64.8%
Disadvantages										
Online lectures require good time-management skills.	10	4.1%	18	7.4%	47	19.3%	69	28.3%	100	41.0%
Online lectures do not have instructors monitoring the learners' progress.	16	6.6%	24	9.8%	73	29.9%	63	25.8%	68	27.9%
Online lectures require the learners to be responsible for their own learning progress.	8	3.3%	5	2.0%	48	19.7%	67	27.5%	116	47.5%

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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