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EFFECTIVE BLENDED LEARNING IN HIGHER EDUCATION DURING COVID-19

Abstract. The COVID-19 pandemic situation has impacted the entire education system, especially universities, and brought a new phase in education, "blended learning." The objective of the research was to study the relationship of eight independent factors: e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment, in the provision of effective blended learning in higher education during COVID-19 pandemic. Additionally, an extended relationship of gender and level of course with the effective blended learning was studied. A descriptive cross-sectional study was conducted with the students of higher education institutions in the Kingdom of Bahrain, and the Kingdom of Saudi Arabia, with a self-administered questionnaire aimed to learn the students' perception of blended learning. All levels of undergraduate and postgraduate students took part in the study with a sample size of 1229. Ultimately, this study used a Structural Equation Modelling (SEM) approach to find the positive relationship between the effective blended learning and the eight independent variables and two mediating variables in the higher education sector. The study results portrayed a positive relationship between the eight independent variables and blended learning effectiveness in higher education institutions. The findings revealed that there is a difference in the students' perception of gender, level of the course, and the effectiveness of blended learning in the HEIs. The research offers guidance to governing bodies, administrators, and teachers of HEIs in decision-making and improves their actions to provide the best teaching and learning through blended learning. HEIs need to focus on the study results to enhance blended learning effectiveness based on e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment. Also, since there is a significant difference between the gender, level of the course, and blended learning, providing blended learning based on gender and level of the course needs to be concentrated on by the higher education institutions.

Keywords: blended learning; effectiveness; student's perspective; higher education; COVID-19 pandemic.

1. INTRODUCTION

Evolving technology has revolutionised the traditional teaching methods and the structure of teaching and learning. The traditional structure is a teacher-centred approach,

where the teacher is actively involved in teaching, while students listen and follow the teacher's instruction. The contemporary structure is student-centred learning, also known as the learner-centred approach. In this approach, students actively interact with the teacher and the peer students. Learning skills can be enriched by incorporating technology in the student-centred approach. Moreover, modern technology helps to implement online education in higher education institutions. Nowadays, numerous higher educational institutions are adopting online education, which gives the working people an opportunity to attend classes during their spare time.

COVID-19 has had a dramatical impact on education. In the global pandemic situation, teachers, students, and the management of higher education institutions aim to maintain the effectiveness of the education system. On March 2020, the Centers for Disease Control and Prevention (CDC) has issued guidelines on alternative teaching methods to communicate the students' class works and assignments. Henceforth, universities and schools introduced e-learning to mitigate disturbance in the educational process. Numerous virtual classroom applications such as ZOOM, Cisco WebEx meetings, Schoology, BigBlueButton, and Blackboard play a vital role in the fundamental shift from the traditional classroom to the virtual classroom and e-learning system. Furthermore, higher education institutions adopt e-learning to tackle face-to-face classroom teaching challenges, since there is a relationship between students' motivation and e-learning.

E-learning delivers many positive impacts on university students, such as student engagement, confidence, responsiveness, curiosity to learn, and learners' motivation. Appropriate e-learning materials and supporting materials provided by the instructors enrich students' analysis, critical thinking, and problem-solving skills. However, students should be guided to use the high-quality learning materials available in the open educational resources [1]. Additionally, the course content of e-learning should be organised to ensure ease of access. However, accessing online resources may be challenging owing to possible issues with understanding the content of learning materials. To address these kinds of problems, teachers develop interactive e-learning platforms with visual aids.

Blended learning is a combination of online and face-to-face instruction, broadly utilised in higher education. It needs the effective use of technology, learner characteristics, and participants' commitment. Computer competency, social support, family support, workload management, age, gender, and attitude play a vital role in blended learning in higher educational institutions [2]. Added to it, blended learning is supported by innovative pedagogy and instructional design.

This research study analyses eight independent variables: e-learning environment (ELE) [3], e-learning facilitation (ELF) [4], e-learning materials (ELM) [4], e-learning technical support (ELT) [5], instructors' personal attention (IPA)[4], interaction with instructors (INI) [4], interaction with peer students (IPS) [6], and laboratory learning environment (LLE) [7] to enhance the blended learning (BLL). The research aims to find the relationship between these independent variables and the effectiveness of blended learning. Additionally, it is endeavoured to find out the extended relationship between gender and level of course and the effectiveness of blended learning. The research model was based on previous ideas from indexed journals, research discussions, published data, and practical experience. The statistical analysis was performed in the research based on the students' perspective and concluded with future research ideas.

The research aims to determine the importance of effective blended learning in higher educational institutions and its significance during the COVID-19 pandemic. Further, the research focused on the utilisation of technology to satisfy student's expectations and quality of education. The research is limited to the Kingdom of Bahrain and the Kingdom of Saudi Arabia. The research outcomes will support the decision-makers of universities, government

policy-makers, teachers, and students in framing guidelines for effective blended learning. The study intended to identify the effective blended learning in the higher educational institutions from the students' perspective.

Several researchers highlighted the vital role of e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment factors in the effective blended learning. Also, some researchers reported effective blended learning from the students' perspective. However, studies related to the effective blended learning of Bahrain and Saudi Arabian students, specifically in the higher educational institutions during the COVID-19 pandemic, are limited. So, the study aimed to address the research gap. The motivation behind the study was to review the various components of effective blended learning, existing literature and utilize the variables in the quality of education.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The efficiency in applying skills and learning is shown in blended learning pedagogies with an organized approach [8]. Besides, blended learning with the e-learning environment and educational technology leads to less cost with sufficient knowledge delivery. Therefore, an e-learning environment is essential in higher educational institutions to support and enhance blended learning. The e-learning environment is essential in the successful learning experience, student satisfaction, and loyalty. Improvement of the e-learning environment in HEIs can be implemented with the support of students, online tutors, and planned face-to-face events. Moreover, the e-learning environment should consider system quality, information quality, instructor quality, academic achievement, academic engagement, digital readiness, and service quality for effective blended learning [9]. Therefore, it is hypothesised that:

H1. There is a positive relationship between the e-learning environment and the effectiveness of blended learning in higher education.

E-learning facilitation plays a vital role in implementing innovative blended learning in higher education. E-learning facilitation has a strong influence on the development of schools and higher educational institutions. E-learning facilitation is the driving force of policies in schools, higher education, students learning environment and teachers [10]. E-learning facilitation can be involved intensely in managing the online program to ensure effective blended learning [11]. Since technology adoption was inevitable in online courses, a cohesive backing structure with a collaborative environment is needed in universities and schools. E-learning facilitation includes nourishing and growing blended learning aspects from instructors and learners' perspective. Accordingly, it is hypothesised that:

H2. There is a positive relationship between the e-learning facilitation and the effectiveness of blended learning in higher education.

The focus on the alignment of e-learning materials with blended learning course design is a crucial factor to be considered. The e-learning materials should use a learner-centred approach and the teacher-centred approach. E-learning content in higher education emphasizes student interaction and dynamic learning [12]. The creation of sufficient and adequate e-learning resources by educational institutions has a considerable impact on implementing effective blended learning [13]. Supporting resources and learning materials are included in the content of e-learning available online to higher education students. The online materials with various quizzes, assignments, and projects facilitate students in problem-solving, analytical skills, and critical thinking. Therefore, it is hypothesised that:

H3. There is a positive relationship between the e-learning materials and the effectiveness of blended learning in higher education.

E-learning technical support is related to effective blended learning. The technological platforms utilised in the blended learning environment need to be user friendly in achieving the learning outcomes of the course [14]. The operation and installation of blended learning applications should be carried out seamlessly and efficiently. Proper availability of blended learning applications facilitates student's transition to the online and face-to-face classes with satisfaction and greater enjoyment. Moreover, it is compulsory to provide the necessary technical skills training to the students and teachers before moving to online courses [15]. Accordingly, it is hypothesised that:

H4. There is a positive relationship between the e-learning technical support and blended learning effectiveness in higher education.

Teachers can devote personal attention to sculpting, integrating, and producing new techniques and ideas to develop major blended learning activities in higher education. The instructors provide timely and accurate feedback. In turn, these strategies will improve effective blended learning in higher education. Furthermore, teachers are an essential component of higher education, providing satisfaction through peer review and allowing instructors' performance to be evaluated to determine their quality. An appropriate fulfilment survey is most important to improve blended learning [16]. Experts from the instruction material committee, the continuous quality improvement committee, the curriculum committee, and the faculty development committee form a working group to analyze, monitor, execute, and create blended learning transitions. Further, instructors' techniques play a vital role in the strategic teaching-learning methodology. Therefore, it is hypothesised that:

H5. There is a positive relationship between instructors' personal attention and blended learning effectiveness in higher education.

Based on the New Media Consortium (NMC) Horizon Report 2017 (HE Edition) [17] blended learning, collaborative learning, more in-depth learning, and evaluating learning trends were all mentioned as ways to attain knowledge and skills utilizing technology tools. According to the researchers, the elements of successful blended learning are proper communication between teachers, and students, course design, student's communication, quality of teaching, course content, and administrative support. The conventional classroom arrangement allows for a direct connection between students and teachers [18]. Meanwhile, blended learning provides a variety of online teaching and learning to meet the learning objectives. Accordingly, it is hypothesised that:

H6. There is a positive relationship between the interaction with instructors and blended learning effectiveness in higher education.

Interaction with peer students in the e-learning system enhances blended learning. Peer interaction will enhance the learning environment and increase the accuracy, also provide the qualitative peer feedback. Further, the data-driven peer interaction approach will increase blended learning [6]. Moreover, interaction with peer students will enhance extrinsic and intrinsic motivation [19]. Therefore, it is hypothesised that:

H7. There is a positive relationship between the interaction with peer students and blended learning effectiveness in higher education.

In laboratory learning, pupils' positive and negative characteristics can be recorded. In higher education, the laboratory learning element fosters digital learning. The model, the

laboratory learning environment, combines learning on the online network and face-to-face learning to maximise the benefits of both methods. Furthermore, the procedure entails creating a blended learning model based on project-based learning and confirming the model based on project-based learning via a virtual scientific laboratory [7]. Further, the application based learning linked with the laboratory environment will enhance blended learning [20]. Accordingly, it is hypothesised that:

H8. There is a positive relationship between the laboratory learning environment and blended learning effectiveness in higher education.

The impact of blended learning varies between gender (male and female students). The relationship between learning persistence and student interaction in online learning environments revealed a moderating effect [21]. The course level and the campus-based experience have a moderating influence on the blended learning experience. With the moderating influence of blended learning content, there is a link between perceived utility and students' perceived fun. Moreover, there is a moderating effect of the level of course and experience and relationship with blended learning [22]. Therefore, it is hypothesised that:

H9. There is a relationship between a) gender, b) level of the course, and the effectiveness of blended learning in higher education.

COVID-19 affected classroom studies at a global level, but the education did not halt. Transformation towards blended learning supported the education process with the internet and suitable technology [23]. Even though blended learning facilitates continuing education, there was a lack of adequate instructions. Instructors were facing difficulty in providing learning materials. Further, most of the higher educational institutions moved to distance education. There is an opportunity to increase the flexible learning model in the blended learning [24].

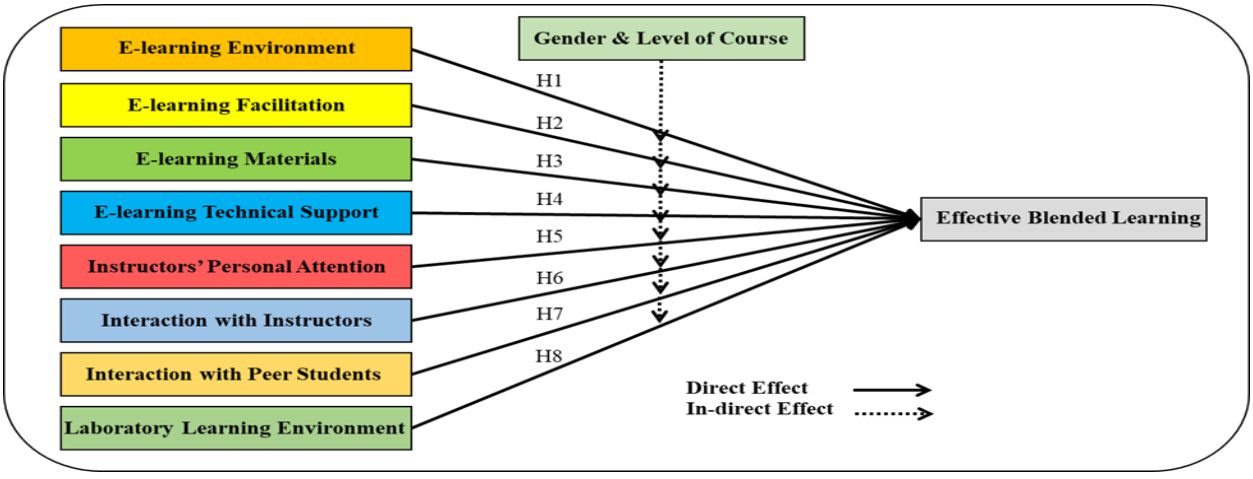

Figure 1. Research Model

The research framework was developed based on the various research outcomes from the unpublished and published data, high indexed reputed journals, practical experience, and discussed using different definitions. The research framework includes a direct relationship with independent variables and dependent variables and an indirect relationship with the moderating variables. Figure 1 represents the research model consisting of 8 independent variables (e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with

peer students, and laboratory learning environment) and two moderating variables (gender and level of course) associated with the dependent variable (effective blended learning).

3. METHODOLOGY

The study population comprises bachelor (1st, 2nd, 3rd& 4th year) and masters (1st & 2nd year) students in universities in the Kingdom of Bahrain and the Kingdom of Saudi Arabia. During COVID-19, data on students who took online classes was analyzed. The 5-point Likert scale (5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree) self-administered questionnaire was used to collect the data. The questionnaire consisted of three divisions. Part 1 consists of two moderating variables: gender, and level of course. Part 2 consists of eight independent variables: e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment and Part 3 with six questions of effective blended learning. The study used an online questionnaire survey method to collect the data to understand blended learning effectiveness. Using google form, the students answered the questionnaire questions and the required attribute is enabled for all the questions in the questionnaire so that the respondents cannot skip any of the questions, and there is no missing data. A-Priori sample size calculator that uses structural equation modelling (SEM) was employed in this study to compute the recommended sample size. The sample size is required to identify effect by inputting desired data for anticipated effect size (Cohen's *d*), statistical power level, and probability level. This research used 0.3 anticipated effect size, 95% desired statistical power level, 0.05 probability level. With the 11 latent variables and nine observed variables of this study, the computed sample size to detect effect is 277; the required minimum sample size for the model structure is 766, and the recommended minimum sample size is 766. Henceforth, 1229 samples used in this study is adequately enough to reflect the total population.

The goodness of model fit, composite reliability, and discriminant validity assessments were used to test the instrument's validity and reliability. Additionally, the analysis of the measurement model and structural model support attest the research model's positive hypothesis effect. SmartPLS software is used to compute assessment criteria and statistical analysis. Hence, SmartPLS 3.3.2 software is opted to compute goodness of model fit, sign indeterminacy, and Dijkstra-Henseler's ρ and analyse the structural model. Correspondingly, the Multi-Group Analysis (MGA) tool of SmartPLS supports assessing the hypothesis on moderating variables. Consequently, the study adopted SmartPLS for structural equation modelling (SEM) using the partial least squares (PLS) path modelling method to compute assessment criteria and statistical analysis.

4. RESULTS

4.1 Goodness of Model Fit

At the initial level of statistical analysis, the difference between the observed values and the statistical model's expected values should be measured. The goodness of model fit statistical hypothesis test shows the fitness of sample data for the actual population. It is essential to do the goodness of model fit hypothesis test before the structural model and measurement model analysis. Henceforth, it is essential to employ PLS with the commencement of goodness of fit tests for confirmatory research.

Table 1

Goodness of Model Fit

Fit criteria	Value
SRMR	0.076
d_{ULS}	2.700

There are several methods of measuring the model's goodness of fit: 1) the standardised root means squared residual (SRMR) method, the unweighted least squares discrepancy (dULS), and the geodesic discrepancy (dG). Table 1 demonstrates the goodness of model fit assessments using standardised root means squared residual and unweighted least squares discrepancy. The traditional value of SRMR is less than 0.1; the calculated result of 0.076 is a good fit for SRMR. Correspondingly, the conventional view of d_{ULS} should be less than 95 per cent of bootstrap quantile; and the computed result of d_{ULS} using the PLS algorithm is 2.700. Therefore, the reflected results show that the criteria are met. The model accomplishes a good fit.

Table 2

Indicator Reliability, Internal Consistency, Convergent Validity, and Fornell-Larcker Test of Discriminant Validity

	Alpha	CR	AVE	ELE	ELF	ELM	ELT	BLL	IPA	INI	IPS	LLE
ELE	0.796	0.880	0.710	**0.842**								
ELF	0.750	0.857	0.667	0.718	**0.817**							
ELM	0.769	0.866	0.684	0.706	0.731	**0.827**						
ELT	0.711	0.837	0.632	0.720	0.705	0.634	**0.795**					
BLL	0.869	0.902	0.605	0.725	0.748	0.758	0.744	**0.778**				
IPA	0.725	0.845	0.646	0.680	0.767	0.769	0.700	0.787	**0.804**			
INI	0.761	0.863	0.677	0.746	0.718	0.721	0.736	0.839	0.768	**0.823**		
IPS	0.767	0.866	0.682	0.681	0.745	0.731	0.744	0.834	0.775	0.792	**0.826**	
LLE	0.711	0.838	0.633	0.726	0.707	0.665	0.908	0.747	0.773	0.768	0.730	**0.795**

The research estimates composite reliability (CR), average variance extracted (AVE=convergent validity), outer loadings, Cronbach's alpha, and discriminant validity to do the measurement evaluation. Internal consistency reliability was assessed to test the research appropriateness. Composite reliability and Cronbach's alpha are the measures of internal consistency reliability. The values of composite reliability and Cronbach's alpha for all the variables should be higher than 0.70. Table 2 exposes the values of composite reliability, and Cronbach's alpha is higher than 0.70. Additionally, the average variance extracted values demonstrate how well the questionnaire represents the characteristics of the research model and the variables; the minimum essential value of AVE should be 0.50; from table 4, AVE also met the required criteria. As the third level of measurement evaluation, the Fornell-Larcker standard was used. Fornell-Larcker criterion is commonly used to evaluate the degree of shared variance. Square root comparison is made using the latent variable correlations with AVE values. The calculated values are less than 0.9, so the discriminant validity is accepted. From all the data provided in table 4, it is proved that the measurement scales are reliable and valid.

Table 3

HTMT Results

	ELE	ELF	ELM	ELT	BLL	IPA	INI	IPS	LLE
ELE									
ELF	0.828								
ELM	0.804	0.866							
ELT	0.846	0.856	0.845						
BLL	0.869	0.824	0.828	0.837					
IPA	0.896	0.842	0.830	0.869	0.892				
INI	0.857	0.853	0.845	0.894	0.829	0.837			
IPS	0.870	0.880	0.852	0.899	0.822	0.839	0.838		
LLE	0.853	0.859	0.884	0.889	0.839	0.866	0.835	0.881	

A novel technique for measuring discriminant validity in PLS structural equation model is the heterotrait-monotrait ratio of correlations (HTMT). If the HTMT value is less than 0.90, the discriminant validity has been endorsed between two latent variables. Based on the Table 3 HTMT results, it is distinctly proved that the measurement scales are reliable and valid.

4.2 Structural Equation Modeling (SEM)

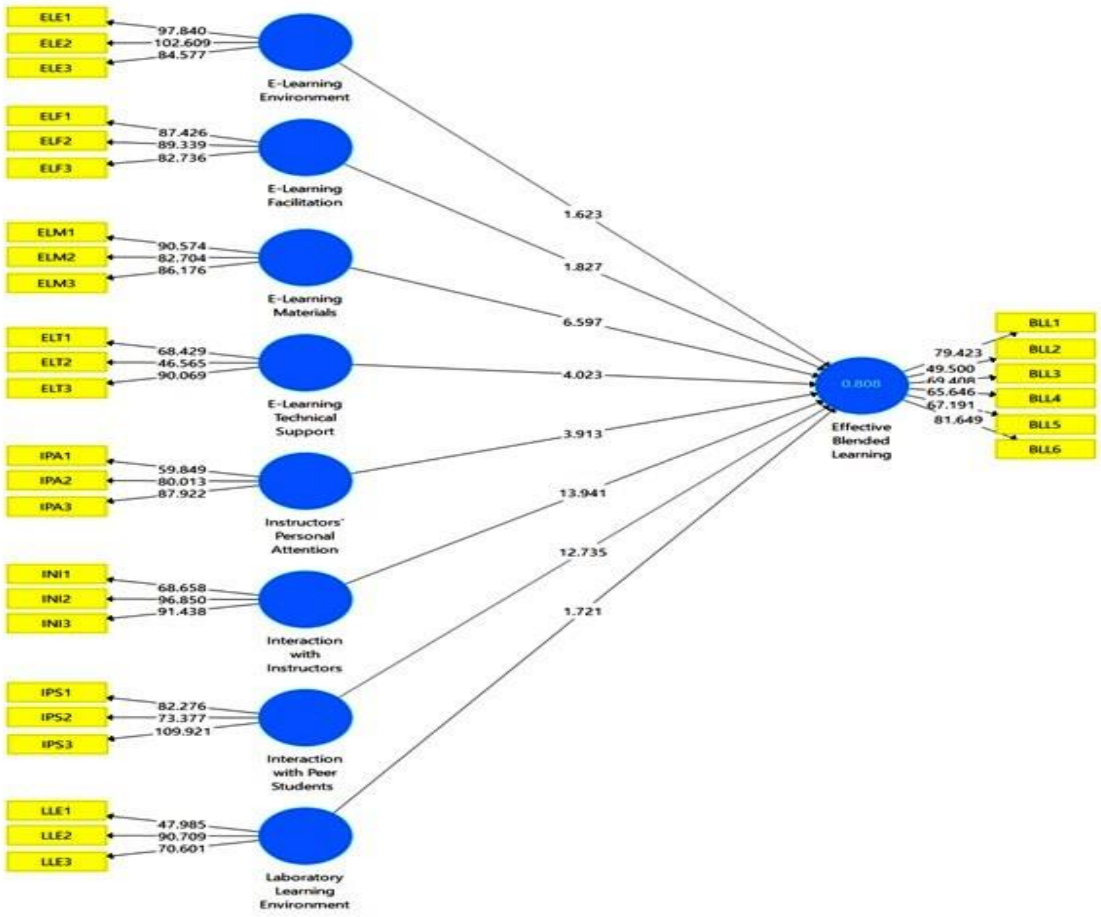

Figure 2. PLS Result

Figure 2 denotes that the R^2 value for the estimated equation is 0.808. It shows that 80.8 per cent of the effective blended learning is defined by e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment.

Table 4

Structural Hypothesis

	Beta	SE	p-Values	VIF
E-Learning Environment→Effective Blended Learning	0.042	0.029	0.000	2.058
E-Learning Facilitation →Effective Blended Learning	0.049	0.025	0.000	2.338
E-Learning Materials →Effective Blended Learning	0.123	0.019	0.000	2.183
E-Learning Technical Support →Effective Blended Learning	0.126	0.032	0.000	2.651
Instructors' Personal Attention →Effective Blended Learning	0.118	0.030	0.000	2.350
Interaction with Instructors →Effective Blended Learning	0.323	0.024	0.000	2.969
Interaction with Peer Students →Effective Blended Learning	0.280	0.022	0.000	2.904
Laboratory Learning Environment →Effective Blended Learning	0.058	0.036	0.000	2.531

Table 4 represents the structural hypothesis results using the PLS algorithm and bootstrapping approaches. From the results of the total effect, Beta and Standard Deviation (SE) values were obtained using the bootstrapping approach. Furthermore, the collinearity statistics method obtained Variance Inflation Factors (VIF) results using the PLS algorithm. Likewise, the p-values of all the variables were obtained using the bootstrapping approach. The values of VIF for all the latent variables with the expected output should be in the range of 0.2 to 4 tolerances. The inner VIF values using collinearity statistics of e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students and laboratory learning environment with effective blended learning are 2.058, 2.338, 2.183, 2.651, 2.35, 2.969, 2.904 and 2.531repectively. All the portrayed results are in the range of 0.2 to 4; there is no multicollinearity effect among the variables.

Table 5

Hypothesis Testing

	Beta	t-Statistics	pValues	Decision
E-Learning Environment →Effective Blended Learning	0.042	1.623	0.000	Supported
E-Learning Facilitation →Effective Blended Learning	0.049	1.827	0.000	Supported
E-Learning Materials →Effective Blended Learning	0.123	6.597	0.000	Supported
E-Learning Technical Support →Effective Blended Learning	0.126	4.023	0.000	Supported
Instructors' Personal Attention →Effective Blended Learning	0.118	3.913	0.000	Supported
Interaction with Instructors →Effective Blended Learning	0.323	13.941	0.000	Supported
Interaction with Peer Students →Effective Blended Learning	0.280	12.735	0.000	Supported
Laboratory Learning Environment →Effective Blended Learning	0.058	1.721	0.000	Supported

Table 5 shows the results of hypothesis testing using the bootstrapping approach. The results for t-statistics and p-values for all the variables concerning effectual blended learning output are excellent. Five thousand bootstrap subsamples were used to perform the hypothesis test. Complete bootstrapping and bias-corrected and accelerated confidence interval method and 0.05 significance level of confidence interval computations were set during the analysis. The findings revealed that e-learning environment has a positive relationship with the

effective blended learning (β=0.042, p<0.05); therefore, H_1 is accepted; e-learning facilitation has a positive relationship with the effective blended learning (β=0.049, p<0.05); therefore, H_2 is accepted; e-learning materials had a positive relationship with the effective blended learning (β=0.123, p<0.05); therefore, H_3 is accepted; e-learning technical support has a positive relationship with the effective blended learning (β=0.126, p<0.05); therefore, H_4 is accepted; instructors' personal attention has a positive relationship with the effective blended learning (β=0.118, p<0.05); therefore, H_5 is accepted; interaction with instructors has a positive relationship with the effective blended learning (β=0.323, p<0.05); therefore, H_6 is accepted; interaction with peer students has a positive relationship with the effective blended learning (β=0.280, p<0.05); therefore, H_7 is accepted; finally, laboratory learning environment has a positive relationship with the effective blended learning (β=0.058, p<0.05); therefore, H_8 is accepted. Henceforth, the blended learning with the structured approach of pedagogies reflects the efficiency in applying skills and learning [8]. Therefore, blended learning requires strategic pedagogies for learning with informal practices that need to be put into practice in higher educational institutions. Moreover, e-learning environments with structured student support, online tutors, and planned face-to-face events improve blended learning [25].

4.3 Partial Least Squares-Multiple Group Analysis (PLS-MGA)

Table 6

Significant difference between genders

	p-value (male vs female)
E-Learning Environment →Effective Blended Learning	0.442
E-Learning Facilitation →Effective Blended Learning	0.283
E-Learning Materials →Effective Blended Learning	0.201
E-Learning Technical Support →Effective Blended Learning	0.717
Instructors' Personal Attention →Effective Blended Learning	0.032
Interaction with Instructors →Effective Blended Learning	0.719
Interaction with Peer Students →Effective Blended Learning	0.017
Laboratory Learning Environment →Effective Blended Learning	0.372

As per the guidelines, if the p-value was higher than 0.95 and smaller than 0.05, there is a significant difference between the group in the specific PLS path coefficient. In other words, the results are significant at the error level of 5 per cent if the p-value is higher than 0.95 or smaller than 0.05. Table 6 reveals a significant difference in the effective blended learning between male and female student's; therefore, H_{9a} is supported. The p-value of 0.032 of instructors' personal attention and the p-value of 0.017 of interaction with peer students are less than 0.05, reflecting a significant difference between the students' gender. Consequently, there is a significant difference between male and female students in blended learning activities. Also, there is an amount of difference between female and male students in the effectiveness of blended learning related to satisfaction and motivation [26].

Based on the guidelines, if p-value was higher than 0.95 and smaller than 0.05, it indicate that there is a significant difference between the groups in the specific PLS path coefficient. In other words, the results are significant at the error level of 5 per cent if the p-value is higher than 0.95 or lower than 0.05. Table 7 represents a significant difference in the effectiveness of blended learning between the courses' levels: therefore, H_{9b} is supported. In Table 9, G1 represents level 6; G2 represents level 7; G3 represents level 8, and G4 represents level 9.

Table 7

Significant difference between levels of course

	p-value (G1-G2)	***p-value (G1-G3)***	***p-value (G1-G4)***	***p-value (G2-G3)***	***p-value (G2-G4)***
E-Learning Environment →Effective Blended Learning	0.341	0.799	0.000	0.327	0.604
E-Learning Facilitation→Effective Blended Learning	0.360	0.230	0.000	0.055	0.041
E-Learning Materials →Effective Blended Learning	0.061	0.132	0.281	0.043	0.101
E-Learning Technical Support →Effective Blended Learning	0.153	0.144	0.451	0.252	0.174
Instructors' Personal Attention →Effective Blended Learning	0.551	0.000	0.038	0.646	0.282
Interaction with Instructors →Effective Blended Learning	0.047	0.022	0.718	0.249	0.169
Interaction with Peer Students →Effective Blended Learning	0.822	0.004	0.000	0.177	0.038
Laboratory Learning Environment →Effective Blended Learning	0.674	0.000	0.198	0.998	0.414

The p-value of (G1-G2) for interaction with instructors is 0.047; it is less than 0.05, reflecting a significant difference between level 6 and level 7. The p-value of (G1-G3) for instructors' personal attention is 0.000; for interaction with instructors 0.022; for interaction with peer students 0.004, and for laboratory learning environment 0.000; which are less than 0.05, reflecting a significant difference between level 6 and level 8 courses. Likewise, the p-value of (G1-G4) for e-learning environment is 0.000; for e-learning, facilitation 0.000; for instructors' personal attention 0.038, and for interaction with peer students 0.000; which are less than 0.05, and hence there is a significant difference between level 6 and level 9 courses. Also, the p-value of (G2-G3) for e-learning materials 0.043 is less than 0.05, for the laboratory learning environment 0.998 is higher than that of 0.95, and there is a significant difference between level 7 and level 8 courses. Likewise, the p-value of (G2-G4) for e-learning facilitation is 0.041, and for the interaction with a peer, students 0.038, which are less than 0.05. Hence, there is a significant difference between level 7 and level 9 courses. The p-values shown in the table revealed that, based on student's study habits, satisfaction, and learning strategies, there is a significant difference between the levels of course, with effective blended learning [27].

5. DISCUSSION AND IMPLICATIONS

The findings show that the hypothesis H_1 is supported; e-learning environment has a positive relationship on the effective blended learning by the 10% (1.65) level of significance. The e-learning environment with system quality, information quality, instructor quality, and service quality improve the effectiveness of blended learning [9]. The hypothesis H_2 is supported; e-learning facilitation has a positive relationship with the effective blended learning by the 10% (1.65) level of significance. Certainly, satisfaction is the criterion of quality [10]. So, e-learning facilitation can be involved intensely in the management and preparation of the online program in ensuring effective blended learning [11]. H_3 is supported; an e-learning material has a positive relationship with the effective blended learning by the 1% (2.58) level of significance. Appropriate alignment of e-learning materials with the course

design enhances effective blended learning. Also, the e-learning materials should follow the learner-centred approach before the teacher-centred approach [12]. H_4 is supported; e-learning technical support has a positive relationship with the effective blended learning by the 1% (2.58) level of significance. E-learning technical support is related to effective blended learning; online classes in blended learning are a useful tool for higher education [13].

Based on the above results, H_5 is supported; instructors' attention has a positive relationship with the effective blended learning by the 1% (2.58) level of significance. Hence, the empowerment of instructors' personal attention in carving, incorporating and generating different practices and ideas in developing significant blended learning activity in higher education [14]. H_6 is supported; interaction with instructors positively correlates with the effective blended learning by the 1% (2.58) level of significance. Accordingly, characteristics for successful blended learning are proper communication between teachers and students, peer students communication, quality of teaching, course design, course content, and administrative support [15]. H_7 is supported; interaction with peer students positively correlates with the effective blended learning by the 1% (2.58) level of significance. Peer interaction will enhance the learning environments, increase accuracy, and provide qualitative peer feedback.

Further, the data-driven approach of peer interaction will increase blended learning [6]. H_8 is supported; the laboratory learning environment has a positive relationship with the effective blended learning by the 10% (1.65) level of significance. For this reason, the process includes developing a blended learning model using the project-based learning via virtual science laboratory and the affirmation of blended learning model using project-based learning via virtual science laboratory [7].

The results revealed a significant difference in the effective blended learning between the male and female; therefore, H_{9a} is supported. There is a significant difference between male and female students with blended learnings [16]. Also, there is a significant difference in effective blended learning between the levels of courses; therefore, H_{9b} is supported. Based on age, maturity level, experience, campus-based experience, there is a difference between the level of the course; and hence the difference in the effective blended learning and other learning strategies and the level of the course. There is a moderating effect or relationship between blended learning and the level of the course[28].

The study provided the decision-makers with suggestions for effective blended learning based on the different gender (male and female) students' perspectives. There is a difference in the perception of male and female students because of the external environment. Young generations are well versed in digital competency; it is the responsibility of the institutions to integrate the digital competency with the learning activity [22]. Though blended learning is offered to both male students and female students. Female students utilise it by maximum when it comes to online teaching and learning. At the same time, male students get more benefits in direct meetings and face to face discussions. There is also a difference in the students' perception of effective blended learning based on the levels of course. Moreover, different laboratory support systems with the backing of information technology for the different levels of courses enhance the effectiveness of blended learning.

The education system may be classified as before and during the COVID-19 pandemic. Thus, during the COVID-19 pandemic, blended learning needs to focus on the factors (e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment) and various strategies for male and female students and levels of the course. There is a need for flexibility in the instructions with proper seating arrangements with social distancing. Furthermore, there is a need for e-learning

portals, training paths, and development tools. In the post-pandemic time, blended learning is sure to play a vital role in ensuring the quality of teaching and learning activity.

6. CONCLUSION

The research findings revealed there is a significant positive relationship between the eight independent factors: e-learning environment, e-learning facilitation, e-learning materials, e-learning technical support, instructors' personal attention, interaction with instructors, interaction with peer students, and laboratory learning environment, and the effectiveness of blended learning. Findings on moderating variables: gender, level of the course (undergraduate & postgraduate) portray a noteworthy difference between moderating variables and the effectiveness of blended learning in higher education during the COVID-19 pandemic. The research findings showed that blended learning is a robust tool for teaching and learning in higher education. From the students' perspective through the study survey, blended learning is useful in education and is highly accepted.

7. LIMITATIONS AND FUTURE RESEARCH

The study was conducted in the Kingdom of Bahrain and the Kingdom of Saudi Arabia. An online survey was conducted to collect the data using a questionnaire. The restrictions on mobility are the significant limitation of the study, as the COVID-19 pandemic has disrupted international travel. Another salient limitation encountered in the research was a technical problem. If the respondents are in a region where the internet connectivity and bandwidth issues occur, blended learning will be impractical.

Despite all the factors, the pandemic's challenging circumstances encourage blended learning in higher education. Redefining instructors' tasks, administering and tracking student's progress, ensuring the coordination of all physical and virtual elements, and, most notably, the management support for redesigning courses are the characteristics to be reflected in future research to establish effective blended learning. This study plays a vital role in future research on a deeper understanding of blended learning and developing a relevant approach to planning and implementing blended learning with optimal blends of face-to-face instruction and online teaching in higher education.

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ЕФЕКТИВНІСТЬ ЗМІШАНОГО НАВЧАННЯ У ВИЩІЙ ОСВІТІ ПІД ЧАС COVID-19

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Анотація. Ситуація з пандемією COVID-19 вплинула на всю систему освіти, особливо на університети, де впроваджувалось змішане навчання як новий етап в освіті. Метою дослідження було вивчення взаємозв'язку восьми незалежних факторів: середовища електронного навчання, фасилітації електронного навчання, електронних навчальних матеріалів, технічної підтримки електронного навчання, особистої уваги викладачів, взаємодії з викладачами, взаємодії з однолітками, та лабораторного навчального середовища для забезпечення ефективного змішаного навчання у вищій школі під час пандемії COVID-19. Крім того, було досліджено ефективність змішаного навчання відповідно до статі студентів та рівня курсу їх навчання. Описове перехресне дослідження щодо ставлення студентів до змішаного навчання було проведено за допомогою анкетування студентів вищих навчальних закладів Королівства Бахрейн та Королівства Саудівської Аравії. У дослідженні взяли участь студенти всіх рівнів навчання та аспіранти, обсяг вибірки дорівнює 1229. Для того, щоб знайти позитивний зв'язок між ефективним змішаним навчанням та вісьмома незалежними змінними, а також двома опосередкованими змінними в секторі вищої освіти, у дослідженні використовувався підхід Моделювання структурних рівнянь (Structural Equation Modelling - SEM). Результати дослідження показали позитивний зв'язок між вісьмома незалежними змінними та ефективністю змішаного навчання у вищих навчальних закладах, відмінності у сприйнятті та ефективності змішаного навчання у ЗВО залежно від статі і рівня курсу студентів. Дослідження надає рекомендації керівним органам, адміністраторам та викладачам ЗВО для прийняття рішень та покращення дій щодо забезпечення якісного викладання та навчання за допомогою змішаного навчання. Закладам вищої освіти необхідно врахувати результати дослідження з метою підвищення ефективності змішаного навчання на основі середовища електронного навчання, сприйняття електронного навчання, електронних навчальних матеріалів, технічної підтримки електронного навчання, особистої уваги викладачів, взаємодії з викладачами, взаємодії з однолітками, та лабораторного навчального середовища. Для впровадження і забезпечення ефективного змішаного навчання заклади вищої освіти повинні також враховувати стать студентів, рівень курсу, на якому вони навчаються.

Ключові слова: змішане навчання; ефективність; ставлення студента; вища освіта; пандемія COVID-19.