Develop a New Model to Measure the Blended Learning Environments Through Students' Cognitive Presence and Critical Thinking Skills

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Abstract—Blended learning environments are one of the significant modern technology updates that could help solve many learning issues. However, blended learning is still in its developmental stage and requires more research to find more efficient models and designs for blended learning programs in an educational environment. Therefore, this study endeavours to address this research gap by questioning the students' utilization of blended learning and developing a model to measure the blended learning environments through their cognitive presence and critical thinking skills. The study used a quantitative questionnaire for data collection to accomplish the research purpose. A questionnaire was distributed to 85 students who are active users of blended learning environments. The collected data was analyzed using Partial Least Squares (PLS) and Structural Equation Modeling (SEM). In light of the empirical findings, the results have shown discrepancies with statistical significance at the level of (0.01) between the median marks of the students' sample in the pre and post-evaluation of the performance analysis card. This study found a significant relationship between students' cognitive presence and critical thinking skills in blended learning environments.

Keywords—blended learning, cognitive presence, critical thinking, structural equation modelling (SEM)

1 Introduction

Lu, Mustapha, and Abdullah [1] investigate Chinese University students' acceptance of blended learning so that better opinions can be put forward to improve the effectiveness of blended learning. The evaluator can study and evaluate blended learning overall through the context, input, process, and product to provide appropriate recommendations for improving the learning process using blended learning in schools [2]. The implications of the research by [3] were to encourage teachers to use blended learning to facilitate students' use of technology to improve academic learning outcomes. A blended model occurs when e-learning is blended into the learning process and traditional classroom learning. Many specialists are usually very excited about this model, as some e-learning tools are used as a part of the learning in real-learning classes. This

model is considered suitable for applying e-learning as it combines the features of e-learning and traditional learning. In this context, using blended learning is one of the main demands of this era as the priorities and demands of learning have been changed [4] from one learner to another. Hence, organizations should use blended learning tools in their learning strategies to get the right content at the proper form and time for the individuals. Blended learning consists of many presentation aids designed to complement each other, besides enhancing the behaviour and applying it. Blended learning programs have included many forms of learning tools, such as cooperative programs or virtual direct ones, electronic curriculums based on the learner's speed, and support systems for e-performance attached to the learning management systems. Blended learning creates different activities that depend on the learning events, including traditional classes (face-to-face), synchronized e-learning, unsynchronized learning, and self-paced learners (where the pace of learning depends on the learner himself). The blended learning experience combines direct e-learning forms with indirect ones at the most superficial level. In this context, we can define the most significant features of blended learning as [4] enhancing learning efficiency through providing greater harmony between the learner's demands and the presented educational program or transferring knowledge.

In contrast, the blended learning model provides many ways to reach the learners and increase the efficiency and use of expensive learning programs, as blending different presentation aids leads to more significant benefits for the presented programs. E-programs are expensive, but presenting them through learning and virtual sessions and blending them with self-paced materials like documents, study cases, recorded events for learning, test aids, and presentation aids may cost the same. One example of a blended learning model is that one or more lessons can be taught in the classroom without using e-learning tools. On the other hand, one or more lessons can be taught using e-learning tools [5, 6, 7], with an evaluation done using both traditional and electronic tools simultaneously. Teaching the lesson in the class may begin using the traditional way, then shift to using e-learning to move to one of the sites to answer some examples and experiences, return to the books and follow up with the lesson.

1.1 Research problem

Educators are integrating new technology techniques with online and conventional face-to-face forms of instruction without understanding if this leads to improved student achievement, which is the general challenge addressed in our present study. Institutions are under pressure to connect their curricula with national efforts by the government that need technological education capabilities that are affected by the global information industry [8, 9]. There are two issues with this circumstance. On the one hand, many teachers currently taught using a completely different paradigm; their teaching was indeed strongly dependent on a classic big-box store, instructor, face-to-face method in which technology development had no role. On the other hand, today's rising worldwide demand to adhere to the rapid speed of change in internet activity has made present approaches obsolete for years.

On the other hand, teachers must bear the burden and obstacles of staying current [10] or risk losing their education. Educators who are ready to integrate technology into their teaching materials properly may unknowingly contribute to the downfall of their teaching techniques, according to the specific situation examined in this qualitative case study (if not to the demise of their careers). According to research, adaptive learning in the guise of summative assessment evaluation benefits classroom instruction [11] and is an under-researched tool [12, 13, 14]. As a result, if learning is a holistic interactive knowledge (as suggested by [15]'s "community of inquiry") involving a complex dynamic of mutual trust between students and teachers [16], then the education system using blended active learning has a lot to gain from the introspection of its primary leaders' learning opportunities [17]. To ensure the current research problem, the researcher has conducted a survey-based study using a questionnaire given to 15 students at King Faisal University. While studying in the traditional learning environment, they were asked about their thoughts on the tools and strategies they used to teach the curriculum, as shown in Table 1.

Table 1. Results of a survey-based study to define the students' problems

No	Questions in the survey	Percentages%
1	Did you like learning with the traditional tools?	28.2
2	Is the university located near where you live?	38
3	Is the learning timeline adequate to cover all of the learning topics in terms of the theoretical or applicable aspect, and does it contribute to enhancing cognitive presence?	34.6
4	Is the classroom space suitable to reach the learning target or goal?	22
5	Are the learning environments comfortable enough for the learners to focus on the curriculum?	18
6	Are visual and hearing aids available to increase the cognitive presence?	42
7	Is traditional learning good at presenting all the curriculum topics to motivate critical thinking skills?	36.9
8	Have new technologies and strategies been provided for you by the instructor?	8
9	Does the learning time allow you to ask all the questions that come to your mind and allow you to think?	17
10	Did you use the education provided to you by the university in increasing your focus and cognitive presence, and did it develop your thinking ability in any way?	37.5
11	Do you prefer to find another effective way to learn?	83.4

By reading the results of the survey-based study that are shown in its items and words, we have found that the problems with the traditional way of learning, which is face-to-face, are as follows:

- Using the traditional way of learning does not help increase focus and cognitive presence.
- The university is located far away from the students' residences most of the time.
- The timeline for the learning to cover all the learning topics, whether the theoretical or applicable aspect, was not appropriate to cover all the learning topics or answer the students' questions, as they were not allowed to practice the thinking and criticism abilities as expected.

- There are no appropriate, well-prepared technology classes for the students.
- There are not enough helping aids, whether visual or theoretical, which hinders the cognitive presence.
- Most students prefer to find another better way to learn their curriculum where they can participate effectively and build their thinking skills, besides developing their cognitive presence to learn the presented educational curriculum.

In this context, the current research uses new strategies and methods that are expected to solve the previously defined research issue shown in blended learning environments and their ability to develop cognitive presence and critical thinking. Therefore, the main research question that the current research tries to solve is: what are the impact of the blended learning environments on developing the cognitive presence and critical thinking skills of the English curriculum students in the computer education faculty at King Faisal University? We developed a model to measure the blended learning environments through students' cognitive presence and critical thinking skills to answer this question.

2 Hypotheses and research models

Computational Thinking (CT) and computing were once considered normal secondary school subjects, emphasizing scripting and method creation. Given the vast development of smartphones and their associated mobile applications, this study aims to see if any apps allow students to enhance their CT abilities. However, the learning of coding abilities has become more possible thanks to the use of developmentally appropriate tools, and the outcome might be the progression of CT fluency or at least familiarity in young children [18]. CT and a grasp of how systems are run are widely recognized as requirements for today's pupils and tomorrow's people. As a result, many smartphone applications with various interfaces and designs pitch themselves as educational tools for teaching CT, computing, and problem-solving skills to children aged 5–7 [19]. The development of CT abilities for young children is gaining traction as a novel reading for the twenty-first century [20, 21]. It is seen as an excellent strategy to develop thinkers and thinkers by involving children in activities transferable across fields that they will indeed require at some point in their lives [22]. As [21] points out, coding may be investigated as a top-level problem-solving method and a process that helps users create shared goods. Moreover, according to [23], all apps positively affect the development of children's CT skills. As evidence shows that children can learn and develop CT abilities, politicians and legislators are including CT in the curriculum, beginning in the primary grades. Singh [23] defines blended learning as collecting multimedia to deliver information designed to be integrated and enhance the learning and learning behaviour based on practical application. Current research defines blended learning as a strategy that combines traditional learning features with online learning to include a combination of a group of interactive tools and methods in the frame of a whole integrated environment. [23] also defines the cognitive presence as the extent to which the learners build profound meaning as a result of the learning in order to face the cultural and educational future challenges in addition to getting rid of the educational limitations

that are related to the content of the curriculum to enhance the cognitive mind presence and direct the learner's attention to focus on the learning outcomes. Finally, [23] defines critical thinking as the students' making serious mind activities when they face a situation or an issue. They practice many mind skills (analysis, fixing, evaluation, proof, and conclusion; evaluation, noticing, explaining, and reasoning) in a reasonable, organized way supported by the evidence and proof. It has measured by the mark they get on the analysis card in the critical thinking prepared for this purpose. The above literature review generated a research question: What factors affect the blended learning environments through students' cognitive presence and critical thinking skills? Thus, this research aimed to develop a model to measure the blended learning environments through students' cognitive presence and critical thinking skills. Consequently, it is with no delay that we have to conduct an exhaustive study to detect the factors of blended learning, students' cognitive presence, and critical thinking skills, see Figure 1.

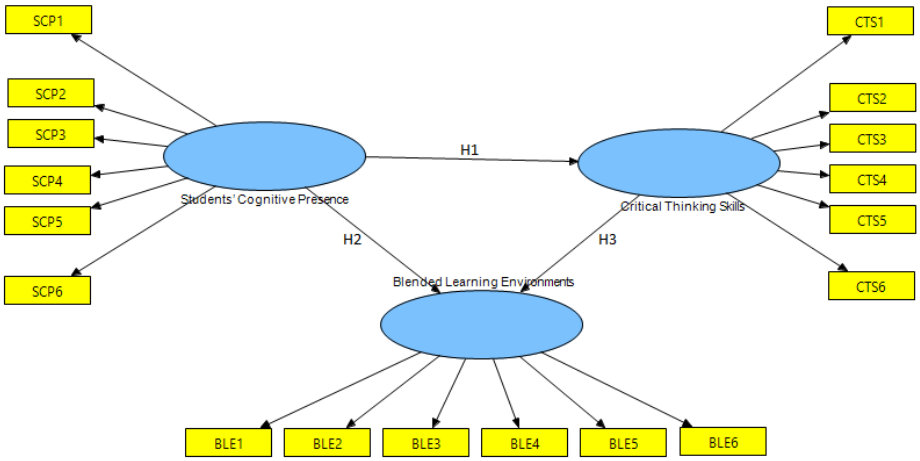

Fig. 1. Research model

2.1 Students' cognitive presence

According to Kfafy [25], personality is the ultimate concept, and it includes many interlaced sides in its relations, such that each scientist considers character according to their point of view. The word "personality" is derived from the Latin word "persona," which means "the mask that covers the features of the actor's role." However, [25] defined the character concept as "the internal system of the self-systems and the individual's psychology; it also decides its unique harmony with his environment" [25]. In a study by [26] on Egyptian Arab society, the character was described as a presence in two aspects: cognitive presence and social presence. In its social meaning, character requires that the person's abilities be integrated with the requirements of the social environment in which they live. [26] Mentioned that the present concept or existence is one aspect of the thinking aspects, but the cognitive presence means the extent to which

learners can build meaning and be present in a critical society through mutual and continuous conversation. This cognitive presence necessitates defining students who circulate or transfer ideas and thoughts, providing positive criticism, and focusing on research that can benefit their society [27]. Based on the above discussion, the following hypotheses were proposed:

H1: students' cognitive presence is positively related to critical thinking skills.

H2: students' cognitive presence is positively related to blended learning.

2.2 Critical thinking capabilities

The thinking skills could be divided into two main categories as follows: the low thinking skills, which mean the limited use of the mental processes such as keeping, remembering, and recalling, all of which are necessary processes to learn before moving into higher thinking levels, and the high thinking skills, which mean the wide use of the mental processes. This happens when the person explains and analyzes the information or deals with them away from the solutions or simple forms to answer a question or solve a problem that could not be solved through the tedious use of low-mind processes. This category includes thinking types such as creative thinking and critical thinking [28]. In its most straightforward meaning, critical thinking is the ability to estimate reality and then make decisions based on evaluating the information and examining the available opinions. Besides considering the different points of view, critical thinking also includes a group of thinking skills that could be learned. Based on the above discussion, the following hypothesis was proposed:

H3: Critical thinking skills are positively related to blended learning.

2.3 Blended learning

Fransen [29] refers to blended learning as a combination of online learning with many other traditional learning methods. It includes choices related to learning the content and different shapes of the communication tools between the learner and the students themselves. Trapp [30] refers to blended learning as the comprehensive integration between electronic multimedia and traditional learning methods. According to [31], blending traditional learning with online learning will focus on desired educational skills such as critical thinking and helping students be responsible for their learning process. Besides organizing the learning resources exchange and the other learning goals, blended learning aims to support the learner with electronic educational resources and traditional learning. The study by [32] aimed to use the learning environment in applying blended learning, and the study has been applied to educational organizations. Results have shown that online learning environments have many benefits when integrated with the blended learning strategy, especially in the interactivity field and lowering the cost of training and education. [23] It is proposed that blended learning includes many benefits that allow those entering the education field to overcome the cons of online and traditional learning.

3 Research methodology

Of the 147 questionnaire participants, 130 were returned. Eleven participants' responses were eliminated from the analysis since they were incomplete. Responses from 119 participants were imported into the SPSS package software. Undergraduate students at King Faisal University, who are active users of blended learning, are the sample of this study. Confirmatory factor analysis is used to ensure the model's validity. Smart PLS 2.0 is employed for Partial Least Square Structural Equation Modelling (PLS-SEM). A quantitative study framework was adopted using the questionnaires as a data collection tool. The primary statistical analysis method was PLS-SEM, with SPSS software used for data analysis following Krejcie and Morgan's approach [33]. Initially, construct validity was performed in two steps by first calculating convergent validity and then assessing discriminant validity. Convergent validity was determined to evaluate the model's fit appropriateness before assessing the hypotheses using factor loadings, average variance extracted (AVE), and composite reliability. A five-point Likert scale was adopted for the questionnaire items, with "5" indicating strong agreement and "1" indicating strong disagreement by the respondent. As inaccuracy in the outcomes may result from some exceptional cases, the data cannot be used in any analysis [34]. The questionnaire used in this research was adopted from previous research [27, 29, 35], which was examined to find relevant factors for the study: blended learning environments (BLE), students' cognitive presence (SCP), and critical thinking skills (CTS).

4 Findings and results

The researcher applied the research tool and calculated the medians and standard deviations and the value of (T) to ensure the meaning of the discrepancies between the medians of the pre and post-practice marks using the SPSS program. To investigate the truth of the hypothesis, "there is a statistically significant discrepancy at the significance level (0.01) between the medians of the student's marks in the analysis of the cognitive presence in the pre and post-practices in favour of the post-practice." Then, following the procedures and following steps in counting the discrepancies between the medians of the student's marks in the pre and post-practices in the performance analysis of the cognitive presence, Table 2 shows the meaning of the discrepancies between the medians of the student's marks in the pre and post-practice in the performance analysis of the cognitive presence through the blended learning environments. Similarly, Cronbach's Alpha reliability coefficient was 0.827 for the (performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, self-efficacy, trust, and adoption of mobile wallet). The evaluation of discriminant validity (DV) was conducted through the use of three criteria, namely: the index among variables, which should be below 0.80 [34], the average variance extracted (AVE) value of each construct that needs to be equal to or above 0.50, and the square of the (AVE) of each construct that is above, in value, the inter-context correlations (IC) connected with the factor [34]. Furthermore, confirmatory factor analysis (CFA) results with factor loading (FL) should be 0.70 or over, while the results of Cronbach's

alpha (CA) are agreed to be 0.70 [34]. The researchers also add that composite reliability (CR) should be 0.70.

Table 2. Pre-test and post-test analysis of the cognitive presence with blended learning

Main cognitive presence terms	Maximum mark	Pre		Post		T value	Eta square η2	D. value	Impact level
		*M*1	*O*1	*M*2	*O*2				
Online connecting	15	7.2	1	21.7	1.34	43.2	0.987	12.47	High
Processing ideas	10	4.6	1.08	16.44	1.04	39.5	0.985	11.4	High
Using various information resources	10	11	0.91	22.64	0.95	44.1	0.988	12.74	High
Applying cognitive tasks and evaluating them	12	7.2	0.82	20.88	0.73	62.6	0.994	18.08	High
Time management skills through the blended learning environment	11	5.6	0.86	14.6	1.35	27.9	0.971	8.08	High
Applying the knowledge through studying the curriculum in the blended learning environment	12	5.04	0.73	16.2	1.12	41.6	0.986	12	High
Total sum	70	40.6	2.2	112.5	3.66	83.7	0.997	24.17	High

Similarly, there is a statistical significance at the significance level (0.01) between the medians of the student's marks in the analysis of the critical thinking skills in the pre and post-practices in favour of the post-practice. The following steps and procedures have been applied in calculating the significant discrepancies between the medians of the student's marks in the pre and post-practice in the performance analysis of critical thinking. Table 3 shows the significance of the discrepancies between the medians of the student's marks in the pre and post-practice in analyzing critical thinking through the blended learning environment.

Table 3. Pre-test and post-test analysis of the critical thinking with blended learning

Main cognitive presence terms	Maximum mark	Pre		post		T value	Eta Square η2	D value	Impact level
		*M*1	*O*1	*M*2	*O*2				
Communicating through the web regarding expressing their opinion about the learning process	21	6.2	1.71	23.31	1.55	41.5	0.965	11.54	High
Processing the ideas through the critical thinking	15	5.6	1.43	18.42	1.87	38.2	0.975	13.6	High
Using various information resources that motivate the critical thinking	22	13	2.91	26.43	1.95	46.3	0.988	12.74	High
Applying cognitive tasks and using the brainstorming method	12	8.2	0.54	18.53	1.64	61.9	0.974	17.08	High
Total sum	70	33	2.53	86.69	3.53	86.7	0.996	26.69	High

In addition, there is a statistically significant discrepancy at the significance level (0.01) between the students' marks in the relation between cognitive presence and critical thinking when studying in blended learning environments. Procedures and steps have been applied to calculate the significant discrepancies between the medians of the student's marks in the pre and post-practice in the cognitive presence and critical thinking performance analysis card. Table 4 shows the significance of discrepancies between the medians of the student's marks in the pre and post-practice in the performance analysis card of the cognitive presence and critical thinking through the blended learning environment.

Table 4. Pre-test and post-test analysis of the cognitive presence with critical thinking

	Cognitive presence				**Critical thinking**			
	Pre		***Post***		***Pre***		***Post***	
	***M*1**	***O*1**	***M*2**	***O*2**	***M*1**	***O*1**	***M*2**	***O*2**
	6.2	1.71	23.31	1.55	7.2	1	21.7	1.34
	5.6	1.43	18.42	1.87	4.6	1.08	16.44	1.04
	13	2.91	26.43	1.95	11	0.91	22.64	0.95
	8.2	0.54	18.53	1.64	7.2	0.82	20.88	0.73
Total	33	2.53	86.69	3.53	30	1.82	81.66	26.69

4.1 Measurement models and instrumentation

The beginning stage in the assertion of the legitimacy and dependability of the model is the use of the Partial Least Square, Basic Equations Modeling (PLS-SEM), and Smart PLS 2.0. Before the theories were tried, two phases were used to affirm the fitness model's integrity. The recommendation is given by [36] in light of the standard test to affirm discriminant legitimacy.

4.2 The Measurement's construct validity

Development legitimacy is delineated as the level to which the things used to gauge a component can appropriately quantify the idea they were meant to quantify [34]. All things used to gauge the development should stick to their individual development rather than different builds. This was guaranteed by leading an orderly audit of writing in the mission to deliver things that have been set up and tried by earlier writers (see Table 5.

Table 5. Factors loading and cross-loading of items

Factors	**Items**	**Blended Learning Environments**	**Critical Thinking Skills**	**Students' Cognitive Presence**
Blended Learning Environments	BLE1	0.813958	0.436362	0.467003
	BLE2	0.789668	0.347136	0.379132
	BLE3	0.805431	0.416478	0.461537
	BLE4	0.816194	0.424278	0.485656
	BLE5	0.801277	0.366117	0.436364

	BLE6	0.722657	0.357139	0.389778
Critical Thinking Skills	CTS1	0.390553	0.758971	0.593394
	CTS2	0.370397	0.799656	0.501839
	CTS3	0.346364	0.762105	0.424207
	CTS4	0.352662	0.777214	0.434886
	CTS5	0.355591	0.776210	0.457985
	CTS6	0.446827	0.713216	0.490488
Students' Cognitive Presence	SCP1	0.444659	0.512746	0.798996
	SCP2	0.421792	0.501561	0.822072
	SCP3	0.434590	0.531816	0.834299
	SCP4	0.364480	0.492550	0.793162
	SCP5	0.507762	0.540074	0.815841
	SCP6	0.517137	0.543727	0.822747

4.3 Measurement convergent validity

The composite reliability values ranged from 0.9042548-0.922086, above the prescribed cut-off estimation of 0.70, with Cronbach values ranging from 0.908377-0.921081, over the prescribed cut-off estimation of 0.60. In addition, the normal change removed (AVE) values ranged from 0.585255 to 0.663645 (all surpassed the cut-off estimation of 0.5), with critical element loadings surpassing 0.50. [34, 36]. Table 6 presents the CFA results of the measurement model.

Table 6. Convergent validity

Factors	Items	Factors Loading	Composite Reliability	Cronbach's Alpha	AVE
Blended Learning Environments	BLE1	0.813958	0.909852	0.921081	0.627545
	BLE2	0.789668			
	BLE3	0.805431			
	BLE4	0.816194			
	BLE5	0.801277			
	BLE6	0.722657			
Critical Thinking Skills	CTS1	0.758971	0.9042548	0.908377	0.585255
	CTS2	0.799656			
	CTS3	0.762105			
	CTS4	0.777214			
	CTS5	0.776210			
	CTS6	0.713216			
Students' Cognitive Presence	SCP1	0.798996	0.922086	0.918734	0.663645
	SCP2	0.822072			
	SCP3	0.834299			
	SCP4	0.793162			
	SCP5	0.815841			
	SCP6	0.822747			

4.4 Discriminant validity of measures

The level to which an idea and its indicators stray from another idea and its markers is surveyed by discriminant legitimacy [37]. The AVE value is well over 0.50 and is critical at p = 0.001, which shows that discriminant legitimacy is bolstered for all builds [36]. In such a manner, [34] clarified that the relationships that develop between two things should not surpass the square base of the normal fluctuation shared by a solitary developed thing, as shown in Table 7.

Table 7. Latent variable correlations

Factors	Blended Learning Environments	Critical Thinking Skills	Students' Cognitive Presence
Blended Learning Environments	1.000000		
Critical Thinking Skills	0.496867	1.000000	
Students' Cognitive Presence	0.554561	0.640096	1.000000

4.5 Analysis of the structural model

After the integrity of the demonstrated estimation has been assured, the following steps are involved in testing the conjectured connections among the buildings. The specialist utilized the Smart-PLS 2.0, where the model was analyzed by leading the PLS calculation. The way coefficients were then delivered is portrayed in Figure 2. What is more, show the theories in Table 8.

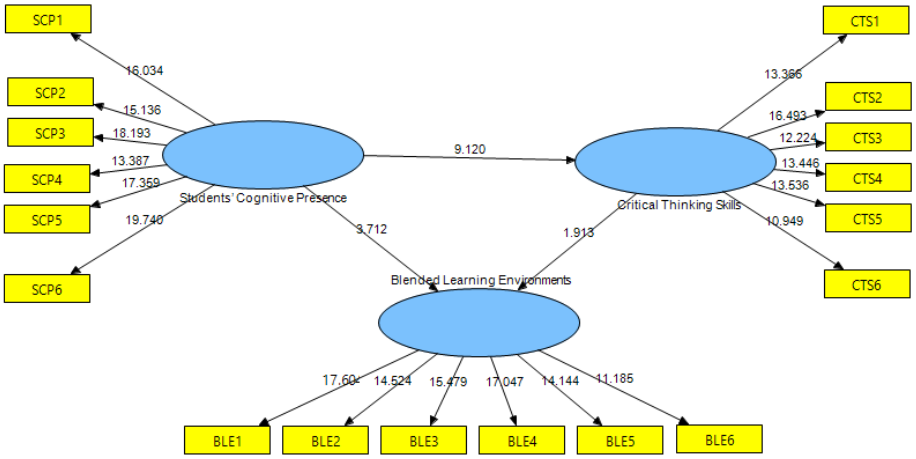

Fig. 2. Path coefficients T values

Table 8. Hypotheses testing

H	Independent	Dependent	Path Coefficient	T. Value	Standard	Result
1	SCP	CTS	0.640096	9.119960	0.070186	Accepted
2	SCP	BLE	0.400691	3.712118	0.107941	Accepted
3	CTS	BLE	0.240387	1.913380	0.125635	Accepted

Regarding Table 8, the first hypothesis, the relationship between students' cognitive presence and critical thinking skills is (= 0.640096, t = 9.119960). Thus, hypothesis H1 is accepted. The analysis shows that the second hypothesis is a positive relationship between students' cognitive presence and blended learning environments (= 0.400691, t = 3.712118). Thus, hypothesis H2 is accepted. Finally, hypothesis H3 is accepted, which is the relationship between critical thinking skills and blended learning environments (= 0.240387, t = 1.913380). From Table 2, the results show T value reached (83.7). At the same time, it has statistical significance at level 0.01, which means there is a statistical discrepancy with significance at the significance level (0.01) between the medians of the student's marks in the analysis card of the cognitive presence in the pre and post-practice, which indicates the growth of the cognitive presence of the students in the search sample through the blended learning environments. Moreover, the two values had reached 0.997, and the impact volume value had reached 24.17, which is a high percentage indicating the effectiveness of the blended learning environments in developing cognitive presence, leading to the truth of the first empirical hypothesis.

As a result, the first hypothesis associated with the previous results has been approved. Table 1 shows a low level of cognitive presence that might result from not studying any of the blended learning strategies available on the internet or not using one of the teaching staff members familiar with the techniques of blended learning and web 2.0 in the education process. In addition, the post-level of the students in the skills of cognitive presence is high as a result of the blended learning environments, as it depended on many cooperative tasks that could be done inside and outside the classroom through utilizing the various internet tools and the Blackboard that are available in each unit of the curriculum, which enriched the learning. Also, the improvement in the performance of the students is a result of the method that has been used in teaching the curriculum for their interaction with the content and offering comments, spreading the online achievements, and exchanging experiences inside and outside the classroom, as they felt the significance of the teaching according to the blended learning environments. The research results comply with the studies [38], [39].

From Table 3, the results show T value had reached (7.86). It was with statistical significance at the level of 0.01, which means there is a discrepancy with statistical significance at the significance level (0.01) between the medians of the student's marks in the critical thinking analysis card in the pre and post-practices, which favours the post-practice, which indicates the critical thinking level of the students of the research sample through the blended learning environments. Moreover, the two values had reached (0.996), and the impact level D had reached (26.69), which is a high percentage that indicates the effectiveness of blended learning in developing cognitive presence,

which proves the truth of the second empirical hypothesis. As a result, the second empirical hypothesis associated with the previous results has been accepted. Critical thinking skills are being taught to each learner regardless of their understanding level, based on the belief that each person has his abilities that could be developed. As these skills grow gradually in a way that fits the development of the other personal aspects, usually the cognitive content and the thinking skills are taught at the same time using the integrated method in teaching thinking so that the thinking skills that should be taught represent a part of the traditional classroom.

Thus, the teacher designs his lesson according to the defined curriculum and includes the right skills for the lesson content. Utilizing thinking in education turns the knowledge acquisition process from a tedious process to an active mind-meditating process that leads to a deep understanding of the cognitive presence, better relationships between the elements and contents, and the ability to apply and practice. With this meditative thinking, the person could live within his life conditions, understand the variables, and deal effectively with the issues and problems. This result agreed with these studies [35, 40].

From Table 4, the results show the value of the mathematic median of the cognitive presence in the post-practice had reached 86.69, while the mathematic median of critical thinking in the post-practice had reached 81.66. It becomes clear that these medians favour the post-practice compared to the mathematical medians of both the cognitive presence and critical thinking in the post-practice. Its results were low in comparison with the post-practice, and they were close to each other, meaning there was a discrepancy with statistical significance at the level of (0.01) between the medians of the students' marks as a result of the primary effect of the relationship between cognitive presence and critical thinking when studying in the blended learning environments. As a result, the third empirical hypothesis has been accepted.

The critical thinking and cognitive presence skills could be organized into two forms related to the personality and the environment in which the student learns in its social frame. It is described as a subjective personality; it focuses on the personal goals behind critical thinking as it is a proper form of meditation that focuses on deciding what the person thinks about or if it is performed to develop his thinking controlling it.

The person thinks in such a way that he seeks to make his thinking clearer and healthier, which is the social aspect of critical thinking. It is a mental process that a person performs when asked to make a judgement about a case, discussion, or evaluation. It is the judgement about an opinion or belief and its effectiveness through analyzing the information, categorizing, and testing it to distinguish between negative and positive ideas. The cognitive structure in the blended learning strategy is no longer limited to the students' definition of the facts and concepts; it also includes the thinking processes because one of the teaching goals using blended learning is to develop the thinking skills of the students in the research sample and help them acquire the scientific method in their thinking or their research, or other words, by teaching the thinking and focusing on the scientific methods and processes.

There is no doubt that academic achievement is strongly related to cognitive presence, which plays a vital role in students' school lives at various levels. It is the only method that categorizes the students into different levels and organizes their movement

from one stage to another. As a natural result, they compete together and do their best to get the best marks to prove themselves in their studies or colleagues, which is a significant indicator of the learners' knowledge acquisition. Hence, it is at the core of the issues that educational organizations treat, which encourages them to study it from different perspectives, especially the items that negatively affect it. This result complies with these studies [41, 42]. Some studies used independent programs to teach critical thinking skills, while others integrated the skills into the content, as some studies that used independent programs showed the positive effect of these programs on the learners' results, such as [18, 19]. Thus, it is clear that there is a real need to put a suggested training program to the test to test its effect on developing the critical thinking skills of university students.

5 Discussions and implementations

The results of the previous research have shown that the experimental sample of students who have studied using blended learning have shown positive attitudes towards blended learning, such as in the studies [29, 30, 32]. In this context, we find that [23] noted that blended learning is still in its developmental stage and needs more research to find more efficient models and designs for blended learning programs in an educational environment with particular items. We need an integrated system that combines traditional class learning with e-learning and individual learning with group learning in an integrated strategy that aims to reach the educational organization's learning goals.

Learning technology is capable of solving these issues through its modern updates that fit the nature of these problems, as it is one of the essential modern technology updates (interactivity) that allows the learner to participate in the learning process by responding to the learning source, which leads to the continuity of the learning process and increases its efficiency. Previous studies' findings confirm that perceived ease of use significantly influences perceived usefulness [43, 44]. In addition, perceived usefulness significantly influences the intention to use [45]. Also, integrating the modern updates should change the structure of the educational organization or its tasks, values, attitudes, or thoughts to cope better with modern technology, the labour market, and the different challenges [46].

Hence, it is significant to make use of modern technology updates to overcome the problems of providing enough interactivity and cognitive presence to build mental abilities for learners who have high critical thinking skills, but with the vast numbers of learners and not having enough time to allow interactivity between the learners themselves or the learners and the instructors to interact with the educational content that is being provided in the class. Education is usually done inside classrooms with a learning process without appropriate strategies that blend traditional educational methods with the proper technological updates. Also, the timeline for their learning is not enough to cover the theoretical aspect of the topics; there is no room for application. In this context, we find that blended learning environments are one of the significant modern technology updates that could help solve many learning issues.

Bonk and Graham [47] noted that blended learning is increasingly used in the academic fields and the training fields in higher education. In 2003, the training and development community defined blended learning as one of 10 new trends in the knowledge industry. In the same context, we found from the researcher's experience and work in university teaching that there is a general fault in focusing on the high thinking skills of the students, as the professors usually depend only on keeping that which makes the instructor the basis for the learning. The students only receive the information from the particular devices that transfer the lectures without interaction. This also confirms the previous studies that the researcher reviewed.

The reality of learning shows there are many undesired features. While it differs from one teaching method to another, there are general things in education: encouraging to keep non-related facts, a shortage in relating the facts with concepts or general concepts and focusing on terms that the learners may not use after getting done with the curriculum. From the preceding, the researcher found a shortage in developing critical thinking skills such as the studies [18, 19]. Previous studies have opened a gateway for developing a student-centred and fun learning approach beneficial to students' higher-order thinking skills [49].

Therefore, the current research problem is shown in the shortage of educational organizations using new methods and strategies that increase the learning motivation and improve the knowledge motivation of the learners, especially the students of King Faisal University, while studying in traditional learning environments, which leads to limiting the chances of developing the learner's critical thinking skills. If students have a solid Wi-Fi connection, time constraints are a relic of the past since blended learning uses online and digital materials. The learning technique is far more advanced than the previous constraints. The online materials are available at all times, 24 hours a day, seven days a week. Furthermore, if your blended learning plan includes a public forum, you may learn from others' experiences and come up with your solution without the help of an educator.

1. A unique training opportunity: obtaining individualized training tailored to each individual's learning requirements is the most potent component of blended learning. This means that each person has various learning capacities and that they are not all now on the same page when it comes to an understanding of the material. They can pick the course through certain topic areas that they believe are appropriate.
2. Collaboration and improved communication: unless a member can access materials in the professor's absence with a blended learning technique, it still enhances the interaction between participants and educators. Through such online learning solutions, email, news bulletins, instant messaging, online marking, internet debate, drop boxes, and other interaction methods.
3. Keep track of the students' progress in talent and efficiency; students can simply trace down the information regarding their ultimate improving performance if you have included the correct tools in your blended learning course. This learning method makes the release of new data much easier and faster.
4. Training techniques that are both inexpensive to implement are sought by any company that seeks to develop both clever and inexpensive techniques, and blended

learning is one of them. You will save money on transportation and work stoppages by adding more robust internet choices into your blended learning system.

Students with different learning styles like this learning technique since it caters to their demands with greater flexibility and comfort. However, there are two critical criteria to consider to thoroughly and adequately implement this learning technique. While some students prefer a mix of online and conventional classroom environments, it is crucial to consider the catered students' target demographic. Not every student is sufficiently motivated to take part in blended learning, and this learning technique is not appropriate for such students. As a result, this is the very first limitation.

Moreover, although statistical evidence is available, this study has several drawbacks. Because the sample in this research came only from one institution, future research will require additional participants with various significant backgrounds. Several studies, however, have looked into the utility of blended learning environments and critical thinking skills during pandemics like COVID-19.

6 Conclusions and future work

This research examined the elements that influence blended learning environments through students' cognitive presence and critical thinking skills. To recapitulate, the findings show that students' cognitive presence and critical thinking skills increase the use of blended learning environments. In conclusion, there is a pressing need to increase the awareness among students about how to deal with blended learning environments and, in turn, improve students' academic performance. The current research developed three hypotheses, all of which were endorsed by the findings of this study. A critical relationship was observed among the elements proposed in the hypotheses. In light of the results, it is suggested that similar studies should be conducted as training programs to develop collaborative learning skills and social presence in the blended learning environments of the other curriculums of the university. Various learning strategies in electronic learning environments for developing high-level thinking skills in public learning students should be investigated. Also, the opinions of the learning staff members and the educators regarding the supporting factors and hindering obstacles to utilizing blended learning environments in the education process should be reviewed. Finally, the university learning programs should be evaluated in light of the teaching requirements and modern strategies in learning. Therefore, the research significance is as follows:

1. It is the recommendation of many educators to focus on developing the learners' thinking skills before and after the learning, besides learning the practical learning skills to develop the cognitive presence reflected in the students' academic performance.
2. Helping educators by providing a list of modern technology methods and strategies that can be used in the learning process is regarded as a reference frame that can be used as a foundation for academic curriculums and explained to students.

3. Helping the students at King Faisal University by focusing on the current situation of their performance in critical thinking skills and trying to attract their attention to the content and activities of the curriculum to raise their level of cognitive presence and academic attainment.
4. Helping the students learn from the curriculum blended with the available electronic tools and utilizing interactive techniques and tools that help develop cooperative learning skills.

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