

The Effect Of E-Collaborative Learning Environment On Development Of Critical Thinking And Higher Order Thinking Skills

Samar Mohammed Alharbi¹, Abdellah Ibrahim Elfeky², Ebtsam Sultan Ahmed³

¹Najran University, Najran, Saudi Arabia, E-mail: smalharbi@nu.edu.sa

²Najran University, Najran, Saudi Arabia, E-mail: abdalah.elfeqi@spe.kfs.edu.eg

³Najran University, Najran, Saudi Arabia, Email: esahmed@nu.edu.sa

Corresponding author: Samar Mohammed Alharbi, E-mail: smalharbi@nu.edu.sa

Abstract

Achieving many learning outcomes needs to go beyond the classroom's four walls into other areas, such e-collaborative learning that involves online social interactions among learners. Therefore, in order to investigate if this alternative is effective on some learning outcomes, the purpose of this study is to expose the impact of E-collaborative learning environment on development of critical thinking and higher order thinking skills. The experiment was conducted on female students of kindergarten department who were randomly assigned to two equal groups. The main study instruments were a critical thinking scale and a higher order thinking skills test. Results showed that E-collaborative learning environment had significant and positive effect on development of critical thinking of 1st group, that mediated by define and adjust variables, hypothesis testing, and reasoning. Results showed also that the difference in grades of female students in 1st group that was taught via E-collaborative learning and 2nd group that taught via E-individual learning in higher order thinking skills was statistically significant in favor of the first group.

Keywords: E-collaborative learning; critical thinking; higher order thinking; hypothesis testing; E-individual learning

1. Introduction

The process of learning is as knowledge construction, or creation, or building [1], and collaboration is a community partnership approach [2], therefore, collaborative learning is a term used to describe instructional situations in which two or more learners collaborate on a common learning goal [3]. Hence, E-collaborative learning is a communicative shared-knowledge building technique that uses networked electronic devices to achieve shared-knowledge building aims. It emphasizes the positive interaction importance among learners via encouraged them to ask questions, exchange arguments, give elaborate explanations, problem solutions and formulate new ideas. Some tools in learning management systems allow E-collaborative practice possibility on a regular basis [4]. Several studies suggest that learners who work in small groups obtain better learning results (e.g., affective-motivational, social, cognitive, and meta-cognitive aspects of

learning) than learners who work alone on a task [5-6]. Besides, learning constructivist theories encourage the idea of collaborative learning and the idea of individuals being in groups [7]. Furthermore, interactivity with peers, lecturers, and behavior of online knowledge sharing has seen a substantial effect on engagement of learners which consequently has a substantial effect on academic performance of them [8]. Specifically, learners can receive aid from one another and complete things they couldn't do without assistance thanks to the scaffolding given in collaborative learning interactions [7]. It is noteworthy that in academic institutions, the Blackboard platform allows learners to access their course contents, build students communities, and interact with their lecturers. Meanwhile, critical thinking encompasses processes of scientific thinking such as recognizing and describing an issue, gathering information to better understand the issue, assessing scenarios related to the issue, providing viable solutions to the problem at hand, and

assessing the recommended solutions [9-10]. It allows the learner to assess current knowledge while also encouraging the new knowledge creation (Sahoo & Mohammed, 2018). Participation, taking responsibility for our actions, and logical decision-making are all examples of critical thinking [11]. The essence of critical thinking abilities is to unite learners in order to tackle difficulties that arise during the process of learning [10]. Additionally, the development and improvement of critical thinking skills is one of the primary goals of all educational systems [12]. Debates can help learners develop critical thinking skills [13]. Critical thinking is also seen as a prerequisite for applying to the most complex real-life events and participating actively in social circles. In fact, enhancing critical thinking skills as a desirable learning outcome requires teaching methods (such as cooperative learning) that help students engaged actively in the educational process and increasing their willingness to employ such skills. On the other hand, thinking skills are the most basic skills that is the key to high achievement for all learners and can be developed with education [14]. Besides, higher order thinking skills necessitates knowledge comprehension and application to novel contexts [15]. They refer to the ability to apply values, skills and knowledge in reflection, reasoning, decision making, problem solving, and creating something new [14]. Hence, when a learner acquires new information and stores it in his memory, and organized, correlates, or appraised this information to attain a certain goal, high order thinking happens [15-16]. In the twenty-first century, Higher order thinking skills are critical for learners [17]. Sub-skills like analysis, synthesis, and assessment, which are the highest levels in Bloom's cognitive taxonomy, is include in higher order thinking skills [16]. Arguably, learners who lack higher order thinking skills are tend to do easy tasks [18]. Thus, learners must use higher order thinking skills to comprehend, analyze, and modify information [16]. As a result, the advantages of higher order thinking outnumber those of low order thinking [15]. Hence, lecturers use different strategies in order to develop higher order thinking skills of learners. Furthermore, cooperative learning as strategy through inquiry-based learning and questioning can improve thinking abilities and directly enhance achievement of learners. Consequently, the purpose of this study is to fill that void by studying the impact of E-collaborative learning environment on development of critical thinking and higher order thinking skills. As a result, the following questions of study are posed:

RQ1: Does E-collaborative learning environment effect on development of critical thinking among learners?

RQ2: Does E-collaborative learning environment effect on development of higher order thinking skills among learners?

2. Theoretical background

2.1. E-collaborative learning environment

Collaborative learning is a strategy of learning in which two or more learner work together to complete a task [10]. It has risen from constructivism, social constructivists, and socio-culturalism; and includes social interactions among learners [19]. In other words, it is based on the notion that learning is a naturally social act in which students converse with one another [20]. Collaborative learning involves cooperatively engaged, negotiate, and interact among learners within a group to solve problems during process of learning by use of their skills of cognitive and metacognitive during interactions [21]. With the technology advancement in education, new learning strategies such as "E-collaborative learning" have been introduced [7]. Meanwhile, the utilize of online tools in learning management systems platforms generate stimulating chance to promote the collaboration and learning of the learners [22], ensuring the learners interaction with peers, lecturers and content in order to obtain knowledge and support the process of learning [23]. Meanwhile, E-collaborative learning focuses on producing rather than receiving knowledge, shifting education from lecturer-centered to student-centered [24]. Among the advantages of E-collaborative learning are: preparation for employment and social situations in real life, understanding and responsibility from different perspectives, increased self-esteem, and enhance of learner-learner interaction [20]. Besides, the search in interactivity in tools of online discussion appeared that there is a significantly positive relationship among learning outcomes and interactivity.

2.2. Critical thinking

Critical thinking is a skill of higher order that aids in evaluating the cons or pros by evidence rational reasoning [12], that starts with the goal of answering a question or solving a problem by considering various possibilities and selecting the most appropriate (Alsaleh, 2020). It is the intellectually disciplined process of skillfully and actively conceptualizing, analyzing, applying, evaluating, synthesizing information gathered from

generated by, experience, observation, reasoning, reflection, or communication, as a guide to action belief (Wang, 2017). In addition, it has been defined as more than just a set of cognitive skills; it also includes the ability to comprehend the substance of drawing conclusions and to analyze the evidence's rationale [12]. In particular, critical thinking is a dialogic practice learners commit to and engage in collaboratively and interactively [25]. It is noteworthy that critical thinking is one of the life skills required in this globalization era [26], that the educational process should assist learners to develop critical thinking [27]. Meanwhile, learners' critical thinking skills could not be improved through a lecturer-centered teaching method (Bustami et al., 2018). This study attempts to fill this gap by examining the impact of E-collaborative learning environment on development of critical thinking skills.

2.3. Higher order thinking skills

Higher order thinking assessment is an assessment that measures analyze, evaluate, and create (the Bloom's Taxonomy's three highest levels) [28]. It is often described as a thinking skill at a high level or cognitive activity, that necessitates for more complex thinking in solve a problem or dealing with situations [29]. In other words, when a learner receives new information, holds it, organizes and associates it with prior knowledge, and then transmits that information to reach a specific item or issue solution, this is known as higher order thinking skills [30]. According to studies on cognitive skills, enabling learners' higher order thinking skills in the process of learning helps them become more conscious of their own thinking while also improving their cognitive growth and learning performance [31]. As a result, learners should be given assistance in developing higher order thinking skills. For instance, the ability of Learners' higher order thinking skills can be promoted by teaching materials based on collaborative [32].

3. Method

3.1. Sample

The experiment was conducted on two hundred female students of kindergarten department who were randomly assigned to two equal groups. While the participants were at their level of seventh academic, they were enrolled in "Research Seminar" course, as a curriculum requirement. The two groups had an average age of twenty years (SD = 3.25). According to the course description, the key learning outcome of the course' Research Seminar was the development of critical thinking

and higher order thinking skills among enrolled participants [33-37]. Prior to the start of the course, all participants were informed about signed consent forms and the research. We gave participants the option of not participating or withdrawing without consequence. When it comes to incorporating human participants in study, the researchers stated that they followed all ethical rules.

3.2. Research Settings

The course' Research Seminar, which was provided on the platform of Blackboard, was the basis for this research. It took place between January 16th and May 23rd, 2022. The first group was split into twenty-five five-learner subgroups. It was taught via E-collaborative learning. The following steps were then included in E-collaborative learning: First, the academic professor presents the course topics via the platform' Blackboard through virtual classroom. Second, the academic professor asks the students in the subgroups to complete assignments relating to the lecture's theme, which are produced weekly in a collaborative manner. Third, cooperatively engaged, negotiate, and interact among learners within the subgroups to complete assignments using Blackboard discussion features. Finally, weekly submitting assignments of each subgroup through the platform of Blackboard. Concomitantly, the second group was taught via E-individual learning. The following steps were then included in E-individual learning: First, the academic professor also presents the course topics via the platform' Blackboard through virtual classroom. Second, the academic professor asks the students in the second group to complete assignments relating to the lecture's theme, which are produced weekly in an individual manner. Third, completing assignments using Blackboard search features. Finally, weekly submitting assignments of each student through the platform of Blackboard. Following that, the critical thinking scale was used to assess these assignments. Besides, all participants were given the higher order thinking skills test.

3.3. Instruments of data collection

3.3.1. Critical thinking scale

The critical thinking scale was developed based on several prior studies, including [38]. The scale was divided into three parts: Define and adjust variables (five items), Hypothesis testing (six items), and Reasoning (five items). A five-point Likert scale was used to rate each item (1 = strongly disagree, 5 = strongly agree). The critical thinking scale was given to an arbitrator's panel who were experts in the domains of psychology, kindergarten,

educational technology, and instruction methods to evaluate if it was valid. Furthermore, the internal consistency of the scale was evaluated by implementing it to a survey group of thirty eighth-level participants from the same Department who were not included in the study's main sample. Cronbach's Alpha had a reliability coefficient of 0.91.

3.3.2. The higher order thinking skills test

The higher order thinking skills test was also developed based on several prior studies, including [16]. The wording of the higher order thinking skills test items was determined by the desired results of the course. The test items also take into account the academic level of the participants. The test' final version has fifteen multiple-choice items and fifteen true/false items. The test was given also to an arbitrator's panel who were experts in the domains of psychology, kindergarten, educational technology, and instruction methods to evaluate if it was valid. Furthermore, the internal consistency of the test was also evaluated by implementing it to a survey group of thirty eighth-level participants from the same Department who were not included in the study's main sample. Cronbach's Alpha had a reliability coefficient of 0.93, and the acceptable time to complete the test was estimated to be around 23 minutes.

3.4. Data analysis

In order to answer the first question, Multiple-group confirmatory factor analysis (CFA) within Structural Equation Model (SEM) was employed to see if using an e-collaborative learning environment created significant differences in critical thinking. Besides, in order to answer the second question, the T. test for independent samples was employed to see if using an e-collaborative learning environment also created significant differences in higher order thinking skills.

4. Results

4.1. The answer of the first question "Does E-collaborative learning environment effect on development of critical thinking among learners?"

To see if employing E-collaborative learning environment influenced the development of critical thinking among students. Utilizing AMOS, multiple-group CFA as a latent measurement model was utilized (Elbyaly & Elfeky, 2021). The three Aspects of critical thinking, i.e., define and adjust variables, hypothesis testing and reasoning, were accounted as specified in Fig. 1. The usage of

E-collaborative learning environment had a positive effect on define and adjust variables aspect ($\beta = 0.92, p < 0.05$) in 1st group, but the usage of E-individual learning environment had a less effect on define and adjust variables aspect ($\beta = 0.37, p > 0.05$) in 2st group. Concomitantly, the usage of E-collaborative learning environment had also a positive effect on hypothesis testing aspect ($\beta = 0.89, p < 0.05$) in 1st group, but the usage of E-individual learning environment had a less effect on hypothesis testing aspect ($\beta = 0.38, p > 0.05$) in 2st group. Besides, the usage of E-collaborative learning environment had a positive effect on reasoning aspect ($\beta = 0.87, p < 0.05$) in 1st group, but the usage of E-individual learning environment had a less effect on reasoning aspect ($\beta = 0.35, p > 0.05$) in 2st group. Furthermore, define and adjust variables aspect had a positive effect on the critical thinking ($\beta = 0.87, p < 0.05$) in 1st group, but this aspect had a less effect on the critical thinking ($\beta = 0.33, p > 0.05$) in 2st group. Additionally, hypothesis testing aspect had also a positive effect on the critical thinking ($\beta = 0.84, p < 0.05$) in 1st group, whereas this aspect had a less effect on the critical thinking ($\beta = 0.32, p > 0.05$) in 2st group. Finally, reasoning aspect had a positive effect on the critical thinking ($\beta = 0.86, p < 0.05$) in 1st group, whereas this aspect had a less effect on the critical thinking ($\beta = 0.31, p > 0.05$) in 2st group. As a result, it can be stated that E-collaborative learning environment effect on development of critical thinking.

4.2. The answer of the second question "Does E-collaborative learning environment effect on development of higher order thinking skills among learners?"

The T-test for independent samples was employed after the grades of learners in both groups on the higher order thinking skills test were recorded following the experiment. Table 1 shows that the difference in grades in the two groups on the test of higher order thinking skills was significant (T. ratio=5.26). Participants in 1st group had a mean grade of (26.17), whereas their counterparts in 2st group had a mean grade of (21.54). That is, between the mean scores of the two groups, there was a significant difference (< 0.05) in favor of 1st group. As a result, it can be stated that E-collaborative learning environment effect on development of higher order thinking skills.

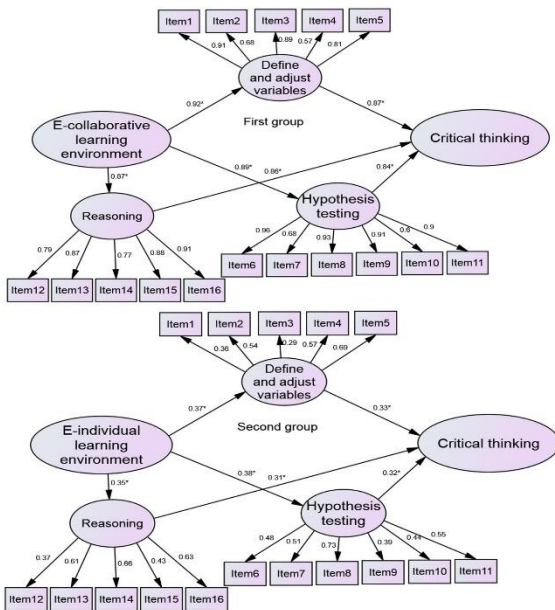


Fig. 1. Multiple-Group CFA for aspects of critical thinking

* $p \leq 0.05$; All of the model's fit statistics were at least good, such as: PRATIO = .968, RMSEA = .039, CFI = .937.

Table 1. Differences in higher order thinking skills among the two groups

Group	M	SD	M-Difference	T. Ratio	Sig.
1st group	26.17	2.96	4.63	5.26	.037
2st group	21.54	4.18			

5. Discussion

The purpose of this study was to expose the impact of E-collaborative learning environment on development of critical thinking and higher order thinking skills. Results showed that E-collaborative learning environment had significant and positive effect on development of critical thinking of 1st group, that mediated by define and adjust variables, hypothesis testing, and reasoning. These findings are consistent with those of a number of previous research, including: [3,5,8,39]. In particular, the findings of this study suggest that E-collaborative learning environment has a large and favorable impact on the development of define and adjust variables, among them "make a crucial question that the research will address", "identifying the variables that are persistent independent, and dependent", "identifying theories, laws, and concepts that are relevant to the topic", "describe the experimental design that has

been proposed", and "defining the phrases that refer to the finding, its events, or causes, as well as their circumstances". The findings suggest also that E-collaborative learning environment has a large and favorable impact on the development of hypothesis testing, among them "investigating the impact of independent on dependent variable", "explaining the relation among variables", "crafting alternative and null hypotheses for research", "decision-making and problem-solving", including a previous research's result in the chosen research's topic", and "discriminating among hypotheses that can be tested quantitatively or descriptively". Meanwhile, the findings suggest that E-collaborative learning environment has a large and favorable impact on the development of reasoning, among them "identifying the methods and tools for data collection", "analyze the data for validity", "making solid decisions and evaluating problem-solving solutions", "recognize the importance of having more information while making decisions", and "discover the ambiguity". Results showed also that the difference in grades of female students in 1st group that was taught via E-collaborative learning and 2st group that taught via E-individual learning in higher order thinking skills was statistically significant in favor of the first group. These findings are consistent with those of a number of previous research, including: [14,16]. These findings might be attributed to a variety of causes or factors. For instance, the ability of Learners' higher order thinking skills can be promoted by teaching materials based on collaborative. Furthermore, interactivity with peers, lecturers, and behavior of online knowledge sharing has seen a substantial effect on engagement of learners which consequently has a substantial effect on academic performance of them (Ansari & Khan, 2020). In particular, E-collaborative learning emphasizes the positive interaction importance among learners via encouraged them to ask questions, exchange arguments, give elaborate explanations, problem solutions and formulate new ideas. Additionally, cooperative learning as strategy through inquiry-based learning and questioning can improve thinking abilities and directly enhance achievement of learners.

5.4. Conclusion

The purpose of this study was to expose the impact of E-collaborative learning environment on development of critical thinking and higher order thinking skills. Results showed that E-collaborative learning environment had significant and positive effect on development of critical thinking, that mediated by define and adjust variables, hypothesis testing, and reasoning.

Results showed also that the difference in grades of female students in 1st group that was taught via E-collaborative learning and 2nd group that taught via E-individual learning in higher order thinking skills was statistically significant in favor of the first group. It gives vital evidence of E-collaborative learning environments benefits in the development of critical thinking and higher order thinking skills.

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