Revista Argentina de Clínica Psicológica
2021, Vol. XXX, N°1, 1016-1023
DOI: 10.24205/03276716.2020.2096

Critical Thinking and Blended E-learning: A Review of Scientific Studies

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ABSTRACT

The concept of e-mastering is innovation that is ordered in the method of excellent ability from an instructive point of view and it is one of the traces of the essential examination of the learning generation in several years maximum. The accidental writing audit factor (SLR) becomes capturing (a) exploration subject; (B) maximum essential speculation; (c) the most investigated modalities; and (d) the inspection method is utilized. For this stop, the Prism Convention is followed, and various devices have been used for bibliographic administration and textual content mining. The writing options turned out to be completed in three first quartile diaries booked in JCR-SSCI working in the generation of education. The amount of 248 articles made by the closing instance. Writing exams diagnosed with three fundamental hubs: (a) under-line; (B) online instructors; and (c) Intuitive instructional programs get knowledge about conditions. It was exposed that the MOOC became the most investigated e-gaining knowledge. The network of inquiry and technology popularity versions is the maximum speculation used in strike investigations. The most successive strategy turned into a contextual investigation. Finally, the purpose of our SRL wishes was taken: the dominant subjects and exam sub-subjects, most e-studying methodologies were investigated, most hypothetical structures related to e-know, and the typology of exploration.

Introduction

There is no doubt that utilizing recent developments in the educational process in order to achieve the education goals is one of the requirements of educational success. They bridge the gap between educational methods and technological developments. With the advent of the coronavirus pandemic (Covid-19) and the trend towards electronic alternatives of education instead of traditional face-to-face education, e-learning emerged. As some academic subjects necessitates attending school or college and practice in laboratories, blended e-learning came to be a suitable solution.

Several studies (Hasanah & Malik, 2020; Wahyuni, Gusti Made Sanjaya, & Jatmiko, 2019; Mosalanejad, 2014) have proven that the shift towards blended e-learning is not a luxury or only a treatment for recent circumstances, but rather for utilizing technology in a way that achieves many objectives of the educational process (Khudhair, Jusoh, Mardani, Nor, & Streimikiene, 2019). This kind of learning, blended e-learning, is badly needed to achieve higher goals in education, such as developing professional skills or developing thinking skills. Schooling has gone beyond the goal of indoctrination and the ABCs of educational skills. Instead, it aims to develop continuous learning skills and various thinking skills. In this context, the results of Korkmaz and Karakus's study (2021) showed the positive relationship between blended e-learning and the development of critical reading and writing skills. Many respondents showed their preference for blended e-learning. The results Fitria et al.'s study (2020) revealed the positive impact of blended e-learning on learners.

Critical thinking is one of the most important types of thinking that requires realization in the educational process, especially in the age of informatics, so that the student becomes a critical thinker that transcends the circle of imitation and negative dependency. Critical thinking has become one of the goals of the modern educational process. That is why researchers have paid more attention to critical thinking. Its models have varied, such as Beyer Model, Ennis Model, Delphi Expert Model, and Watson and Glaser Model. Critical thinking is defined by Facione (1990, 2) "a purposeful, self-organizing judgment that leads to interpretation, analysis, evaluation, and inference, as well as an explanation of the evidence, concepts,

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methodology, standards, or contextual considerations upon which this judgment is based."

Actually, critical thinking is not a problem-solving method, although one of its results is a solution to problems. It is not limited only to the higher levels of the Bloom level (Harith Yas, Alkaabi, Al Mansoori, Masoud, & Alessa, 2021). It does not depend on evaluation and decision-making. It is a process that includes multiple purposes and skills. It is the process of critical thinking that goes through three stages: introduction, middle and conclusion (Khudhair, Jusoha, Mardania, Nora, & Streimikieneb, 2019). To the researcher's knowledge, every stage is important as the focus on it during definition. Critical thinking passes, in its beginning, with mental processes, then the middle stage. During the middle stage, it uses thinking skills related to critical thinking. Then the conclusion comes, according to the purpose. Whenever the definition of critical thinking fulfills these stages, it is comprehensive because the stages of critical thinking is systematic and connected to each other. So the researcher defines critical thinking as: a mental process carried out by an individual characterized by objectivity, perseverance, and the like, when confronting any situation, opinion and disagreement, and the desire to demonstrate judgment through the ability to practice the skills of identifying assumptions, the ability to deduce, interpret, and the like; together with the ability of evaluating evidence and arguments in order to arrive at correct judgments and make decisions and interpretations of various situations (El-Ghadouni, 2013).

This scientific paper aims to reveal the relationship between critical thinking and electronic learning mixed through scientific studies in the field of blended e-learning, to identify the educational stages in which e-learning was used and the extent of its impact on the development of critical thinking, and to try to answer the following:

1- What is the nature of the educational stage in which e-learning is used in the development of critical thinking?
2- What is the effect of blended e-learning on critical thinking through scientific studies?

This research paper gains its importance from the following:

- Drawing the attention of researchers to the extent of the relationship between blended e-learning and critical thinking.
- This research paper may reveal a research gap in subjects in the field of e-learning and critical thinking.
- Providing researchers with a summary of the results of scientific studies in the field of e-learning and critical thinking.

Study methodology

The study used document analysis.

The nature of the educational stage in which blended e-learning is used in the development of critical thinking:

Through previous scientific studies in the field of e-learning and critical thinking, it is clear that it is not limited to an educational stage without others, but scientific studies reveal the possibility of this in all educational stages. This is confirmed by studies in psychology in line with the characteristics of the age stages with the nature of critical thinking (H Yas, Alsaud, Almaghrabi, Almaghrabi, & Othman, 2021). Critical thinking includes several thinking skills, which in themselves are not at one level, indicating that the development of critical thinking skills at the primary stage is not the same as the level at which critical thinking skills are developed at the university level. Scientific studies in the field of e-learning and critical thinking in the primary level have indicated this point (Hee-jung, & Sun-Yeun, 2016). This clearly shows the relationship between the use of e-learning and the development of critical thinking. This relationship is applicable among learners at the primary stage; together with the advancement of technology with its available means for children and young people. This confirms the development of a skill, for example, verification of news, and information, evaluation, and inference results, unless they go according to the methodology of scientific thinking. Studies, for example Wahyuni, Gusti Made Sanjaya, and Jatmiko (2019), Suphamart and Thanongsak (2020), Mosalanejad, Mahdi and Alipor, (2011), and Wannapiroon (2014) revealed the application of e-learning to learners of the secondary stage in the development of critical thinking skills. A high school student, at the age of adolescence, is attracted by different ideas. This confirms the need to equip him/her with critical thinking skills. One of the school's methods in regard is the use of blended e-learning in the educational process to suit the characteristics and nature of the age of the high school student. Based on the scientific studies, the lofty goals of the school is shown, going beyond the task of transmitting information and teaching the student traditional skills to the goal of building the student's thought and personality through the development critical thinking. This requires attention to the nature of evaluation methods, as indicated by Jou, et al. (2016). The student can

express an opinion according to scientific rules and standards and clarify the opinion from the truth. These areas are available through blended e-learning applications. By reviewing scientific studies in the field of blended e-learning and critical thinking, (Hasanah & Malik, 2020), (Svenningsen, & Pear, 2011), (da Silva Ezequiel et al., 2019), (Mosalanejad, Alipor, & Zandi, 2010), (Alotaibi, 2013) and (Korkmaz & Karakus, 2021), the development of critical thinking skills is evident through blended e-learning among undergraduate students. Moreover, most previous scientific studies in this field have confirmed this result: (Korkmaz & Karakus, 2021), (Hee-jung, & Sun-Yeun, 2016), (Fitria et al., 2020), (Minoru et al., 2020), (Marheny et al., 2019) and (Akyüza, & Samsa, 2009). Undergraduate students are in the stage of mental maturity and psychology. He/She seeks to clarify his opinion clearly and abstractly. He/She has the skill of inference, interpretation and evaluation at its highest levels. This is part of the critical thinking skills. The following figure shows a summary of the results:

The impact of blended e-learning on critical thinking based on reviewing scientific studies:

By reviewing previous scientific studies in the field of blended e-learning and critical thinking, the efficacy and impact of blended e-learning on developing critical thinking is evident. Most of the previous scientific studies in this field have shown a positive impact of blended e-learning on the development of critical thinking. These studies, (Hasanah & Malik, 2020), (Wahyuni, Gusti Made Sanjaya, & Jatmiko, 2019), (da Silva Ezequiel et al., 2019), (Suphamart & Thanongsak, 2020), (Akyüza, & Samsa, 2009) (Suphamart & Thanongsak, 2020) (Akyüza, & Samsa, 2009), (Minoru et al., 2020), (Fitria et al., 2020), (Mosalanejad, 2014), (Bolandifar, 2017), (Jou, et al. 2016) and (Faslah et al., 2020), revealed this effect, indicating the strong relationship between the use of blended e-learning and the development of critical thinking. This may be due to the nature of blended e-learning and its multiple applications. It gives the student the freedom to choose to read the sources and the ability to search and make sure of the validity of the information and data through reliable electronic sources and websites; this enhances evaluation skill. It enables him/her to correctly use the skill of interpretation and the possibility of searching in such a source which increases his understanding. Additionally, it provides the possibility of dialogue with others, draws inference with valid and strong arguments and evidence. This is undoubtedly based on critical thinking skills. The great potential of e-learning and the multiplicity of information sources enable the learner to review several interpretations and assumptions through which he can he/she can issue sound scientific judgment. This in turn increases the level of critical thinking for the learner. Some scientific studies in the field of blended e-learning and critical thinking have indicated a lack of clarity of an impact on the development of critical thinking: (Mosalanejad, Alipor, & Zandi, 2010), (Alotaibi, 2013) and (Wannapiroon, 2014). This means that the use of blended e-learning does not directly affect the development of critical thinking, although as previously stated that the majority of scientific studies have indicated a positive effect. This urges us to do more scientific studies in comparison among several groups that are taught according to traditional education and groups that are taught through blended e-learning. This should be done with control on the variables to reach a level of reliability. It is noticed that the studies indicating the lack of effect in the use of blended e-learning on the development of critical thinking directly are related to secondary and university stages, with diversity of study subjects. Some of these studies, which revealed the lack of impact, used the Watson and Glaser model. They also used the blackboard system or forums and chat rooms. It can be concluded that there is a small percentage of the scientific studies have revealed that there is no effect on the use of blended e-learning on the development of critical thinking. This conclusion urges us to search for models, tools, and the type of the electronic system that bring a required effect. The above discussion can be summarized in Table 1 concerning results: (Table 1)

By reviewing previous studies and commenting on them, certain points could be concluded as follows:

- There is a positive relationship between blended e-learning and critical thinking.
- Blended e-learning is provided at all school levels and used it in developing critical thinking.
- The importance of the compatibility of teaching methods and strategies with the blended nature of e-learning, in a way that suits with the characteristics of critical thinking, instead of traditional teaching methods and limiting information to the teacher and the textbook.
- Providing blended e-learning with the goal of developing critical thinking requires innovation in evaluation methods and techniques.
- Some scientific studies have not proven the positive relationship between blended e-

learning and critical thinking. Consequently, it calls for more research and studies in depth to reach scientific results in this regard.

- In this field of research, it is essential to design scientific standards in blended e-learning programs for the development of critical thinking.
- Scarcity of the studies in the field of blended e-learning and critical thinking at the primary and lower secondary levels of education.
- The reason for not proving the positive relationship between blended e-learning and critical thinking, in some few studies, may be due to the nature of the teaching process or study tools, and the lack of precise scientific control over the study variables.

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Table 1. **Results of scientific studies**

Sr No.	Study	Stage of education	Results
1	(Hasanah & Malik, 2020).	University	The findings show that: (1) the implementation of the blended learning model effectively increases the critical thinking skills; (2) the use of the blended learning model effectively improves students' communication skills and (3) according to the independent sample t-test, students' critical thinking skills and communication skills in the experimental class had a significant difference from those in the control class
2	(Wahyuni, Gusti Made Sanjaya, & Jatmiko, 2019).	Secondary	There is an increase in scientific critical thinking skills of students
3	(da Silva Ezequiel et al., 2019)	University	Collaborative concept maps may be useful tools to help teachers better understand their students' critical thinking changes during a blended strategy.
4	(Suphamart & Thanongsak, 2020)	University	Results concluded that the experimental group with blended service learning achieved higher academic achievements and critical thinking skills than the control group at the .05 significance level. Learners who learn according to blended learning achieve more academic achievement and critical thinking skills than learners who learn according to traditional learning.
5	(Alotaibi, 2013)	University	There were no statistically significant differences between the experimental group and the control group in critical thinking skills.
6	(Korkmaz & Karakus, 2021)	Secondary	Blended learning model contributed more to student attitudes toward geography course when compared to the traditional learning model; blended learning model contributed more to student critical dispositions and levels when compared to the traditional learning model; and there was a positive correlation between student attitudes toward geography course and their critical thinking dispositions and levels
7	(Akyüza, & Samsa, 2009)	University	There was no significant difference between pre-tets and post-test results.
8	(Fola-Adebayo, 2019)	University	The results revealed that the students perceived a positive relationship between exposure to BL and the development of online critical literacy skills. Many of the respondents showed a preference for the BL mode, and the benefits they derived from it include: the improvement of Information and Communications Technology skills, the acquisition of more knowledge after the class, convenient time to work and ease with self-expression.
9	(Marheny et al., 2019)	University	The results showed that the application of blended-PBL was able to train students to improve their critical thinking skills in term of how to answer the test given. However, further studies need to be done with a wider number of samples and material scope to get more comprehensive information.

10	(Minoru et al., 2020)	University	, two out of four factor scores for critical thinking disposition increased significantly, though one factor score decreased significantly. This process of development was examined using causal relational analysis of the factors for personality, literacy of science and technology, and individual differences in disposition toward critical thinking. A statistically significant model was extracted, confirming that learning performance affects the causal relationship.
11	(Fitria et al., 2020)	University	Through this process, students are expected to get a comprehensive understanding, and obtain effectively relevant guidelines regarding the material that must be trained. Exceedingly students can generate critical thinking, which later give influence in song interpretation.
12	Mosalanejad, 2014)	University	There was a significant increase in student's critical thinking skills in both groups after conducting of the course. Analysis of variance results showed that there was a significant relationship between students' final score, teaching method and critical thinking in conclusion skills. The mean of final scores of the students who participated in the blended educational group was significantly more than that of those who participated in the face to face teaching approach. The use of blended educational method is recommended for teaching in Medical and Para-medical sciences
13	(Bolandifar, 2017)	University	The main findings demonstrated that the proposed blended learning method of instruction was more effective in improving reading comprehension and critical thinking skills of undergraduate ESL students than the traditional face-to-face instruction. This method of instruction offers an alternative teaching and learning approach with an effective use of Moodle-supported strategy instruction which supports the constructivist theory of learning in order to enhance the reading comprehension and critical thinking skills of students.
14	(Jou, et al. 2016)	University	Given the research findings, it was determined that blended learning in nursing education was more effective in improving the critical thinking of nursing students than the existing nursing education curriculum.
15	(Straus et al., 2013)	In-service professional development	The results of this study indicate that: 1) There are differences in critical thinking skills between students who use the blended learning method and conventional methods, 2) There are differences in critical thinking skills between students who are given essay and multiple choice quiz forms, 3) There is an interaction between learning methods and forms of quiz on critical thinking skills, 4) There are differences in students 'critical thinking abilities given the form of essay quiz in the blended learning method and conventional methods, 5) There are differences in students' critical thinking skills which are given a multiple choice quiz form on the blended learning method and conventional methods, 6) There are differences in students 'critical thinking skills using the method blended learning by providing essay and multiple choice quiz forms, 7) There are differences in students' critical thinking skills using conventional methods by providing essay test and multiple-choice forms.

16	(Renee, 2016)	Secondary	1) The teachers and students of the vocational institutions have the needs to develop blended learning for the critical thinking of the students at the PNI(modified) rate of 0.10 in the aspects of critical thinking, study achievement, and learning management. 2) The students of the vocational institutions have the needs to develop blended learning for the critical thinking of students at the PNI(modified) rate of 0.10 in the aspects of critical thinking, study achievement, and learning management. 3) The teachers of the vocational institutions have the needs to develop blended learning for the critical thinking of students at the PNI(modified) rate of 0.09 in the aspects of critical thinking, study achievement, and learning management. 4) The students and teachers of the vocational institutions suggest that there should be more discipline in every school, facilities should be adjusted and maximized to be more up-todate, test formats should be consistent and up-to-date with the student context, and learning formats should be up-to-date according to the needs of students and realit
17	(Hasani, Niusha, & Salibi, 2016)	Primary	This report describes a set of studies designed to evaluate the ILE Advanced Operations Course taught via blended distributed learning and to identify areas for improvement in course design and delivery. The report also discusses evaluation approaches to support continuous improvement in ILE. The report will be of interest to those involved in planning, developing, delivering, and evaluating leader education and those who develop and implement distributed learning courses that incorporate group collaboration on topics involving complex analytical skills and related competencies
18	(Sholikh, Sulisworo, & Maruto, 2019)	Secondary	All students improved their CTSR (Classroom Test of Scientific Reasoning) score. There was no statistical difference in CSTR scores between treatment and control groups or between genders or age groups. This implicates that the level of technology used in a classroom does not directly impact critical thinking ability. Future studies could provide a more drastic difference in the amount of technology used or measure growth over an entire academic year
19	(Marnita, 2020)	University	Based on these findings, the intervention on students' epistemological beliefs and their dimensions, including basic knowledge, certainty and knowledge, quick learning ability and awareness of things was significant, but the impact on the natural ability was not significant. The results showed that a combination of critical and creative thinking, can improve learners' beliefs about the structure, stability, speed resources, knowledge and understanding