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Framework Brain-Based Learning: The Impact of Critical Thinking-Based Learning on Memory and Recall

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Abstract

The research analyzes the potential of brain-based learning based on critical thinking on memory and memory. The purpose of this study is to produce a framework of brain-based learning methods, which integrate critical thinking in the learning process into students' memory and memory abilities. This study uses a qualitative descriptive method to collect and analyze data. Through literature review, relevant studies are obtained to produce a framework that can be implemented in learning. The findings suggest that brain-based learning, which centers on critical thinking activities, positively affects both memory retention and students' recall abilities. This research emphasizes the importance of incorporating critical thinking strategies into educational practices to improve learning outcomes. In conclusion, this study highlights the significant impact of brain-based learning on memory and recall.

Keywords: Brain-Based Learning; Memory; Critical Thinking

INTRODUCTION

Memory is the main intellectual process, subjugating many aspects of the socio-psychological makeup of the human being. Humans need to understand the facts about forgetting, dismantle myths, analyze information processing models, identify various potential "causes" in this search for memory, and examine several factors that can help retain what is learned (Squire, 1986). According to Okano et al. (2000), memory is a fundamental mental process, and without memory, we are incapable of

doing anything but simple reflexes and stereotypical behaviors. According to Squire (2009), Current memory in psychology is defined as the ability to encode, store, and retrieve information.

According to Zlotnik and Vansintjan (2019), psychologists have identified that memory is divided into three main categories: sensory, short-term, and long-term. Each of these types of memory has different characteristics. For example, sensory memory operates without conscious control, short-term memory is capable of holding a finite amount of information, while long-term memory can store an unlimited amount of information. In summary, memory is the main intellectual process that plays an important role in the socio-psychological structure of human beings. Understanding memory includes knowledge of the mechanism of forgetting, analysis of information processing models, and identification of various factors that can affect the ability to remember and retain information. Without memory, humans are only capable of performing simple and automatic behaviors.

Before a person remembers information or an event in the past, there are several stages that the memory must go through to be able to reappear. Atkinson et al. (2008), argue that psychologists divide three stages of memory, namely: 1) Endcoding, inserting messages in memory which refers to the way individuals transform sensory physical input into a type of mental representation in memory; 2) Storage, memory storage which refers to the way individuals retain information that has been stored in memory; and 3) Retrieval refers to how individuals gain access to information that has been stored in memory. Epigenetic research reveals that simple organisms can pass on memories between generations through the genetic code, which raises the question of whether humans and other complex organisms also have similar abilities. These advances have deepened our understanding of how memory is stored (Klosin et al., 2017; Posner et al., 2019).

According to Dudai (2004), and Schacter (2012), memory is an important ability that allows us to utilize past experiences to support our current and future lives. In the context of learning, memory plays a central role, in shaping our identity and identity. Without memory, we would be stuck in the present state that keeps repeating. Josselyn and Tonegawa, 2020), add that the brain's ability to store and reconstruct experiences suggests that memories can persist after events have occurred, so they can be reused to face future situations. Research conducted through interviews with elementary school teachers revealed several obstacles

faced by students, namely: 1) Students have difficulty maintaining focus; 2) Students are less interested in actively participating in the learning process; and 3) Students have difficulty understanding the concepts taught. The results of these interviews are the basis for strengthening the literature review in the preliminary study, which motivates researchers to trace the causes of these difficulties. One of the relevant approaches to address this problem, which has the potential to affect students' memory and cognitive development, is to integrate critical thinking learning in the Brain-Based Learning method.

Brain-Based Learning (BBL) is a student-focused, instructor-guided approach that harnesses students' natural cognitive strengths and talents while emphasizing knowledge acquisition with real-world applications (Uzezi & Jonah, 2017). Brain-based learning is related to neurology and educational science, where educational psychology plays an important role. Neuroeducation in the classroom is a scientific tool for educators as well as teachers, designed to help identify academic failures and assimilate key cognitive functions in children (Singaravelu et al., 2018). In addition, BBL uses strategies found through neuroscience and cognitive science studies to improve educational practices (Williams et al., 2010). In a nutshell, BBL is a learning and instruction approach that uses insights gained from studying the human brain and studies that have been conducted on the topic (Sani et al., 2019). (Caine et al., 1991), have demonstrated several principles of brain-based learning, namely: 1) the brain is a parallel learning processor. Brain-based learning is a lifelong process; 2) learning involves the entire physiology; 3) Helps to find meaning in innate; 4) learning involves focused attention and exterior perception; 5) learning always involves conscious and unconscious processes. This research integrates critical thinking into BBL.

Critical thinking (CT) is one of the basic skills of the 21st century that must be incorporated into the pedagogical environment (Ennis, 2018). Critical thinking is described as the ability to ask discriminatory questions in search of better ideas or to find better solutions (Carvalho et al., 2017). CT is defined as a conscious and self-regulatory thinking process that includes skills such as interpretation, analysis, evaluation, inference, and evidence questioning (Facione, 1990). According to Watson-Glaser (2010), the CT process involves the ability to recognize the existence of problems, question the source of information question the accuracy of the evidence, and evaluate different data and evidence (Sternod and French, 2016). In other words,

the source of the CT process can be said to achieve results with observations and knowledge that have been questioned and tested for accuracy (Paul, 1992).

Several studies on the implementation of BBL in learning, the results of Singaravelu et al. (2018) research that learning through Brain Based Learning helps in increasing student achievement scores, on the other hand, brain-based learning increases problem-solving and creativity in selected students. Another finding by Ali and Yousuf, (2019), was that there was a statistically significant difference at the level (0.01) between the average pre and post-test scores of lateral thinking and the scale of attitudes in favor of the post-test. The study recommends the use of brain-based learning teaching strategies with gifted students, as well as teacher training to use those strategies. Similar findings by Garusiyan Shad et al. (2023), suggest differences in the effectiveness of brain-based learning and self-regulation training on the executive function of students with reading learning disorders. In particular, the improvement in the brain-based learning group was more significant than in the self-regulation training group.

This study is different from previous studies because this study combines BBL and critical thinking as instructions given by teachers to improve students' memory and recall. So the question of this study is how is the brain-based learning framework based on critical thinking memory and recall in learning?. Based on the problems that have been described, the purpose of this research is to produce a brain-based learning framework based on critical thinking memory, and recall.

METHODS

This research method uses qualitative description. Researchers are intensively involved in a community to get a comprehensive picture of a situation or experience that is then processed and the results explained. The research data is collected in depth with the aim of obtaining a clear and detailed picture. The research subjects consisted of 5 teachers in East Jakarta elementary school classes. The data collected in this study involved interviews with teachers. The research instrument consists of an interview guide. Interview guides are used to gather initial information about how students are doing in the learning process, and the learning approach that teachers use in the classroom. Analyze the results data using the Miles & Huberman. The data analysis process involves three steps, namely data reduction, data presentation, and conclusion or validation.

Table 1. Teacher Interview Guidelines

No	Indicators	Questions
1	Student Performance in Learning	How students respond to the learning process, including the difficulties they face and their involvement in learning activities.
2	Learning Approach by Teachers	The learning methods or approaches applied by teachers in the classroom, as well as how these approaches affect student understanding and participation.
3	Challenges and Obstacles to Learning	obstacles faced by students during the teaching and learning process, both in terms of understanding concepts, motivation, and learning focus.
4	Teachers' Strategies to Improve Student Performance	Efforts and strategies are made by teachers to overcome students' learning difficulties and improve their performance.
5	Teachers' Perception of Learning Effectiveness	Exploring teachers' views on the effectiveness of the learning approaches they apply, as well as their impact on student learning outcomes.

RESULTS AND DISCUSSION

As a result of interviews with teachers, teachers observed that students had various responses to the learning process, where some students showed active involvement, while others had difficulty understanding the material. The most common difficulties was faced by students include understanding concepts and maintaining focus during learning activities. However, students tend to be more engaged in activities that were interactive and challenge their critical thinking skills. Teachers applied a variety of learning methods, focusing on a critical thinking-based approach. This approach was designed to encourage students to explore the material in depth and develop their analytical skills. Teachers noted that this approach not only improved students' understanding of concepts but also encouraged their participation in class discussions.

The main obstacles was identified by teachers include students' difficulty in understanding abstract concepts, low motivation to learn, and lack of focus during the teaching and learning process. Some students also had difficulty connecting theory with practical applications, which hindered their in-depth understanding

of the material being taught. The teachers implement strategies that focused on increasing motivation and providing additional support. These strategies included the use of problem-based learning techniques, group discussions, and the provision of constructive feedback. Teachers also tried to facilitate more individualized learning by adjusting the approach according to the needs and abilities of each student.

Teachers felt that a learning approach based on critical thinking was very effective in improving student learning outcomes. This approach not only helped students in remembering and applying information but also improved their ability to think critically and analytically. Teachers noted that this approach had a positive impact on students' memory and ability to remember and relate the concepts they had learned. The results of the interview led to the conclusion that the application of the brain-based learning framework with a critical thinking-based learning approach had a significant impact on students' memory and recall skills. This approach increased student engagement in the learning process, helped them to overcome various obstacles, and contributed positively to their learning outcomes. Teachers affirmed that this approach was effective in building strong memory and critical thinking skills, which were important elements in brain-centered learning. Framework BBL-based critical thinking for memory and recall was below.

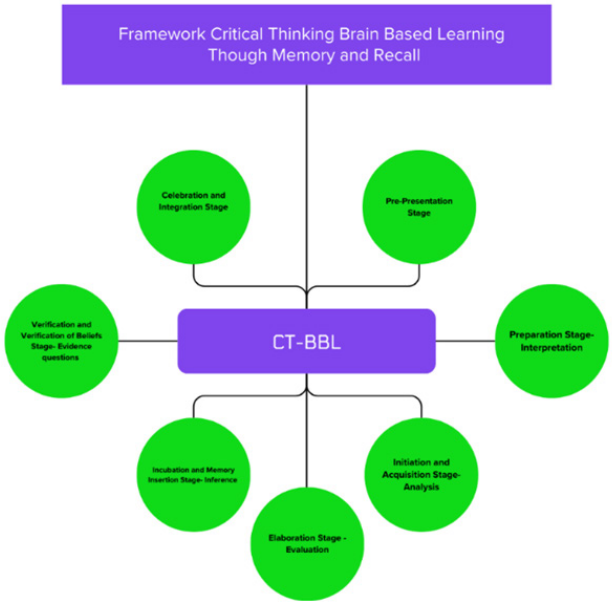

Figure 1. Framework BBL-Based Critical Thinking

Based on the BBL-based critical thinking framework, involves 7 stages of learning and integrates five indicators of critical thinking. In the first stage, the teachers started by introducing the topic or concept to be learned through complex narratives, the use of engaging images or visuals, or in-depth video screenings. Students were not only observed but also directed to think critically and actively engage in this learning process. Students were encouraged to share their opinions on the topic being studied, asked questions if any concepts were poorly understood, and collaboratively discussed the implications of the information presented.

In the second stage, learned from real situations or everyday experiences to affirm the relevance and practical application of the material. The teacher facilitated the discussion, and students reflected on how the concept could be applied in the student's daily lives. The interpretation process was the main focus here, where students not only understood the concept theoretically but also tried to relate it to the experience and knowledge that the student had before. Students were active in identifying the relevance of topics to students' personal experiences, looking for connections between the concepts learned and the situations students encounter in everyday life. It involved deep reflection on how the concept can influence or enrich the student's real-world experience.

Giving a discussion was a positive and fun teaching process because students were given the opportunity to convey their ideas and ideas, this was relevant to the results of the research (Calp, 2020), which highlighted the importance of a positive learning environment for students and teachers. Schools, as institutions that aimed to educate children, should be peaceful and pleasant places. In a peaceful and happy school, there were principles such as love, respect, honesty, courage, empathy, and kindness. Supported by the findings of Ahmad (2021), a positive learning environment was important to avoid three causes of students' reluctance to participate in class discussions, namely tension when forced by the teacher to answer questions, becoming tense and nervous to speak in front of the whole class, and have a wrong pronunciation in the United Kingdom. Additionally, the most popular strategy was used by students to participate in class discussions was to think carefully about what to communicate before they participate

In the initiation and acquisition stage, teachers enriched the student's learning experience by integrating critical thinking indicators, especially analysis, into the

learning process. This was done by providing complex supplementary material, such as challenging case examples, in-depth case studies, or experiments specifically designed to encourage students to conduct a more in-depth analysis of the concept being studied. In addition, students were given exercises or practiced questions that were specifically designed to test students' understanding of the concepts they had learned. These exercises were not only intended to test students' understanding but also to encourage students to conduct critical analysis of the material they have studied. Students were required to identify areas that required further understanding, delve deeper into complex concepts, and develop more advanced analytical skills. Through a combination of providing challenging supplemental material and exercises designed to encourage critical analysis, teachers helped students develop a deeper understanding and higher thinking skills related to the concepts being studied. These processes not only improved students' understanding of the learning material but also helped students to become more independent and critical learners. The results of this study were in line with the opinions of Reis et al. (2021) which stated that providing challenging and interesting learning opportunities was one way to motivate students in learning.

In the Elaboration Stage, teachers integrated critical thinking indicators, especially evaluations, into the learning process. Teachers not only facilitated reflective discussions in the classroom but also encouraged students to conduct in-depth evaluations of their own learning. Reflective discussions were focused on the learning that occurs during the learning process, with the aim of identifying student's achievement and areas that still needed improvement. The students were encouraged to analyze mistakes in applying concepts that had been learned. The students were given the opportunity to identify areas where difficulties were still being experienced, which helped to recognize gaps in understanding. This process involved critical self-evaluation, where students must honestly identify their own weaknesses and develop strategies to overcome those challenges.

The results of this study were in line with the findings of Lim et al. (2021), which showed a positive relationship between personalized feedback and students learning tactics and strategies, as well as time management, carried out gradually by considering the context of the course, including learning design and delivery modalities. In addition, students were also encouraged to share experiences or insights gained during the learning process. (Nicol, 2021), stated that in order to

uncover the potential for internal feedback, teachers needed to encourage students to transform their natural comparisons into more formal and explicit comparisons, as well as help them to develop the ability to utilize their own comparison process. This not only helped students to broaden their understanding through different perspectives, but it also made it possible to learn from each other and enrich the learning experience. By integrating critical evaluation into the Elaboration Stage, teachers helped students develop critical self-evaluation skills and became aware of their own weaknesses. These processes not only improved students' understanding of the learning material but also helped them to become more independent and reflective learners.

In the incubation and inclusion of memory stage, teachers integrated critical thinking indicators, specifically inference, into the learning process by selecting videos that were appropriate to the curriculum or topic being studied. Teachers not only chose relevant videos but also ensured that they motivated students and presented information in an engaging and easy-to-understand way. The students were given the opportunity to watch educational videos that were relevant to the topic being studied. These videos can be in-depth documentaries, engaging animations, or inspiring presentations. Through these video screenings, students were not only exposed to new information but were also encouraged to make inferences or conclusions based on what they saw and heard in the video. In addition, students were also invited to pay attention to details that may not be immediately visible or explained in the video. The students were encouraged to make inferences or draw conclusions about the concepts presented in the video, relate them to pre-acquired knowledge, and develop a deeper understanding of the topic. By selecting videos that were relevant and motivating and providing opportunities to make in-depth inferences, teachers helped students develop critical thinking skills.

This process not only deepened students' understanding of the learning material but also helped to become more independent and analytical learners. This finding was consistent with the results of research by Hanif (2020), which showed that interactive motion graphic video media was effective in improving science learning achievement of 5th-grade elementary school students. In addition, the findings of Arguel and Jamet (2009), stated that animations and videos were often designed to present information that showed changes over time, thus aiding

understanding and facilitating learning. Another study by Djaga et al. (2022), also supported that animated videos can improve learning outcomes.

In the verification and checking stages of belief, teachers integrated critical thinking indicators, specifically evidence questions, into the learning process by providing questions that encouraged students to think critically about the evidence or information learned. The teachers not only presented information to students but also asked questions that stimulated analytical and evaluative thinking. These questions were designed to spark students' critical thinking about the truth of the evidence or information they had received. The students were encouraged to critically evaluate the evidence, considered the strengths and weaknesses of the evidence, and drawed conclusions that were supported by the evidence found. In addition, students were also asked to make presentations or reports that presented evidence that supported beliefs or judgments.

Through this process, students must not only understand the information they were learning but also be able to organize and present the evidence logically and coherently. By providing evidence questions that demanded analytical and evaluative thinking and giving students the opportunity to present their own evidence, teachers helped students develop critical thinking skills that were important in the learning process. This process not only deepened students' understanding of the learning material but also helped to become more independent and critical learners. In accordance with the opinion of Faujiah et al. (2024), this collaborative approach allowed students to share ideas and strategies with each other, thus deepening their understanding. By holding sessions where students can present their solutions and receive feedback from their peers, the resulting discussion and criticism help foster a deeper understanding.

In the Celebration and Integration Stage, teachers integrated critical thinking indicators, especially providing positive feedback, into the learning process by giving recognition and appreciation to students for their achievements in understanding the material they have just learned. The teachers not only provided positive feedback in general but also specifically identified and praised students' progress in understanding difficult or complex concepts. This positive feedback not only served to increase students' motivation and confidence in learning but also helped to strengthen the connection between effort and the results achieved. The students felt valued and motivated to

continue learning and developing. In addition, students were also encouraged to make summaries or mind maps about the concepts they had just learned.

Through this process, students must be able to synthesize the information learned and organize it in a logical and systematic way. This helped to consolidate the understanding of the learning material and strengthened the connections between different concepts. By providing focused positive feedback and providing students with opportunities to summarize and organize the concepts learned, teachers helped students develop critical thinking skills that were important in the learning process. This process not only deepened students' understanding of the learning material but also helped to become more independent and reflective learners. These findings were consistent with the results of Stokhof et al. (2020), which showed that visualizing knowledge constructs through shared mind maps helps students learn learning objectives and improve their knowledge structure.

CONCLUSION

The stages in brain-based learning that have been described, which integrate critical thinking indicators, such as analysis, evaluation, inference, and evidence questions, form a complex and holistic framework. In each stage, teachers play a key role in facilitating the student learning process, while students are encouraged to be active, reflective, and critical in student thinking. These findings highlight the role of teachers in facilitating deep learning and critical thinking, through an environment that supports and encourages students to ask questions, analyze, and draw evidence-based conclusions. In addition, students should be given the opportunity to develop critical thinking skills through practice, discussion, and reflection. This will not only improve the understanding of the learning material but also help to become a more independent and reflective learner. This research has implications for the field of education, especially in the development of more effective learning methods. These findings emphasize the importance of creating a learning environment that supports and encourages students to develop critical thinking skills. By integrating a critical thinking approach into brain-based learning, this research contributes to the development of more adaptive teaching strategies, which not only improve students' understanding of the subject matter but also help them become more independent and reflective learners.

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