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RESEARCH ARTICLE

EFFECTIVENESS OF TEXTBOOK WITH BRAIN-BASED LEARNING APPROACH ACCOMPANIED BY MIND MAPPING OF EARTH LAYER MATERIAL TO IMPROVE LEARNING OUTCOMES CRITICAL THINKING JUNIOR HIGH SCHOOL STUDENT'S

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Abstract

One of the 21st-century skills targeted in implementing the 2013 curriculum is critical thinking skills. However, the facts in junior high school students' critical thinking skills are still low. An exciting and fun media is needed to improve critical thinking skills, namely a textbook with a brain-based learning approach using mind mapping. This study aims to determine the textbook's effectiveness with a brain-based learning approach accompanied by mind mapping for critical thinking. The design of the research used was one group pretest-posttest design with three meetings. The results showed an increase in learning outcomes and critical thinking skills. The results can be seen from the N-gain value of the first meeting is 0.56, with "medium" criteria. The second meeting is 0.58, with the "medium" criteria, and the third meeting is 0.65, with the "medium" criteria. The mean result of critical thinking from the first meeting to the third meeting were 72.57, 76.57, and 80.29 with "good" criteria. So it can be concluded that textbooks with a brain-based learning approach effectively improve learning outcomes and criticalthinking.

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Introduction:-

Education is a humane way to deal with any changes that occur toward a better civilization. According to Harshbarger (2016), competencies that need to be developed and owned by the students in the 21st-century are critical thinking skills, creativity, communication, and collaboration, or often referred to 4C's. One of the 21st-century skills targeted in implementing the 2013 curriculum is critical thinking skills. Critical thinking is a person's ability to decide an action through investigation, reasoning, skills resulting from reflective thinking, and reasoning that is focused on something to be achieved (Ennis, 2011; Cukwuyenum, 2013). Critical thinking is one of the main goals of education needed to involve deep reasoning and consideration of different ideas (Hashemi, 2011; Mansoor, & Pezeshki, 2012; Kaleiloglu & Gulbahar, 2014). Critical thinking skills are useful for analyzing students' concepts in a lesson (Widita et al., 2018). One of the main objectives of education is to teach students critical thinking (Kaleiloglu and Gulbahar, 2014; Setyowati, 2018).

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The results of a preliminary questionnaire study of 10 science teachers in Banyuwangi Regency - Indonesia show that 90% of teachers have never made their textbooks. 80% of teachers have never made textbooks that maximize the left and right brain's function simultaneously or textbooks based on brain-based learning. 70 % of textbooks used have not improved critical thinking skills, with scores still below the minimal mastery learning score. Thirty respondents conducted the results of student questionnaire analysis with the following results: 87% of textbooks used were not able to support the learning process, and 93% had never used textbooks that were able to optimize left and right brainfunction.

The development of textbooks is one of the efforts that teachers can make to overcome these problems. The textbook is a teaching material that contains information, discussion, and evaluation (Nuriyah, 2019). Printed textbooks are a form of learning media needed in the learning process (Tania and Fadiawati, 2015). Printed textbooks are used more frequently than electronic textbooks. Millar and Schrier (2015) state that 57% of students prefer printed textbooks, 25% prefer electronic versions of textbooks, and 18% do not. According to Knight (2015), printed textbooks are considered a reliable medium and provide reliable, accurate information to improve students' understanding of learning.

The utilization of printed textbooks can improve communication in learning to get maximum results (Nuriyah, 2019). The development of textbooks that are attractive and able to support students' attention has various forms, one of which is a printed textbook with the approach Brain-Based Learning and mind mapping. BBL is a comprehensive approach to instruction using neuroscience and aims to empower the potential of the left brain and right brain in various aspects, namely thinking, learning, and remembering (Bonomo, 2017). The brain is a parallel processor that can perform several activities at once (Caine and Caine, 1990). Mind mapping is one technique of brain-based learning approach.

Mind mapping is a technique to optimize the potential of the human brain by utilizing the right brain and left brain because mind mapping combines colors, symbols, shapes, and so on, making it easier for the brain to absorb the information received (Jones, 2012; Fuad et al., 2017). Mind mapping is a visual tool and builds critical thinking (Akbar & Taqi, 2017). Mind mapping plays an essential role as an active learning process in understanding the teacher's material (Madu & Metu, 2012). Mind mapping is applied to improve students' understanding of concepts that have been taught so that students can reconstruct the information obtained. The development of science textbooks brain-based learning needs to be combined with mind mapping because the development of textbooks brain-based learning has fun characteristics and is based on optimizing the functions of the left and right brains simultaneously.

This research aims to determine the effectiveness of textbooks with a brain-based learning approach accompanied by mind mapping on earth layer material to improve junior high school students' learning outcomes and critical thinking.

Research Method:-

The research design used was a one-group pretest-posttest design, a research activity by providing a pretest and the end of learning given the final test (posttest). At the same time, critical thinking tests are given after posttest activities. The research subjects consisted of 28 grade VII students of SMP Al-Qur'an Al-Mubarak. This research was conducted in the even semester of 2019/2020. Learning outcomes were obtained from the pretest and posttest, while the assessment of critical thinking skills was obtained from each meeting's test scores at the end of the lesson. Learning outcomes are analyzed using N-gain (formula 1), and critical thinking is analyzed using formula 2.

$$N - g = \frac{S_{post} - S_{pre}}{100 - S_{pre}} \dots \dots \dots (1)$$

Description:

$N - g$ = Normalized gain

S_{pre} = average pretest score

S_{post} = average post-test score

The obtained normalized gain criteria in Table.1

Tabel 1:- Classification of N-Gain.

Gain Score	Criteria
$g < 0.3$	Low
$0.3 \leq g < 0.7$	Medium
$g \geq 0.7$	High

Hake (2002)

$$V = \frac{\sum \text{achieved score}}{\text{maximum score}} \times 100 \dots \dots \dots (2)$$

Tabel 2:- Value criteria of Critical Thinking.

Value	Criteria
20.0 – 36.0	Very Bad
36.0 – 52.0	Bad
52.0 – 68.0	Good Enough
68.0 – 84.0	Good
84.0 – 100.0	Very Good

In this research, there are five aspects of Ennis's critical thinking indicators: elementary clarification, essential support, inference, advanced clarification, and strategies and tactics.

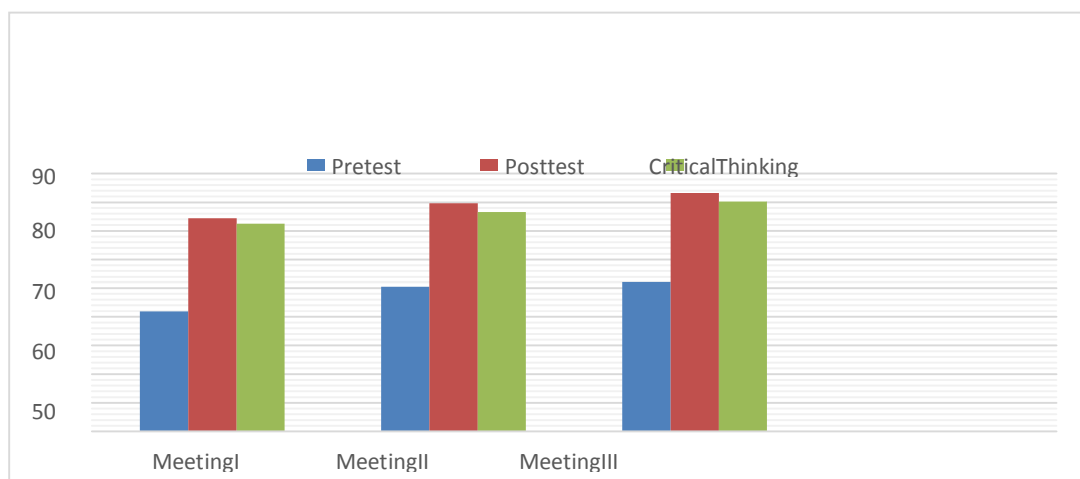
Results:-

This study examines science textbooks' effectiveness with a brain-based learning approach with mind mapping to improve learning outcomes and critical thinking. The research results can be seen in the Table. 3

Table 3:- Average Pretest, Posttest, and Critical Thinking.

Meeting	Cognitive learning outcomes	Average Score	N-Gain	Categories
I	Pretest	41.93	0,56	Medium
	Posttest	74.46		
	Critical Thinking	72.57		Good
II	Pretest	50.54	0.58	Medium
	Posttest	79.64		
	Critical Thinking	76.57		Good
III	Pretest	52.14	0.65	Medium
	Posttest	83.21		
	Critical Thinking	80.29		Good

Based on data in Table 3, textbooks with a brain-based learning approach accompanied by mind mapping on earth layer material can improve learning outcomes and critical thinking skills. The percentage of students' critical thinking skills and learning outcomes can be seen in the following histogram.

Figure 1:- Average Pretest and Posttest and Critical Thinking Histogram.

Based on Table 3 and figure 1, there is an increase in the average value of learning outcomes and critical thinking skills. At the first meeting, the pretest, posttest average value, and critical thinking were 41.93, 74.46, and 72.57. The means scores obtained at the second meeting were 50.54, 79.64, and 76.57. While at the third meeting, an average score was obtained 53.14, 83.21, and 80.29. The n-gain mean of the first to the third meeting was 0.56, 0.58, and 0.65 with "medium" categories.

Discussion:-

Based on research data, textbooks with a brain-based learning approach accompanied by mind mapping effectiveness improve critical thinking skills. This is in line with Setyowati (2018) opinion that textbooks can improve critical thinking. The critical thinking study (Table 3) show that the mean value of the pretest posttest has increased at each meeting. At the first meeting, the pretest score (before being given treatment) was 41.93, there was an increase in the posttest (after being given a textbook with a brain-based learning and mind mapping approach) 74.46 with N-gain score 0.56 the criteria of "medium", while the average critical thinking is 72.57 with "good" criteria. The average pretest score for the second meeting was 50.54, there was an increase in the posttest as much as 76.57 with N-gain score 0.58 the criteria of "medium", while the average critical thinking is 76.57 with "good" criteria. The average pretest score of the third meeting was 53.14, and there was an increase in the average posttest score of 83.21 in the "good" criteria, and average critical thinking is 80.29 with "good" criteria. The textbook on the brain-based learning approach contains fun activities equipped with several features that are under the principles of brain-based learning. This is in accordance with Prihatin (2019) opinion that the technique of implementing BBL creates pleasure, is collaborative, active learning, and stimulates curiosity. Features in textbooks are adapted to different student learning styles, namely auditory learning styles, visual learning styles, and kinesthetic (Craig, 2007; Lidiastuti, 2019; Hervianto, 2020). In the textbook, the brain-based learning approach includes pictures and videos to facilitate students in visual learning. This is the same as Bolton et al. (2012) statement that visual components can improve students' understanding.

Before the learning activities began, students did a brain gym movement. The Brain gym movement involves the hands and feet, which can provide a stimulus to the brain, increase blood flow, and stretch muscles. This is in line with the explanation of Watson et al. (2014), that the brain gym technique is an activity that involves the hands, feet, eyes, ears, and the whole body designed to focus attention. Brain gym movements can be accessed via barcode scanning in the textbook on the "Brain Refresh" feature. The following is an example of the "Brain Refresh" feature found in the textbook.



Figure 2:- Feature "Brain Refresh"

Another factor that causes an increase in critical thinking is that students are asked to make mind maps. Following the opinion of Keles (2012), mind mapping can train the student's critical thinking. Mind mapping was made in groups. Making mind mapping with groups can encourage students to express themselves, exchange ideas, activate all student abilities in critical thinking, focus on subjects, make plans, compile and express student understanding (Lestari et al., 2020). Students make a summary of the material using mind mapping techniques according to the material being studied. Textbooks with a brain-based learning approach with mind mapping are proven to make students more active and enthusiastic in discussing to improve critical thinking. This is according to the statement Fuad et al. (2017); mind mapping is an effective technique for enabling students to remember, design, organize, and combine meaningful information. Besides, mind mapping can enrich the learning experience in developing critical thinking skills. The following is an example of mind mapping from students' results.



Figure 3:- Mind Mapping about the layer of earth from students' results.

Conclusion:-

The presentation of results and discussion shows that there has been an increase in critical thinking skills after participating in textbook learning with a brain-based learning approach with mind mapping on earth layer material. This can be seen from the n-gain value of the first meeting is 0.56 with the criteria of "medium" increase, the second meeting is 0.58 with the "medium" criteria, and the third meeting is 0.65 with the "medium" criteria. The mean result of critical thinking from the first meeting to the third meeting were 72.57, 76.57, and 80.29 with "good" criteria. It can be concluded that the textbooks with a brain-based learning approach accompanied by mind mapping on earth layer material are effective in improving learning outcomes and critical thinking skills.

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