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The effectiveness of brain-based learning model (BBL) integrated with the whole brain teaching (WBT) model toward students' retention

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ABSTRACT

Retention of learning results is a measurement of students' ability to remember the lesson being learned after an amount of time before. This research aimed at investigating the effectiveness of the Brain-Based Learning Model (BBL) integrated with the Whole Brain Teaching (WBT) model on the retention of students' learning results. This research was a quasi-experiment using a posttest-only control group design. The population of this research was the students of State Junior High Schools in Malang in the 2017/2018 academic year. The samples were selected from State Junior High School 1, State Junior High School 4, State Junior high School 6, State Junior High School 8, State Junior High School 15, State Junior High School 17, Junior high school 25, and Junior High School 26. The results of the data analysis showed that the learning model provides a significant effect on the retention of students' science learning in Junior High schools in Malang. LSD notation shows that the effect of the WBT model integrated BBL model on student learning retention is lower as much as 6,79% and significantly different compared to the WBT model. The effect of that model is significantly different from the effect of BBL learning but higher as much as 8,06% and significantly different compared to the effect of the BBL learning model as well as higher (14,12%) and significantly different compared to the effect of conventional learning.

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INTRODUCTION

The teaching and learning process is a part of the external stimuli to the information processing inside the brain (Handayani, et al., 2020; Ristanto, et al., 2020). The amount of information processed can be seen from the students' learning results (Suparini, et al., 2020; Harahap, et al., 2020a). The students' learning results consist of the cognitive, affective, and psychomotor aspects (Djamahar, et al., 2020). Learning results would be more meaningful if the information is not easily lost from the students' memory (Hayati & Fitriyah, 2021; Kristiani, et al., 2020). The information that the students remember is measured in the form of students' retention. Based on the results of observations to the 25 science teachers at State Junior High Schools in Malang, 80% of them never measured the students' retention. To date, teachers measure the students' understanding through cognitive learning tests.

Retention is the ability to remember information until a certain period. Remembering is retrieving the necessary knowledge from long-term memory (Anderson & Krathwohl, 2001; Trilipi et al., 2019). According to Santrock (2004), retention is the memory of the information from time to time which involves inserting the information into memory or encoding, saving the information, and recalling the information from memory. Similarly Rose & Nicoll (2007), and Herleny (1999), stated that the retention of cognitive learning results showed the students' ability to remember the material taught in several intervals of time. The measurement of retention needs to be done, because, according to Bandura (1971) and Hill, (2001) retention was one of the essential components of learning. Retention also could provide a practical effect on the learning process. In the relevance of 21st-century learning, retention is one of the skills that students need, especially in their efforts to find, use, and manipulate information. Students must be able to use these skills to generate new ideas. In this case, the ability to recall previously acquired knowledge is very important and affects how much and quickly a student can build his knowledge with new ideas (Greenstein, 2012).

The low retention of Junior High School students in Malang, Indonesia based on the cognitive learning results was caused by a lack of variations of learning models used by the teachers. Based on the results of observations on the methods used by the teachers at Junior High Schools in Malang, 60% of teachers used information discussion or lecturing and sometimes cooperative learning, lab work, modeling, and PBL (Handayani, 2016). Teachers are required to be innovative, adaptive, and creative and can bring joyful learning (Mufida, et al., 2020; Suyono & Hariyanto, 2012). The use of an effective learning model is one way to improve the students' retention (Noel & Levitz, 2008). An effective learning model takes into account the way of the information processes in the brain as the intelligence machine in learning (Ristanto, et al., 2021; Aprilia, & Suryadarma, 2020; Suryanda, et al., 2018). Teachers' understanding and knowledge of brain-based learning can increase teachers' creativity in teaching the students (Sele, 2019).

One of the learning models that is suitable for learning and the way the brain works is the Whole Brain-Based Learning (WBBL) model. WBBL is a learning model derived from the integration of the Brain-Based Learning (BBL) model and Whole Brain Teaching (WBT) model. Brain-Based Learning (BBL) is derived from cognitive neuroscience theory, coming from the research on how the work function of the brain by neuroscience (Jensen, 2008). Biffle (2010) explained that Whole Brain Teaching (WBT) was learning with an instructional approach that was derived from a neurolinguistic picture based on the function of the left and the right brain. Both models are based on brain-based learning, but each model has its advantages and disadvantages. These reasons are the basis for integrating the BBL and WBT models. The integration of the two models produces a new model that is implemented by using visual, verbal, and body language, as well as with relaxation and self-reflection. The syntax of BBL integrated with the WBT model consists of a) clas yes, b) pre-exposure with a gesture, c) inaquition ready, d) elaboration with teach and mirror, e) incubation and insert a memory, f) comprehension check, and g) celebration.

To date, research on the effectiveness of the BBL model integrated with the WBT model has not been done. However, there have been many types of research investigating the effectiveness of the BBL and WBT models, such as related to the BBL (Munfaridah, 2013; Yuntari, 2013; Prawoto, 2013; Saleh, 2012), related to WBT (Jabar, 2014). Furthemore Biffle, (2010) found that the WBT learning model could make strong retention. The learning syntax integrating the BBL and WBT models is expected to have better effects on learning. This research aimed at investigating the effect of the BBL model integrated with the WBT model on students' learning retention.

METHODS

Research Design

This study is an experimental research of posttest only control group design conducted by comparing the effectiveness of traditional learning, BBL, WBT and BBL integrated with the WBT model on the students' retention of State Junior High Schools in Malang. The experimental research design can be seen in Table 1.

Population and Samples

This research was conducted for one semester, in the first semester of the 2017/2018 academic year beginning from July until December 2017. The population of this research was the students of State Junior High School in Malang. The samples were selected by using random sampling and 8 schools were selected which consisted of 260 students. Previously the equality test had been conducted on the research samples.

Table 1.
Posttest Only Control Group Design

Group	Treatment	Posttest	Retention
Exsperiment	T1	X1	Y1
	T2	X2	Y2
	T3	X3	Y3
Control	T0	X0	Y0

Information:
T 1 = positive control group using BBL model
T2 = positive control group using WBT model
T3 = positive control group using BBL model integrated with WBT model
T0 = negative control using conventional learning
X0 = cognitive learning results of conventional learning
X1 = cognitive learning results of BBL model
X2 = cognitive learning results of WBT model
X3 = cognitive learning results of BBL model integrated with WBT model
Y1 = learning retention using BBL model
Y2 = learning retention using WBT model
Y3 = learning retention using BBL model integrated with WBT model
Y0 = learning retention using conventional learning

Instrument

The instruments used in this research consisted of treatment instruments and measurement instruments. The treatment instruments were in the form of learning materials, such as syllabus, lesson plans, and students' worksheets, which were developed based on the implemented learning model. While the measurement instrument consisted of 10 essay questions provided after the learning process is complete. The subject matter measured in this research is all of science subject learning material for seventh grade in odd semesters, namely objects of science and their observations, classification of living things, substances and the changes, temperature, heat and the changes, and energy in living systems. The instruments used previously have been validated by experts and empirical validation. Expert validation looks at the content validation and constructs validity of the device. Content validity refers to the accuracy of the instrument in terms of content fit with the curriculum and concerning the construction of the concepts to be tested. The validity of the construction refers to the suitability between the measuring instrument and the ability to be measured. Empirical validity was carried out on 60 students of State Junior High School in Malang to measure the validity and reliability of the tests. The result of empirical validity shows that the ten questions are valid. While reliability refers to the level of test scores that are free from measurement error, the result Crobanch's Alpha is 0.703 which means high category reliability.

Procedure

The data collection process was carried out with the procedure as shown in the flow chart (Figure 1).

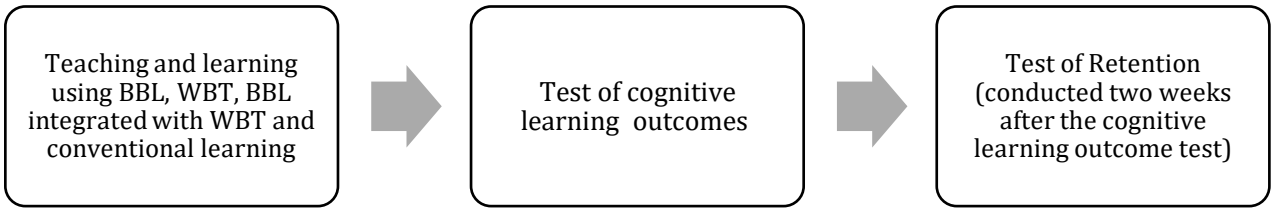

Figure 1. Data Collection Process

Data Analysis Techniques

Research data were analyzed using the ANCOVA test supported by SPSS for Windows software. Hypothesis testing was done after the prerequisite tests were carried out, including the normality test using the Kolmogorov-Smirnov test and homogeneity test using Leven's Test of Equality of Errors Variance.

RESULTS AND DISCUSSION

Based on the measurement of cognitive learning outcomes and learning retention, the results are shown in Figure 2. From Figure 2 it can be seen that the BBL model combined with WBT has the highest average retention value compared to the WBT and BBL models as well as conventional learning. In addition, the BBL combined with the WBT model has the smallest difference between cognitive learning outcomes and retention, which means the

smaller the difference from cognitive learning results to retention, the better the ability to remember or the better student's retention.

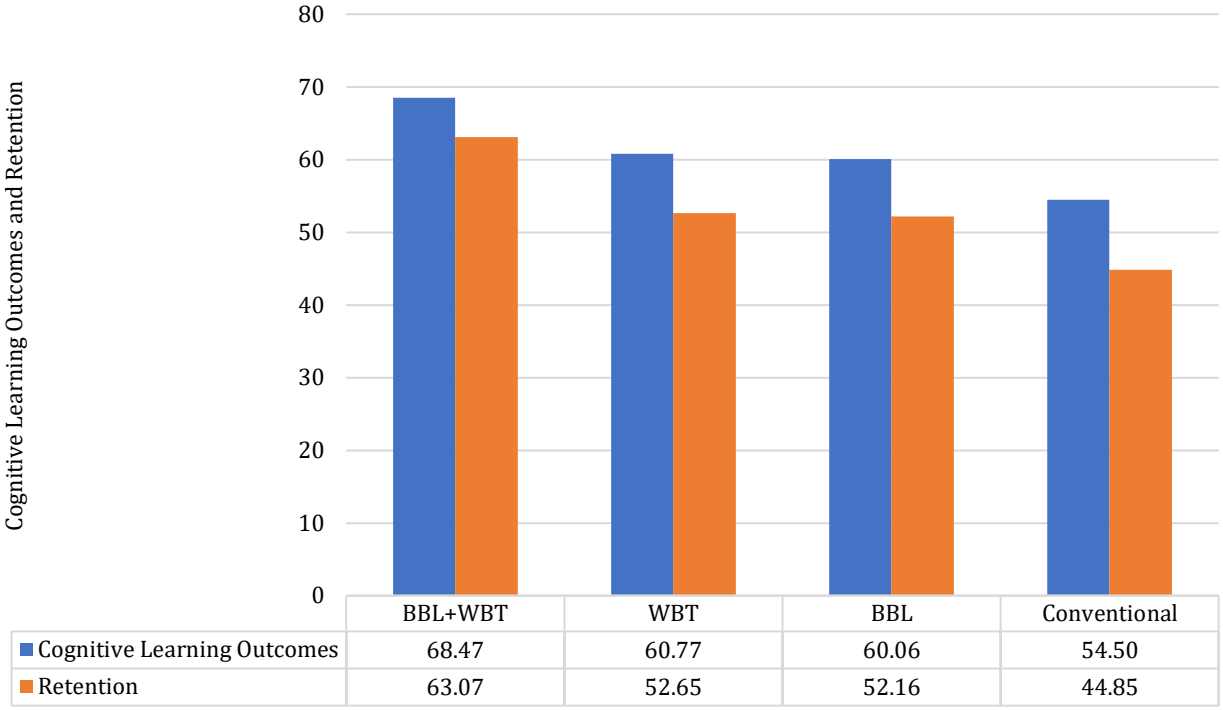

Figure 2. Mean Score of Cognitive Learning Outcomes and Retention of Each Learning

In Table 2 it can be seen that the ANCOVA results related to the influence of the learning model on learning retention, obtain the significance value of 0.00. This means that there are differences in science learning retention of students of State Junior High Schools in Malang who experience BBL and WBT models, BBL combined with WBT (WBBL) model, and conventional learning.

Table 2.
Tests of Between-Subject Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	38426,258[a]	8	4803,282	155,323	0,000
Intercept	36,681	1	36,681	1,186	0,277
YKog	15513,251	1	15513,251	501,649	0,000
Model	1124,132	3	374,711	12,117	0,000

Data were then analyzed using Least Significance Difference (LSD) test. The results of the analysis can be seen in Table 3

Table 3.
Results of the LSD Test of each Learning related to Retention

Model	YCog-nitive	Retention	Difference	RetCor	Notation LSD
BBL+WBT	68,4744	63,0708	-5,4036	56,959	a
WBT	60,7687	52,6469	-8,1218	53,337	b
BBL	60,0648	52,1567	-7,9081	52,709	b
Conventional	54,4954	44,8529	-9,6425	49,91	c

Based on the test result presented in Table 3, the highest corrected mean is found in the BBL model combined with WBT (WBBL) and is significantly different from the corrected mean in the WBT and BBL models as well as conventional learning. The corrected mean of the WBBL model is 6.79% higher than that of the WBT model, 8.06% higher than that of the BBL model, and 14.12% higher than that of conventional learning.

The results of ANCOVA showed that the learning model had a significant effect on students' retention (sig = 0,000). These results are in line with the research by Sidabalok (2013) stating that the learning model had a significant effect on the retention of Biology science of students in Junior High Schools. Among the four learning models, the BBL model integrated with the WBT model and BBL model has higher retention compared to that of

the WBT model and conventional model. It is clearly seen that the BBL model integrated with the WBT model and BBL model has a greater potential to improve the retention of students' learning results.

The integration of the BBL model with the WBT model is carried out so that the two models can complement each other in facilitating the students to remember the information well. The weaknesses of the BBL model are the lack of active greetings to the students which can attract their attention and concentration, while the weaknesses of the WBT model are too many instructional movements which can cause the depletion of students' energy in thinking or moving. In the BBL model, students are listened to classical music to include memories that can provide a calming effect for students (Handayani & Corebima, 2017). According to Harmon et al., (2008) Mozart's music can improve spatial abilities and increase alpha waves which have an impact on positive learning abilities. Movements or body linguistics are a form of response to the stimulus in learning (Handayani & Corebima, 2017). These movements are one of the advantages of the WBT learning model. According to Jensen (2000), physical activity in the form of movements in the learning process can stimulate the liver to produce glucose so that it remains stable which supports memory function.

The syntax of the BBL model integrated with the WBT model that can help students to remember information better is the movements that are performed at the stage of elaboration with teach and mirror in which the students are asked to make a repetition while making some movements. The movements or gestures as a form of association of what has been remembered will help students to remember more complex information. The movements will be able to give more attention to the people who see them, either the movements performed by teachers or the movements performed by the students. Joyce & Calhoun (2009) found that attention was important in remembering something we liked. Furthermore, Sousa David (2012) explained that the effectiveness of complex repetition depended on how to make meaningful associations personally. The more senses involved in the repetition, the stronger the students' memory. According to (Kuswana, 2011) and Schunk, D.H. & J.T (2012), the information that goes into short-term memory is limited in time; it can only store information between15 to 30 seconds, therefore, it is necessary to do some repetitions and practices so that the information can go into the long-term memory. Long-term memory has a function to store big information in a long time both verbal and visual information (Suyono & Hariyanto, 2012).

The syntax of the BBL model integrated with the WBT model which also can improve students' learning retention is the stage of incubation and insertion of the memory where the students are asked to relax by playing classical music while taking notes on the material that is considered important and recalling the material by reading and making movements. Classical music can provide a relaxing effect on the students so that these conditions will help students to remember more easily what has been learned. The results of this research are supported by (Tenesa & Andrijanto, 2011) stating that students who listened to classical music could remember and understand new terms better than those who were not exposed to classical music. The research by Setyaningsih and Setyaningsih & Muis (2002) also explained that the combination of music and relaxation exercises was is effective in reducing stress.

Stress is a state of tension in a person that decreases their concentration and their ability to recall information. Some opinions and research results showing the effect of stress on the learning process are: high levels of stress, caused by either cognitive challenges or not, will not harm the spatial or explicit information processing, stress can interfere with a person in differentiating the words being learned (Payne, Jackson, et al., 2010), stress interfere the memory for visual information (Payne, Nadel, et al., 2010), and stress significantly affects the development of the brain and the organization behavior and memory processes (Lemaire et al., 2000), To reduce the effect of stress, music has a direct power through melody, rhythm, and harmony to move the human soul. Therefore, music is believed to be useful in ensuring the success of learning and has been proven through empirical research and laboratories (Martopo, 2005).

In summarizing or rewriting what has been learned, the students look for and find important concepts and process them into a whole concept written in the form of a summary (Harahap, et al., 2020b; Ristanto, et al., 2018). The information would be stored better if the information was accompanied by the mentioning activity or writing it along with accurate examples of the action . De Porter & Hernacki, (2000) reveal that we would remember information best when the information was mainly characterized by the association of sensory vision, involving sound, touch, and movement. It will generally be clearer in our memory. Therefore, the combination of the WBT and BBL model which has the characteristics of movements, music, and reflections can make the model more effective in improving students' ability to recall or retention.

Thus, the whole syntax of the BBL model integrated with the WBT model illustrates the process of storing information in accordance with the information processes in the brain, namely the encoding through movements, storing information through writing down the important material and repeating it by reading and making movements, and recalling information from memory through comprehension check where teachers ask the material already learned. Comprehension check in the syntax is intended that teachers know how much information the students understand and to reduce the information gap among students. Nevertheless, the result of students' learning retention on the learning model did not show a better result compared to that of the BBL model, because the students had not the skills yet to perform the movements existing in the model. Passive characteristics of student learning cause the movement by done difficultly by students.

The overall syntax of the BBL learning model integrated with the WBT learning model provides an overview of the information-storing process that corresponds to the information-storing process in the brain. Information-storing begins with the encoding process, which is through movement, then the process of storing information through the activity of recording important materials and repeating by reading and performing the movements; and then it is followed by the process of retrieving information from memory through comprehension check activities with the teachers ask questions about the learning materials that have been learned. The purpose of the comprehension check in the syntax is to make the teachers know how much information is understood by the students and to reduce students' misconceptions.

The final stage of the BBL integrated with the WBT learning model is a celebration, where the teacher rewards the best group. Baranek (1996) explained that when a person gets more rewards than expected, he would work harder. The type and amount of rewards will affect the students' motivation and performance. Similarly, Lotfi & Akbarzadeh-T (2013) stated that emotional stimuli, such as rewards and punishment from real-life, could cause various internal emotional states, such as joy, sadness, and fear, which affect the future.

CONCLUSION

Based on the results of this research, it can be concluded that: (1) learning models have a significant effect on retention; (2) based on the test result the highest corrected mean is found in the BBL model combined with WBT (WBBL) and is significantly different from the corrected mean in the WBT and BBL model as well as and conventional learning. The corrected mean of the WBBL model is 6.79% higher than that of the WBT model, 8.06% higher than that of the BBL model, and 14.12% higher than that of conventional learning.

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