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Retention Achievement in Brain-Based Whole Learning is Supported by Students' Scientific Literacy and Concept Mastery

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Abstract

The learning model should be able to improve student's learning abilities. The Brain-Based Whole Learning (BBWL) model is one of the alternative learning models that can improve students' retention achievement, supported by scientific literacy and concept mastery. This study aims to determine the effect of the BBWL model on students' scientific literacy, concept mastery, and retention. This research method was quasi-experimental, with a sample of four classes taken randomly. The total sample was 132 students in grade XI Science Specialization in Madrasah Aliyah Bengkulu who enrolled in Biology. The data were analyzed using the ANOVA test after the assumption test was carried out, namely the normality and data homogeneity test. The results showed an effect of the BBWL model on students' scientific literacy skills, concept mastery, and retention. There is a significant difference between the BBWL model with BBL, WBT, and control. Based on the study results, it can be concluded that the BBWL model can improve students' retention achievement by supporting the result of good scientific literacy and concept mastery.

Keywords: BBWL, Brain-Based Whole Learning instructional model, retention, scientific literacy, concept mastery

Introduction

Retention in learning is a significant one among other learning outcomes that should be achieved; it is about how long scientific information that has been taught for a specific time is retained in students' memory (Anderson & Krathwohl, 2001) and recalled after a certain period (Rose & Nicholl, 1997). This aspect is based on the mastery of the concepts being studied. Student retention is the primary concern of all educational institutions since it is a strong foundation for a country's growth (Einolander & Vanharanta, 2015). The retention examination measures students' memorizing capabilities and long-term information retention (Utaberta & Hassanpour, 2012).

Students' retention so far has been less considered (Alfred, Neyens, & Gramopadhye, 2019; Crosling, Heagney, & Thomas, 2009; Kamuche, 2015). Some reports show the low students retention capability (Hikmawati, 2018; Khairunnisak, 2018; Setiawan et al., 2019). It is suggested that the development of students' retention has not been carried out systemically by teachers and schools (Lee & Hung, 2009). Others reported that low student retention is also influenced by low concept mastery (Kula & Budak, 2020; Lewis, 2016), which some were caused by improper learning outcomes assessment; some teachers carried out remedial activities for more than 50% of students who failed to achieve the Minimum Completeness Criteria (KKM) (Sasmita et al., 2021; Arievitch, 2020; Mulyono, Bustami & Julung, 2017). Low concept mastery was also reported by (Sagap et al., 2014; Turnip et al., 2018). On the other side, students' scientific literacy was not developed well enough, affecting their learning achievement and mastery (Anggraini, 2014; Rizkita et al., 2016).

Scientific literacy refers to an attitude toward understanding science and being able to apply science in daily life (DeBoer, 2000; Eisenhart et al., 2014; Gormally et al., 2012; Hurd, 1998), which including in it the ability to use knowledge (Dragoş & Mih, 2015), to investigate, and draw conclusions based on scientific facts, laws, theories, and phenomena found about the universe that lead to decisions based on changes that occur due to human activities (OECD, 2006). A well-developed student's scientific literacy positively impacts

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their learning mastery (Mitee & Obaitan, 2015). Students learning mastery is measured based on knowledge (cognitive), remembering, understanding, applying, analyzing, evaluating, and creating from what is learned (Anderson & Krathwohl, 2001; Nasution, 2006; Robinson et al., 2017). The proper assessment instruments will help teachers determine each student's learning mastery level. Thus further improvements can be made (Mitee & Obaitan, 2015). The mastery of concepts learned (concept mastery) is one of the supporting factors for achieving retention, which also pictures student achievement in the learning process (Robinson et al., 2018). The reports above show that student retention, concept mastery, and scientific literacy are interrelated.

Various strategies and learning models have been developed to help teachers encourage students to participate actively in learning activities directly (Hughes et al., 2017). However, some weaknesses exist in every learning strategy and model since multiple factors should be considered. Not all models could facilitate students to develop their scientific literacy, reach concept mastery, and gain good retention in one. Meanwhile, they must acquire knowledge and investigative skills and develop a professional attitude to follow science's fast development (Dragoş & Mih, 2015; Demirel & Caymaz, 2015). On the other side, there is an undeniable fact that students intend to choose information based on their thinking preferences (Kapadia, 2014; Le Roux, 2011), which in turn causes students to receive critical information in a way that they like (Le Roux, 2011). This problem causes the amount of knowledge received by students, and students' mastery of the information received is also lacking (Caine, 1994; Huang, 2020). Therefore, we need innovative learning strategies and models, a comfortable learning environment to train students through remembering strategies (Ramakrishnan & Annakodi, 2015), and at the same time, facilitate scientific literacy and concept mastery for student retention achievements.

Brain-Based Learning and Whole Brain Teaching models/strategies consider brain function the primary consideration since this organ is the most important one in learning and achievement. Brain-Based Learning (BBL) was developed based on the structure and function of the human brain with an emphasis on meaningful learning (Akyürek & Afacan, 2013; Noureen et al., 2017). This model/strategy encourages students to be active and feel more comfortable, confident, and motivated in class. It has been proven successful in helping students achieve learning outcomes and retention (Haghighi, 2013; Saleh & Subramaniam, 2018). However, BBL has some drawbacks; teachers require a basic understanding of the brain system, and it also needs specific classroom design completed with adequate facilities considering some specific learning steps. Whole Brain Teaching (WBT), on the other hand, approaches the instructional process through a neurolinguistic picture based on right and left brain functions (Biffle, 2013; Bawaneh et al., 2012; Eagleton & Muller, 2011). WBT motivates students to be involved in the learning process in class, thinking skills increase, and students actively participate in class. (Kharsati dan Prakasha, 2017; Clark, 2016; Bawaneh, et al. 2012). WBT, as with other instructional models/strategies, also bears some drawbacks. Including not all materials can be used; it requires understanding a more demanding concept and much reading. It has been reported that the students who read more have a better level of knowledge and concept mastery than students who read less (Guida, Tardieu, & Nicolas, 2009); in addition, learning that is classified as fast can allow misconceptions to occur (Armstrong, 2009).

Considering the strengths and weaknesses of those two instructional models/strategies, combining those two into a new one is believed to be promising. Brain-Based Whole Learning (BBWL) provides a conducive learning environment for students and an enjoyable learning process. This model is based on the brain's working system adopted from WBT, and its process describes the movement in the learning process. The BBWL model steps refer to BBL, which provides a basis for bridging the gap between individual learners by sending lesson information to other students; *the activity may lead to more tangible social changes students require in real life.* This model also provides students a chance to carry out their educational experiences based on scientific findings, not only on subjective assumptions in different scenarios, as reported by (Clark, 2016)it is not known if there is a relationship between WBT and ASC. Given the benefits derived from positive ASC, it becomes important to assess WBT as a predictor variable of positive ASC. The purpose of this quantitative study was to examine the relationship between different levels of exposure to WBT techniques and the mean difference in ASC, as measured by the general-school, mathematics, and reading subscores on the Self Description Questionnaire I, between treatment conditions. Self-concept theory as posited by Shavelson et al. and the Marsh/Shavelson revision, the skill development approach to self-concept enhancement, and the reciprocal effect model provide the theoretical foundations of this dissertation. A one-way multivariate analysis of variance (MANOVA.

This newly developed instructional model consists of some steps from the opening to the end as follows: (1) pre-exposure, (2) preparation through brainstorming, (3) initiation and acquisition by investigation/experiment, (4) elaboration with discussion, (5) incubation and memory entry, (6) verification, trust checking and repeating, and (7) celebration and integration. In the very first step of this model, the pre-exposure stage leads the student to do a little exercise through muscle stretching for a few minutes. This step is followed by an "incubation state" (preparation through brainstorming) when students listen to teacher-selected recorded instrument music; these two stages are the characteristics of BBWL aimed to warm-up students' brain function to its maximum attract students' attention with an enjoyable learning atmosphere. The third step involved an appropriate investigation or experiment activities regarding the current topic. In this step, students plan investigation activities or experiments that will be carried out with their groups, and it is fun because it emphasizes experiments. Upon finishing the investigation or experiment, students were requested to present their result and discuss it openly in the classroom. This activity not only provides students to share their finding but also let them interact with others. The step following the discussion is another "incubation" aimed to let students embed their understanding and experiences into their memory, again in a joyful situation with recorded music play. In the sixth step, students are requested to present the findings and group discussions in front of the class and conduct open questions and answers. The learning activities then terminated with a celebration in which students and teacher cheer, meet hands, and high-five fingers. Brain Based Whole Learning (BBWL) has also been declared valid and practical based on the assessment of experts and the results of implementation in learning. This paper reports the impact of a newly developed BBWL instructional model on students' retention in consideration of their scientific literacy and concept mastery achievement. The research hypothesis is that there is an effect of BBWL on scientific literacy and mastery of concepts to achieve student retention.

Method

This research was a quasi-experimental one performed at the Madrasah Aliyah Negeri, Bengkulu, Indonesia, in Pre-test, Post-test Non-Equivalent Control Group Design. The population of this research was grade XI students majoring in Natural Science Research samples were taken randomly with a total of 132 students separated into four groups, i.e., 1) Experiment group run in BBWL model, 2) positive control #1 run in BBL model, 3) positive control #2 run in WBT model; and 4) negative control run in the conventional model (Table 1). The experiment was carried out during the study of Cell, Plant Tissue, Animal Tissue, Skeletal and Muscular Systems, and Circulatory System topics.

The data on scientific literacy skills and concept mastery were collected using instruments in essay form adapted from Gormally et al. (2012) and Anderson & Krathwohl's revised Bloom's Taxonomy (2001), respectively. The question instrument used already has high validity and reliable criteria with a Cronbach's Alpha score of 0.664. The retention data collection was carried out two weeks after the post-test was given using the same exam instruments for concept mastery assessment. The Analysis of Variate examination was performed on all data since they were homogeneous and normally distributed.

Findings

Hypothesis Test of Retention Ability

Based on the mean score of the pretest-posttest, it was found that students' retention in all learning models has decreased. The BBWL model showed the lowest decrease in retention compared to the BBL, WBT, and control models (Table 2). The student retention score data was customarily distributed (0,352 > 0.05and homogeneous (0.084 > 0.05). The results of the Anava test analysis showed that there was a significant effect on retention between the four models (F count 3.831; significant 0.011 < 0.05) (Table 3). Thus, Ho is rejected so that there is an effect of the BBWL model on student retention.

Based on the post hoc test results on the retention variable, it was found that there was a significant difference (P value <0.05) between the treatment groups (Table 4). LSD test results showed that the BBWL group was significantly different from the WBT and control models but not significantly different from the BBL; the BBL group was not significantly different from BBWL, WBT, and Control; the WBT group was significantly different from BBWL but not significantly different from BBL and control (Table 5).

Hypothesis Test of Students' Scientific Literacy Ability

Based on the mean score, it was found that the students' scientific literacy ability was increased. Students' highest

Table 1: Research Design

Group	*Pretest*	*Model*	*Post-Test*
Experiment	O1	BBW	O2
Positive control #1	O1	BBL	O2
Positive control #2	O1	WBT	O2
Negative control	O1	Conventional	O2

Table 2: Mean Score and Percentage of the Score Changes of Pretest-Posttest on Retention

	Mean score			
Learning Model	*Pretest*	*Posttest*	*Mean Difference Post-Pre*	*Category*
BBWL	81,89	72.80	9.09 ± 4.86	Decrease
BBL	79,62	68.38	11.24 ± 5.66	Decrease
WBT	77,50	65,26	12.24 ± 6.25	Decrease
Control	67.27	53,94	13.33 ± 4.19	Decrease

Table 3: The result of the Anava Test of BBWL Model on Retention

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	322.919	3	107.640	3.831	.011
Within Groups	3624.239	129	28.095		
Total	3947.158	132			

Table 4: The result of the post hoc Test on Retention

	(I) Class	*(J) Class*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
LSD	BBWL	BBL	-2.14439	1.29525	.100
		WBT	-3.15152*	1.30488	.017
		Control	-4.24242*	1.30488	.001
	BBL	BBWL	2.14439	1.29525	.100
		WBT	-1.00713	1.29525	.438
		Control	-2.09804	1.29525	.108
	WBT	BBWL	3.15152*	1.30488	.017
		BBL	1.00713	1.29525	.438
		Control	-1.09091	1.30488	.405
	Control	BBWL	4.24242*	1.30488	.001
		BBL	2.09804	1.29525	.108
		WBT	1.09091	1.30488	.405

Table 5: The result of the LSD Test

Class of Research	*Mean*	*LSD Notation*
BBWL	9.0909	a
BBL (K+)	11.2353	a b
WBT (K+)	12.2424	b
Control (K-)	13.3333	b

Table 7: Anava Result of BBWL Model on Scientific Literacy

	Sum of Squares	*Df*	*Mean Square*	*F*	*Sig.*
Between Groups	2541.919	3	847.306	7.021	.000
Within Groups	15568.998	129	120.690		
Total	18110.917	132			

scientific literacy ability was achieved in the BBWL model, with the lowest standard deviation compared to the BBL, WBT, and negative control models (Table 6). The students' scientific literacy scores were normally distributed (0,676 > 0.05) and homogeneous (0.092 > 0.05). Anava examination resulting in a significant value (F = 7.021; 0.000 < 0.05) (Table 7). Thus, Ho is rejected, so the BBWL model affects students' scientific literacy. It means that the four learning models have a significantly different effect on scientific literacy skills.

The posthoc test shows significant differences in students' scientific literacy ability among groups (P value <0.05; Table 8). The LSD test result showed that the BBWL model had

Table 6: Scientific Literacy Ability Achievement

Learning Model	*Mean score*		*Mean Difference Post-Pre*	*Category*
	Pretest	*Posttest*		
BBWL	47,48	81,33	33,85 ± 8.75	Increased
BBL	52,17	79,88	27,71 ± 10.29	Increased
WBT	50,09	78,30	28,21 ± 11.45	Increased
Control	44,74	69,39	24,65 ± 18.28	Increased

significantly different effects than BBL, WBT, and control models. Meanwhile BBL model gave a significantly different effect compared to BBWL and control, but not significantly different from WBT, and the WBT model gave giving significantly different effect compared to BBWL and control, but not significantly different from BBL (Table 9).

Hypothesis Test of Students' Concept Mastery Ability

Statistical analysis showed that students' concept mastery was increased. The students' concept mastery ability was highest in the BBWL model, with a lower standard deviation compared to the BBL, WBT, and control models (Table 10). The data was normally distributed (0,935 > 0.05) and homogeneous (0.672 > 0.05). Anava analysis showed a significant value (F = 6.592; 0.000 < 0.05) (Table 11). Thus, Ho is rejected so that there is an effect of the BBWL model on students' concept mastery. It means that those four models have a significantly different effect on concept mastery.

Table 8: Post-hoc analysis Result on Scientific Literacy

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.
LSD	BBWL	BBL	6.14260*	2.68458	.024
		WBT	5.63636*	2.70454	.039
		Control	12.39394*	2.70454	.000
	BBL	BBW	-6.14260*	2.68458	.024
		WBT	-.50624	2.68458	.851
		Control	6.25134*	2.68458	.021
	WBT	BBW	-5.63636*	2.70454	.039
		BBL	.50624	2.68458	.851
		Control	6.75758*	2.70454	.014
	Control	BBW	-12.39394*	2.70454	.000
		BBL	-6.25134*	2.68458	.021
		WBT	-6.75758*	2.70454	.014

Table 10: Mean Score and Percentage of the Score Changes on Pretest-Posttest of Concept Mastery

Learning Model	Mean score		Mean Difference	Category
	Pretest	Posttest		
BBWL	47.95	81.89	33.94 ± 9.99	Increased
BBL	53.59	79.62	25.97 ± 11.46	Increased
WBT	47.77	77.50	29.73 ± 10.94	Increased
Control	45.00	67.27	22.27 ± 12.31	Increased

Table 13: The result of the LSD Test

Class of Research	Mean	LSD Notation
BBWL	33.9394	a
BBL (K+)	25.9706	a b
WBT (K+)	29.7273	b c
Control (K-)	22.2727	c

Table 9: The result of the LSD Test

Class of Research	Mean	LSD Notation
BBWL	33,85	a
BBL (K+)	27,71	b
WBT (K+)	28,21	b
Control (K-)	21,45	c

Table 11: The result of the Anava Test of BBWL Model on Concept Mastery

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2484.872	3	828.291	6.592	.000
Within Groups	16207.940	129	125.643		
Total	18692.812	132			

Table 12: The result of the post hoc Test on Concept Mastery

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.
LSD	BBWL	BBL	7.96881*	2.73911	.004
		WBT	4.21212	2.75948	.129
		Control	11.66667*	2.75948	.000
	BBL	BBW	-7.96881*	2.73911	.004
		WBT	-3.75668	2.73911	.173
		Control	3.69786	2.73911	.179
	WBT	BBW	-4.21212	2.75948	.129
		BBL	3.75668	2.73911	.173
		Control	7.45455*	2.75948	.008
	Control	BBW	-11.66667*	2.75948	.000
		BBL	-3.69786	2.73911	.179
		WBT	-7.45455*	2.75948	.008

Based on the post hoc test results on the concept mastery variable, it was found that there was a significant difference (P value <0.05) between the treatment groups (Table 12). Further test results showed that the BBWL group was significantly different from the WBT and the control group but not significantly different from the BBL; the BBL group was different from BBWL and control, but not significant from WBT; the WBT group was significantly different from BBWL and control, but not significantly different from BBL; The control group differed significantly with BBWL and BBL, but not significantly with WBT (Table 13).

The results of the effect of the BBWL model on retention, concept mastery, and student retention showed that increased retention was supported by increased scientific literacy and concept mastery. Based on the statistical test results, the BBWL model got a retention score of -9.09, scientific literacy of 33.85, and mastery of concepts of 33.84. In BBL, the retention score is -11.24, scientific literacy is 27.71, and concept mastery is 25.97. In WBT, the retention score is -12.24, scientific literacy is 28.21, and concept mastery is 29.73. The scientific literacy retention score in control was 24.65, and concept mastery was 22.27, -13.33 (figure 1).

Discussion

The retention of students in this study decreased, but the retention of BBWL was significantly higher than the control. The decrease in retention can be seen from the decrease in test scores compared to scores after (Anderson et al., 2018). The longer the time running, it is suspected that student retention will decrease because the decrease in retention follows the length of time (Guida et al., 2009; Alfred et al., 2019)), cognitive abilities, and student learning outcomes (Afoan &

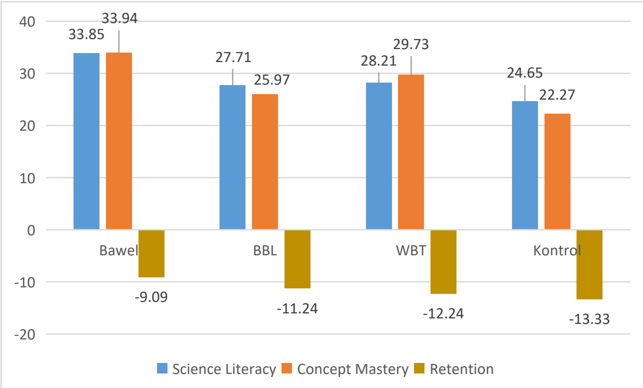

Fig. 1 : Students' Scientific Literacy, Concept Mastery, and Retention

Corebima, 2018). Someone literate and master's in science has a better memory than those who learn by rote (Einolander & Vanharanta, 2015). Learning by a good learning model can produce good learning outcomes (Karaçalli & Korur, 2014).

Students' retention has been built since the beginning of learning. In the BBWL model, there are interlude activities that support retention. Interlude activities include drinking water, stretching muscles, regulating breathing, and music. This activity can help the students recall retained information and connect it to concepts that have been learned. At the beginning of the lesson, students regulate their breathing and drink water to nourish the brain and stretch their muscles; then, music is played in the middle of student learning during discussion activities. This makes students more motivated and focused on learning because stretching muscles can maintain brain balance and relax the body (Shichida, 2014). Stronger retaining memory is also supported by learning using videos and images and conducting investigations because visualization and investigation can improve student learning retention to achieve better learning outcomes (Gargrish et al., 2021; Klingenberg et al., 2020; Yilmaz et al., 2022). In addition, behavior that comes from within the students themselves is perfect for maintaining retention (Dewberry & Jackson, 2018; Guida et al., 2009)

Retention is supported by celebration activities and rewards such as applause or cheers. Rewards at the end of learning can increase retention (Hamel et al., 2019). This activity helps students inquire and give an impression about the concept of the lesson that has been received. Learning that gives the impression can positively improve retention (Kusumaningrum et al., 2021). Celebrations build positive responses that help construct students' memory of the concepts studied (DeSipio et al., 2018). In the end, the better the student retention, the better the achievement of learning objectives. Strategies and/or learning models are needed to achieve better learning objectives to increase student retention. Strategies and learning models can stand alone or the result of a combination of both. One thing that needs to be considered is that each learning model and strategy must be built in synergy, mutually supportive, not forced, and adapted to the character of the subject matter. The teacher, as a facilitator, does not only master the subject matter but also has to master the strategies and learning models. The government as a centralized policy maker should focus primarily on policies that increase equity in Education (Kalkan et al., 2020)

The BBWL learning model positively affected scientific literacy (Table 3). This effect was proved by the scientific literacy score of the BBWL model, which is significantly higher than the control (Table 4). This model can motivate the students to be active from the beginning of learning. At the preparation stage, through brainstorming, BBWL encourages the students to identify valid scientific opinions and explore empirical literature so that students can connect their knowledge of biology subject matter studied with previous knowledge. Group support for this brainstorming activity accelerates the reception of information. Based on this, it can generate ideas about specific problems and determine the right solution (Cheddak et al., 2021).

The students conducted investigations and experiments in the next stage, initiation, and acquisition. During the investigation, through observation activities, the students gain knowledge, and through experimental activities, the students acquire the skills to design and carry out experiments, then collect data and results (Wen et al., 2020). The existence of group collaboration can help the improvement of students' collaboration skills. This stage allows students to accept learning easily and get a better learning experience. The impact of this activity, theoretically accepted knowledge, can be well understood (Cheddak et al., 2021; Klucevsek, 2017).

In the Elaboration Stage, the fourth stage in the BBWL learning model, the students in groups conducted discussions to solve the teacher's problems. The Students practiced analyzing and interpreting it in the form of reports. The discussion process makes students more active and produces better problem-solving (Zheng, 2016). During the discussion process, the students listened to the music. With music, students feel more relaxed and focused on solving problems and increasing group collaboration because music has a physiological effect and improves the emotional aspects of student behavior (Savan, 2009). Based on the indicators of learning achievement, it is proven that the students achieve it together. This is proven by the results of the scientific literacy score, which has a **smaller standard deviation** value than the control class.

Verification, Trust Checking, and Repeating are the following stages of the BBWL model. The students presented the results of group discussions openly in class, then connected them to what they had learned and made conclusions. This open and group learning covers the weaknesses of independent learning so that students can make more representative conclusions (Blum et al., 2022).

Question and answer activities in this open discussion resulted in good communication between students and teachers and students with other students. The discussion process becomes a forum for communication within the group that makes students feel free to express their opinions and impacts knowledge transfer (Tanaka & Watanabe, 2013)we investigated whether transfer would occur even when the intervals and the visual configurations in a sequence were drastically changed so that participants did not notice that the required sequences of responses were identical. In the experiment, two (or three.

Students mastery of concepts gets the highest score in learning using the BBWL model (Table 6). These scores were significantly different compared to the con1trols (Table 7). This concept mastery score is not much different from the scientific literacy score because scientific literacy significantly impacts student learning outcomes and concept mastery (Mitee & Obaitan, 2015; Piper et al., 2018). In the BBWL model, students must read a lot during the learning process. At the brainstorming stage, students see and read what the teacher is showing; before conducting investigations and experiments, students also conduct a literature study first to get to know the concept of the material that underlies the experiment.

Furthermore, in the discussion process, students also conducted a literature study on the material concept to analyze the experimental results. The impact of continuous reading increases knowledge compared to students who rarely read (Guida et al., 2009). The relationship between concept mastery and scientific literacy is that when building scientific literacy, students explore their cognitive knowledge (Bauer & Booth, 2019; Reiska et al., 2015).

In learning biology using BBWL, students conduct investigations and experiments. Investigations and experiments in groups occur in a scientific process. During the initiation and acquisition stage, students follow a scientific process consisting of planning, investigating, conducting experiments, collecting data, discussing, and finally presenting the results in front of the class. The science process activities support increasing the mastery of concepts and process skills (Demirel & Caymaz, 2015). Students are directly involved in applying biological concepts and proving them. Investigations carried out in groups keep students active, discover and strengthen mastery of concepts (Bawaneh et al., 2012; Gozuyesil & Dikici, 2014; Gyamah, 2022). After students successfully collect data and conduct discussions to analyze the findings, students present these resu0lts by conducting open discussions to evaluate each other and find answers. Discussion is a communication forum that makes students free to express their opinions and transfer knowledge with each other (Tanaka & Watanabe, 2013). Students' involvement in this activity impacts natural cognitive development (Lewis, 2016; Cannady et al., 2019), so the learning process improves (Cannady et al., 2019).

The increase in concept mastery in the BBWL model is also supported by the health of the student's nervous system. Nervous system health is carried out through relaxation activities at the beginning of learning and during the discussion process. At the exposure stage, the initial part of the fussy model, there are activities to nourish the brain by drinking water, stretching muscles, and regulating breathing. Optimizing brain nutrition affects nerve performance and brain function (Georgieff et al., 2018), and muscle stretching is an alternative to tension-releasing methods that make students feel comfortable (Carlson & Curran, 1994). This activity also supports the understanding that students need to receive, retain and master the information received (Guida et al., 2009); (Moghaddam & Araghi, 2013). The next activity is brainstorming, where activities build students' abilities to connect their ideas to carry out analysis, synthesis, and evaluation (Gogus, 2012).

Furthermore, in the group discussion process, students listen to music. It has been proven that music helps students relax and focus more, and the process of analyzing biological concepts improves because music can increase intelligence, calmness, motivation, and self-development (Merritt, 2003; Morris, 2016). According to the teacher's guidance, students also do muscle stretching and drink water. When students are involved in many activities that explore sensory organs, the information received is channeled into student process skills so that students understand the concept of the material better than before. The sensory information of students receives information related to student activities so that the learning process becomes more effective (Cannady et al., 2019). At the celebration and integration stage, students reflect on themselves and share what they have received. Students learning styles during learning affect students' feelings in the acquisition of knowledge (concepts) (Huang et al., 2020), learning outcomes, and independent learning (Eagleton & Muller, 2011; Yao-Ping Peng & Chen, 2019).

Conclusion

The Brain-Based Whole Learning (BBWL) learning model has a positive effect on the achievement of students' retention. Students' retention is successfully supported by good scientific literacy and concept mastery using the BBWL model. The BBWL model effectively improves students' retention, scientific literacy skills, and concept mastery.

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