


## The Effect of Video-Assisted Brain-Based Learning Model on Mathematical Critical Thinking and Mathematical Problem Solving Skills

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### ABSTRACT

This study aims to determine the effect of the video-assisted Brain-Based Learning (BBL) learning model on mathematical critical thinking ability and mathematical problem-solving. This research is a quantitative research type of quasi-experimental design. The population in this study were all students in class VIII of SMPN 1 Tanjung Bintang for the 2023/2024 academic year. The sampling technique used cluster random sampling, namely three classes: class VIII B as experimental class 1 using the BBL learning model assisted by learning videos, class VIII A as experimental class 2 using the BBL learning model, and class VIII D as the control class using direct instruction learning model. The instruments used have previously been tested for validity, difficulty level, distinguishing power, and reliability. The data collection technique used was an essay test to measure mathematical critical thinking and problem-solving abilities. The data analysis techniques used are the normality test and the homogeneity test. Hypothesis testing uses the MANOVA test. Based on the results of hypothesis testing that has been carried out, it can be concluded that the BBL learning model assisted by video learning influences students' mathematical critical thinking and mathematical problem-solving abilities. Students' mathematical critical thinking and mathematical problem-solving skills are better using the BBL learning model assisted by learning videos than the BBL learning model and direct instruction learning model. This can be seen from calculations using MANOVA to obtain a significance level of 0.000 and value  $\alpha$  test criteria = 0.05, which means  $p\text{-value} < \alpha$  so that  $H_{0AB}$  is rejected and  $H_{1AB}$  is accepted. **Keywords:** BBL Learning Model, Learning Video, Mathematical Critical Thinking Ability, and Mathematical Problem Solving Ability.

### ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran Brain Based Learning (BBL) berbantuan video terhadap kemampuan berpikir kritis matematis dan pemecahan masalah matematika. Penelitian ini merupakan penelitian kuantitatif jenis *Quasy Experimental Design*. Populasi pada penelitian ini adalah seluruh siswa kelas VIII SMPN 1 Tanjung Bintang tahun ajaran 2023/2024. Teknik pengambilan sampel menggunakan *cluster random sampling* yaitu sebanyak tiga kelas, kelas VIII B sebagai kelas eksperimen 1 dengan menggunakan model pembelajaran BBL berbantuan video pembelajaran, kelas VIII A sebagai kelas eksperimen 2 dengan menggunakan model pembelajaran BBL, dan kelas VIII D sebagai kelas kontrol dengan menggunakan model pembelajaran *direct instruction*. Teknik pengumpulan data yang digunakan adalah tes *essay* untuk mengukur kemampuan berpikir kritis matematis dan pemecahan masalah matematika. Instrumen tes yang digunakan sebelumnya sudah diuji validitas, tingkat kesukaran, daya pembeda, dan reliabilitas. Teknik analisis data yang digunakan yaitu uji normalitas dan uji homogenitas. Pengujian hipotesis menggunakan uji manova. Berdasarkan hasil pengujian hipotesis yang telah dilakukan maka dapat disimpulkan bahwa terdapat pengaruh antara model pembelajaran BBL berbantuan video pembelajaran terhadap kemampuan berpikir kritis matematis dan pemecahan masalah matematika siswa. Kemampuan berpikir kritis matematis dan pemecahan masalah matematika siswa lebih baik menggunakan model pembelajaran BBL berbantuan video pembelajaran dibandingkan model pembelajaran BBL dan model pembelajaran

direct instruction. Hal ini dapat dilihat dari perhitungan menggunakan MANOVA di peroleh tingkat signifikansi 0,000 dan nilai  $\alpha$  kriteria uji = 0,05 yang berarti  $p\text{-value} < \alpha$  sehingga  $H_{0AB}$  ditolak dan  $H_{1AB}$  diterima.

**Kata kunci:** Model Pembelajaran BBL, Video Pembelajaran, Kemampuan Berpikir Kritis Matematis, dan Kemampuan Pemecahan Masalah Matematika.

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## Introduction

Education is a learning process that helps learners develop their potential (Jaiswal & Arun, 2021). The formation of good and quality individuals and the empowerment of society are the goals of education that is carried out deliberately and planned. This is done through organizing an atmosphere and learning methods that encourage students to actively develop their potential in various aspects, such as religion, self-control, personality, intelligence, morals and ethics, and skills that are useful both for themselves and for society (Fitriani, 2023). Mathematics is a logical science concerned with form, structure, magnitude, and interrelated concepts (Susanto, 2021). In many fields of study, mathematical understanding plays an important role in the academic world (Aulia et al., 2024). In knowledge, the importance of mathematics is evident in the high standards that must be met in mathematical ability (Ginne et al., 2024). The role of mathematics education is not only to provide educational values to help students become smarter, but also to develop educational values that help students form their own personalities, including mathematical critical thinking skills.

Mathematical critical thinking ability is the process of processing information related to mathematical knowledge, reasoning and proof to be able to solve a problem, especially in learning mathematics (Fitriana et al., 2019). Critical thinking is an intellectual thought process that involves assessing the quality of thought, reflectiveness, independence, clarity, and rationality (Yasir & Alnoori, 2020). Schoenfeld argues that mathematical critical thinking is a developmental process from a mathematical point of view - appreciating the mathematization process and having the desire to apply it, developing skills and equipping oneself with all the traps, and using these tools to understand the structure of mathematical understanding (Fajri, 2017). Critical thinking skills can help make the learning process positive. When living in society, we are often faced with problems that require critical thinking skills (Huda et al., 2021). Learning helps us gain knowledge and insight, while thinking helps us process the information we have to solve problems (Wulandari et al., 2023). In addition to mathematical critical thinking skills, another mathematical skill that students need to have is problem solving skills (Aida et al., 2023).

Mathematical problem solving is an activity that aims to find solutions to mathematical problems faced by using all the mathematical knowledge that students already have. Problem solving is an earnest effort to find solutions or ideas related to the goals to be achieved (Dethan & Tangkin, 2022). Polya defines problem solving as an effort to find a solution to a difficulty to achieve a goal that cannot be achieved immediately. Problem solving in this case includes two aspects, namely problems to find and problems to prove (Wardana & Rifaldiyah, 2019). Soedjadi stated that mathematical problem solving ability is the ability that allows students to apply mathematical activities to solve mathematical problems, problems in other sciences, and problems in everyday life (Layali & Masri, 2020).

In learning mathematics, students are trained to solve problems, with the hope of being able to solve the problems or problems posed, but it is also expected that there is a bias in the problem-solving process. However, in reality, students' mathematical problem solving skills in schools today still do not achieve the desired goals. This condition is supported by the results of pre-research tests conducted by researchers on class VIII students at SMPN 1 Tanjung Bintang to determine students' mathematical problem solving ability on algebraic form material. The results of the pre-research tests conducted showed that students' math problem solving skills were still relatively low. This is indicated by the average student's math problem solving ability test score which is still below the KKM. In addition to the results of the math problem solving ability test, researchers also investigated students' ability to think critically mathematically. The results of the pre-research test conducted showed that students' mathematical critical thinking skills were still relatively low. This is indicated by the average student's mathematical critical thinking ability test score is still below the KKM.

From the two test data above, it shows that students' mathematical problem solving and mathematical critical thinking skills are low. This is evident from the results achieved by students in the tests given. In solving math problems, many students are still not used to solving small problems they encounter, and indicators of mathematical problem solving ability and mathematical critical thinking ability have not been fully achieved. The low ability of these students has many causes, one of which is due to the lack of use of media and learning models that are less varied. Based on the results of interviews conducted at SMPN 1 Tanjung Bintang with mathematics subject teachers, he said that learning activities at SMPN 1 Tanjung Bintang are still lacking in utilizing various kinds of learning media such as learning video media. The learning process in the classroom takes place using a direct instruction learning model, where the teacher still plays an active role in delivering learning materials. During math learning, students still do not play an active role. The passive attitude of students makes it

difficult for students to express their thoughts when facing problems that are different from the usual problems. Students who are passive in the learning process cause their thinking to be less developed so that it leads to low critical thinking and mathematical problem solving skills.

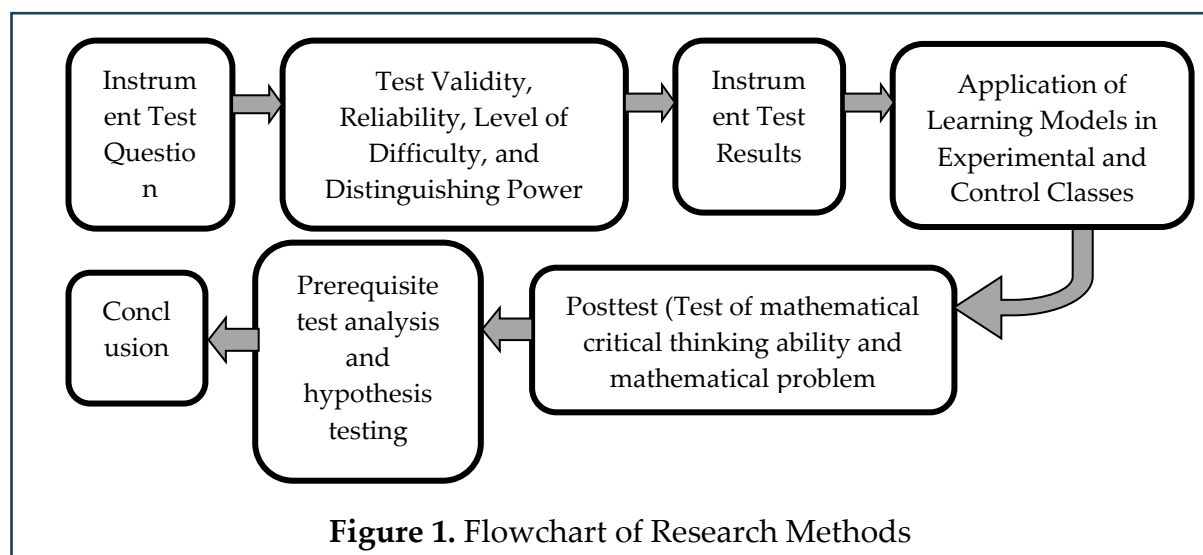
To overcome the various problems that have been described, it is necessary to use efficient and effective learning models and media with the conditions described above. One of the learning models and media that can overcome the obstacles faced and improve students' mathematical critical thinking skills and mathematical problem solving skills is the Brain Based Learning (BBL) model assisted by learning videos. The BBL learning model or brain-based learning is learning by using an approach that is in accordance with the way the brain thinks that is naturally designed to learn (Farida, 2021). Brain-based learning takes into account the nature of the brain and its influence on the environment and experiences so that it can learn to its full potential. Brain-based learning introduces a concept that aims to create learning that is geared towards unleashing the potential of the student's brain (Lubis, 2022). BBL is learning that is in accordance with brain function, naturally designed, does not emphasize order but prioritizes fun and love for learning so that students easily absorb learning content (Kartini, 2023). Brain-based learning requires students to actively explore knowledge about the topics they learn, which is based on the students' cognitive structure and how the brain works (Sari et al., 2020). Learning videos are a means of transferring knowledge and can be used as part of the learning process. Cheppy Riyana argues that learning video media is media that presents audio and visual elements that contain learning messages that contain concepts, principles, processes, theories, and applications of science to help understand learning material (Andra et al., 2023).

Based on the results of previous research conducted (Juliantini et al., 2020) it shows that students who learn using the BBL learning model assisted by concrete media have good mathematical problem solving skills compared to students who are not taught with the BBL learning model assisted by concrete media. The existence of a significant difference in students' mathematical problem solving ability indicates that the Brain Based Learning learning model assisted by concrete media has an effect on students' mathematical problem solving ability. (Solihah, 2019) stated in his research that learning using the BBL approach shows the achievement and improvement of students' mathematical critical thinking skills better than students whose learning uses a conventional approach in terms of overall and based on KAM (high, medium and low groups). Likewise, research conducted by Royyatina Jannatil Firdaus et al concluded that the use of contextual science learning videos in learning was able to improve students' critical thinking skills (Fiirdaus et al., 2021).

Based on the information above, researchers are interested in conducting research by combining brain-based learning models with assisted learning videos to determine two dependent variables at once, namely students' mathematical critical thinking skills and mathematical problem solving.

### Research Methods

The method used in this research is quantitative, where data is collected in numerical form, data is processed and hypotheses are tested using statistical analysis. This type of research uses Quasi Experimental Design or pseudo experiment. Experimental research methods are part of quantitative methods because this research is conducted on certain populations or samples. The population in this study were all grade VIII students at SMPN 1 Tanjung Bintang in the 2023/2024 school year. Sampling in this study used cluster random sampling technique. In this study, there were three groups randomly selected by lottery. This study uses three classes with different treatments, in the first class, namely experimental class 1, will be given learning with the brain-based learning (BBL) learning model assisted by learning videos, the second class, namely experimental class 2, will be given learning with the brain-based learning (BBL) learning model, while the third class is the control class will be given learning with the direct instruction learning model.



Data collection techniques used interviews, documentation, and tests in the form of descriptions to measure students' mathematical critical thinking and mathematical problem solving skills. The tests used were previously tested to ensure their validity, difficulty level, discriminating ability, and reliability. The use of data analysis techniques included normality testing as well as homogeneity testing. Manova test

was used in this study to test the hypothesis using SPSS 24 software. From the results of the instrument trial, it was found that the questions used as research instruments had valid questions; the difficulty level of easy questions was 25%, moderate was 50% and difficult was 25%; had sufficient and good differentiation, and was reliable. The question has covered all indicators of mathematical critical thinking ability and mathematical problem solving as well as indicators of the learning material tested. These essay questions are suitable for collecting data on mathematical critical thinking ability and mathematical problem solving which will be used in experimental and control classes. Figure 1 is also presented as a flowchart of the research method to explain the sequence of stages.

### Result and Discussions

Existing data were obtained after learning in experimental and control classes, with a focus on statistical data centering material. Data on students' mathematical critical thinking and mathematical problem solving skills consisted of three classes. The first class is experimental class 1 which is treated with BBL learning model assisted by learning video, the second class is experimental class 2 which is given BBL learning model, and the third class is control class which is given direct instruction learning model. In the control class, learning is carried out in accordance with the steps of the direct instruction learning model, where student participation still looks inactive and tends to be monotonous. While in experimental class 2 which applies the bbl learning model, students are seen to be starting to be active in discussing and asking questions. Then in experimental class 1 which applies the bbl learning model assisted by learning videos, it can be seen that students are more active in discussing and asking questions and with the help of learning videos in the process of teaching and learning activities takes place making students more enthusiastic, and interested in solving the problems given.

**Table 1.** Description of Observed Data of Posttest of Mathematical Critical Thinking Ability

Group	$X_{max}$	$X_{min}$	Measures of Central Tendency			Group Variance Measure	
			$\bar{x}$	$M_o$	$M_e$	R	Sd
			Experiment1	100	75,00	84,45	87,50
Experiment2	100	65,62	77,04	65,62	75,78	34,38	8,87
Control	87,50	60,93	69,57	62,50	68,75	26,57	6,82

Table 1 and Table 2 show that the experimental class had higher average posttest scores in mathematical critical thinking ability and mathematical problem solving

ability when compared to the control class. This shows that there is a significant difference in mathematical critical thinking ability and mathematical problem solving ability among the three classes.

**Table 2.** Description of Observed Data for Posttest of Mathematical Problem Solving Ability

Group	$X_{max}$	$X_{min}$	Measures of Central Tendency			Group Variance Measure	
			$\bar{x}$	$M_o$	$M_e$	R	Sd
			Experiment1	97,50	67,50	80,15	85,00
Experiment2	87,50	65,00	76,09	77,50	77,50	22,50	7,01
Control	85,00	60,00	69,06	65,00	70,00	25,00	6,56

In this study, normality testing used the Kolmogorov Smirnov method with the help of SPSS software and used a significance level of 0.05. Testing was carried out on samples from experimental and control classes. This text presents the results of normality testing on the sample data of students' mathematical critical thinking ability and mathematical problem solving ability.

**Table 3.** Summary of Normality Test of Mathematical Critical Thinking Ability and Mathematical Problem Solving Data

		Tests of Normality					
Class		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Critical	Experiment1	.114	32	.200*	.924	32	.027
Mathematical	Experiment2	.116	32	.200*	.942	32	.083
Thinking	Control	.131	32	.174	.926	32	.030
Problem	Experiment1	.121	32	.200*	.955	32	.205
Solving	Experiment2	.142	32	.100	.932	32	.045
Mathematics	Control	.138	32	.124	.923	32	.024

Based on [Table 3](#), it can be seen that the results of the normality test on mathematical critical thinking ability and students' mathematical problem solving with Kolmogorov Smirnov at a significance level of 5%, namely  $\alpha = 0.05$ . Based on the results of these calculations, the significance value on the mathematical critical thinking ability of experimental class 1 = 0.200, experimental class 2 = 0.200, and control class = 0.174. In accordance with the existing criteria if the sig value  $> 0.05$  then  $H_0$  is accepted, thus it can be concluded that the data is normally distributed.

Furthermore, the results of the normality test of mathematical problem solving ability obtained a significance value in each class, namely experimental class 1 = 0.200, experimental class 2 = 0.100, and control class = 0.124. In accordance with the existing criteria if the sig value  $> 0.05$  then  $H_0$  is accepted, thus it can be concluded that the data is normally distributed.

This research involves homogeneity testing on the data of mathematical critical thinking ability scores and students' mathematical problem solving ability. The method used in this study to test data variance is to use the Test of Homogeneity of Variance in the SPSS program. homogeneity test with the results of calculations that use a significance level of 5% or  $\alpha = 0.05$ . Table 4 shows the results of calculations using SPSS on the homogeneity test:

**Table 4.** Results *Levene's Test of Equality Error Variances*

	F	df1	df2	Sig.
Critical Mathematical Thinking	1.789	2	93	.173
Problem Solving Mathematics	2.026	2	93	.138

Based on the results of these calculations, it was found that there were significance values of 0.173 and 0.138 for mathematical critical thinking ability and mathematical problem solving. Given that the values of 0.173 and 0.138 are greater than 0.05, the conclusion that can be drawn is that  $H_0$  is accepted. So that students' mathematical critical thinking and mathematical problem solving abilities have homogeneous variants.

**Table 5.** Results *Box's Test of Equality of Covariance Matrices*

Criteria	Score
Box's M	12.324
F	1.990
df1	6
df2	215559.692
Sig.	.063

Then related to the homogeneity test on the Box's M value, the results are in Table 5. Based on the data in Table 5, it can be observed that the significance of Box's M test for homogeneity on the posttest scores of mathematical critical thinking and mathematical problem solving is 0.063. This value is higher than the alpha set at 0.05. This indicates that the variance-covariance matrices for the mathematical critical thinking and

mathematical problem solving variables have uniformity or similarity. Therefore, since the conditions have been met, the manova analysis process can continue.

After knowing that the research data was obtained from a population that had a normal and homogeneous distribution, the next step taken by the researcher was to conduct a MANOVA (Multivariate Analysis of Variance) test. In this study, researchers used the manova test using SPSS software. The results of this test are shown in Table 6.

**Table 6.** Manova Test Calculation Results

		Multivariate Test				
	Effect	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.995	8572.923b	2.000	92.000	.000
	Wilks' Lambda	.005	8572.923b	2.000	92.000	.000
	Hotelling's Trace	186.368	8572.923b	2.000	92.000	.000
	Roy's Largest Root	186.368	8572.923b	2.000	92.000	.000
Class	Pillai's Trace	.488	15.025	4.000	186.000	.000
	Wilks' Lambda	.515	18.118b	4.000	184.000	.000
	Hotelling's Trace	.937	21.311	4.000	182.000	.000
	Roy's Largest Root	.930	43.256c	2.000	93.000	.000

Based on Table 6, it can be concluded simultaneously that the results of the treatment that is significant by the Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root procedures obtained the p-value on the class label as a whole, each = 0.000. This shows that, with a significance confidence level of  $\alpha = 0.05$ , the p-value is lower than 0.05. Therefore, the hypothesis  $H_{0AB}$  is rejected. Thus, it can be concluded that there is an influence between the use of BBL learning model with the help of learning videos on students' ability in critical thinking and mathematical problem solving. This shows that the class that received the BBL learning model treatment assisted by learning videos was better than the class with the BBL learning model treatment and the class with the direct instruction learning model treatment. This is in line with the average value of the posttest results of mathematical critical thinking skills and mathematical problem solving obtained by experimental class 1 is greater than the average value of experimental class 2 and the control class.

**Table 7.** Inter-subject Effect Test Results

Tests of Between-Subjects Effects						
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Critical Mathematical	3539.678a	2	1.769.839	31.302	.000
	Thinking Problem Solving Mathematics	2016.146b	2	1.008.073	18.221	.000
Intercept	Critical Mathematical	569.561.363	1	569.561.363	10.073.505	.000
	Thinking Problem Solving Mathematics	541.501.042	1	541.501.042	9.787.471	.000
Class	Critical Mathematical	3.539.678	2	1.769.839	31.302	.000
	Thinking Problem Solving Mathematics	2.016.146	2	1.008.073	18.221	.000
Error	Critical Mathematical	5.258.270	93	56.541		
	Thinking Problem Solving Mathematics	5.145.313	93	55.326		
Total	Critical Mathematical	578.359.310	96			
	Thinking Problem Solving Mathematics	548.662.500	96			
Corrected Total	Critical Mathematical	8.797.947	95			
	Thinking Problem Solving Mathematics	7.161.458	95			

a. R Squared = ,402 (Adjusted R Squared = ,389)

b. R Squared = ,282 (Adjusted R Squared = ,266)

Furthermore, to find out the effect between subjects or variables can be seen in [Table 7](#). From the results of the calculations that have been carried out, it can be concluded that:

- 1) On mathematical critical thinking ability, the p-value is 0.000 with a significance level of  $\alpha = 0.05$ . This shows that the p-value is smaller than 0.05, so the hypothesis  $H_{0A}$  should be rejected. Thus, it can be concluded that the BBL

learning model using learning videos has an impact on the development of critical thinking skills in mathematics.

- 2) The p-value on math problem solving ability is equal to 0.000 with a significance level of  $\alpha = 0.05$ , which indicates that the p-value is less than 0.05. Therefore,  $H_{0B}$  is rejected. In other words, the conclusion is that the use of the BBL learning model using learning videos has an impact on the ability to solve mathematical problems.

Based on the results obtained from the treatment of significance by the Pillai's Trace procedure, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root, the p-value obtained on the class label as a whole is respectively = 0.000. So with a significance level of  $\alpha = 0.05$ , it means that the p-value  $< 0.05$  so that  $H_{0AB}$  is rejected and  $H_{1AB}$  is accepted, thus it can be concluded that there is a significant influence between the BBL learning model assisted by learning videos on students' critical thinking skills and mathematical problem solving. This is in line with the average value of the posttest results of mathematical critical thinking ability and mathematical problem solving obtained by experimental class 1 is greater than the average value of experimental class 2 and the control class. So it can be concluded that the ability to think critically mathematically and solve mathematical problems of experimental class 1 students who get the BBL learning model treatment assisted by learning videos is better than students who get the BBL learning model treatment and direct instruction learning model. The improvement of these abilities is influenced by the learning model applied. The BBL learning model requires students to actively explore knowledge about the topics they learn, which is based on students' cognitive structures and the way the brain works. BBL learning provides opportunities for students, in group discussions, to understand, analyze and provide arguments from the results of discussions to understand the material presented. Students are directed to be able to find their own concepts from the material studied, so that students not only memorize but also understand the concept of the material well. So that when faced with problems that are different from before, students are able to solve the problem well. In addition, with the help of learning videos in the process of teaching and learning activities, students are more enthusiastic and interested in solving the problems given.

Based on the results obtained from the Test Of Between-Subjects Effects, the p-value in mathematical critical thinking ability = 0.000 with a significance level of  $\alpha = 0.05$ , which means the p-value  $< 0.05$  so that  $H_{0A}$  is rejected and  $H_{1A}$  is accepted. Thus it can be concluded that there is a significant influence between the BBL learning model assisted by learning videos on mathematical critical thinking skills. This shows that the class that gets the treatment of BBL learning model assisted by learning video is better than the class with BBL learning model treatment and the class with direct

instruction learning model treatment. This is in line with the average value of the posttest results of mathematical critical thinking skills obtained by experimental class 1 is greater than the average value of experimental class 2 and the control class. BBL learning requires students to actively explore knowledge about the topics they learn, which is based on students' cognitive structures and the way the brain works. BBL learning provides opportunities for students, in group discussions, to understand, analyze and provide arguments from the results of discussions to understand the material presented. In addition, learning video media is very helpful for teachers in delivering learning materials, because it combines audio and visual elements so that it is easier for students to understand. Based on the description above, we can see that the BBL learning model assisted by learning videos can invite students to actively participate and be enthusiastic in discussions, the goal is to improve their mathematical critical thinking skills by providing the right solution. The results of this study are supported by previous research conducted by Sri Solihah, found that learning using the BBL approach shows the achievement and improvement of students' mathematical critical thinking skills better than students whose learning uses a conventional approach (Solihah, 2019). This is also shown in research conducted by Hesta Anggia Sari et al which states that the implementation of the BBL learning model has a significant effect on the critical thinking skills of seventh grade students (Sari et al., 2020). Likewise, research conducted by Royyatina Jannatil Firdaus et al concluded that the use of contextual science learning videos in learning was able to improve students' critical thinking skills (Fiirdaus et al., 2021).

Based on the results obtained from the Test Of Between-Subjects Effects, the p-value in math problem solving ability = 0.000 with a significance level of  $\alpha = 0.05$ , which means the p-value  $< 0.05$  so that  $H_{0B}$  is rejected and  $H_{1B}$  is accepted. Thus it can be concluded that there is a significant influence between the BBL learning model assisted by learning videos on mathematical problem solving ability. This shows that the class that gets the BBL learning model treatment assisted by learning videos is better than the class with the BBL learning model treatment and the class with the direct instruction learning model treatment. This is in line with the average value of the posttest results of mathematical problem solving ability obtained by experimental class 1 is greater than the average value of experimental class 2 and the control class. BBL learning provides opportunities for students, in group discussions, to understand, analyze and provide arguments from the results of discussions to understand the material presented. Students are directed to be able to find their own concepts from the material studied, so that students not only memorize but also understand the concept of the material well. So that when faced with problems that are different from before, students are able to solve the problem well. With the help of learning videos in the process of teaching and learning activities, students are more enthusiastic and

interested in solving the problems given. Based on the description above, we can see that the BBL learning model assisted by learning videos can invite students to actively participate and be enthusiastic in discussions, the goal is to improve their math problem solving skills by providing the right solution. The results of this study are supported by previous research conducted by Luh Seri Juliantini et al. It was found that students who learned using the BBL learning model assisted by concrete media had good mathematical problem solving skills compared to students who were not taught with the BBL learning model assisted by concrete media (Juliantini et al., 2020). Likewise, research conducted by Sri Margiani and Ali Mustadi concluded that the BBL model with the RME approach has a positive influence on the learning outcomes of third grade students on multiplication material (Margiani & Mustadi, 2023). Prastomo Budiargo and Achmad Sopyan also said in their research that Brain Based Learning is effective on math problem solving skills (Budiargo & Sopyan, 2016). Darmawan Harefa and Hestu Tansil La'ia also stated in their research that audio video learning media affects students' mathematical problem solving skills (Harefa & La'ia, 2021). Research conducted by Nurul Yuli Rachmawati and Brilian Rosy states that there is an effect of PBL learning model on students' critical thinking and problem solving skills (Rachmawati & Rosy, 2021).

### **Conclusion**

The research that has been conducted found that the use of learning videos in the BBL learning model has a positive impact on mathematical critical thinking skills and mathematical problem solving skills. Students' critical thinking skills and mathematical problem solving skills can be improved by using the BBL learning model with learning videos, compared to the BBL learning model and direct instruction. This fact has been confirmed through data research and hypothesis testing that has been carried out.

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