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Implementation of Brain-Based Learning Approach to Increase Mathematics Learning Interest and Outcomes of Third-Grade Students

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ABSTRAK

Rendahnya minat siswa disebabkan karena pendekatan yang kurang inovatif sehingga membuat siswa merasa bosan terhadap pembelajaran matematika. Rendahnya minat siswa dalam belajar juga berdampak pada hasil belajar matematika pada siswa yang rendah. Berdasarkan hal tersebut, tujuan penelitian ini yaitu untuk menganalisis penerapan pendekatan brain based learning untuk meningkatkan minat dan hasil belajar matematika siswa kelas III sekolah dasar. Jenis penelitian ini yaitu penelitian kualitatif. Metode penelitian pada desain penelitian kuantitatif yang digunakan yaitu metode ex post facto. Populasi dalam penelitian ini adalah seluruh peserta didik kelas III berjumlah 26. Sampel penelitian ini adalah seluruh peserta didik kelas III SD yang berjumlah 26 peserta didik. Metode yang digunakan dalam mengumpulkan data yaitu wawancara, angket, dokumentasi dan tes. Instrumen yang digunakan dalam penelitian ini yaitu lembar kuesioner. Teknik analisis data dalam penelitian ini yaitu metode analisis statistik dengan menggunakan aplikasi komputer SPSS. Hasil penelitian ini menunjukkan adanya peningkatan minat dan hasil belajar setelah penerapan pendekatan Brain-Based Learning (BBL) dalam pembelajaran matematika. Disimpulkan bahwa pendekatan Brain-Based Learning (BBL) dapat meningkatkan minat dan hasil belajar pada siswa sekolah dasar secara signifikan.

ABSTRACT

The low interest of students is caused by a less innovative approach, which makes students feel bored with learning mathematics. Low student interest in learning also has an impact on students' low mathematics learning outcomes. Based on this, this research aims to analyze the application of the brain-based learning approach to increase interest and learning outcomes in mathematics for grade III elementary school students. This type of research is qualitative research. The research method used in the quantitative research design is the ex post facto method. The population in this study was all 26 class III students. The sample for this research was all class III elementary school students, totaling 26 students. The methods used to collect data are interviews, questionnaires, documentation, and tests. The instrument used in this research was a questionnaire sheet. The data analysis technique in this research is a statistical analysis using the SPSS computer application. The results of this research show an increase in interest and learning outcomes after implementing the Brain-Based Learning (BBL) approach in mathematics learning. It was concluded that the Brain-Based Learning (BBL) approach can significantly increase interest and learning outcomes in elementary school students.

1. INTRODUCTION

Education is an essential factor for a nation. This is because every individual is required to pursue education so that they have quality human resources that can compete in the global era (Karmini & Paramartha, 2019; Mantiri, 2019; Mardhiyah et al., 2021). Quality education is education that can facilitate students' learning and teachers' good quality teaching (Buchori Muslim, 2020; Rahayuningsih, 2020; Slavin et al., 2021). Education is a benchmark in social status. This is because education can influence, change, and even develop a person's perspective, attitudes and life skills (Barlian et al., 2022; Kelkay & Mola, 2020). This is why quality education will only occur if teachers are professional. Therefore, the presence of qualified and professional teachers is significant (Hady, 2020; Hartanti & Yuniarsih, 2018; Sappaile, 2017). Based on this, education is an effort to shape students to be of high quality and to shape students to continue to progress and develop. Learning activities should be designed maximally so that educational goals can be achieved maximally (Agustini et al., 2020; Barlian et al., 2022; Kelkay & Mola, 2020; Pratiwi et al., 2021).

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Learning is the process of interaction between students and educators and learning resources in a learning environment (Astiningtyas, 2018; Dewi et al., 2021; Pebriyanti et al., 2021). Learning for elementary school students is a process that involves providing knowledge, skills and values to children at the basic education level. The learning approach for elementary school students needs to pay attention to the developmental characteristics of children at that age so that learning objectives can be achieved optimally (Gularso et al., 2021; Prasetyo & Kristin, 2020; Syafa et al., 2022). Learning objectives can be achieved optimally if students get good learning results. One of the subjects studied by elementary school students is mathematics. Mathematics learning in elementary schools must be designed interestingly so that children can learn well (Dewi et al., 2021; Nugraheni, 2017; Rurut et al., 2022). Learning mathematics is very important to teach since students enter elementary education. In learning activities, teachers need to ensure that students understand basic mathematical concepts before they move on to more complex material (Dewi et al., 2021; Muhammad et al., 2021; Supriyadi & Wijayati, 2020). Mathematics education involves learning abstract material, which can cause difficulties for students, so understanding the subject requires approaches, strategies, methods, or models to conceptualize and clarify the material to be discussed (Dewi et al., 2021; Nugraheni, 2017; Rurut et al., 2022; Supriyadi & Wijayati, 2020).

The problem that often occurs is students who prefer to avoid learning mathematics. This was revealed by previous research findings, which stated that there are still many students who are afraid and feel bored when learning mathematics (Azzahra & Pramudiani, 2022; Dewi et al., 2021; Nugraheni, 2017; Rurut et al., 2022; Sabrina et al., 2017). Previous research findings also confirmed that there are still many students who have difficulty learning mathematics, which has an impact on students' low mathematics learning outcomes (Arifah et al., 2019; Rahayu & Hidayati, 2018). Based on initial observations and interviews conducted at SDN 1 of Karanganyar, there were several problems related to mathematics. The results of interviews with teachers found that students had low interest in learning and low mathematics learning outcomes. Abstract mathematics learning makes it difficult for students to understand the learning material. Apart from that, many students think that learning mathematics is the most challenging learning because students find it difficult when trying to solve a problem.

The ability of class III students at SDN 1 Karanganyar to analyze, understand and solve mathematics could be much higher. This problem affects learning activities and has an impact on student interest and learning outcomes. Observation results also show that students are not active in learning. Apart from that, the learning activities carried out by the teacher only use the lecture method. This learning model makes students quickly feel bored and less interested in participating in learning activities. This has an impact on student understanding and low student learning outcomes. The use of lecture methods that do not make full use of teaching aids or learning media results in teacher explanations becoming abstract and students being less active in learning. Students tend to be passive and only listen to the teacher's explanations, take notes, and memorize the teacher's explanations during learning activities.

Based on these problems, one solution that can be taken is to design appropriate learning activities for students. Previous research also states that learning approaches, strategies, methods and models play an essential role in learning activities carried out in the classroom (Ndiung & Jediut, 2020; Ulia & Sari, 2018). This is considered necessary because it guides students to connect their previous knowledge with the material to be studied (Azzahra & Pramudiani, 2022; Dewi et al., 2021; Nugraheni, 2017; Rurut et al., 2022; Sabrina et al., 2017). Therefore, the choice of approach, strategy, method or model should be adjusted to students' abilities and enable students to construct their knowledge actively. Apart from that, a good learning approach can also improve student learning outcomes (Dores et al., 2019; Ediyanto et al., 2020). Learning outcomes are the abilities students gain after undergoing learning activities (Kurnia et al., 2019; Winoto & Prasetyo, 2020). Learning outcomes refer to the results achieved by students after participating in Learning Activities. These results can be in the form of various abilities, which include aspects of knowledge, attitudes and skills acquired by students through their learning experiences (Azzahra & Pramudiani, 2022; Kurnia et al., 2019; Winoto & Prasetyo, 2020). One approach that can be used to improve student learning outcomes is the Brain-Based Learning Approach. The Brain-Based Learning approach is a learning approach that is based on an understanding of how the human brain learns and processes information (Adiansha & Sani, 2021; Greipl et al., 2021; Solihat et al., 2017). This concept emphasizes the importance of understanding neuroscientific principles to improve learning effectiveness. Teachers' understanding of brain-based learning will help teachers design learning methods that suit the way the brain receives, stores and accesses information (Adiansha & Sani, 2021; Greipl et al., 2021; Nurasiah et al., 2022; Solihat et al., 2017).

Other research also states that mathematics is one of the subjects that students consider intimidating, so teachers need to design engaging and appropriate learning activities to improve student learning outcomes (Siamy et al., 2018; Yerizon et al., 2020). Previous research findings also reveal that appropriate learning approaches can help students understand mathematics learning (Ruslam et al., 2023;

Winata & Friantini, 2018). Other research also reveals that Brain-Based Learning (BBL) combines neuroscience principles with learning practices to create better learning experiences, focusing on how the brain effectively processes information and builds new understanding, thereby improving student learning outcomes (Adiansha & Sani, 2021; Shabatat & Al-Tarawneh, 2016; Silvana & Wibisono, 2016). Based on this, the Brain-Based Learning (BBL) approach can be used in mathematics learning. The advantage of the Brain-Based Learning (BBL) approach in teaching mathematics is that this approach takes into account individual differences in learning styles, thus allowing teachers to present mathematics material in various ways, ensuring that each student can access and process information according to their preferences. There has yet to be a study regarding the application of the brain-based learning approach to increase interest and learning outcomes in mathematics for third-grade elementary school students. Based on this, this research aims to analyze the application of the brain-based learning approach to increase interest and learning outcomes in mathematics for third-grade elementary school students.

2. METHOD

This type of research is qualitative research. The research method used in the quantitative research design is the ex-post facto method. Ex-post facto is an observation made after the incident occurs so that someone researches to find out what happened (Sugiyono, 2017). This research was carried out at SDN 1 Karanganyar, Karangrayung District, Grobogan Regency. The population in this study was all class III students at SDN 1 Karanganyar, totalling 26 students. The sampling technique used in this research used a purposive sampling technique. The samples taken in this research were all class III students at SDN 1 Karanganyar, Grobogan Regency, totalling 26 students. The reason for using the entire population as a sample is that if the population is less than 100, then all of them will be used as research samples. Therefore, the researcher took 26 students from all class III students.

The methods used to collect data are interviews, questionnaires, documentation and tests. Interviews were conducted to obtain initial information about the problems existing in the object and a general description of what occurred at the research site and in this research. Interviews were conducted with class III teachers at SDN 1 Karanganyar, Grobogan Regency. The type of questionnaire in this study, the researcher used a closed questionnaire. Indicators of students' learning interests guided the questionnaire in this research. This research documentation was used to collect data on the number of students, list of names of students, and data on odd semester PTS grades for students' mathematics subjects. Then, to see further learning results after implementing the Brain-Based Learning approach, namely using documentation of the results of daily test one and daily test two. This research also uses documentation in the form of photographs during interviews, observations, and when filling out research questionnaires. The instrument used in this research was a questionnaire sheet. The instrument grid is presented in Table 1.

Table 1. Research Instrument Grid

Variable	Dimension	Indicator
Learning Interest	Feeling Happy	1. Enjoy the subject matter 2. Enjoy learning media
	Insterest	1. Interested in the subject matter 2. Interested in learning media
	Intention in Learning	1. Pay attention to learning activities 2. Attend every teacher's explanation
	Participation in Learning	1. Actively engage in class 2. Actively ask questions 3. Learn based on your own will

The data analysis technique used in this research is a statistical analysis using the SPSS computer application. The data in this research are student interest questionnaire scores, odd semester PTS Mathematics scores, one daily test and two daily tests for class III students at SDN 1 Karanganyar, Grobogan Regency. Index analysis is carried out to analyze descriptive variables of interest in learning, which aims to determine the general perception of respondents regarding a variable to be studied using index analysis. Descriptive analysis of student learning outcomes will be presented with a 5-scale conversion guideline table along with learning outcome assessment criteria to present learning outcome data. Analysis prerequisite tests are carried out before hypothesis testing. The prerequisite tests for analysis in this research are the basic assumption test and the classic regression assumption test. The basic assumption tests used to determine multiple regression analysis are the normality test and linearity test. Then, in the

classic regression assumption test, the requirements are the multicollinearity test and the heteroscedasticity test.

3. RESULT AND DISCUSSION

Result

From the process of analyzing the questionnaire of as many as 26 students with 20 questionnaire items, the result of learning interest questionnaire scores show that the index value of the dependent variable learning interest can be known if the index value of each indicator has been calculated first. Based on the calculation of the learning interest variable index, the result is 78.62%. Based on the Three Box Method criteria, the index value of the learning interest variable of 78.62% falls into the high category. According to the calculations, the highest learning interest index is on indicator 1, which is a feeling of happiness with an index value of 82.66%. Meanwhile, the lowest learning interest index is on indicator 3, which is attention in learning with an index value of 74.60%. This shows that the implementation of the Brain-Based Learning Approach can increase the students' learning interest because based on the results of the learning interest questionnaire calculations, it falls into the high category. Furthermore, it shows that the students' learning outcomes before the implementation of the Brain-Based Learning approach have a minimum learning outcome score on the mathematics PTS of 50, then a maximum value of 88, a data range of 38, and an average score (mean) of 65.80. Based on the 5-scale conversion guideline table, the average score of the mathematics PTS for the third grade is 65.8. This means that the learning outcomes of the third-grade students based on the mathematics PTS score fall into the category C (Average).

The implementation of the Brain-Based Learning approach in mathematics learning in the third grade of SDN 1 of Karanganyar was conducted to determine the students' learning outcomes through the scores of Daily Test 1 and Daily Test 2. Based on data collected it demonstrates that the minimum score of learning outcomes on Mathematics Daily Test 1 is 60, then the maximum score is 86, the data range is 26, and the average score (mean) is 71.15. The average score of Mathematics Daily Test 1 for the third grade is 71.15. This means that the learning outcomes of the third-grade students based on the Mathematics Daily Test 1 scores fall into the category B (Good). The minimum score of learning outcomes on Mathematics Daily Test 2 is 66, then the maximum value is 90, the data range is 24, and the average score (mean) is 81.23. The average score of Mathematics Daily Test 2 for the third grade is 81.23. This means that the learning outcomes of the third-grade students based on the Mathematics Daily Test 2 score fall into the category A (Excellent).

Based on data analysis showed that the students' scores after the implementation of the Brain-Based Learning approach are higher than the scores before the implementation of the approach. In addition, the learning outcomes are also considered to have improved from previous learning outcomes. Based on the diagram, it can be seen that the students' learning outcomes can be said to have improved from the previous learning outcomes. The learning outcome from the average of PTS scores is 65.8, then the average score of Daily Test 1 is 71.1, and the average score of Daily Test 2 is 81.2. Next, a hypothesis test is carried out. The normality test results are presented in Table 2.

Table 2. Data Normality Test Results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Unstandardized Residual	0.123	26	0.200	0.957	26	0.340

Based on the results of the normality test, the Sig. value was obtained. (Significant) residual data from the Brain-Based Learning Approach variable, student interest and learning outcomes have a value of Sig. 0.340 where the Sig value >0.05. So, the data from all variables is usually distributed. Next, a linearity test was carried out. The results of the linearity test are presented in Table 3.

Table 3. Data Linearity Test Results X_1 with Y_1 and X_1 with Y_2

			Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Interest * BBL	Between Groups	(Combined)	47.386	8	5.923	231.313	0.000
		Linearity	47.143	1	47.143	1841.029	0.000
		Deviation from Linearity	0.243	7	0.035	1.354	0.286
	Within Groups		0.435	17	0.026		
	Total		**47.821**	**25**			

			Sum of Squares	df	Mean Square	F	Sig.
Learning Outcomes * BBL	Between Groups	(Combined)	13.228	8	1.653	2.705	0.040
		Linearity	5.584	1	5.584	9.136	0.008
		Deviation from Linearity	7.644	7	1.092	1.787	0.155
	Within Groups		10.391	17	0.611		
	Total		**23.619**	**25**			

Based on Table 3, Sig. (Significant) the linearity row in the Brain-Based Learning and Interest variables has a Sig value. 0.000, which means that the Sig. value <0.05. It can be concluded that the Brain-Based Learning variable with Interest in learning has a linear relationship. The results of the linearity test on the Brain-based Learning variable with learning outcomes have a value of Sig. 0.008, which means that the Sig. value is <0.05. The Brain-based learning variable and learning outcomes have a linear relationship. Next, a multicollinearity test was carried out. Based on the multicollinearity test, the Variant Inflation Factor (VIF) value of the Brain-Based Learning variable with an Interest of 1.000 was obtained. The VIF value is <10. The conclusion is that there is no multicollinearity problem. Based on the multicollinearity test, the Variant Inflation Factor (VIF) value of the Brain-Based Learning variable was obtained with a learning outcome of 1.000. The VIF value is <10. The conclusion is that there is no multicollinearity problem. Based on the heteroscedasticity test, it can be seen that there is no heteroscedasticity problem between the Residual Unstandarddizer and the Brain-Based Learning variable because a significant value of >0.05 was obtained. The correlation between Brain-based learning and Residual Unstandardizer obtained a significant value of 0.547.

Based on the results of a simple correlation analysis of X_1 with Y_1, the Sig. value is 0.000, then the Sig. value is <0.05, which indicates that the results of the analysis are correlated, and H_0 is rejected. The person correlation value of 1.000 is in the interval of 0.80 – 1.000, which means that Brain-Based Learning and interest in learning have a solid relationship. Next, the results of a simple correlation analysis between Brain-Based Learning and learning outcomes. The results of the data analysis show a significance value of 0.009, which means <0.05, so the results of the analysis are correlated, and H_0 is rejected. The person correlation value is 0.500, which is in the interval 0.40 – 0.599, which means Brain-Based Learning and Learning Outcomes are at a moderate level of relationship. Next, a simple regression analysis was carried out using the t-test. The results of the simple regression test for the Brain-Based Learning variable with interest in learning are presented in Table 4.

Table 4. Simple Regression Test Results for the Brain-Based Learning Variable with Interest in Learning

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.584	1.029	0.707	2.511	0.019
	BBL	0.704	0.144		4.904	0.000

The results of data analysis show that the Brain-Based Learning variable gets a coefficient of 0.704, meaning that 1 Brain-Based Learning increases by 1, so interest in learning increases by 0.704. A positive coefficient value means there is a positive relationship between Brain-based Learning and interest in learning. The results of the simple Brain-Based Learning regression test with learning outcomes are presented in Table 5.

Table 5. Simple Regression Test Results of Brain-Based Learning with Learning Outcomes

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.485	0.933	0.500	5.876	0.000
	BBL	0.353	0.125		2.828	0.009

The results of data analysis show that the Brain-Based Learning variable has a coefficient of 0.353, meaning that 1 Brain-Based Learning increases by 1, so learning outcomes increase by 0.353. A positive coefficient value means there is a positive relationship between Brain-based Learning and learning outcomes. Next, analysis of the coefficient of determination is carried out. The results of the data analysis show that the R Square value is 0.501. The coefficient of determination is 0.501 x 100% = 50.1%. So, the magnitude of the influence of the application of Brain-based learning on the learning interest of class III

students at SDN 1 Karanganyar, namely 50.1% and 49.9%, is influenced by other factors. Based on data analysis, the R Square value is 0.250. The coefficient of determination is 0.250 x 100% = 25%. So, the magnitude of the influence of the application of Brain-based learning on the learning outcomes of class III students at SDN 1 Karanganyar is 25% and 75% influenced by other factors.

Discussion

The results of the data analysis show that the application of the brain-based learning approach has an effect on mathematics learning for third-grade elementary school students. Various factors cause this. First, Brain-Based Learning can increase elementary school students' interest in learning mathematics. Learning activities involve two-way communication between educators and students (Dewimarni et al., 2022; Japa et al., 2017; Rahma & Pujiastuti, 2021). Learning activities involve the transfer of knowledge from educators to students and vice versa (Herawati, 2017; Mujahadah et al., 2021). Learning activities that apply the Brain-Based Learning approach are student-centred (Adiansha & Sumantri, 2017; Nahdi, 2015). Such learning activities make students active, thereby increasing students' interest in learning. Previous research findings also state that increasing student interest in learning will have an impact on increasing student learning outcomes (Agustina, 2015; Komariyah et al., 2018; Mujahadah et al., 2021). Learning that applies the Brain-Based Learning approach attracts more student interest because students are required to be fully involved in learning. Implementation of the Brain-Based Learning Approach in mathematics learning has had a positive impact on students' increasing interest in learning mathematics.

Second, Brain-Based Learning can improve mathematics learning outcomes for elementary school students. Mathematics learning is the process of providing students with experience through a series of planned activities so that students gain competence (Azzahra & Pramudiani, 2022; Dusalan & Wirahmad, 2022; Sari et al., 2019). The Brain-Based Learning approach is a practical approach that can influence student learning outcomes, student responses, and student activities in the classroom (Adiansha & Sani, 2021; Nahdi, 2015). Brain-based learning is able to facilitate students in increasing their interest in learning and student learning outcomes through stages, compared to conventional approaches. The Brain-Based Learning Approach provides many benefits to students, including showing interest and making students enthusiastic about learning mathematics. Previous research also states that increasing mathematics learning outcomes indicates that learning objectives have been maximally achieved (Haeruddin & Hadijah, 2019; Janah et al., 2019; Rahmayanti et al., 2018). Activities with Brain-Based Learning make it easier for students to understand the concept of the material.

Third, Brain Based Learning can create active and fun learning activities. By applying brain-based learning, the teacher creates a conducive classroom atmosphere. This is supported by previous research findings, which state that implementing Brain Based Learning makes the classroom atmosphere active and fun (Adiansha & Sumantri, 2017; Nahdi, 2015; Nurasiah et al., 2022). The BBL model provides opportunities for students to learn according to what students want by exploring the experiences that students have and utilizing these experiences as initial information to carry out further learning (Adiansha & Sani, 2021; Shabatat & Al-Tarawneh, 2016; Silvana & Wibisono, 2016). In the classroom learning process, the left brain focuses on the knowledge and information from the teacher, while the right brain investigates how knowledge is implemented. This is what causes students not only to interact with the teacher but also with all their friends. Applying the BBL model, students can feel fully involved in learning activities so that the learning process is enjoyable. This causes students to be motivated to learn (Adiansha & Sani, 2021; Silvana & Wibisono, 2016).

Previous research findings also state that mathematics skills are really needed by humans at an early age of development, especially when they are in elementary school (Habibi & Setyaningtyas, 2021; Kusmawati, 2016; Sugianti et al., 2018). Psychological and mathematical abilities, along with limited abilities, can help humans think logically and digest other knowledge. Other findings also reveal that Brain-Based Learning is learning that is able to provide students with space to think without pressure, a supportive learning environment, and full of stimuli that stimulate creative thinking (Duman, 2010; Listiani, 2022). The Brain-Based Learning approach requires students to be more active in learning because students are given the tools to manage learning independently (Adiansha & Sani, 2021; Shabatat & Al-Tarawneh, 2016; Silvana & Wibisono, 2016). This research implies that the optimal application of brain-based learning can increase student interest and learning outcomes. Students are required to be able to identify various problems that need to be studied further. Implementation of the BBL model provides opportunities for teachers to carry out objective assessments of students through observation. Implementation of the BBL model can teach students to be more active and able to reflect on learning activities so that students' minds are entirely focused on the ongoing learning process.

4. CONCLUSION

The results of data analysis show that there is an increase in the application of the Brain-Based Learning Approach in an effort to increase interest and learning outcomes in Mathematics learning for class III elementary school students. It was concluded that the interest and learning outcomes of class III mathematics students who applied the Brain-Based Learning (BBL) approach showed better improvement compared to previous learning. This shows that teachers in mathematics learning can use the Brain-Based Learning Approach because it makes it easier for students to understand mathematics learning material, and it has an impact on students' learning outcomes and interests as well.

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