THE IMPROVEMENT OF MATHEMATICAL ABILITY THROUGH CARTESIAR COORDINATE BOARD MEDIA ON GEOMETRY MATERIAL

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Abstract

Education is an important part of life through this means of transformation, including mathematics. Mathematics plays an important role in learning and is part of other sciences. However, students often have difficulty remembering and applying mathematical formulas correctly. This study aims to improve the mathematical ability of VIII grade junior high school students on geometry material using cartesian coordinate board media. The research approach used is experimental method with pretest-posttest control group design. The research subjects consisted of two randomly selected classes, one class as an experimental group using cartesian coordinate board media and one class as a control group using conventional methods. Data were collected through mathematical ability tests given before and after treatment, as well as through observations and interviews. The results showed that the use of cartesian coordinate board media significantly improved students' mathematical abilities on geometry material compared to conventional methods. This improvement can be seen from the comparison of pretest and posttest scores which show a greater improvement in the experimental group. In addition, students showed higher interest and motivation in learning geometry by using this media. From the results of this study it can be concluded that the cartesian coordinate board media is effective in improving students' mathematical abilities in geometry material in class VIII junior high school. Therefore, it is recommended that math teachers consider using this media in the learning process to improve student learning outcomes.

Keywords : Cartesian Coordinate Board Media, Geometry, Mathematical Ability, Mathematics Learning, Junior High School

Abstrak

Pendidikan merupakan bagian penting dalam kehidupan melalui sarana transformasi ini, termasuk matematika. Matematika memegang peranan penting dalam pembelajaran dan merupakan bagian dari ilmu pengetahuan lainnya. Akan tetapi, siswa sering kali mengalami kesulitan dalam mengingat dan menerapkan rumus matematika dengan benar. Penelitian ini bertujuan untuk meningkatkan kemampuan matematika siswa SMP kelas VIII pada materi geometri menggunakan media papan koordinat kartesius. Pendekatan penelitian yang digunakan adalah metode eksperimen dengan pretest-posttest control group design. Subjek penelitian terdiri dari dua kelas yang dipilih secara acak, satu kelas sebagai kelompok eksperimen menggunakan media papan koordinat kartesius dan satu kelas sebagai kelompok kontrol menggunakan metode konvensional. Pengumpulan data dilakukan melalui tes kemampuan matematika yang diberikan sebelum dan sesudah perlakuan, serta melalui observasi dan wawancara. Hasil penelitian menunjukkan bahwa penggunaan media papan koordinat kartesius meningkatkan kemampuan matematika siswa pada materi geometri secara signifikan dibandingkan dengan metode konvensional. Peningkatan tersebut terlihat dari perbandingan nilai pretest dan posttest yang menunjukkan peningkatan yang lebih besar pada kelompok eksperimen. Selain itu, siswa menunjukkan minat dan motivasi yang lebih tinggi dalam mempelajari geometri dengan menggunakan media ini. Dari hasil penelitian ini dapat disimpulkan bahwa media papan koordinat kartesius efektif dalam meningkatkan kemampuan matematika siswa pada materi geometri di kelas VIII SMP. Oleh karena itu, disarankan kepada guru matematika untuk mempertimbangkan penggunaan media ini dalam proses pembelajaran guna meningkatkan hasil belajar siswa.

Kata kunci: Media Papan Koordinat Kartesius, Geometri, Kemampuan Matematika, Pembelajaran Matematika, SMP

INTRODUCTION

Mathematics is considered to play an important role in shaping students to be qualified in thinking to study things logically and systematically. Considering the importance of mathematics and its application in everyday life, mathematics is one of the lessons taught from an early age (Hidayati et al., 2020). Khusnah et al. (2020) stated that in studying mathematics students are taught to think systematically, creatively, critically, logically and analytically. One of the mathematical materials that needs more attention is discussion related to geometric material (Fauziah et al., 2017). Geometry is a part of mathematics where the object of discussion is abstract, so studying it requires teaching aids to understand the material (Kustiawati, 2017). This of course applies to studying geometric transformation material where students have to imagine reflections, shifts, rotations and dot multiplication. Certain (Avcu & Çetinkaya, 2021; González-Campos et al., 2022). The displacement of a point or plane in geometric transformation material needs to be visualized for students so that students can understand the displacement in question (Fife et al., 2019; Wang et al., 2023).

Sutiarso et al. (2018) said that the level of difficulty in learning geometry is much more difficult than algebra and statistics. Misunderstanding geometry includes two aspects, namely conceptual and procedural. Difficulty in studying certain parts of geometry will have an impact on difficulties in studying other geometries, because geometry has many interrelated topics of discussion. Transformation materials have many applications in life, for example a flat plane so that you can shift, enlarge or reduce an image to create a new image, the concept of transformation can be used. Of course, something similar is a reference for educators to be able to pay serious attention to the teaching and learning process at the school level.

Based on initial observations at SMP Plus Maulana Malik Ibrahim, it was found that students' mathematical abilities, especially in geometry material, were still low. Students have difficulty understanding geometric concepts, solving geometric problems, and connecting geometric concepts with everyday life. This is caused by several factors, one of which is the use of less varied learning media. Teachers tend to only use lecture methods and practice questions without using learning media that can help students understand geometric concepts (A Van De Walle, 2007). Therefore, this research has the potential to contribute to the development of more effective mathematics learning strategies at the junior high school level. By focusing on the conceptual understanding and problem-solving abilities of eighth

grade junior high school students, this research can provide a strong empirical basis to guide the development of more effective mathematics curriculum and learning methods at this level. Based on the description above, the author is interested in conducting research with the title "Improving Students' Mathematical Ability Through the Media of Cartesian Coordinate Boards in Geometry Material for Class VIII SMP".

METHODS

This type of research is quantitative research that uses experimental research methodology (Kusumastuti, Adhi, 2020; Priyatna, 2020). Quantitative research includes an experimental approach (Sugiyono, 2020). Experimental techniques are a study approach to determine the effect of one treatment on another treatment in a controlled setting during treatment (Sugiyono, 2016). This research was carried out at Plus Maulana Malik Ibrahim Middle School class VIII Jl. KHR. Moch. Rosyid 556 Ngumpakdalem Village, Dander District, Bojonegoro Regency. SMP Plus Maulana Malik Ibrahim is one of the foundation schools in Bojonegoro Regency, which occupies approximately 2867 M² of land. The exact location is on Jl. KHR. Moch. Rosyid 556 Ngumpakdalem Village, Dander District, Bojonegoro Regency. The population in this study were class VIII students at SMP Plus Maulana Malik Ibrahim, Ngumpakdalem, Dander, Bojonegoro. totaling 38 students. The size and characteristics of the population were determined by sampling. The step in determining the research sample size is to determine the sample size. Purposive sampling is a sampling approach based on certain criteria (considerations) from population members, which researchers used in this research (Puspitaningtyas, 2016). The data collection technique used in this research was interviews. According to Sugiyono (2022) an interview is a meeting between two individuals with the aim of exchanging information and ideas through a question and answer process, which then results in a conclusion about the topic being discussed. In the context of this research, an unstructured interview technique was used which was conducted with counselors at SMP Plus Maulana Malik Ibrahim. Data analysis is the process of arranging the sequence of data, organizing it into patterns, categories and basic units of description. Data analysis is a series of activities of reviewing, grouping, systematizing, interpreting and verifying data so that a phenomenon has social, academic and scientific value (Purwanto, 2008). In this research, researchers used quantitative data analysis techniques, while this quantitative data was

analyzed using statistical analysis. Researchers use SPSS tools, namely tools in the form of software designed to help with statistical data processing (Sugiyono, 2020).

RESULTS AND DISCUSSION

From the results of the research carried out, an overview of the data regarding "Increasing Mathematical Ability through Cartesian Coordinate Board Media in Geometry Material for Class VIII SMP" was obtained. The results of the post test & pre test showed that the pre test results were an average of 68.42105263 and the post test results were an average of 68.42105263. 82.8947, we can see that the student's pre-test score got the lowest score of 45 and the highest score of 85. Meanwhile, the student's post-test score got the lowest score of 65 and the highest score of 95.

One of the prerequisites for carrying out a t test in a study is the normality test. The purpose of the normality test is to find out whether the data is regularly distributed or not. In this research, the normality test is seen from the results of pre-test and post-test data. When using the SPSS application, the normality test can be seen using the Kolmogorov-Smirnov normal test with a significance level of 0.05 with the criterion that if the sig value is more than 0.05 then the data is normally distributed and vice versa. Data is not regularly distributed if sig is more than 0.05. The following is how SPSS 16.0 is used for this normality test .

Table 1 Normality Test

		Kolmogorov-Smirnov$_a$			Shapiro-Wilk		
	Kelas	Statistic	df	Sig	Statistic	df	Sig
Hasil Belajar Siswa	PreTest Ekspreimen	.148	19	.200	.959	19	553
	PostTest Eksperimen	.156	19	.200	.914.	19	87
	PreTest Kontrol	.179	19	.111	.927	19	156
	PosTest Kontrol	.157	19	.200	.957	19	520

a. Likkefirs Significance Correction

*. This is a lower bound of the true significance

From the table above it is known that the significant value for the Experimental pretest class is 0.200, the Experimental post-test class is 0.200, the control pre-test class is 0.111 and the control post-test class is 0.200. It can be concluded that all classes tested are normally distributed.

The next step is to run a homogeneity test after ensuring that the data is distributed regularly. The purpose of this test is to assess whether the two data are homogeneous or not. Data is said to be homogeneous if the significance level is set to be greater than 0.05, then the conditions are met or homogeneous. Furthermore, if the sig is less than 0.05 then the data is not homogeneous.

Table 2 Homogenety Test

		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	.975	1	36	.330
	Based on Median	.607	1	36	.441
	Based on Median and With adjusted df	.607	1	31.852	.442
	Based on trimmed mean	.973	1	36	.331

So, looking at table 4.4 above, it proves that the posttest day value obtained was 0.331. As a result, the data shows that the sig value is greater than the threshold, namely greater than 0.05 therefore, the tests carried out show that the post-test values are distributed evenly (equally).

Hypothesis testing was carried out to see whether the use of Cartesian coordinate board media affected the mathematical abilities of class VIII students at SMP Plus Maulana Malik Ibrahim, Ngumpakdalem, Dander, Bojonegoro. The first step a researcher takes is to create a hypothesis before testing it. This research hypothesis includes:

H_0 There is an influence of Cartesian coordinate board media on the mathematical abilities of class VIII students at SMP Plus Maulana Malik Ibrahim.

H_1 There is no influence of Cartesian coordinate board media on the mathematical abilities of class VIII students at SMP Plus Maulana Malik Ibrahim.

The researchers used an independent samples t test in their analysis to evaluate this hypothesis. The following data will be examined by conducting an independent samples t test when the data is considered homogeneous and regularly distributed. The author used SPSS version 16.0 for the independent samples t test. The results of the independent sample t test are shown in the table below.

Table 3 T Test

	Kelas	Levene's Test for Equality Of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tai*led*	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Belajar Siswa	Equal Variances assumed	.975	.330	6.473	36	.000	23.684	3.659	16.263	31.105
	Equal variances not assumed			6.473	33.873	.000	23.684	3.659	16.247	31.121

So the results of the independent sample t test analysis of student learning outcomes based on the t test criteria, were rejected and given treatment after treatment (using Carteasius coordinate board media) showed a sig value (2 tailed) = 0.00 < 0.05. As a result, we

already know that using Cartesian coordinate board media can influence the learning outcomes of VIII students at SMP Plus Maulana Malik Ibrahim.

Student learning outcomes in the experimental class, which used Cartesian coordinate board media, were higher than student learning outcomes in the control class, which used conventional learning. The difference in learning outcomes between the experimental class and the control class did not occur by chance, but was due to differences in treatment in learning. Students' mathematical abilities can be seen in the diagram presented next. The use of Cartesian coordinate board media in experimental classes has been proven to significantly improve student learning outcomes compared to control classes that use conventional learning. This difference did not occur by chance, but was caused by differences in the treatment given.

Based on the calculation of the final test data (post-test), the research can prove that there is an increase in learning outcomes between the experimental class which uses the creative coordinate board media and the control class which uses traditional education. The results of calculating the final test data (post-test) from this research can prove that there is an increase in learning outcomes between the experimental class and the control class. The experimental class, which used a Cartesian coordinate board, had an average post-test score of 83.00. The control class, which uses traditional education, has an average post-test score of 75.00. The difference in the average post-test score between the experimental class and the control class shows that the use of Cartesian coordinate board media can improve student learning outcomes significantly compared to traditional learning. The use of Cartesian coordinate board media in learning has been proven to improve student learning outcomes better than conventional learning.

Based on the research results, it can be proven that there is an influence of the Cartesian coordinate board media on students' mathematical abilities which has been obtained from the independent sample t test. In this case, it can be seen that the sig (2tailed) value is smaller than 0.05, so it is rejected while it is accepted, as seen in the t test criteria, where the sig (2tailed) value is. These results have been proven in the results obtained based on applicable regulations. So it can be concluded that there is an influence of Cartesian coordinate board media on the mathematical abilities of class VIII students at SMP Plus Maulana Ibrahim.

The utilization of a Cartesian coordinate board as an instructional aid can markedly enhance students' comprehension of mathematical concepts (Suharto, 2020). This visual and interactive approach renders abstract geometric ideas more tangible and comprehensible (Turmudi et al., 2021). Through the plotting of points and construction of shapes on the coordinate plane, students can more effectively grasp concepts such as distance, midpoint, and slope (Salam et al., 2020). Furthermore, the board facilitates the clear demonstration of geometric transformations, including translations, rotations, and reflections. This tactile method of instruction not only engages students but also fosters a deeper understanding and retention of mathematical principles. The integration of a Cartesian coordinate board into mathematics curricula cultivates a more dynamic and efficacious learning environment, thereby enabling students to develop enhanced spatial reasoning skills and a more intuitive understanding of geometric relationships (Indrapangastuti et al., 2021; Purwasih et al., 2019).

The continuous inventions and evolutions in all information technology fields open new channels and opportunities to enhance teaching and educational methods (Hertel & Wessman-Enzinger, 2017; Keswari & Abadi, 2022). On one side, these may improve the abilities of educators to present information in interactive and media-enhanced formats relative to traditional methods (Piccialli et al., 2024). This may help students or learners through offering them the information in channels and methods that can be easier to understand, deal with and retrieve (Çoban & Göktaş, 2023; Zebo Makhmudjanovna, 2021). On the other hand, offering those alternative methods of teaching can be helpful particularly for children, people with special needs, or students in rural areas where they can have virtual or remote instructors, especially for majors who have shortages (Chytas et al., 2022; Killam & Camargo-Plazas, 2022; Petruse et al., 2024).

CONCLUSION

The results of the research prove that by using Cartesian coordinate board media in the experimental class and conventional learning which is usually applied in the control class, the average post-test result for the experimental class is 83.00, and the average post-test result for the control class is 75. 00. Thus it can be concluded that the use of Cartesian coordinate board media can improve the mathematical. This study provides implications for the learning

process that media is one of the techniques used to improve students' abilities in the learning process. The limitations of this study are the limited number of samples used owing to time and space constraints. Further research should be able to expand the population and compare the use of alternative media.

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