

Research article

The Effectiveness of Using Virtual Reality-Based Mathematics Learning Media With an Ethnomathematical Approach

Noviana Dini Rahmawati*, Achmad Buchori, Muhammad Hafidz Azizal Ghoffar

Department of Mathematics Education, Universitas PGRI Semarang, Indonesia

Abstract.

Learning mathematics is considered difficult by many students. The difficulty they face is in applying concepts in solving everyday problems. Therefore, innovative learning media are needed to improve students' understanding of these concepts. This study aimed to determine whether virtual reality-based mathematics learning media with an ethnomathematical approach are effective in improving student learning outcomes. This was development research, using the ADDIE model (analysis, design, development, implementation, evaluation); however, this article describes only the implementation and evaluation stages. The research subjects were students of class XI SMA N 1 Tahunan Jepara who were recruited using purposive sampling. According to the findings, the average learning outcomes of the experimental class were better than the control class. In addition, the experimental class had higher results for learning mastery than the control class. So, it can be concluded that the virtual reality-based mathematics learning media with an ethnomathematical approach can be effectively used for high school students.

Keywords: mathematics learning, virtual reality, ethnomathematics

Corresponding Author: Noviana Dini Rahmawati; email: novianadini@upgris.ac.id

Published: 28 September 2022

Publishing services provided by Knowledge E

© Noviana Dini Rahmawati et al. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the ICESRE 2021 Conference Committee.

1. Introduction

Learning mathematics is a basic learning for children to improve logical thinking that is obtained from an early age to college. However, competence in mathematics has not yet been achieved. This is due to the lack of students learning mathematics based on everyday experience. So there is a need for high-quality mathematics teaching, adequate curriculum and creative and innovative teaching staff [1]. One of the duties of the teaching staff is to always try to improve the quality teaching and learning process by innovating in the use of learning media. So that it can motivate students to be more active in learning to understand problems through learning creative math game app [2].

Teaching materials assisted by innovative learning media are able to bring out students' creativity. The teaching and learning process that is centered on students can bring out students' creativity in solving a problem. Thus, the treatment has a

OPEN ACCESS

positive effect on student creativity on learning achievement [3]. Mathematics learning achievement at SMA N 1 Tahunan Jepara is still low because students have difficulty in solving problems related to mathematical concepts. Therefore, it is necessary to have teacher support to package an attractive learning media and appropriate learning approach.

Learning development through the application of culturally relevant pedagogy poured into the curriculum is a good alternative in measuring aspects of students' knowledge, attitudes and skills. In the context of mathematical pedagogy in culture, describing an ethnomathematical perspective that takes cultural traits into the mathematics curriculum. The ethnomathematical approach is able to make the child's learning process more meaningful with interesting experiences based on the culture that exists in the local environment [4]. Mathematics education is influenced by game-based cultural values. Mathematics curriculum development and implementation that combines elements and cultural values of everyday life can increase student motivation and achievement [5]. Game-based mathematics learning with local wisdom is able to display interesting math material. Learning media based on local culture can help the teaching and learning process become more effective and practical [6].

Based on research conducted by [7] concluded that Virtual Reality technology to support education has been widely recognized. The development of this technology includes the creation of virtual reality-based learning media, namely changing student interactions in the virtual world into the real world. The results of evaluations that have been carried out in several schools state that the application of virtual reality technology is very practical to use in education.

Learning process activities using real situations involve high costs, and adequate infrastructure and are risky. Thus, the virtual environment is the right alternative to help students understand the real context of the material. Virtual reality-based learning media makes the learning process more interesting and increases student motivation [8]. Therefore, the authors want to know about the effectiveness of the application of virtual reality-based mathematics learning media with an ethnomathematical approach.

2. Research Methods

This type of research is research and development. The population in this study were students of Class XI SMA N 1 Tahunan Jepara. Data collection techniques used are tests, questionnaires, and documentation. The mathematics material in this learning media is trigonometry. Data analysis techniques in this study were normality test, homogeneity

test, and t-test. The development model used is the ADDIE model which includes analysis, design, development, implementation, and evaluation. **The ADDIE model can be shown in Fi**

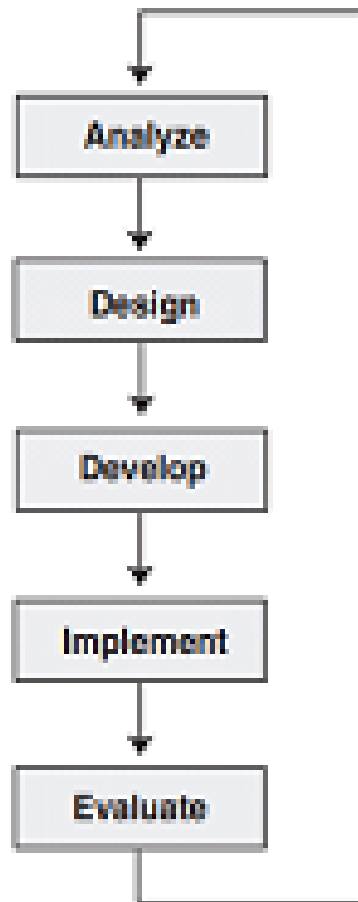


Figure 1: ADDIE Model [9].

3. Results and Discussion

3.1. Normality test

To determine the normality of the sample from the population, it was done using the Liliefors test with a significant level of 5%. The criteria in the normality test for samples from a normally distributed population are $L_{count} \leq L_{table}$. The results of the analysis of the final data normality test can be seen in table 1.

Based on the table of critical values for the Lilliefors test, with $n = 17$ and a significant level of 5%, it shows that the L_{count} value in the experimental class is 0,0974 and the

TABLE 1: Result of analysis of final data normality test.

Class	n	L_{count}	L_{table}	Conclusion
Experimer17		0,0974	0,2060	Normal Distribution
Control	17	0,1149	0,2060	Normal Distribution

control class is 0,1149. While the price of the L_{table} is 0,2060. Thus, the L_{count} calculated for the experimental class and the control class is smaller than the L_{table} . Because $L_{count} \leq L_{table}$ so that H_0 is accepted. Based on these calculations, it can be concluded that the sample comes from a normally distributed population.

3.2. Homogeneity Test

The homogeneity test in this study used the Bartlett test with a significance level of 5%. The criteria in the homogeneity test for the sample have the same variance if $b_{count} \geq b_{table}$. The results of the homogeneity test analysis can be seen in table 2.

TABLE 2: Results of analysis of final data homogeneity test.

Class	n	b_{count}	b_{table}	Conclusion
Experimer17		1,3716	0,8836	Homogeneous Variance
Control	17			

Based on the table, it shows that for a significant level of 5%, $n_1 = 17$, $n_2 = 17$, and $k = 2$, the values obtained are $b_{table} = 0,8836$ and $b_{count} = 1,3716$. This shows that $b_{count} \geq b_{table}$ so H_0 is accepted. This shows that the experimental class and the control class have the same variance (homogeneous).

3.3. T-test

This test is to find out one indicator of the effectiveness of learning media products, namely the average learning outcome of the experimental class is better than the control class. The results of the t-test analysis can be seen in table 3.

The table shows that for $n_1 = 17$ and $n_2 = 17$ with a significant level of 5% after obtaining t_{count} of 1,723 and t_{table} of 1,694. This shows that the price of $t_{count} > t_{table}$ so that H_0 is rejected. Based on these calculations, it can be concluded that the average learning outcomes of the experimental class are better than the control class.

Mastery student learning outcomes are shown individually if they reach a score of 68 in accordance with the Minimum Mastery Criteria. The result of the percentage of

TABLE 3: Results of analysis of final data homogeneity test.

Class	n	t_{count}	t_{table}	Conclusion
Experiment	17	1,723	1,694	The average learning outcomes of the experimental class are better than the control class
Control	17			

mastery learning in the experimental class is 76% and for the control class, it is 53%. So it was concluded that the percentage of completeness of the experimental class was greater than that of the control class. This is supported by the analysis of the t-test results in table 4.

TABLE 4: Result of Studying Completeness Test Analysis.

Class	n	t_{count}	t_{table}	Conclusion
Experiment	17	2,572	2,11	The proportion of completeness of student learning outcomes is achieved
Control	17	0,3717	2,11	The proportion of completeness of student learning outcomes is achieved

Based on the table for the experimental class with $n = 17$ and a significant level of 5%, $t_{count} > t_{table}$ is obtained so that H_0 is accepted, while the t-test calculation for the control class shows $t_{count} < t_{table}$ so that H_0 is rejected. Based on these calculations, it can be concluded that in the experimental class the proportion of student learning mastery is achieved and in the control class the proportion of student learning mastery has not been achieved.

The results of this study are relevant to the research conducted by [10] which concluded that the implementation of ethnomathematics in the measurement material applied to the teaching curriculum in the classroom meets the effective criteria. This is indicated by the enthusiasm of students in understanding mathematical concepts given by the teacher. In addition, it is easier for teachers to make the learning process more active and student-centered.

4. Conclusion

Based on the results of the study, it can be concluded that the application of virtual reality-based learning media with an ethnomathematical approach in high school meets

the effective criteria. This is indicated by $t_{count} > t_{table}$ is $1,723 > 1,694$ which means that the average student learning outcomes of the experimental class are better than the control class. In addition, the experimental class student learning outcomes have met the complete criteria of 76%.

5. Authors' Contributions

The author hopes that the results of this study can be an alternative for educators to further develop and implement virtual-based learning media with an ethnomathematical approach with different materials. So it is expected to improve student learning outcomes.

Acknowledgments

Thank you to those who were involved and helped, namely SMA N 1 Tahunan and Universitas PGRI Semarang.

References

- [1] C.T. Cross, T.A. Woods, and H. Schweingruber, *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity*. National Academies Press, Washington, 2009.
- [2] Sunandar AB, Rahmawati ND. Development of media kocerin (Smart box interactive) to learning mathematics in Junior High School. *Global Journal of Pure and Applied Mathematics*. 2016;12(6):5253-5266.
- [3] N.D. Rahmawati, A.A. Nugroho, L. Harun, T.A. Kusmayadi, and B. Usodo, "Effect Of Students Creativity In Wolfram Mathematica Assisted On Learning Achievement In Linear Algebra Course.," In: *Proceeding ICMETA*. pp. 157–164. *Universitas Sebelas Maret, Solo* (2017)
- [4] ROSA, M.; OREY, D. C. Culturally relevant pedagogy : an ethnomathematical approach. *Revista Horizontes*, v. 28, n. 1, p. 19-31, jan./jun. 2010
- [5] Fouze AQ, Amit M. On the importance of an ethnomathematical curriculum in mathematics education. *EURASIA Journal of Mathematics, Science and Technology Education*. 2017;14(2):561-567.
- [6] Buchori A, Sudargo S, Rahmawati ND. Dissemination products applications based digital math game with Java local wisdom into learning mathematics in higher

education. Proceeding of International Conference on Mathematics, Science, and Education; 2016;3(1):85-90

- [7] Youngblut C. Educational uses of virtual reality technology. Institute for Defense Analyses, Virginia 1998.
- [8] M. Sholihin, R.C. Sari, N. Yuniarti, and S. Ilyana, "A new way of teaching business ethics: The evaluation of virtual reality-based learning media.," *The International Journal of Management Education*. vol. 18, no. 3, pp. 1–13, 2020.