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The Influence of Realia Media Usage on Middle School Students Mathematics Learning Outcomes

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Abstract

The purpose of this study is to ascertain how the use of visual aids, such as refusi boards, affects the learning outcomes of mathematics students at Al-Munir Islamic Junior High School when studying Relations and Functions. The study employed a posttest-only control group design and a quasi-experimental research methodology. Two classes made up the research sample: the experimental class, which learned using a refusi board as a visual aid, and the control group, which learned using traditional techniques devoid of visual aids. A post-treatment mathematics learning outcome test was used to collect data. The two groups' learning outcomes differed significantly, as indicated by the Asymp. signature value (2-tailed) of 0.033 (<0.05), which was obtained from data analysis using the Mann-Whitney U test. In comparison to the control class, which had an average rank of 21.14 for student learning outcomes, the experimental class had an average rank of 29.86. These findings suggest that using a refusion board as a visual aid improves students' learning outcomes in mathematics when it comes to Relations and Functions. As a result, this media is suggested as a different but equally effective learning method for enhancing comprehension of mathematical ideas.

Keywords: Refusi Board, Visual Media, Learning Outcomes, Relation and Functions, Junior High School Mathematics

1. Introduction

Mathematics is an essential subject in the curriculum as it promotes the development of critical, logical, and systematic thinking skills. But because a lot of mathematical ideas are abstract and need for sophisticated cognitive abilities, mathematics is often frequently regarded as challenging. Teachers keep creating teaching methods that give students a more tangible understanding of mathematical ideas in order to overcome this difficulty. One popular tactic is the use of visual media, which is thought to be able to translate abstract ideas into more easily understood visual forms (Anwar & Rahimu, 2021).

It has been demonstrated that using visual aids to teach mathematics improves student learning outcomes. For instance, Putri, Hadi, and Wulandari's study demonstrated that using visual board media could greatly enhance learning results in mathematics, increasing the average score from 52.71 to 82.87 (L. A. Putri et al., 2020). Additionally, a board medium for the Two-Variable Linear Equation System (SPLDV) material was created by Atmadi and Janan, who observed an increase in N-gain of 0.6724, or roughly 63.9% (Atmadi & Janan, 2023). According to Wardiatin, Rahayu, and Andriani, the application of realistic mathematics visual media can greatly enhance students' comprehension, demonstrating the effectiveness of visual media in elementary schools as well (Wardiatin et al., 2023).

It has also been demonstrated that other forms of media, like interactive films and audiovisual materials, improve students' learning of mathematics. After adopting interactive video media, Octaviani, Supatmi, and Yuliani found that grade V elementary school students' learning results for fractional material increased from 48% to 84% (Octaviani et al., 2022). Additionally, studies by Shelvi, Cahyani, and Ain demonstrate that audiovisual materials can significantly improve students' math performance and motivation to learn (Shelvi et al., 2024). Rangkuti, Situmorang, and Sidabutar discovered similar results, stating that audiovisual medium is useful in enhancing grade III elementary school pupils' comprehension of mathematical ideas (Rangkuti et al., 2025).

Realia media refers to actual objects used as teaching materials. The characteristics of realia media include being original objects that are intact, operable, alive, in their real size, and recognizable as they are. Through the use of real objects, the teaching and learning process can engage all of the students' senses. Additionally, one of the advantages of realia media is its ability to translate abstract ideas or concepts into something tangible and realistic (Fitra Amalia et al., 2023).

Realia media has several advantages that are highly beneficial in learning. First, it provides students with the maximum opportunity to learn something or perform tasks in real-life situations, allowing them to relate the learning experience to their daily lives. Second, the use of realia media enables students to directly experience actual situations, which not only deepens their understanding but also trains their skills by engaging as many senses as possible. This makes the learning process more concrete and engaging, helping students better grasp the concepts being taught (SaThierbach et al., 2021).

Mathematics education in schools plays a vital role in building students' character and skills, particularly in developing logical, rational, and critical thinking. Although students have been learning mathematics since elementary education, efforts to improve the quality of teaching continue to be made through various approaches and methods, aiming to support students' understanding and abilities (Wardiatin et al., 2023). At the Junior High School (SMP) level, mathematics education aims to equip students with knowledge and skills that are relevant to everyday life, while also preparing them for the next level of education. Mathematics is a mandatory subject for all students, from elementary school to the next level of education. The purpose is to help students think logically, analytically, systematically, and critically.

Generally, mathematics is seen by students as a difficult subject. Even today, many students still struggle and feel apprehensive about learning mathematics. This is often due to monotonous teaching methods or the lack of enjoyment in learning math. Therefore, alternative teaching methods are needed to make learning mathematics more enjoyable, one of which is by using applications that are already available and provided by third parties (Agustina & Martha Rusmana, 2019).

Relations and Functions is one of the more abstract mathematical materials since it necessitates that students have a mental understanding of the link between sets and the laws of element pairs. Visual learning materials that may illustrate the connection between domain and codomain elements in a tangible and engaging way are therefore required. The refusi board, a visual board that shows a diagram of the element pairings in a straightforward and understandable manner, is one of the pertinent media. This is consistent with Pertiwi & Novtiar's findings, which demonstrate that students make conceptual mistakes when attempting to understand relationships and functions. For this reason, unambiguous visual representations, like those found on refusei boards, are crucial (Pertiwi & Novtiar, 2022).

The usage of refusi boards is theoretically consistent with Dual-Coding Theory (Paivio), which holds that simultaneous verbal and visual information processing might enhance understanding and long-term memory (Kurniawan & Sari, 2022). According to empirical evidence from Liu et al. (2020), verbal and visual memory systems follow distinct but connected pathways, and both short-term and long-term memory capacity can be increased by presenting text and images in a clear, consistent manner, such on a board (Liu et al., 2020).

Based on previous research, Dita Mesrwati Hulu, in her study titled "The Influence of Visual Media Usage on Student Learning Outcomes," employed an experimental method. The results of the study showed a significant difference in student learning achievements between the class that used visual media and the class that did not. This was evidenced by a 13% difference in test results, with the class using visual media achieving 83%, while the class without visual media only scored 70%. Based on the analysis conducted at SMA MULIA PRATAMA MEDAN during the 2021/2022 academic year, it can be concluded that the use of visual learning media yields more effective results compared to learning methods without visual media.

Therefore, the dual coding principle is satisfied by using a refusi board that displays a representation of codomain domain pairs together with spoken explanations. This method may help students grasp topics more quickly and improve their long-term retention of the Relations and Functions content.

Based on this background, the purpose of this study is to ascertain how the use of visual aids, such as refusi boards, affects the learning outcomes of mathematics for students at Al-Munir Islamic Junior High School who are studying Relations and Functions. This study uses a quantitative approach with a quasi-experimental method and the non-equivalent group design model to analyze the effect of the independent variable on the dependent variable in two groups

that were not randomly selected. The main objective of this study is to determine whether the use of relation and function boards affects the learning outcomes of middle school students.

2. Methods

This study uses a quantitative approach with a quasi-experimental method and the non-equivalent group design model to analyze the effect of the independent variable on the dependent variable in two groups that were not randomly selected. In order to ascertain the impact of using visual media, such as refusi boards, on students' learning outcomes in mathematics, a posttest-only control group approach was employed. By comparing the outcomes to the control group, which did not receive the therapy, this design was selected because it was appropriate for assessing the effect of a treatment on the experimental group (Tondok et al., 2020). Two classes, one experimental and one control, from Al-Munir Islamic Junior High School's VIII were chosen to serve as research subjects. There are fifty students in all, with twenty-five students in each group. Purposive sampling is a sampling technique.

The researcher created a learning tool in the form of a Learning Implementation Plan (RPP) during the preparation phase. This tool was tailored to the visual learning approach, particularly the use of refusi board media, which serves to determine function values, identify non-functional relationships, and display the relationship between domain and codomain elements in the form of graphics. Furthermore, in compliance with the relevant curriculum, the researcher created a 30-question multiple-choice test instrument for learning outcomes based on competency attainment indicators (CP) and learning objectives in the Relations and Functions content. After preparing 30 questions, the author conducted validation with a mathematics expert and a teacher before the questions were given to the students. Then, reliability testing was carried out to determine which questions were valid. The results of the reliability test showed that 20 questions were valid and ready to be tested on the students.

Six meetings were held throughout the implementation phase. The refusi board, a visual aid for learning, is used in the experimental class. Students can manipulate parts, view the graphical representation of connections and functions, and witness the relationship's outcomes in the form of dynamic visuals. Through the use of media, learning activities are created using a Discovery Learning strategy, which enables students to investigate and uncover their own ideas. Conversely, the control group was taught using a traditional method, which included lectures, explanations of the content on the board, and practice questions devoid of visual aids. The purpose of this approach difference is to examine the precise impact that visual media has on students' learning results in mathematics (A. D. Putri & Wahyuni, 2021).

Following the learning process, a posttest using the same tool is administered to both groups to gauge the learning outcomes of the students in terms of their comprehension of concepts, their capacity for problem-solving, and their application of relationships and functions within the framework of fundamental mathematics. Because the learning outcome data was not normally distributed according to the results of the preceding normality test, the Mann-Whitney U non-parametric statistical test was used to collect and analyze the posttest results. Even though the

data were not normally distributed and the sample size was modest, the Mann-Whitney U test was used since it could evaluate the differences between two independent groups. The interpretation of the results is focused on the Asymp value. Sig. (2-tailed) as the basis for hypothetical decision-making, with a significance level set at 0.05 (Sari & Mulyana, 2020).

3. Result and Discussion

3.1 Result

The student learning outcomes in this study can be seen in table 1.

Table 1.
Student Post-test Scores

Skor	$\bar{x}$	SD
Experimental Class	79,72	16,147
Control Class	67,20	20,518

3.2.1. Post-Test Data Analysis of Experimental Class and Control Class Students

The data from the post-test results in the form of scores are analyzed first with a prerequisite test, namely the normality test. The normality test can be seen in table 2.

Table 2.
Results of Data Normality Test Post-test for Experimental Class and Control Class

Group	N	Statistic Shapiro-Wilk	Sig. (p-value)	Conclusion
Experimental	25	0,862	0,003	Abnormal
Control	25	0,882	0,008	Abnormal

Based on Table 2, the results of the normality test using Shapiro-Wilk showed that the data in the experimental group had a significance value of 0,003 and the control group of 0,008. Because the two values < 0,005, the data from both groups are not normally distributed. Therefore, hypothesis testing was continued using the Mann-Whitney U test. The Mann-Whitney U test can be seen in table 3 and table 4.

Table 3.
Ranks of Mann-Whitney U: Post-test Data Experimental Class and Control Class

Group	N	Mean Rank	Sum of Ranks
Experimental	25	29,86	746,50
Control	25	21,14	528,50
Total	50		

Table 4.
Statistics of Mann-Whitney U: Post-test Data Experimental Class and Control Class

Statistical Test	Value
Mann-Whitney U	203,500

Wilcoxon W	528,500
Z	-2,132
Asymp.Sig. (2-tailed)	0,033

Based on the results of the Mann-Whitney U test in table 4, a significance value of 0,033 (p < 0,005) was obtained, which shows that there was a significant difference in learning outcomes between students in the experimental class and the control class. The mean rank of the experimental class was 29,86 > 21,14 of the experimental class.

3.2.2. Effect Size (ES) Calculation

The calculation of effect size is carried out using the formula $r = \frac{Z}{\sqrt{N}}$ as stated by (Rosenthal, 1991).

$$r = \frac{Z}{\sqrt{N}} = \frac{-2,132}{\sqrt{50}} = \frac{-2,132}{7,071} = -0,301$$

The effect size value of 0.0301 is included in the medium effect category according to (Cohen, 1988), which states that:

- $0,10 - 0,29 = \text{small}$
- $0,30 - 0,49 = \text{medium}$
- $\geq 0,50 = \text{big}$

Thus, in addition to showing significant differences, the use of visual media also has a sufficient influence on the improvement of learning outcomes of Al-Munir Islamic Junior High School students.

3.2 Discussion

The purpose of this study is to ascertain how students' learning results in mathematics for the Relations and Functions subject are affected by the usage of visual media in the form of refusi boards. Following the learning treatment, the same posttest was administered to the experimental class (using the refusi board) and control class (using traditional methods). An Asymp value was derived from the analysis's findings using the Mann-Whitney U test. The significance level of 0.05 is exceeded by the sig. (2-tailed) of 0.033. This shows a significant difference between the learning outcomes of the two groups. The mean rank value of the experimental class was 29.86, while the control class only reached 21.14, which means that the use of the refusi board has a positive impact on students' understanding of mathematical concepts.

Clear, vibrant, and interactive arrow diagrams are the visual media of the refusi board utilized in this study, which is intended to show the interaction between domain and codomain elements. Students can witness firsthand how two sets are combined to create consecutive pairs with this view. The ability to translate abstract ideas into tangible representations is greatly aided by this vision.

Figure 1.
Refusi Board

The refusi board not only makes the subject more understandable but also promotes active student participation in class discussions and self-discovery. Through visual observation and manipulation, students participate in the process of knowledge production in addition to passively absorbing information. Students have a more intuitive understanding of the distinction between relationships and functions, learn to correlate domain elements with codomains, and comprehend functions as mapping.

As evidenced by the lower mean rank values, students in a control class that solely employed traditional lecture and practice techniques without visual aids, on the other hand, tended to struggle to comprehend sequential pair interactions. The limits of traditional teaching approaches in communicating abstract information are demonstrated by the fact that some pupils even make conceptual mistakes when figuring out function pairs.

Therefore, it can be said that the use of visual media in the form of refusi boards not only greatly improves student learning outcomes but also enhances the quality of learning interactions and students' conceptual understanding of relationship and function materials. This conclusion is based on both quantitative data and qualitative observations made during the learning process. It is strongly advised that this medium be used as a component of a student-centered, visual approach to mathematics education.

4. Conclusion

The use of realia media significantly affects the learning outcomes of students at Al-Munir Islamic Junior High School, according to the findings from data analysis and discussions. There was a significant difference between the experimental group using visual media and the control group using traditional learning methods. This difference was confirmed by the results of the

Mann-Whitney U nonparametric statistical test, which yielded a significance value of 0.033 (< 0.05).

Furthermore, the effect size calculation of 0.301 indicates that, according to Cohen's classification, the impact of visual media falls into the medium effect category. This suggests that using realia media not only has a statistically significant impact but also improves student learning outcomes in a meaningful and practical way. Therefore, relia media can be utilized as an effective alternative learning strategy to enhance student comprehension and learning outcomes, particularly in subjects that require a deep conceptual and visual understanding.

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