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OPTIMIZING THE RATIO CONCEPT LEARNING THROUGH GAME WORDWALL IN 4TH GRADE ELEMENTARY SCHOOL

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Abstract

This study aimed to evaluate the effectiveness of using Wordwall games to enhance fourth-grade elementary school students' understanding of ratio concepts. A one-group pretest-posttest design was implemented involving 19 participants. Data were gathered through pretest and posttest assessments administered before and after the instructional intervention utilizing Wordwall games. The results of the paired samples t-test revealed a statistically significant improvement in students' performance, with pretest scores ($M = 42.63$, $SD = 11.349$) substantially lower than posttest scores ($M = 80.79$, $SD = 9.319$), $t(18) = -29.806$, $p < .001$. Additionally, Pearson correlation analysis indicated a strong and significant positive relationship between pretest and posttest scores ($r = 0.872$, $p < .001$), suggesting consistency in learning gains. These findings demonstrate that integrating gamified learning tools such as Wordwall games can effectively support students' comprehension of mathematical concepts, particularly ratios. The study underscores the pedagogical value of gamification in elementary mathematics education, offering both cognitive and motivational benefits that contribute to improved learning outcomes.

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Keywords: Wordwall game; Ratio concepts; Learning effectiveness; Gamification.

INTRODUCTION

Understanding the concept of ratio is one of the most important basic skills in mathematics, especially for elementary school students. This concept is not only the basis for understanding more complex mathematics, but also has practical applications in everyday life. However, many students still have difficulty understanding the concept of ratio due to conventional and less interactive learning. (Dewi & Ekawati, 2022; Kimmons, 2020; Lamon, 2020).Learning that only relies on lectures and practice questions is often inadequate to accommodate the various learning styles of students, causing difficulties in understanding the concept of ratio in depth and its application in everyday life (Amalia & Mawardini, 2023; Fiani et al., 2024).

In this digital era, the use of technology in learning has become an effective alternative to increase student interest and understanding. One innovation that can be applied is the use of educational games such as Wordwall. Wordwall is an interactive learning platform that allows teachers to create games and quizzes that can be used in the classroom learning process (Rodriguez-Escobar et al., 2023; Safitri et al., 2022; Timotheou et al., 2023). The use of this digital platform not only provides a fun and interactive learning environment, but also allows students to learn in a way that is more suited to their needs and learning pace (Sakti, 2023; Wahyudi & Jatun, 2024).

Previous studies have shown that the use of educational games can increase students' learning motivation and make the learning process more interesting and meaningful (F. A. Rahma & Nurlaelah, 2024). Educational games such as Wordwall provide a more contextual and applicable learning experience, helping students to better understand abstract concepts. (Hasanah & Sutiah, 2023). In the context of mathematics learning, games like Wordwall can help students understand abstract concepts in a more concrete and fun way (Rahma et al., 2023; Syamsudin et al., 2024). Therefore, the integration of technology in learning not only improves students' understanding but also provides a more memorable learning experience (Khreisat et al., 2024; Shihab et al., 2023).

This study aims to examine the effectiveness of using the Wordwall game in optimizing learning the concept of ratio in grade 4 elementary school students. With this approach, it is expected that students can more easily understand the material and be motivated to learn through fun and interactive methods (Allman et al., 2024; Kirana & Al Ghani, 2024). This study not only aims to improve students' understanding of the concept of ratio, but also to evaluate how effective educational games are in increasing student engagement and motivation to learn.

Furthermore, this research is expected to make a significant contribution to the development of innovative and effective learning methods at the basic education level. The findings obtained from this research are expected to serve as an important reference in the development of more advanced educational technology that is relevant to the needs of current students.

METHODS

This study adopts a quantitative approach with a quasi-experimental method with a design. one group pretest-posttest design (Hastjarjo, 2019). This design involves one group receiving one treatment and taking measurements before and after the treatment. The one group pretest-post test design scheme is shown in Table 1.

Table 1. One group pretest-posttest design scheme

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2

In one group pretest-posttest design, the sample is first given a pretest (O_1) before the treatment is applied. Then the treatment is given using the Wordwall game (X), and after the treatment is given, the sample is given a posttest (O_2).

The population of this study was 4th grade students of Aisiyah Mataram Elementary School, as many as 19 students as samples selected by purposive sampling. The instrument used in this study was a ratio concept understanding test consisting of 10 multiple-choice questions that measure the level of students' understanding of the ratio concept.

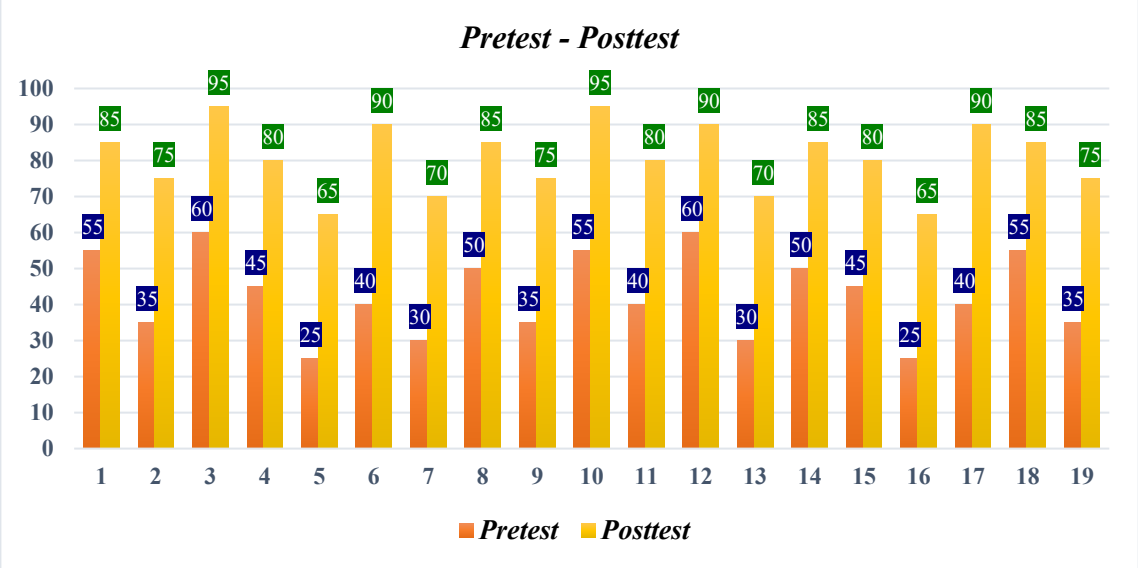
The research procedure was carried out by having the sample fill out a pretest before being given treatment. Then, the sample was given treatment by delivering material using the

Wordwall game for three weeks. Each week there were three learning sessions, each lasting 45 minutes. After the treatment was completed, the sample took a posttest using the same instrument as in the pretest.

The data collected from the pretest and posttest were analyzed using a paired t-test to evaluate whether there was a significant difference between the pretest and posttest scores. This statistical analysis was performed with the help of SPSS version 26 software.

RESULTS

The results of the study showed an increase in students' understanding of the concept of ratio after using the Wordwall game in learning. This can be seen from the posttest scores which were higher than the pretest scores for most students, as shown in Graph 1.



Graph 1. Pretest and posttest results

The results shown in graph 1 show that of the 19 students who were the subjects of the study, almost all of them experienced an increase in their scores in understanding the concept of ratio after learning with game intervention Wordwall. This increase in score indicates that the Wordwall game has the potential to be an effective learning medium to improve understanding of the ratio concept.

To test the significance of the increase in the understanding score of the ratio concept after using the Wordwall game, a paired samples t-test was conducted.

Table 2. Paired Samples Statistics Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre	42,63	19	11,349	2,604
	Post	80,79	19	9,319	2,138

Based on the table data, it can be seen that there is a significant increase in the average value from pretest to posttest, where the average pretest value is 42.63 while the average posttest value is 80.79.

Table 3. Paired Samples Correlations Test

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre & Post	19	0.872	0,000

Based on the results of the paired samples correlations, it can be concluded that there is a strong and significant positive correlation between the pretest and posttest scores. There is a strong and significant positive correlation between the pretest and posttest scores ($r = 0.872$, $p < 0.001$). This shows that subjects with high pretest scores tend to have high posttest scores as well.

Table 4. Paired Samples Test

Paired Samples Test

							t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pre - Post	-38,158	5,580	1,280	-40,848	-35,468	-29,806	18	0,000

Based on the results of the Paired samples t-test conducted on 19 subjects, it showed a very significant difference between the ratio concept understanding scores before the pretest and after the posttest using the Wordwall game ($t(18) = -29.806$, $p < 0.001$).

The average score of understanding the concept of ratio after using the Wordwall game ($M = 80.79$, $SD = 9.319$) was much higher than the score before using the Wordwall game ($M = 42.63$, $SD = 11.349$). The average difference of -38.158 showed a substantial increase

in the score. So it can be concluded that the Wordwall game is effective in improving the understanding of the concept of ratio in grade 4 elementary school students.

Based on the results of the data analysis that have been described, there is a significant increase in the understanding of the ratio concept of grade 4 elementary school students after implementing learning using the Wordwall game. The significant increase in scores from pretest to posttest ($t(18) = -29.806$, $p < 0.001$) shows that the Wordwall game contributes positively to optimizing learning the ratio concept.

DISCUSSION

This finding is in line with the constructivist learning theory that emphasizes the importance of active student involvement in the learning process (Stapleton & Stefaniak, 2019). The Wordwall game provides an interactive and fun learning environment, allowing students to construct their own knowledge through exploration, experimentation, and interaction with learning materials (Mukti et al., 2024; Taiyeb, 2024). Features in Wordwall such as quizzes, matching games, and anagrams stimulate active student participation, increase learning motivation, and facilitate a deeper understanding of the concept of ratio (Atika & Amelia, 2024; Marlita et al., 2024).

The results of this study also support previous studies that show the effectiveness of games in improving learning outcomes. Several studies have shown that the use of digital games can improve students' motivation and learning achievement in mathematics learning (Islam et al., 2024; Novita & Sundari, 2020). Other studies have found that educational games are effective in improving students' conceptual understanding and problem-solving skills (Firdausi, 2022; Handican et al., 2023).

More specifically, several studies have shown the effectiveness of Wordwall in improving student learning outcomes. Lubis & Nuriadin (2022), found that the Wordwall application was effective in improving student learning outcomes in elementary school mathematics. Other studies have shown that Wordwall can increase student learning interest (Ferlina & Fratiwi, 2024), improve students' critical thinking skills (Cahyaningsih et al., 2024; Saptaaji et al., 2023), and help students understand mathematical concepts better (Oktaviasari et al., 2024).

The strong positive correlation between pretest and posttest scores ($r = 0.872$, $p < 0.001$) indicates that students with better prior understanding tend to show greater improvement after receiving the intervention. This suggests that the Wordwall game can be used to strengthen the understanding of students who already have sufficient prerequisite knowledge, while also helping students who are still struggling to understand the concept of ratio (Cahyaningsih et al., 2024; Fauziyyah & Priatna, 2024; Oktaviasari et al., 2024).

However, this study has several limitations. First, this study was conducted on a small scale with a limited number of samples. Second, this study only focused on the use of the Wordwall game in learning the concept of ratio. Therefore, further research is needed with a larger scale and more diverse variables to strengthen the generalization of the research results.

The results of this study have important implications for learning practices in elementary schools. Wordwall games can be used as an alternative learning media that is interesting and effective to improve students' understanding of mathematical concepts, especially the concept of ratio. Teachers can utilize the various features available in Wordwall to create a fun and meaningful learning experience for students.

CONCLUSION

Based on the results and discussion, it can be concluded that the use of the Wordwall game significantly enhanced 4th grade students' understanding of the concept of ratio. Statistical analysis using a paired samples t-test demonstrated a marked improvement in student performance, with post-test scores significantly higher than pre-test scores. The strong positive correlation between pre- and post-test scores further suggests that the intervention effectively supported learners across varying levels of prior knowledge.

The success of Wordwall as a learning tool can be attributed to its interactive design, immediate feedback mechanisms, and the diversity of engaging game formats that reinforce conceptual understanding. These pedagogical features contribute to its effectiveness in making learning both enjoyable and impactful.

In view of these outcomes, it is recommended that future research explore the application of Wordwall across different subjects and educational levels to assess its broader educational utility. Expanding sample sizes and incorporating longitudinal and qualitative

approaches could provide deeper insights into its impact on long-term learning and classroom dynamics. Integrating Wordwall with complementary instructional strategies may further enhance its pedagogical potential.

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