The Influence of Wordwall Game Media on Students' Creativity and Conceptual Understanding in Elementary Schools

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Abstract: Creativity and conceptual understanding are the main components in supporting more meaningful learning, because students are not only required to memorize information, but also to use it creatively in real life situations. This study aims to describe the effect of Wordwall Game Media on creativity and conceptual understanding of elementary school students. This type of research is a quasi-experimental study. The data collection technique is a creativity test and conceptual understanding. The results of the study show that the use of Wordwall Game Media has a significant influence on increasing creativity and conceptual understanding of elementary school students, value of creativity is 0.115 and the sig. value of conceptual understanding is 0.773. The use of this media has been proven to improve students' creative thinking skills, including fluency, flexibility, and elaboration of ideas, as well as deepening their conceptual understanding through more interesting and applicable interactions. Several recommendations can be suggested so that teachers and education practitioners consider the use of Wordwall Game Media as a learning aid to improve students' creativity and conceptual understanding. Further research can be conducted to explore the effectiveness of this media in various subjects and levels of education.

Keywords: Conceptual understanding; Creativity; Media; Wordwall game

Introduction

Creativity and conceptual understanding are two important skills that are the basis for 21st century learning. Creativity is defined as an individual's ability to generate new and original ideas, which are relevant and useful in solving a problem or facing a challenge (Runco & Pritzker, 2020). On the other hand, conceptual understanding refers to students' ability to connect existing knowledge with practical applications, enabling students to deeply internalize information and apply it in a variety of contexts (Entwistle, 2017). Both of these abilities are the main components in supporting more meaningful learning, because students are not only required to memorize information, but also to use it creatively in real-life situations.

Creativity and conceptual understanding can be measured through various indicators that reflect high-level thinking skills. Indicators of creativity include fluency (fluency in generating many ideas), flexibility (ability to generate varied ideas), originality (uniqueness or novelty of ideas), and elaboration (development of ideas in detail) (Kaufman, 2016; Glăveanu, 2018). Meanwhile, conceptual understanding is demonstrated through students' ability to recognize relationships between concepts, explain in their own words, provide concrete examples, and apply concepts in real situations (Chandio et al., 2016). Previous studies have confirmed that these indicators are interrelated and contribute to supporting an effective learning process (Abraham, 2022; Yulaikah et al., 2022).

Creativity and conceptual understanding play a strategic role in the cognitive and social development of

students at the elementary school level. At this stage, students are in the development phase of concrete thinking towards abstract, so the ability to be creative and understand concepts becomes an important foundation for future learning success (Singer, 2017; Duchesne & McMaugh, 2018). Creativity enables students to solve problems innovatively and see challenges from multiple perspectives, while conceptual understanding helps students to integrate the knowledge gained with real experiences (Raphael-Leff, 2018; Cropley, 2015). In addition, various studies show that students who have creativity and good conceptual understanding tend to be more adaptive in dealing with complex situations and are able to achieve optimal learning outcomes (Fakhriyani, 2016; Robinson & Aronica, 2016). Various studies show that the use of innovative learning media can be an effective alternative to improve students' creativity and conceptual understanding, especially at the elementary school level (Asmara et al., 2023; Sitorus & Masrayati, 2016).

One of the innovative learning media that can be used to improve students' creativity and conceptual understanding is the Wordwall Game Media, which is an interactive digital platform designed to support learning activities through educational games. This media allows teachers to create various learning activities, such as quizzes, puzzles, and other interactive games that can be accessed online or offline (Bouzaiane & Youzbashi, 2024). With a variety of engaging formats, Wordwall Game not only increases student engagement in learning, but also facilitates the development of critical thinking skills, collaboration, and creativity (Zahrah & Anwar, 2023). In addition, this platform supports the implementation of technology-based learning that is relevant to the digital era, where students can learn more flexibly, responsively, and according to individual needs (Herta et al., 2023). Technology-based learning media such as Wordwall Game can stimulate students' creativity because it provides varied challenges and provides direct feedback. In addition, the interactive elements of the game also allow students to think flexibly and adapt student learning strategies according to the situation given in the game (Serrano, 2019). Gamification-based learning media can improve conceptual understanding because students are more actively involved in the learning process and have the opportunity to receive direct feedback. This helps students to improve their understanding of the material being studied, as well as improve their memory of the information (Zeybek & Saygı, 2024). Thus, Wordwall Game Media plays an important role in developing students' creativity and conceptual understanding in a fun, challenging, and repetitive way.

Previous studies have shown that the use of technology-based learning media has a positive impact on students' creativity and conceptual understanding. Interactive digital media is able to create a learning environment that supports the exploration of ideas, thereby increasing students' ability to think creatively (Wu & Chen, 2020). Integration of technology into learning, such as educational games, can help students understand complex concepts through interactive and fun visualizations (Hwang et al., 2015). The use of game-based digital media improves students' ability to connect theoretical concepts with practical applications in science learning (Mulyasari et al., 2021). Overall, these results indicate that technology-based media, including Wordwall Game, have great potential to enhance students' creativity and conceptual understanding through an innovative and relevant approach to today's learning needs.

Based on the background above, this study aims to describe the influence of Wordwall Game Media on creativity and conceptual understanding of elementary school students. This kind of research is important because increasing creativity and conceptual understanding are two key elements in forming 21st century competencies, including critical thinking skills, communication, collaboration, and digital literacy (Peña-Ayala, 2021). In the midst of rapid technological developments, an innovative approach to learning is needed that is able to respond to students' needs holistically (Luo, 2022). Thus, this study is expected to provide practical contributions in improving the quality of learning through Wordwall Game Media, as well as providing theoretical insights that enrich the literature on the application of Wordwall Game Media in the context of elementary education so as to support effective and meaningful learning.

Method

Table 1. Pretest-posttest with nonequivalent control group design

Class	Pretest	Treatment	Posttest
Control	T_1	-	T_2
Experiment	T_1	X	T_2

This type of research is quasi-experimental, namely a research method used to test the causal relationship between independent variables and dependent variables without full control over external variables or randomization processes (Reichardt, 2019). Quasi-experimental research aims to provide practical information about the effectiveness of interventions in a less controlled environment, so that the results can be applied in real-world contexts (Creswell & Creswell,

2017). In the context of this study, the researcher wants to describe the influence of Wordwall Game Media (independent variable) on creativity and conceptual understanding (dependent variable) of elementary school students, so that the results can be applied in other real learning contexts. The design that the researcher uses is Pretest-Posttest Only Control Group Design (Payadnya & Jayantika, 2018).

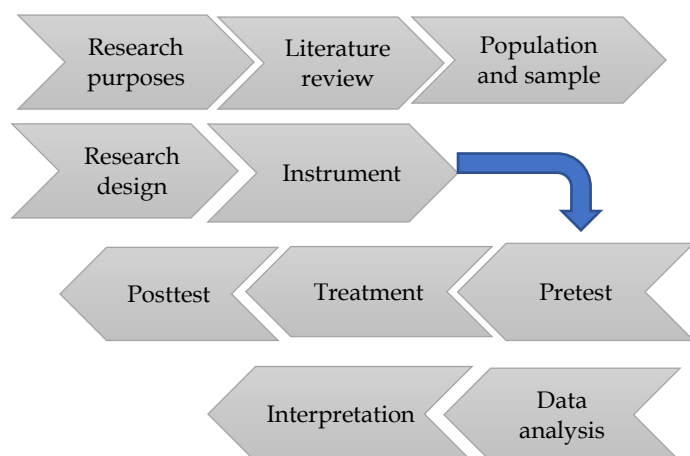Below, the researcher presents the research flow that will be implemented.

Figure 1. Research flow chats

The population in this study were students SD Negeri Wonosari 01 Puger Jember with a sample of class VI. The research was conducted in the Odd Semester of the 2024/2025 Academic Year in Mathematics with the topic of Fractions and Decimals.

The data collection technique in this study is a test. A test is a data collection method used to measure knowledge, skills, abilities, attitudes, or other characteristics of an individual systematically (Reynolds & Livingston, 2021). This technique is often used in quantitative research because the results are in the form of numerical data that can be analyzed statistically to answer research questions or test certain hypotheses (Creswell & Creswell, 2017). In the context of this study, the test was used to measure creativity and conceptual understanding of elementary school students after the implementation of the Wordwall Game Media. The test was compiled based on creativity indicators related to the material. Fractions and Decimals, which includes fluency, flexibility, originality, and elaboration, as well as the concept of Fractions and Decimals.

The pretest data of creativity and conceptual understanding that have been collected in this study will first undergo prerequisite tests, namely homogeneity tests and normality tests. Homogeneity test researchers do to confirm if the groups to be compared have the same variability. While the normality test researchers do

with the aim of being able to check whether the normal distribution assumption is acceptable or not.

After fulfilling the prerequisite tests, the researcher collected posttest data of creativity and conceptual understanding in the control class (not using Wordwall Game Media) and experimental class (using Wordwall Game Media). The data will be tested using Multivariant Analysis of Variance or MANOVA. at a 5% error rateon the following basis (Sugiyono, 2017).

- H_0 = There is no significant effect Wordwall Game Media on Creativity and Conceptual Understanding of Elementary School Students
- H_a = There is a significant influence Wordwall Game Media on Creativity and Conceptual Understanding of Elementary School Students

The formula that researchers use is MANOVA test with the help of SPSS 21 for Windows are as follows. The MANOVA test formula is

$$Y_1 i, Y_2 i = \alpha 0 + \beta 1\ Xi + \varepsilon i \qquad (1)$$

MANOVA itself can be interpreted as a statistical method that aims to explore the relationship between several independent variables of the categorical type (nominal or ordinal) with several dependent variables of the metric type (interval or ratio) (Santoso, 2015).

Result and Discussion

Based on the research conducted, the researcher will first present the results of the homogeneity test and normality test as a form of prerequisite test. The homogeneity test was analyzed based on the results of the creativity and conceptual understanding pretest to determine whether the groups to be compared have homogeneous variances or not. The results are as follows can be seen in the following table.

Table 2. Creativity homogeneity test

Levene Statistics	df1	df2	Sig.
2.523	1	118	.115

Table 3. Concept understanding homogeneity test

Levene Statistics	df1	df2	Sig.
.084	1	118	.773

Based on the results of the homogeneity test above, it shows that the sig. value of creativity is 0.115 and the sig. value of conceptual understanding is 0.773. Because the sig. values of both are > 0.05, it can be concluded that the sample variance is homogeneous.

Table 4. Creativity normality test

Group	Kolmogorov-Smirnov		
	Statistics	df	Sig.
1	.109	60	.073
2	.110	60	.066

The normality test was analyzed based on the results of the creativity and conceptual understanding pretest to determine whether the normal distribution assumption is acceptable or not. The results are as follows can be seen in Table 4 and 5.

Table 5. Concept understanding normality test

Group	Kolmogorov-Smirnov		
	Statistics	df	Sig.
1	.127	60	.084
2	.095	60	.200*

Based on the results of the normality test above, it shows that the sig. value of creativity and conceptual understanding in the Kolmogorov-Smirnov column in the control group and the experimental group are normally distributed because > 0.05.

After fulfilling the prerequisite tests, the researcher collected posttest data of creativity and conceptual understanding in the control class (not using Wordwall Game Media) and experimental class (using Wordwall Game Media). Here are the results: The highest student score obtained in the control group was 86 and the lowest was 73. The mean score was 77.87 with a standard deviation of 3.95. A complete description of the analysis of the control group's creativity posttest scores can be seen in the following table.

Table 6. Statistical data of posttest creativity scores of control group

Statistic Posttest Control		
N	Valid	44
	Missing	0
Mean		77.8750
Std. Error of Mean		.69958
Median		77.0000
Mode		73.00
Std. Deviation		3.95743
Variance		15,661
Skewness		.629
Std. Error of Skewness		.414
Kurtosis		-.661
Std. Error of Kurtosis		.809
Range		13.00
Minimum		73.00
Maximum		86.00
Sum		2492.00
Percentiles	25	75,0000
	50	77.0000
	75	81.0000

The highest student score obtained in the experimental group was 89 and the lowest was 75. The mean value was 83.5 with a standard deviation of 4.45. A complete description of the analysis of the post-test creativity scores of the experimental group can be seen in the following table.

Table 7. Statistical data of experimental group's posttest creativity values

Posttest Experiment Statistics		
N	Valid	44
	Missing	0
Mean		83.5188
Std. Error of Mean		.65644
Median		87.0000
Mode		87.00
Std. Deviation		4.45340
Variance		13,789
Skewness		.663
Std. Error of Skewness		.414
Kurtosis		-.078
Std. Error of Kurtosis		.809
Range		15.00
Minimum		75.00
Maximum		89.00
Sum		2791.00
Percentiles	25	84.0000
	50	87.0000
	75	89.0000

The highest student score obtained in the control group was 78 and the lowest was 58. The mean score was 67.78 with a standard deviation of 5.7. A complete description of the analysis of the post-test scores for understanding the concept of the control group can be seen in the following table.

Table 8. Statistical data of posttest value of concept understanding of control group

Statistic Posttest Control		
N	Valid	44
	Missing	0
Mean		67.7875
Std. Error of Mean		.69741
Median		72.0000
Mode		75.00
Std. Deviation		5.71259
Variance		21,544
Skewness		-.304
Std. Error of Skewness		.414
Kurtosis		-.842
Std. Error of Kurtosis		.809
Range		14.00
Minimum		58.00
Maximum		78.00
Sum		2302.00
Percentiles	25	69.0000

Statistic Posttest Control	
50	72.0000
75	75.7500

The highest student score obtained in the experimental group was 97 and the lowest was 72. The mean score was 85.3 with a standard deviation of 6.54. A complete description of the analysis of the post-test scores for understanding the concept of the experimental group can be seen in Table 9.

From the results of the control and experimental group scores obtained through creativity tests and students' conceptual understanding, the MANOVA test results will be presented, which can be seen in the Table 10.

Based on the output of the MANOVA test results on Table 10, it is known that the value of Pillai's Trace, Wilk's Lambda, Hotelling's Traceand Roy's Largest Root has a sig. 0.000 < 0.05. This can be interpreted as if there is an influence of Wordwall Game Media on the creativity and understanding of elementary school students' concepts of what is accepted and rejected.$H_a H_0$.

Table 9. Statistical data of posttest values of concept understanding of experimental group

Posttest Experiment Statistics		
N	Valid	44
	Missing	0
Mean		85.3438
Std. Error of Mean		.65320
Median		85.0000
Mode		85.00
Std. Deviation		6.54320
Variance		42.814
Skewness		.419
Std. Error of Skewness		.414
Kurtosis		-.403
Std. Error of Kurtosis		.809
Range		16.00
Minimum		72.00
Maximum		97.00
Sum		2731.00
Percentiles	25	83.0000
	50	85.0000
	75	90.0000

Table 10. MANOVA significance test results

Effect		Value	F	Hypothesis df	df error	Sig.	Noncent. Parameter	Observed Power
Intercept	Pillai's Trace	.998	20050.996	2.000	61.000	.000	40101.992	1.000
	Wilk's Lambda	.002	20050.996	2.000	61.000	.000	40101.992	1.000
	Hotelling's Trace	657,410	20050.996	2.000	61.000	.000	40101.992	1.000
	Roys Largest Root	657,410	20050.996	2.000	61.000	.000	40101.992	1.000
Class	Pillai's Trace	.626	50.997	2.000	61.000	.000	101.995	1.000
	Wilk's Lambda	.374	50.997	2.000	61.000	.000	101.995	1.000
	Hotelling's Trace	1,672	50.997	2.000	61.000	.000	101.995	1.000
	Roys Largest Root	1,672	50.997	2.000	61.000	.000	101.995	1.000

Computed using alpha = 0.05

Discussion

The results of this study indicate that the use of Wordwall Game Media has a significant influence on creativity and conceptual understanding of elementary school students. This finding is relevant to previous studies that confirm that technology-based learning media has great potential to increase student engagement and learning effectiveness (Luo, 2022; Nurfadhillah et al., 2021). In this study, students who used Wordwall Game Media showed increased ability in creativity, as seen from indicators of fluency, flexibility, and idea elaboration. In addition, students' conceptual understanding also increased, especially in their ability to understand and apply Fractions and Decimals material comprehensively.

The influence of Wordwall Game Media on students' creativity can be explained through the interactive features and gamification elements offered by this media. As a learning tool, Wordwall Media gives students the freedom to explore materials independently, complete challenges in various ways, and get direct feedback. Interactive elements in gamification can stimulate students' creativity because they are encouraged to think outside the box and solve problems in innovative ways (Serrano, 2019).

In terms of conceptual understanding, the results of this study support study that show that gamification-based learning can improve students' ability to understand and apply concepts in depth (Zeybek & Saygı, 2024). This is because media such as Wordwall facilitates the delivery of information in a visual, engaging, and repetitive manner, which helps students absorb and internalize the material. In addition, this learning approach also increases students' learning motivation, which is an important factor in understanding concepts (Ryan & Deci, 2016).

The results of this study also revealed that technology-based learning media improves students'

learning experiences and produces better critical thinking skills (Nurfadhillah et al., 2021). In this context, the Wordwall Game Media not only helps students in understanding Fractions and Decimals material, but also builds a more fun, interactive, and challenging learning atmosphere.

However, the results of this study also indicate the importance of good management and guidance by teachers when using this media. The effectiveness of technology in learning is highly dependent on the competence of teachers in designing and integrating the technology into the learning process (Willermark, 2018). Therefore, training and guidance for educators in utilizing technology-based learning media needs to be a priority to optimize student learning outcomes.

Overall, this study strengthens the evidence that the use of Wordwall Game Media can have a positive impact on students' creativity and conceptual understanding. In addition to supporting the results of previous studies, these findings also provide practical contributions to the development of learning strategies in the digital era, especially at the elementary school level.

Conclusion

Based on the results of the research and discussion that has been done, it can be concluded that the use of Wordwall Game Media has a significant influence on increasing creativity and understanding of elementary school students' concepts. The use of this media has been proven to improve students' creative thinking skills, including fluency, flexibility, and elaboration of ideas, as well as deepening their understanding of concepts through more interesting and applicable interactions. This study supports previous findings that show that technology-based media, especially those that adopt gamification elements, can significantly improve student learning outcomes. Therefore, Wordwall Game Media can be an effective alternative in supporting learning in elementary schools, especially in the context of increasing creativity and understanding of concepts. Based on the findings of this study, several recommendations can be suggested, namely: Teachers are advised to integrate Wordwall Game Media into the learning process routinely, especially to improve students' creativity and conceptual understanding. The use of this media can be applied in various subjects by adjusting the needs and characteristics of the material being taught; Intensive training is needed for teachers to improve their understanding in utilizing technology, especially gamification-based learning media, in order to optimize the potential of media such as Wordwall in supporting effective and interesting learning; and Further research needs to be done to explore various types of other gamification media and compare their impacts on various aspects of student abilities, including problem solving, social skills, and learning motivation. Research at various levels of education and subjects is also important to determine the effectiveness of this media in a broader context.

Author Contributions
R.M.W. contributed in conceptualizing the research idea, developing the instrument, collecting data, analyzing data, and writing the article. A.Z.E. and E.T. as supervisors who have managed the research activities from conceptualizing the research idea to writing, reviewing, and editing the article. All authors have read and approved the published manuscript.

Conflict Interest
The authors declare no conflict of interest.

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