

## **The influence of using wordwall media on students' conceptual understanding of composition function material**

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### **Abstract**

The main objective of using Wordwall learning media is to facilitate students in understanding mathematical concepts, particularly in composition function material, through interactive and engaging activities. The method used is a quasi-experiment with a Nonequivalent Control Group Pretest-Posttest Design involving two grades of XI high school, namely the experimental class that learned using WordWall media and the control class that learned conventionally. Data were obtained through essay tests that had been tested for validity, reliability, difficulty level, and discriminatory power, then analyzed using the Liliefors normality test, Bartlett's homogeneity test, and the Independent Sample t-test with the help of SPSS. The results showed that the data were normally distributed and homogeneous, and the significance value (Sig.)  $< 0.05$ , which indicates a significant difference between the understanding of the concept in the experimental and control classes. In addition, more than 75% of students in the experimental class achieved the Minimum Completion Criteria (KKM), so it can be concluded that the use of WordWall media is effective in improving the understanding of mathematical concepts.

**Keywords:** Composition Function; Concept Understanding; Quasi-Experiment; T-test; WordWall.

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## **INTRODUCTION**

Conceptual understanding is a fundamental aspect in mathematics learning, because students who are able to understand concepts well will more easily apply that knowledge in solving various problems. Ummah (2019) stated that conceptual understanding includes students' ability to think, behave, and act in understanding the definition, specificity, nature, and essence of mathematics, including in identifying the appropriate procedures for solving problems. In line with this, JR Sengkey et al., (2023) emphasized that conceptual understanding not only helps students solve problems but also plays a role in developing higher-order thinking skills that are very important in meaningful learning. Given that every material in mathematics is interconnected and forms a continuous knowledge structure, a strong conceptual

understanding is an important requirement for student learning success. When students do not Even if students understand the basic material well, they will have difficulty understanding the following material, which can ultimately lead to increasingly complex confusion or misunderstandings (Hikmah, 2017) . Therefore, a deep understanding of concepts needs to be instilled early on so that students can build knowledge consistently and achieve success in mathematics learning as a whole. However, facts in the field show that students' level of understanding of mathematical concepts is still in the low category.

Research by Fajar et al., (2019) A study at SMP Negeri 17 Kendari showed that only 3% of students had a high conceptual understanding, 10% were in the moderate category, and the remaining 87% were classified as low, especially in understanding basic algebraic concepts and their application in problem solving. Similar findings were also presented by Hidayat (2017) which shows that only 12% of junior high school students in Bandung have a high level of conceptual understanding, while most students have difficulty interpreting concepts into symbolic forms or appropriate mathematical representations. Similarly, Sari and Suparman (2018) reported that more than 70% of students in Mataram City were unable to connect the mathematical concepts they had learned with their application in story problems, indicating weak conceptual understanding in real-life contexts and difficulties in applying these concepts practically. Furthermore, the same study revealed that in Karanganyar Regency only 15% of students were able to explain algebraic concepts correctly and consistently, while the majority experienced difficulties in recognizing general forms and performing basic algebraic operations, including the use of variables and the simplification of expressions. This indicates that students have not yet fully understood the essence of mathematical concepts. Nuraeni et al. (2018) strengthens these findings by stating that many students are unable to re-explain mathematical concepts in their own words, indicating that their understanding is still procedural memorization without truly understanding the meaning of the concepts being learned. This condition indicates that poor conceptual understanding is a serious problem that needs to be addressed immediately in the mathematics learning process in schools.

One of the main causes of students' low understanding of mathematical concepts is the use of teaching methods that are less varied, do not actively involve students, and minimal use of interesting and meaningful learning media. Ayu Ardani et al., (2018) stated that mathematics learning tends to be considered boring because teachers rarely use innovative media, resulting in students being passive and less enthusiastic about delving deeper into the material. This finding is reinforced by Sulistyو & Alyani (2021). who found that the use of visually appealing

and interactive learning media can increase learning motivation while facilitating better conceptual understanding. In addition, Yulianty (2019) emphasizes that learning that only emphasizes cognitive aspects without considering affective and psychomotor elements makes it difficult for students to connect the material to real-life experiences. To address this problem, learning strategies are needed that can comprehensively integrate cognitive, affective, and psychomotor aspects. Edutainment elements in learning can also be an effective approach to increasing student engagement. Hidayat (2017) Studies have shown that the use of interactive game-based digital media can increase interest, active engagement, and understanding of mathematical concepts through enjoyable and meaningful learning experiences. Therefore, updating learning methods and media is very important to improve students' understanding of mathematical concepts, one of which is through the use of interactive learning media such as WordWall.

WordWall is a digital learning media based on interactive games and is considered effective in helping mathematics learning. This media is easy to use by teachers and students and has been proven to be able to increase conceptual understanding and student involvement in the learning process. Sahanata et al., (2023) and T. Untung et al., (2024) said the use of WordWall as a learning aid is considered interesting and effective in developing students' understanding of mathematical concepts. According to Pradani (2022) , WordWall is also able to increase student involvement in the learning process and help organize information visually so that it can facilitate understanding of concepts. Another study conducted by Annisa (2024) concluded that the use of WordWall media is effective in improving student learning outcomes in mathematics material. In today's digital era, the use of digital learning media is not only a trend, but a necessity to create interactive and meaningful learning.

The material of composition functions is one part of mathematics that requires a deep understanding of the concept because it involves combining two related functions. A good understanding of this material is important so that students are not only able to solve problems procedurally, but also understand the meaning and application of composition functions in various contexts (Sengkey et al., 2023; Ummah, 2019) but in reality, many students still have difficulty in understanding this concept because of its abstract nature and the lack of interactive learning methods (Hasibuan & Dalimunthe, 2022) In this context, the use of media such as WordWall becomes very relevant. WordWall can help students visualize and organize the concept of composition functions in a fun and interesting way (Sahanata et al., 2023; A. Pradani, 2022) Through interactive activities. Untung et al, (2024) and Annisa, (2024) said available in

WordWall, students can explore and deepen their understanding of the function of composition, making the concept more concrete and easier to apply.

Based on this background, this study aims to determine the effect of using WordWall media on students' understanding of mathematical concepts in composition material. This research is expected to provide practical contributions for teachers in implementing more innovative media and provide alternative solutions to improve the quality of mathematics learning. With the innovation of this digital learning media, it is hoped that the teaching and learning process will be more interactive, enjoyable, and have a positive impact on students' conceptual understanding, especially in understanding the material on composition functions.

## **METHODS**

This research uses a quantitative approach with quasi-experimental method because it aims to test the hypothesis and determine the effect of using WordWall media on students' understanding of mathematical concepts. The research design used is the Nonequivalent Control Group Pretest-Posttest Design, which involves two groups, namely the experimental group that received learning using WordWall media, and a control group that received conventional learning. This design was chosen because it allowed researchers to compare the learning outcomes of the two groups and observe the effects of the treatment under conditions that approximated the actual experiment

The research population was all 2th grade students of SMA Negeri 11 Bandar Lampung in the 2025/2026 academic year. The sample was determined using a purposive sampling technique. Based on considerations of the equivalence of students' initial abilities, as measured by pretest scores on the composition function material. Based on the results of the initial analysis, two classes with relatively equal abilities were obtained, so one was designated as the experimental class and the other as the control class. This selection aimed to ensure that any differences in learning outcomes were truly caused by the treatment provided, not by differences in initial abilities.

Research data were obtained through essay tests designed to measure students' understanding of mathematical concepts on the topic of composite functions. The test's construction indicators refer to Yulia et al. (2021), which include the ability to restate concepts, classify objects, identify examples and non-examples, apply specific procedures, and use concepts in problem-solving. Prior to use, the instrument was tested for validity, reliability, difficulty level, and discriminatory power. The test results showed that most test items were

valid because  $r_{count} > r_{table}$  reliable with a Cronbach's Alpha coefficient of 0.84, had a moderate level of difficulty, and good to excellent discriminatory power.

Data analysis was carried out in two stages, namely initial analysis and final analysis. The initial analysis included a normality test (Liliefors), a homogeneity test (Bartlett), and a t-test to ensure equality of initial abilities between the two groups. The final analysis was conducted after treatment by conducting a normality and homogeneity test of the post-test data, followed by a two-sample independent t-test to determine significant differences between the experimental and control groups. The results of the analysis showed a Sig. value  $< 0.05$ , which indicated a significant difference in the understanding of mathematical concepts between students who learned using WordWall media and students who learned conventionally.

## RESULTS AND DISCUSSION

Before administering the treatment, the initial step was to measure the ability levels of students in both classes, the experimental and control classes. Descriptive analysis revealed that the average pretest score for the control class was 6307 with a standard deviation of 3.81, while the experimental class had an average score of 62.67 and a standard deviation of 3.59.

The normality test shows a significance value of 0.200 ( $> 0.05$ ) can be seen in Table 1, the homogeneity test gives a value of Sig 0.929 ( $> 0.05$ ) can be seen in table 2. And the results of the Independent Sample t-test show a value of Sig = 0.677 ( $> 0.05$ ) which can be seen in table 3 which indicates there is no significant difference between the two groups. This reflects that the level of understanding of students in both classes is quite similar, so that the results of the post-treatment comparison can be considered valid and not affected by significant differences in initial abilities.

**Table 1.** Pretest Normality Test

|         | Class      | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|---------|------------|---------------------------------|----|------|--------------|----|------|
|         |            | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| Pretest | Control    | ,093                            | 30 | ,200 | ,988         | 30 | ,200 |
|         | experiment | ,112                            | 30 | ,200 | ,979         | 30 | ,200 |

**Table 2.** Pretest Homogeneity Test

|                                  |      | Levene statistic | Df1           | Df2    | Sig. |
|----------------------------------|------|------------------|---------------|--------|------|
|                                  |      | Pretest          | Based on mean | ,008   | 1    |
| Based on median                  | ,014 |                  | 1             | 58     | ,905 |
| Based on median with adjusted of | ,014 |                  | 1             | 57,177 | ,905 |
| Based on trimmed mean            | ,011 |                  | 1             | 58     | ,918 |
|                                  |      |                  |               |        |      |

**Table 3.** Independent Samples Test

| Pretest                     | Levene's test for equality of variances |      | T-test for equality of means |        |                 |                 |                            |                                           |       |
|-----------------------------|-----------------------------------------|------|------------------------------|--------|-----------------|-----------------|----------------------------|-------------------------------------------|-------|
|                             | F                                       | Sig. | T                            | Df     | Sig. (2-tailed) | Mean difference | Stand and error difference | 95% confidence interval of the difference |       |
|                             |                                         |      |                              |        |                 |                 |                            | Lower                                     | Upper |
| Equal variances assumed     | ,008                                    | ,929 | ,419                         | 58     | ,677            | ,400            | ,954                       | -1,511                                    | 2,311 |
| Equal variances not assumed |                                         |      | ,419                         | 57,795 | ,677            | ,400            | ,954                       | -1,511                                    | 2,311 |

After the treatment, students in the experimental class studied the learning materials with the help of WordWall media, while the control class continued with a traditional approach without the use of digital media. The posttest results showed a significant improvement in the experimental class. The average posttest score for the experimental class was recorded at 78.37 with a standard deviation of 2.72, while the control class obtained an average of 71.17 with a standard deviation of 2.63. Normality and homogeneity tests again showed that the data were normally distributed and homogeneous (Sig > 0.05). On the other hand, the results of the t-test on two independent samples showed a value of Sig = 0.000 (< 0.05), which can be seen in table 4 for the normality test, table 5 for the homogeneity table, and table 6 for the independent sample test, which indicated a significant difference between the two groups after the learning process.

**Table 4 .** Posttest Normality test

| Posttest |            | Kolmogorov-Smirnov <sup>a</sup> |    |       | Shapiro-wilk |    |      |
|----------|------------|---------------------------------|----|-------|--------------|----|------|
|          |            | Statistics                      | Df | Sig.  | Statistics   | Df | Sig. |
|          | Control    | ,124                            | 30 | ,200* | ,957         | 30 | ,261 |
|          | Experiment | ,113                            | 30 | ,200* | ,973         | 30 | ,632 |

\*This is a lower bound of the true significance.

a. Lilliefors Significance Correction

**Table 5.** Posttest Homogeneity test

| Posttest |                                    | Levene statistics | Df1  | Df2    | Sig. |
|----------|------------------------------------|-------------------|------|--------|------|
|          |                                    | Based on mean     | ,001 | 1      | 58   |
|          | Based on median                    | ,000              | 1    | 58     | 1000 |
|          | Based on median with adjustment df | ,000              | 1    | 57,337 | 1000 |
|          | Based on trimmed mean              | ,002              | 1    | 58     | ,965 |

**Table 6.** Independent Sample Test

| Posttest                    | Levene's test for equality of variances |      | t-test for equality of means |    |                 |                 |                           |                                           |        |
|-----------------------------|-----------------------------------------|------|------------------------------|----|-----------------|-----------------|---------------------------|-------------------------------------------|--------|
|                             | F                                       | Sig. | t                            | Df | Sig. (2-tailed) | Mean difference | Standard error difference | 95% confidence interval of the difference |        |
|                             |                                         |      |                              |    |                 |                 |                           | lower                                     | upper  |
| Equal variances assumed     | ,001                                    | ,977 | -10,423                      | 58 | ,000            | -7,200          | ,691                      | -8,583                                    | -5,817 |
| Equal variances not assumed |                                         |      | -10,423                      | 58 | ,000            | -7,200          | ,691                      | -8,583                                    | -5,817 |

The average increase of 7.2 points in the experimental group indicates that the use of WordWall positively influenced students' understanding of mathematical concepts, particularly in the composition function material. This finding indicates that WordWall functions as an interactive learning tool that can increase student participation and enthusiasm for learning. Features in WordWall such as interactive quizzes, concept matching games, and exercises with a competitive approach are believed to stimulate students' cognitive activity and support mastery of abstract mathematical concepts.

This result is in line with the opinion Arsyad (2016) which states that technology-based learning tools can improve student attention, motivation, and learning outcomes through more engaging and meaningful learning experiences. Furthermore, these findings align with research by Nuraeni et al. (2018). which shows that the use of interactive media in learning can improve students' conceptual thinking skills.

The results of the study showed that the use of Wordwall media had a significant impact on the learning process of grade XI students related to the composition of functions material. Before the treatment, both groups appeared to have comparable levels of ability, as evidenced by the results of the independent sample t-test with a Sig. value  $> 0.05$ . After the treatment, the average post-test score for the experimental class was recorded at 78.37, while the control class was at 71.17, with a Sig. value  $= 0.000 < 0.05$ . This shows a significant difference between the two classes, so it can be concluded that the use of Wordwall media has a positive impact on students' understanding of mathematical concepts.

Research conducted by Sukma et al. (2024), which revealed that the use of Wordwall media has the capacity to improve student learning outcomes and motivation during

mathematics learning. The same finding was also stated by Diah Ayu Lestari (2024) , who found that game-based learning such as Wordwall can improve understanding of mathematical concepts due to more active student involvement in the learning process.

In an international context, these findings support research by Yong et al., (2016) which emphasized that digital game-based learning substantially improves student learning outcomes and engagement in STEM subjects, including mathematics. Furthermore, research conducted by Christopoulos et al., (2024) showed that experiences in three-dimensional virtual games can improve students' mathematical thinking skills and conceptual understanding by simultaneously stimulating cognitive and affective aspects. A study conducted by Yong et al., (2016) also emphasized that learning mathematics through interactive digital games encourages students to collaborate and think critically, and reduces feelings of anxiety related to learning mathematics.

These results support research showing that using WordWalls as an educational game-based learning tool can create a fun learning environment, increase intrinsic motivation, and deepen conceptual understanding through repetitive and reflective activities. Therefore, Wordwalls can be an effective innovation in mathematics learning methods, particularly for topics that require in-depth conceptual understanding, such as composition functions.

## **CONCLUSION**

Based on the research results and data analysis, it can be concluded that WordWall media has a significant effect on improving students' understanding of mathematical concepts in the composition function material. Students who learned using WordWall obtained higher post-test results compared to students who learned using conventional methods. The results of the achievement test showed that more than 75% of students in the experimental class achieved or exceeded the KKM, so that learning using WordWall media was declared successful in improving students' conceptual understanding. Thus, the use of interactive digital media such as WordWall is worthy of being an innovative alternative in mathematics learning, especially to improve students' conceptual understanding abilities.

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