

EFFECTIVENESS OF USING GAMIFICATION-BASED WORDWALLS TO IMPROVE UNDERSTANDING OF FOOD CHAIN CONCEPTS IN SCIENCE LEARNING

A. Muafiah Nur, Nur Fitriany, Putri Awalia Syahra

^{1,2,3}Teacher Professional Education Study Program, Faculty of Teacher Training and
Education, Muhammadiyah University of Makassar, Indonesia

ABSTRACT

The use of technology-based learning media is increasingly needed to improve the quality of science learning in elementary schools, especially to help students understand abstract concepts such as the food chain. Initial observations indicate that fifth-grade students still have difficulty identifying the role of organisms, understanding energy flow, and are less active during conventional learning. This condition emphasizes the need for more interactive and engaging media to encourage student engagement. Gamification-based wordwalls are an effective alternative because they present educational games that provide direct feedback and help visualize concepts. This study aims to analyze the effectiveness of gamification wordwalls in improving understanding of the food chain concept in fifth-grade students of UPT SD Negeri 74 Bontorita II. The method used was an experiment with a One-Group Pretest–Posttest design involving 20 students. The instruments used included a pretest–posttest, observation of student activities, and learning documentation. Data analysis was carried out using descriptive statistics, the Shapiro–Wilk normality test, and a paired sample t-test. The results showed a significant increase from the average pretest score of 51.57 to 89.86 in the posttest. A significance value of 0.000 ($p < 0.05$) proves that Wordwall effectively improves understanding of the food chain concept. This finding confirms that gamification can increase motivation, engagement, and provide a more meaningful learning experience. The study recommends Wordwall as an alternative medium for science learning that requires visualization and interaction.

Keywords; Gamification, Understanding Concepts, Wordwall

INTRODUCTION

Education is one of the efforts to master creative thinking skills to face the competition of the industrial revolution 4.0 era in the 21st century. Concrete efforts made by educators and the Indonesian government are to prepare an education system that is able to connect knowledge and skills (Anindayanti, 2020). Natural Sciences (IPA) is one of the subjects that is directly related to students' real lives. Science learning can improve students' thinking processes to understand a material concept so that students are able to apply it to their daily lives (Nahdi, Yonanda, & Agustin, 2018).

Science learning allows children to understand and apply various concepts to explain events related to these concepts. Children's understanding of concepts in science learning must develop well through direct observation, before being introduced to abstract information (Deliany, Hidayat, & Nurhayati, 2019). Conceptual understanding plays an important role in the teaching and learning process, namely being able to provide an explanation or provide a more detailed description of a concept using one's own words (Lestari, Rini, & Gumilar, 2024). Understanding concepts has an important role in the implementation of teaching and learning, namely the basis for achieving learning output

(Aen & Kuswendi, 2020). In understanding concepts, teachers must be able to relate real-world contexts to their surrounding environment (Savitri & Meilana, 2022).

Based on the results of initial observations conducted at the UPT SD 74 Bontorita II, it was found that students still experience difficulties in understanding the concept of the food chain. During conventional science lessons, most students are less active in answering questions, some are confused about distinguishing producers, consumers, and decomposers, and have difficulty explaining the relationships between organisms in the ecosystem. Teachers tend to use lecture and question-and-answer methods, so that interaction between students is relatively low and learning motivation appears to decrease. Some students show curiosity, but it has not been utilized optimally because the learning media used are less interesting and do not actively involve students. This observation indicates the need for the implementation of more interactive learning media to improve students' conceptual understanding before being given treatment using gamification-based Wordwall.

To address current problems, it's crucial for creative and innovative teachers to boost students' enthusiasm for learning and prevent them from getting bored and tired during lessons. Often, classroom interaction is lacking due to conventional learning methods and the use of textbooks as the primary source. As a result, students are no longer motivated to learn, and they become bored with the lessons more quickly (Juan, Ama, & Panis, 2025). Learning media that is suitable for students is visual (visually-literate) using digital technology such as gamification. Gamification is the application of games in video form which aims to be applied in other fields. Various digital technologies have been developed based on gamification principles, one of which is Wordwall (Fauziyati & Sriyanto, 2023). Wordwall offers a variety of activities such as grouping, quizzes, and matching games. These activities encourage students to actively participate, sparking curiosity and enthusiasm for learning. Furthermore, games can provide immediate feedback that helps students determine their understanding of the subtopics being taught (Widiyanti, Arni, Azzahra, & Feby, 2024).

This research presents a novelty by using gamification-based wordwall learning media to improve students' conceptual understanding in science learning in Grade 5 of UPT SDN 74 Bontorita II which has not yet implemented wordwall learning media. Interactive learning media is needed to help students understand the material more easily, one of which is by using wordwall media. Wordwall media is a learning aid in the form of interactive visual media that allows students to interact directly with learning materials, facilitating the understanding of complex concepts and ideas (Astuti, Dewi, & Sobri, 2025). Wordwall is a learning trigger that actively involves students in using their cognitive abilities to resolve conflicts or games within it (Sintya, Fadila, Prasetyo, Suprijono, & Surabaya, 2022).

This research provides a relevant solution in learning because the factors that cause low conceptual understanding that make students feel threatened, less familiar with the material and embarrassed to ask questions, or (Anggraeni & Syafira, 2024). Understanding requires the ability to grasp the meaning and significance of a concept (Junaid, Salahudin, & Anggraini, 2021). Conceptual understanding is defined as the ability to absorb the meaning of the material or material being studied (Susanti, Asrin, & Khair, 2021). Students tend to have difficulty understanding abstract concepts and require media assistance in the learning process (Swistiyawati, & Indrayani, 2024). WordWall is a web-based digital gamification application that provides a variety of games and quizzes that educators can use to rate material. This application is suitable for educators who want to create a learning

assessment method, one of the strategies teachers can apply so that children are motivated to learn, so they are on time to do their assignments (Putra, Aryani, & Ariessanti,2021).

This study aims to investigate the effectiveness of gamification-based Wordwall media in improving students' conceptual understanding of the food chain (ecosystem) material in science learning. Students who consider science subjects difficult because the concepts are sometimes abstract and require a deeper understanding. The difficulties experienced by students when learning science are often related to material that involves unfamiliar science concepts (Siti Sopia Nasutio, 2025). The use of Wordwall has been proven effective in improving students' understanding of science concepts (Tahir & Rahmatih,2025), as well as fostering students' activeness and understanding of the food chain directly (Rahmawati, 2025). In addition, the development of Wordwall for the ecosystem sub-theme has shown an increase in students' understanding (Zahra, Yusuf, Anggraini, & Amelia,2024).

RESEARCH/EXPERIMENTAL METHODS

This research is a quantitative experimental study that aims to measure the effectiveness of the use of Wordwall gamification media in improving elementary school students' understanding of the food chain concept. This study was chosen because the focus of the study was to compare student learning outcomes before and after the treatment was given, namely through pretest and posttest measurements in one experimental group without a control group. Thus, this study is still able to provide an overview of the increase in student understanding after receiving treatment in the form of Wordwall-based learning. The subjects in this study were 20 fifth-grade students at UPT SD Negeri 74 Bontorita II, Galesong sub-district, Takalar district. The subjects in this study were 20 fifth-grade students at one elementary school. The selection of subjects was carried out using a purposive sampling technique, because the researcher chose the class that was considered most appropriate to the research objectives, namely the class that was studying the food chain material and had readiness for the use of digital learning media such as Wordwall. This consideration was considered relevant to ensure that the treatment could be applied optimally to the research subjects.

The research design used was the One-Group Pretest–Posttest Design, which is an experimental design in which one group is given a pretest first to measure the initial conditions of students, then given treatment in the form of learning using Wordwall, and ended with a posttest to measure the changes that occur. In the context of this study, the treatment was in the form of a series of science learning using interactive Wordwall games, such as random quizzes, matching games, picture puzzles, and games about the flow of the food chain. After the treatment was completed, students took a posttest to determine the extent to which their understanding had improved compared to the pretest results.

The data collection method in this study was carried out through several techniques, namely learning achievement tests, observation of student activities, and documentation of the learning process. The main technique used was the learning achievement test, which consisted of pretest and posttest questions designed to measure students' understanding of the food chain concept. This test was compiled based on validated indicators of conceptual understanding, so that the measurement results can describe students' abilities objectively. Observations were used to assess student engagement and responses during learning using Wordwall, while documentation in the form of grades from the Wordwall platform, activity photos, and learning implementation notes were used as supporting data in the analysis.

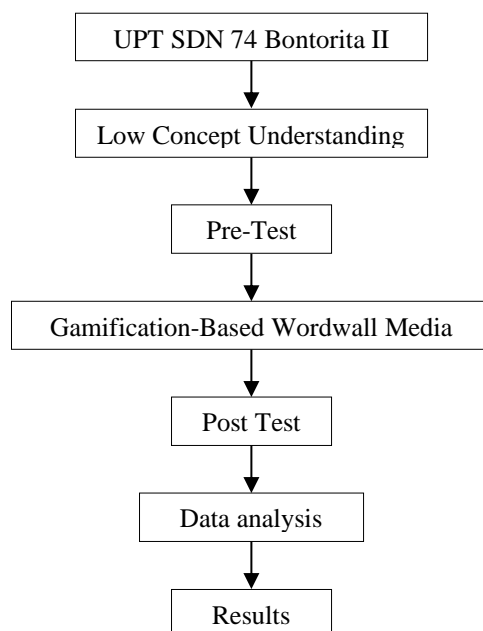


Figure 1.Data Collection Diagram

Data obtained from the pretest and posttest results were analyzed quantitatively to determine the effectiveness of using Wordwall gamification media in improving students' understanding of the food chain concept. Data analysis was conducted through several systematic stages, including descriptive statistical analysis, normality testing, and paired sample t-tests.

a. Descriptive Statistical Test

Descriptive statistical analysis was used to provide an overview of student learning outcomes before and after using the Wordwall gamification media. This analysis aimed to determine the trend and distribution of student scores in the pretest and posttest. Data were analyzed using descriptive statistical measures, including: number of samples, maximum and minimum scores, average (mean), and standard deviation (SD). The results of this descriptive analysis were used to observe changes in student abilities after the treatment.

b. Normality Test

A normality test was conducted to determine whether the pretest and posttest data were normally distributed, thus meeting the basic assumptions of parametric statistical tests. A normal distribution is necessary for subsequent analysis, namely the paired sample t-test, to produce valid and interpretable results. In this study, the normality test was conducted using the Shapiro–Wilk test because the sample size was less than 50 students. The results of the normality test were then compared with the significance value (p-value), where the data is declared normally distributed if the significance value is greater than 0.05.

c. Paired Sample T-Test

A paired sample t-test was used to determine whether there was a significant difference between the pretest and posttest results after implementing Wordwall gamification media in science learning on the food chain topic. Analysis was performed by comparing the average pretest and posttest scores and calculating the significance value (p-

value). If the significance value is less than 0.05, it can be concluded that there is a significant increase in conceptual understanding after using Wordwall media.

RESULTS AND DISCUSSION

This study aimed to determine the effect of using Wordwall gamification media on the understanding of the food chain concept in fifth-grade students at UPT SD Negeri 74 Bontorita II, Galesong District, Takalar Regency. The study was conducted on one group of students who received treatment in the form of learning using Wordwall with the aim of observing the increase in conceptual understanding before and after the treatment.

Before further analysis, a summary of descriptive statistics is presented, providing an overview of students' pre-test and post-test scores. This presentation aims to examine how students' initial and final abilities changed after participating in learning using the Wordwall gamification medium.

Table 1. *Descriptive Statistics*

	N	Minimum	Maximum	Mean	Standard Deviation
Pre-Test	21	30	75	51.57	14,316
Post-Test	21	75	100	89.86	8,132
Valid N (listwise)					

The results showed a significant improvement in student scores. The pre-test average of 51.57 increased to 89.86 after the treatment. Furthermore, the decrease in the standard deviation indicates that student abilities have become more evenly distributed. The increase in minimum and maximum scores confirms that the Wordwall media has a positive impact on improving understanding of the food chain concept.

Before determining the type of statistical analysis to be used, a normality test was performed to ensure that the pre-test and post-test data were normally distributed. This test is crucial for proper execution of subsequent analysis steps.

Table 2. *Test of Normality*

	Shapiro-Wilk		
	Statistics	df	Sig
Pre-Test	911	21	058
Post-Test	916	21	071

The results of the Shapiro–Wilk test method showed a significance value above 0.05. Thus, the pre-test and post-test data were normally distributed. This allows the use of parametric tests such as the paired sample t-test to analyze differences in pre- and post-treatment scores.

Before drawing a final conclusion regarding the effectiveness of the Wordwall media, a paired sample t-test analysis was conducted to determine whether there was a significant difference between the values before treatment (pre-test) and after treatment (post-test).

Table 3. *Paired Samples Test*

	Paired Differences					t	df	Sig (2-tailed)
	Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pre-Test– Post-Test	-38,286	9,339	2,038	-42,537	-34,035	-18,787	20	000

The analysis results showed an average difference of -38.286 with a significance value of 0.000 ($p < 0.05$). This proves a very significant increase in conceptual understanding after learning using the Wordwall. The confidence interval that does not cross zero and the large t-value confirm that the improvement occurred consistently across almost all students.

The results of this study are in line with various previous findings which show that the use of interactive game media Wordwall is able to improve the quality of science learning in elementary schools. Muflikha, Pulungan, & Oktariani, (2024) emphasized that Wordwalls not only improve science learning outcomes but also foster interest and motivation, leading to more active student engagement during the learning process. This increased motivation also contributes to student engagement in a deeper understanding of science concepts.

These findings are reinforced by research (Napisah, Yulianci, & Fiqry, (2025) showed that Wordwall educational media made a significant positive contribution to students' understanding of science concepts and learning motivation. This study emphasized the need for teachers to be more flexible in utilizing learning technology to meet students' learning needs. Wordwalls were proven not only to facilitate the learning process but also to encourage students to actively construct scientific knowledge.

Besides increasing motivation, Wordwalls have also been shown to have an impact on conceptual understanding. (Haliza, Dewi, & Mulyana, (2024) found a difference in average posttest results between the experimental class using Wordwall and the control class not using Wordwall. This difference indicates that the use of Wordwall has a significant impact on improving students' conceptual understanding compared to conventional learning.

Another study by Hafsari & Ansori (2025) also showed that integrating Wordwalls into learning is effective in aiding comprehension, even in abstract topics such as fractions. The results of student evaluation tests after using this medium demonstrated that Wordwalls can facilitate more understandable and enjoyable learning. Specifically, in the science subject (Jannah, Nabila, & Umami, (2025) revealed that the use of Wordwalls had a positive impact on motivation, active participation, and the ability to understand science concepts. This medium was deemed capable of adapting to students' learning styles and providing instant feedback, making learning more meaningful.

The fundamental difference between this study and previous studies lies in the focus of the application of Wordwall media which is specifically directed at improving the understanding of the concept of the food chain in the fifth grade science subject. Previous studies tend to examine the effectiveness of Wordwall on other materials such as international trade, Pancasila, fractions, and science in general, without highlighting the conceptual aspects of ecology involving relationships between organisms.

Furthermore, this study applies a structured gamification approach, including points, challenges, levels, and instant feedback as strategies to encourage student engagement and motivation. While some previous studies have only used Wordwall as a quiz medium without systematically designing gamification elements, this study also adds specific analysis of changes in student understanding patterns, ranging from the ability to identify the roles of producers, consumers, and decomposers to understanding energy flow in the food chain, which has not been discussed in depth in previous studies.

CONCLUSION

The use of gamification-based Wordwall media has been proven to be effective in improving the understanding of the food chain concept in fifth-grade students of UPT SD Negeri 74 Bontorita II. This is indicated by a significant increase in the average pretest score from 51.57 to 89.86 in the posttest, with the results of the paired sample t-test showing a significance of 0.000 ($p < 0.05$). Learning observations also show an increase in student activity, motivation, and involvement during the use of Wordwall. The gamification element helps students understand ecological concepts in a more concrete and interesting way. Thus, Wordwall can be used as an alternative effective science learning media to improve learning outcomes and the quality of learning in elementary schools.

BIBLIOGRAPHY

- Aen, R., & Kuswendi, U. (2020). Improving Elementary School Students' Understanding of Science Concepts Using Visual Media in the Form of Images in Science Learning. *COLLASE (Creative of Learning Students Elementary Education)*, 3(3), 99-103.
- Anggraeni, R., & Syafira, H. (2024). Training junior high school students' creative thinking skills through differentiated learning based on integrated stem projects. In *Proceedings of the National Science Seminar*. 555-563.
- Anidayanti, A. (2020). A study of the STEM learning approach using the PJLB model in honing students' mathematical creative thinking skills. *Education*, 5, 217–225.
- Astuti, AP, Dewi, NK, & Sobri, M. (2025). The Effect of Wordwall Learning Media on the Understanding of the Concept of Changes in Energy Forms in Grade IV Students of SDN 34 Mataram. *Pendas: Scientific Journal of Elementary Education*, 10(03), 221-233.
- Deliany, N., Hidayat, A., & Nurhayati, Y. (2019). Application of Interactive Multimedia to Improve Students' Understanding of Science Concepts in Elementary Schools. *17(2)*, 90–97.
- Fauziyati, KA, & Sriyanto, S. (2023). STEM-Based wordwall labeled diagram gamification learning media for Elementary Students' critical thinking in social studies learning. *DIDAKTIKA: Journal of Elementary School Education*, 6(2), 91-98.
- Hafsari, N., & Ansori, H. (2025). Development of Assisted Learning Media. *5*, 70–82.
- Haliza, VN, Dewi, DA, & Mulyana, A. (2024). The Effect of Using Wordwall Interactive Learning Media on Students' Understanding of Concepts in Pancasila Education Subjects in Class IV. *8*, 16195–16221.
- Jannah, PMN, Nabila, U., & Umami, AK (2025). Application of Wordwall Learning Media to 3rd Grade Students' Understanding of Science Subjects at Bugih 3 Pamekasan State Elementary School. *Pendekar: Journal of Character Education*, 3(3), 42-55.

- Juan, F.A., Ama, O., & Panis, I.C. (2025). Analysis of Wordwall-Based Gamification Design in Science Learning on Force and Motion Materials. 7(1), 50–60.
- Junaid, M., Salahudin, S., & Anggraini, R. (2021). The Effect of Problem-Based Learning Model on Students' Understanding of Science Concepts at Smpn 17 Tebo. *Physics and Science Education Journal (PSEJ)*, 16-21.
- Lestari, L., Rini, CP, & Gumilar, A. (2024). Analysis of Concept Understanding in Science Learning for Fourth Grade Elementary School Students. *Journal of Education Research*, 5(4), 4533-4538.
- Muflikha, RR, Pulungan, M., & Oktariani, AP (2024). Improving Science Learning Outcomes Through Interactive Wordwall Game Media for Fourth Grade Elementary School Students. 4, 2541–2548.
- Nahdi, DS, Yonanda, DA, & Agustin, NF (2018). Efforts to improve students' conceptual understanding through the application of demonstration methods in science subjects. *Jurnal Cakrawala Pendas*, 4(2), 266398.
- Napisah, E., Yulianci, S., & Fiqry, R. (2025). The Effect of Wordwall Learning Media on Elementary School Students' Understanding of Science Concepts and Learning Motivation. 5(2), 313–319.
- Putra, SD, Aryani, D., & Ariessanti, HD (2021). Utilization of Wordwall Gamification Applications in the Covid-19 Pandemic Era to Improve Online Learning Processes. *Terang*, 4(1), 83-90.
- Rahmawati, T. (2025). The Effect of Using Wordwall Media on the Activeness and Understanding of the Food Chain of Fifth Grade Students at UPTD SD Negeri Kebun 1 Kamal. 3(2), 73–84.
- Savitri, O., & Meilana, SF (2022). The effect of the flipped classroom learning model on elementary school students' understanding of science concepts. *Basicedu Journal*, 6(4), 7242-7249.
- Sintya, D., Fadila, N., Prasetyo, K., Suprijono, A., & Surabaya, UN (2022). The Effect of the Wordwall Game-Based Learning Model on Concept Understanding of Grade VII Junior High School Students. 2(2), 171–180.
- Siti Sopia Nasutio, DM (2025). Analysis of Students' Difficulties in Understanding the Concept of Science Learning Material for Class V of SDN 17 Pekanbaru. 4, 1549–1555.
- Susanti, NKE, Asrin, A., & Khair, BN (2021). Analysis of the Level of Understanding of Science Concepts of Fifth Grade Students of Elementary School Cluster V, Cakranegara District. *Scientific Journal of Educational Professions*, 6(4), 686-690.
- Swistiyawati, NLP, & Indrayani, IAM (2024). Analysis of Students' Difficulties in Understanding Science Concepts in Grade II of SD NO. 5 Taman. *Dharmas Education Journal (DE_Journal)*, 5(2), 1316-1324.
- Tahir, M., & Rahmatih, AN (2025). The Effect of Problem Based Learning Model Assisted by Wordwall Media on the Understanding of Science Concepts in Grade IV at SDN 27 Cakranegara. *Pendas: Scientific Journal of Elementary Education*, 10(02), 230-244.
- Widiami, R., Arni, Y., Azzahra, N., & Feby, HM (2024). The Effectiveness of Using Digital Wordwall Game Media in Science Learning Sub-Theme: Flora and Fauna Biodiversity for Grade 5 at SDN 89 Palembang. 4, 1703–1711.

Zahra, A., Yusuf, YA, Anggraini, NC, & Amelia, S. (2024). Alacrity: Development of Wordwall-Based Learning Media to Improve Students' Understanding of the Ecosystem Sub-Theme of Science Subjects in Grade 5 Students at SDN 19 Muara Telang Aprilia. 4(3), 449–459.