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The Use of the Wordwall Application as a Game-Based Learning Media to Overcome Multiplication Learning Difficulties in IV Students of Muhammadiyah Elementary School

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A B S T R A C T

Many elementary school students, especially fourth graders, still experience difficulties in understanding the concept of multiplication. This is influenced by the use of conventional learning methods that tend to be less interesting, thus reducing learning motivation and causing students to be less active in the mathematics learning process. This study aims to describe the difficulties in learning multiplication and the implementation of game-based learning media using the Wordwall application in improving student understanding. The research method uses a descriptive qualitative approach with subjects of fourth grade students of Muhammadiyah Elementary School Tanjungpinang in the 2024/2025 academic year. Data collection techniques include observation, interviews, and documentation, then analyzed through data reduction, data presentation, and drawing conclusions. The results of the study show that Wordwall is able to increase students' enthusiasm, activeness, and understanding in multiplication through fun interactive exercises. Thus, Wordwall is an effective alternative learning media to overcome difficulties in learning multiplication in elementary school students.

1. Introduction

Mathematics is a fundamental subject that plays a crucial role in developing elementary school students' logical, critical, and problem-solving skills (Rahmawati, 2023). Mastery of arithmetic operations, particularly multiplication, is a crucial numeracy competency because it serves as the foundation for more advanced materials such as fractions, exponents, and problem-solving in everyday life (Lestari, 2023). However, actual conditions indicate that many fourth-grade elementary school students still experience difficulties in understanding and

memorizing basic multiplication facts (Hidayat, 2020). A similar finding was found at Muhammadiyah Elementary School in Tanjungpinang, based on initial observations, where some students still used repeated addition strategies and frequently made errors when multiplication operations involving intermediate numbers such as 6x8, 7x9, and 8x9. Furthermore, some students reported difficulty focusing and fear when working on math problems, which impacted their low motivation to learn (Rohmana, 2021).

One cause of these difficulties is a learning approach that tends to be conventional, with teachers delivering material through lectures and providing exercises that require memorization without providing meaningful context or engaging visualizations (Nissa & Renoningtyas, 2021). This approach is less aligned with the characteristics of the digital generation, which favors visual interaction, playful experiences, and the use of technological devices in learning (Prensky, 2010; Maisaroh etal., 2025; Edwana et al., 2023).

In response to the challenges of the 21st century, educational technology offers a significant opportunity to create innovative learning methods through game-based learning approaches. Game-based learning models can increase motivation, provide enjoyable learning experiences, and provide immediate feedback on student learning outcomes (Gee, 2007). Learning that integrates games has been shown to reduce math anxiety and increase student persistence in problem-solving (Vanbecelaere et al., 2022).One digital platform that is easily integrated into math learning is Wordwall. This application provides various interactive game templates that can be customized to the material, such as quizzes, matching games, and spinning wheels, which encourage direct student engagement in multiplication exercises (Fauzi, 2023; Alqadri et al., 2025; Gusmida & Islami (2017).

With the support of scoring and timing features, students are encouraged to answer more quickly and accurately, thus helping to reinforce multiplication facts in a fun learning environment (Rembulan et al., 2018). Based on the above context, utilizing Wordwall as a game-based learning medium is a potential alternative solution to address multiplication difficulties among fourth-grade students at Muhammadiyah Elementary School, Tanjungpinang. The use of Wordwall is believed to increase learning motivation, active participation, and students' ability to complete multiplication operations more accurately.

In line with this urgency, this study aims to: (1) Identify the multiplication learning difficulties of fourth-grade students at Muhammadiyah Elementary School, Tanjungpinang, (2) Describe the process of implementing Wordwall as a game-based learning medium for multiplication, (3) Evaluate student responses to the use of Wordwall in multiplication learning, including aspects of motivation and conceptual understanding. Thus, this research is expected to be able to contribute to the development of innovative technology-based learning strategies and provide alternative solutions for teachers in improving students' mathematics learning outcomes in elementary schools.

2. Methodology

This study employed a qualitative method with a descriptive approach because it focused on an in-depth understanding of naturally occurring phenomena in the school environment (Nasution, 2020). This approach was chosen to describe the difficulties experienced by fourth-grade students in learning multiplication and the process of utilizing the Wordwall application in mathematics learning at Muhammadiyah Elementary School Tanjungpinang in the 2024/2025 academic year. The research subjects consisted of a teacher and several students selected purposively based on the criteria of experiencing difficulties memorizing and calculating multiplication (Sugiyono, 2019). The researcher acted as a participant observer directly involved in the learning process to obtain authentic data (Moleong, 2017).

Research data were collected through observation, interviews, and documentation as triangulation techniques to strengthen data validity (Creswell, 2017). Observations were conducted to record learning activities using the Wordwall, interviews explored teacher and student perspectives regarding multiplication difficulties and interactive learning experiences, while documentation was used to obtain supporting evidence such as photographs and student practice results. Data analysis was carried out continuously through the stages of data reduction, data presentation, and drawing conclusions according to the Miles et al., (1994) model, so that a comprehensive picture was obtained regarding the effectiveness of Wordwall in improving understanding and motivation to learn multiplication in elementary school students.

3. Results and Discussion

In addition, the condition of class IV at Muhammadiyah Elementary School Tanjungpinang in the 2024/2025 academic year consists of 26 students, with a composition of 14 male students and 12 female students. The majority of students come from socio-economically heterogeneous school environments and are accustomed to using gadgets for daily activities, but not all of them use them for learning. So far, mathematics learning has mostly used lecture methods, question and answer sessions, and exercises in textbooks, resulting in a relatively passive learning atmosphere with one-way interaction from teachers to students. Technological facilities such as LCDs, school Wi-Fi, and several tablet devices are available, but their use has not been optimal in mathematics learning. Some students showed high enthusiasm for digital games, but were less motivated during regular multiplication exercises. Teachers also reported that differences in arithmetic abilities among students were quite apparent, especially in terms of speed and accuracy in solving problems. These conditions provided the basis for the need for digital media-based innovations such as Wordwall to increase engagement and learning effectiveness in the classroom.

From initial observations, students tend to sit in groups based on their closeness to their playmates and become unfocused during conventional learning, such as

talking to themselves and waiting for instructions without trying first. Interactions between students are stronger in a social context than in an academic one, so teachers need to package learning in a way that is competitive but still collaborative. In terms of technological skills, some students are able to operate the devices well, while others still need assistance, especially in selecting answers on the screen. Teacher support and device readiness are important factors for game-based learning to run smoothly. Under these conditions, the application of Wordwall is expected to bridge students' needs for visualization, games, and direct feedback, while fostering confidence and an enjoyable learning experience in understanding the concept of multiplication.

The implementation of learning and data collection in this study was carried out in stages during three meetings during mathematics lessons. The teacher began by providing pre-instruction in the form of a brief explanation of multiplication material and an introduction to how to use Wordwall. In each session, students were asked to participate in a multiplication quiz game using devices provided by the school in groups and individually. During the learning process, the researcher conducted direct observations of student enthusiasm, responses to feedback from the application, activity in answering questions, and interactions between students. After the game was over, the teacher clarified concepts and reflected with students on questions that were still considered difficult. In addition, brief interviews were conducted with several students and teachers to find out their perceptions of using Wordwall. Documentation in the form of photos of activities, screenshots of quiz results, and observation notes were used to support data analysis. The entire procedure was designed to maintain the authenticity of student learning behavior and provide a comprehensive picture of the effectiveness of Wordwall as a medium for learning multiplication.

Learning Difficulties in Multiplication

Fourth-grade students still experience difficulties in mastering basic multiplication facts, especially for more difficult number pairs such as 6x7, 7x8, and 8x9. They tend to rely on repeated addition, which takes longer and increases the risk of errors (Wijayanti, 2022). Teachers confirm that students' low accuracy and speed are influenced by a lack of meaningful practice and low learning motivation. These difficulties are related to cognitive and affective factors, such as math anxiety, low self-confidence, and the perception that mathematics is a difficult subject (Siregar, 2021). According to Gee (2007), failure to create an engaging learning environment makes students reluctant to repeat the material, thus hindering their memorization of multiplication.

Implementation of Wordwall in Multiplication Learning

Learning with Wordwalls creates a lively classroom atmosphere and stimulates students' interest in learning. As illustrated in Figure 1, the Wordwall application presents an engaging initial interface that supports playful learning activities. The game-based format encourages positive competition among students, motivating them to focus on the screen and respond to questions quickly.

Figure 1. Initial view of the wordwall application

This image shows the Wordwall homepage, which offers a variety of game templates, including matching games, multiple-choice quizzes, random wheels, flashcards, and anagrams. Teachers can choose templates relevant to the multiplication topic and then customize the questions to suit their learning needs. Before the quiz activity begins, students are first introduced to the initial interface of the Wordwall application, as shown in Figure 2. On this screen, the teacher selects the “Quiz” template, and the system displays the game title “Multiplication” along with a “Start” button. This initial display helps students understand the learning context and prepares them for the interactive activity before the game starts.

Figure 2. Display when starting learning

In this screen, the teacher selects the "Quiz" template, and the system displays the game title "Multiplication" along with a "Start" button. Students are instructed to tap the correct answer to each question that appears. This screen serves as an introduction before the game begins. During the learning process, students interact directly with the quiz interface presented in Figure 3. At this stage, the screen displays a simple multiplication problem accompanied by several answer choices. The presence of time and score indicators encourages students to respond quickly and accurately, creating a more engaging and competitive learning atmosphere

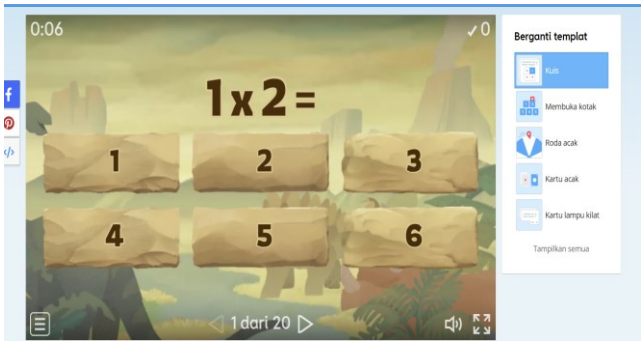

Figure 3. Display during learning

This image shows an example of a "1 × 2 = …" problem, which students must answer by selecting the correct number from the available options. Time and scoring indicators add a challenging element and increase students' competitive motivation to answer the multiplication problem quickly and correctly. The learning process with Wordwall has taken place over several sessions. In the first session, the teacher introduced how to use Wordwall and explained the rules of the game. Some students needed time to adjust to the app's interface and how to answer questions, but in subsequent sessions, they appeared more skilled. Observations showed that the game format allowed students to repeat multiplication facts without feeling overwhelmed. When an answer was incorrect, the app provided immediate feedback so students could immediately recognize their error and work on correcting it the next time. The teacher also used the time after the game to re-explain concepts, emphasize calculation strategies, and reinforce students' understanding of frequently misinterpreted multiplication facts.

Over the course of the sessions, students' skills in operating the application and answering multiplication problems more quickly and accurately improved. This was supported by the Wordwall's direct feedback feature, which allows students to identify errors and correct them independently (Chen, 2016; Hwang & Sung, 2020). Learning became a fun and non-monotonous exercise (Vanbecelaere et al., 2022). Teachers also stated that the Wordwall was very helpful in providing varied exercises and saving time on completing the material. However, technical limitations, such as internet connection, need to be considered for the continuity of learning (Darmawan, 2020).

Student Responses to Wordwall

Students responded very positively. They said they enjoyed multiplication using Wordwall more than regular exercises because it felt like a game and displayed their scores. This fostered intrinsic motivation to study harder, as well as extrinsic motivation through the challenge of scores and peer cheers (Fauzi, 2023; Rembulan et al., 2018). Participation increased dramatically: 1. Passive students became active, 2. Shy students became more willing to answer questions, 3. Student interaction improved through group work and shared enthusiasm (Handayani, 2022). This increased motivation is relevant to the behaviorist approach, which emphasizes reinforcement (feedback) and rewards as learning stimulants, as well

as the constructivist approach, which actively engages students in building understanding through interactive learning experiences (Nasution, 2020).

Discussion of Research Findings

The use of Wordwalls significantly contributes to students at the concrete operations stage of development by providing playful, visual, and interactive experiences tailored to their psychological needs (Piaget, 1972). Wordwalls serve as a means of bridging abstract mathematical understanding into meaningful and enjoyable learning contexts. The findings also support the results of several previous studies, which state that Wordwalls and game-based learning models: 1. increase student motivation and engagement, 2. improve the accuracy and speed of mathematical work, 3. increase positive attitudes toward mathematics (Asmiati et al., 2024; Silviani & Parisu, 2025; Sung & Hwang, 2018). Teachers also benefit from ease of material delivery and efficient management of learning time (Handayani, 2022). However, Wordwall is not the only solution, but rather an innovation that can be combined with learning multiplication concepts through concrete manipulatives or structured memorization strategies for more comprehensive results (Debrenti, 2024).

Overall, the discussion of the findings of this study leads to the use of the Wordwall application as a game-based learning medium has the potential to reduce some of the difficulties in learning multiplication experienced by fourth-grade students of Muhammadiyah Elementary School Tanjungpinang (Rahmawati, 2023). This potential is particularly evident in the increase in motivation, active participation, frequency of practice, and students' confidence in solving multiplication problems (Zhang, 2020; Hartati et al., 2025; Rosyida et al., 2025). Although this study did not focus on quantitative measurements of improvements in learning outcomes, indications of improvements in students' accuracy and speed in solving problems as well as teacher reports regarding changes in student learning behavior provide the basis for Wordwall as a viable alternative media for development in mathematics learning at the elementary school level. However, the use of Wordwall should not be considered the sole solution, but rather as part of an integrated learning strategy, which combines conceptual understanding, structured practice, and the use of media appropriate to student characteristics.

4. Conclusion

The use of the Wordwall application as a game-based learning medium has been proven to help overcome multiplication learning difficulties in fourth-grade students at Muhammadiyah Elementary School in Tanjungpinang. Through multiplication practice packaged in various interactive games (quizzes, matching, game shows, and spinning wheels), students receive ample repetition opportunities, direct feedback, and a fun learning experience, increasing their motivation, engagement, and confidence in solving multiplication problems. Qualitatively, observation, interview, and documentation data indicate positive changes in learning behavior, such as students becoming more focused, more willing to try

answers, working collaboratively, and experiencing a reduced fear of mathematics. Teachers are also better equipped to vary their learning and evaluation methods because Wordwall provides templates that are easily adapted to the objectives and material of multiplication lessons. Therefore, theoretically and empirically, Wordwall is worthy of recommendation as a game-based learning medium in elementary school mathematics, particularly for multiplication operations, as it can increase student interest, participation, and learning outcomes. However, its implementation still requires infrastructure readiness (devices and internet) as well as teacher competence in designing content so that it is not only interesting but also aligned with the expected learning outcomes.

References

Alqadri, Z., & Munawwarah, M. (2025). Mental Models and Conceptual Change in Chemistry: A Literature-Based Perspective on Learning Challenges. *Journal of Educational Sciences*, *9*(2), 811-826. https://doi.org/10.31258/jes.9.2.p.811-826

Asmiati, A., Kasman, M. R., & Amaliah, F. (2024). Penerapan Media Wordwall Untuk Meningkatkan Hasil Belajar Siswa Mata Pelajaran Matematika Kelas V SD. *Jurnal Pendidikan Dasar Dan Keguruan, 9*(2), 28–33. https://doi.org/10.47435/jpdk.v9i02.3174

Chen, C. H. (2016). Formative Assessment With Digital Games. *Computers & Education, 96*, 24–36. https://doi.org/10.1016/j.compedu.2016.02.013

Creswell, J. W. (2017). Research Approaches And Designs. In *Research And Biostatistics For Nurses* (pp. 89–96). *Jaypee Brothers Medical Publishers*. https://doi.org/10.5005/jp/books/13016_6

Darmawan, R. (2020). *Teknologi Pembelajaran Abad Ke-21*. Kencana Prenada Media Group.

Debrenti, E. (2024). Game-Based Learning Experiences In Primary Mathematics Education. *Frontiers In Education, 9*, Article 1331312. https://doi.org/10.3389/feduc.2024.1331312

Edwana, N., Islami, N., & Zulirfan, Z. (2023). Development of Android-Assisted Sound Wave Experiment Devices as an Effort to Improve High School Students' Motivation and Physics Learning Outcomes. *Journal of Educational Sciences*, *7*(4), 598-608. https://doi.org/10.31258/jes.7.4.p.598-608

Fauzi, A. (2023). Penerapan Wordwall Dalam Pembelajaran Matematika. *Journal Of Social And Educational Science, 10*(1), 85–95.

Gee, J. P. (2007). *What Video Games Have To Teach Us About Learning And Literacy* (Rev. ed.). Palgrave Macmillan.

Gusmida, R., & Islami, N. (2017). The development of learning media for the kinetic theory of gases using the ADDIE model with augmented reality. *Journal of Educational Sciences*, *1*(1), 1-10.

Handayani, S. (2022). Praktik Penerapan Wordwall Pada Pembelajaran SD. *Academic Of Community Service Journal, 2*(2), 140–155.

Hartati, F. D., Islami, N., & Rahmad, M. (2025). Needs Analysis of Learning Video Development Using Edpuzzle Based Problem Based Learning to Improve

Critical Thinking Skills of High School Students. *Journal of Educational Sciences*, *7*(1), 27-34. https://doi.org/10.31258/jes.7.1.p.27-34

Hidayat, R. (2020). Kesulitan Belajar Matematika Siswa Sekolah Dasar. *Cakrawala Pendidikan, 39*(2), 384–395.

Hwang, G. J., & Sung, H. Y. (2020). Game-Based Learning Strategies And Effectiveness. *Educational Technology & Society, 23*(3), 1–12.

Lestari, I. (2023). Game Interaktif Untuk Belajar Perkalian Siswa Sekolah Dasar. *Innovative Mathematics Education, 5*(1), 45–55.

Maisaroh, Munatayeva, E., Rakhymbekova, V., Islami, N., & Nasir, M. (2025). Development of Multiple Representation Based Physics Module to Improve Students' Conceptual Understanding and Scientific Attitude. *Journal of Educational Sciences*, *9*(3), 1109-1126. https://doi.org/10.31258/jes.9.3.p.1109-1126

Miles, M. B., Huberman, A. M., & Saldaña, J. (1994). *Qualitative Data Analysis: An Expanded Sourcebook* (2nd ed.). SAGE Publications.

Moleong, L. J. (2017). *Metodologi Penelitian Kualitatif* (Edisi Revisi). PT Remaja Rosdakarya.

Nasution, A. (2020). *Pembelajaran Konstruktivistik Di Sekolah Dasar*. Prenadamedia Group.

Nissa, S. F., & Renoningtyas, N. (2021). Penggunaan Media Pembelajaran Wordwall Untuk Meningkatkan Minat Dan Motivasi Belajar Siswa Pada Pembelajaran Tematik Di Sekolah Dasar. *EDUKATIF: Jurnal Ilmu Pendidikan, 3*(5), 2854–2860. https://doi.org/10.31004/edukatif.v3i5.880

Piaget, J. (1972). *The Psychology Of The Child*. Basic Books.

Prensky, M. (2010). *Teaching Digital Natives: Partnering For Real Learning*. Corwin Press.

Rahmawati, S. (2023). Perkalian Sebagai Dasar Numerasi Siswa Sekolah Dasar. *Jurnal FKIP UCTY, 7*(1), 60–70.

Rembulan, A., & Putra, R. W. Y. (2018). Pengembangan Bahan Ajar Gamifikasi Pada Materi Statistika Kelas VIII. *JMPM: Jurnal Matematika Dan Pendidikan Matematika, 3*(2), 84–98. https://doi.org/10.26594/jmpm.v3i2.1221

Rohmana, E. (2021). Math Anxiety Dalam Pembelajaran Matematika Sekolah Dasar. *Jurnal Psikologi Pendidikan, 18*(2), 101–112.

Rosyida, U., Islami, N., & Azhar, A. (2025). The Effectiveness of Cooperative Learning Model Type Tgt Assisted by Kahoot Application to Improve Students' Cognitive Learning Outcomes Material Pressure Substance Class VIII Middle School. *Journal of Educational Sciences*, *6*(4), 637-644. https://doi.org/10.31258/jes.6.4.p.637-644

Silviani, N., & Parisu, M. (2025). Media Digital Berbasis Permainan Untuk Materi Perkalian. *Jurnal Pendidikan Matematika, 11*(1), 15–25.

Siregar, S. (2021). Drill And Practice In Multiplication Learning. *Mathematics Education Review, 6*(2), 55–66.

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D*. Alfabeta.

Sung, H. Y., & Hwang, G. J. (2018). Effects Of Mobile Game-Based Learning On Students' Motivation And Performance. *Interactive Learning Environments, 26*(4), 491–507. https://doi.org/10.1080/10494820.2017.1354238

Vanbecelaere, S., Demedts, F., Reynvoet, B., & Depaepe, F. (2022). The Effectiveness Of Adaptive Digital Games For Learning: Calling For A Broader View On Assessment. *Lecture Notes In Computer Science,* 13422, 269–278. https://doi.org/10.1007/978-3-031-22124-8_26

Wijayanti, R. (2022). Kesulitan Siswa Dalam Operasi Perkalian Matematika. *Jurnal Pendidikan Dasar, 13*(1), 33–41.

Zhang, K. (2020). Digital Games In Elementary Mathematics Learning. *Journal Of Computer Assisted Learning, 36*(6), 833–844. https://doi.org/10.1111/jcal.12452

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