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Development Of Interactive Wordwall Activity-Based Learning Media For Whole Number Concept In Grade 2 At Balonggemek 1 Public Elementary School

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ABSTRACT

This research was motivated by the need for interactive and engaging learning media to help second-grade students understand the concept of whole numbers. Mathematics learning in lower grades is often delivered through conventional methods, which can make students easily bored and less motivated. The use of digital tools such as Wordwall is expected to create a more enjoyable, participatory, and student-centered learning atmosphere. The study employed a Research and Development (R&D) method using the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. The participants were second-grade students at SD Negeri Balonggemek 1. Data were collected through observation, interviews, questionnaires, and learning outcome tests. Validation by media and material experts was conducted to assess the feasibility of the developed product. The results indicated that the Wordwall-based learning media was highly feasible, with an average validation score above 90%. The practicality test showed that both teachers and students found the media easy to use and engaging, achieving an attractiveness level of 94.3%. In addition, students' learning outcomes improved significantly after using the media, as seen from the increase in post-test scores compared to pre-test results. In conclusion, the Wordwall learning media for whole numbers material is effective for use in second-grade mathematics learning. It not only improves students' conceptual understanding but also enhances their enthusiasm and motivation to learn actively.

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Introduction

Mathematics is a core subject in elementary schools that primarily aims to train students' logical, analytical, and problem-solving abilities (Ramadhani et al., 2019). In Grade 2, students begin to learn the concept of whole numbers, which serves as the foundation for various other mathematical topics. This material includes the introduction, addition, subtraction, and comparison of numbers. The purpose of mathematics learning is to educate, broaden knowledge, experience, and students' perspectives so that they can solve problems using the knowledge and experience they have gained. However, many students experience difficulties in understanding the material due to conventional and less interactive teaching approaches. This often makes learning less engaging, especially for lower-grade students. Novilanti et al. (2021) also argue that mathematics is one of the most avoided subjects among

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students. They believe that mathematics is difficult to understand and often perceive it as an abstract subject disconnected from real life.

According to the *Minister of National Education Regulation (Permendiknas) No. 22 of 2006*, mastery of mathematical concepts aims to develop creative, innovative, critical, and logical thinking, as well as to apply mathematics as a tool to solve real-life problems. It is expected that mathematics learning enables students to think of multiple solutions to a problem. To support the development of these abilities, students should be trained to use various learning resources and media that can enhance their interaction, logical reasoning, creativity, and systematic thinking. Learning mathematics requires media that can make the delivery of material more engaging and easier to understand (Rezeki & Amelia, 2019).

Learning media play a major role in the teaching and learning process. Therefore, teachers are required to develop special skills that allow them to create enjoyable learning environments that motivate students. Learning media serve as key components in the learning process, functioning as tools and materials that help deliver messages to students (Retnowati, 2017). Media design should be done carefully to not only convey material but also to create an engaging and enjoyable learning atmosphere. According to Yaumi (2018), physical media specifically designed for classroom learning are needed to facilitate knowledge transfer from teacher to student. This supports the learning process and helps students achieve learning goals. Common physical media include blackboards, real objects, charts, and slides. However, there are now more advanced media such as DVDs, the Internet, interactive videos, CD-ROMs, and educational applications like *Hoop, Kahoot, Quizizz, EdApp,* and *Wordwall*.

One digital tool that has become increasingly popular in education is Wordwall. Wordwall is an interactive learning platform that provides various templates for games, quizzes, and exercises that can be customized to the lesson material. This media allows teachers to adjust questions and formats according to students' comprehension levels. Its interactive design helps motivate students to participate more actively. Some Wordwall features even work offline, which is particularly useful in limited connectivity environments. Students can receive instant feedback after completing activities, helping them understand mistakes and improve their comprehension (Turohmah et al., 2020).

Based on this, the researcher seeks to develop Wordwall as a learning tool to increase students' interest in mathematics. Wordwall functions as an online evaluation tool, learning media, and study reference (Ningtia & Rahmawati, 2022). It provides various creative templates to guide new users in developing their ideas. As a web-based platform, it allows the creation of quiz-based educational games that attract student interest. Wordwall content can also be customized based on instructional design and assessment analysis (Pradani, 2022).

This research focuses on the use of Wordwall as a teaching medium in mathematics learning activities for Grade 2 at Balonggemek 1 Public Elementary School, Megaluh District, Jombang Regency. The monotonous and limited use of learning media has prompted this research and development. Teachers tend to rely on conventional methods lectures and one-way communication despite the availability of facilities. Many teachers have limited technological skills, which hinders the adoption of innovative media and teaching models.

Although these studies demonstrate Wordwall's potential, most focus only on validity, practicality, and short-term learning outcomes. They often treat teachers merely as end users rather than co-developers of the media. In reality, Wordwall holds broader potential for developing 21st-century skills such as critical thinking, collaboration, innovation, and digital literacy. (Permadi et al., 2026).

In lower elementary grades, challenges extend beyond content to include limited digital resources many students lack personal devices, making individual digital learning difficult. Therefore, there is a need for media that are easy to use, group-friendly, enjoyable, and adaptable to classroom realities. This study introduces three key innovations: (1) Group-based use of Wordwall to overcome limited access to devices. (2) Active teacher involvement from the initial design stage to ensure contextual alignment with classroom needs. (3) Focus on whole number material for Grade 2, which has rarely been explored in prior studies. It is expected that this media will serve as an equitable, contextual, and engaging digital learning

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alternative that promotes active and meaningful learning experiences aligned with modern educational challenges. (Abdulghani & Sya'ban, 2026).

Method

This study is a Research and Development (R&D) type of research that aims to produce an interactive learning media based on Wordwall for teaching whole numbers to second-grade elementary students. The development model used in this study is the ADDIE model, consisting of five main stages: *Analysis*, *Design*, *Development*, *Implementation*, and *Evaluation*. The analysis stage was conducted to identify students' learning needs, curriculum alignment, and the characteristics of second-grade learners who are in the concrete operational stage. The design stage involved creating an initial blueprint of the Wordwall media, including the selection of suitable game types, learning content, visual design, and activity flow. The development stage covered the creation of the media using the Wordwall platform, followed by validation from media and material experts to assess its feasibility. Once declared feasible, the implementation stage was carried out through a limited trial involving second-grade students at **SD Negeri Balonggemek 1**, to examine the practicality and attractiveness of the media. The final stage was the evaluation, conducted both formatively and summatively, to determine the effectiveness of the media in improving students' understanding of whole number concepts. Data were collected through observation, interviews, questionnaires, and learning outcome tests, and were analyzed using qualitative descriptive methods supported by simple quantitative analysis through a comparison of pre-test and post-test results.

Result

1. Validation by Learning Media Design Expert

The learning media design expert in this research was Dr. Drs. Achmad Noor Fatirul, ST., M.Pd., an expert in Educational Technology from PGRI Adi Buana University Surabaya. With extensive experience in instructional design and media development, he was deemed suitable to evaluate the quality of the developed media. Quantitative results show that the Wordwall-based learning media achieved a validity score of 86%, categorized as very valid. This indicates that the media meets the standards of design attractiveness, clarity of visuals, appropriate typography, navigational ease, and compatibility with the characteristics of Grade 2 students. Qualitatively, the validator suggested adding font variations to make the design more engaging. This feedback served as a basis for further improvement in the visual presentation. Therefore, the Wordwall media is considered feasible and ready for classroom implementation in terms of design quality.

2. Validation by Material Expert

The material expert validator was Mr. Hidayat Nuryanto, S.Pd., a Grade 2 teacher at SD Negeri Balonggemek 1, who has extensive experience in elementary-level instruction. Quantitative validation results indicated a 90% validity score, which falls into the very valid category. This means that the learning material presented in the media aligns with the Core Competencies (KI), Basic Competencies (KD), and learning indicators outlined in the curriculum. The language used is clear, simple, and appropriate for young learners, and the exercises provided help reinforce students' understanding of whole numbers. From qualitative feedback, the validator recommended using standard Indonesian language in writing questions and instructions to ensure clarity and grammatical accuracy. Based on these findings, the Wordwall media is considered highly appropriate and effective in terms of content quality and instructional alignment.

3. Pretest–Posttest Data Analysis

The product trial was conducted on 10 second-grade students at SD Negeri Balonggemek 1, Megaluh District, Jombang Regency. A *pretest* was administered before using the media and a *posttest* afterward to measure learning improvement. The results demonstrated a clear improvement: the average pretest score was 81.8, increasing to 84 in the posttest, with all students scoring above the minimum mastery criterion (KKM = 75). This

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shows that the use of Wordwall-based media effectively improved students' comprehension of whole number concepts.
Students also appeared more enthusiastic and engaged during lessons, as the interactive and game-based nature of the media made learning more enjoyable. Thus, Wordwall media proved to be effective in enhancing both engagement and academic performance in mathematics learning.

4. Student Response Analysis

To assess students' interest and acceptance of the media, a response questionnaire was distributed after the trial. The overall response rate reached 94.3%, classified as very interesting.
Most students agreed that learning through games made the lessons more fun, that the visuals were attractive, the language was clear, and the material was aligned with their mathematics lessons. They also appreciated that the media was easy to understand, visually appealing, and complete in content coverage. These findings suggest that the Wordwall-based learning media not only meets validity and feasibility criteria but also significantly enhances students' motivation and interest in mathematics. Therefore, overall, the Wordwall media can be categorized as valid, engaging, and effective for use in elementary mathematics learning.

5. Product Revision (English Version)

1. Revision by the Learning Media Design Expert
   Dr. Drs. Achmad Noor Fatirul, ST., M.Pd. served as the learning media design expert for the Wordwall-based media in this study. He provided constructive feedback and recommendations to improve the developed product. His main suggestions included:
   a. Adding more appealing images and colors to enhance visual attractiveness.
   b. Using a greater variety of fonts to make the design more engaging. Based on these suggestions, revisions were made to the Wordwall-based learning media to ensure that the final product was truly valid, visually appealing, and ready for material testing before and after revision.
2. Revision by the Learning Material Expert
   Mr. Hidayat Nuryanto, S.Pd. SD., acted as the learning material expert for the Wordwall-based media. The validation process showed that the content required only minor revisions, as it was already aligned with the learning materials used by students. He suggested revising the wording of several questions in the media to ensure clarity and accuracy. Overall, he concluded that the Wordwall-based learning media was already well-developed and appropriate in terms of content, particularly for the topic of cubes and rectangular prisms.

Before Revised	After Revised
	

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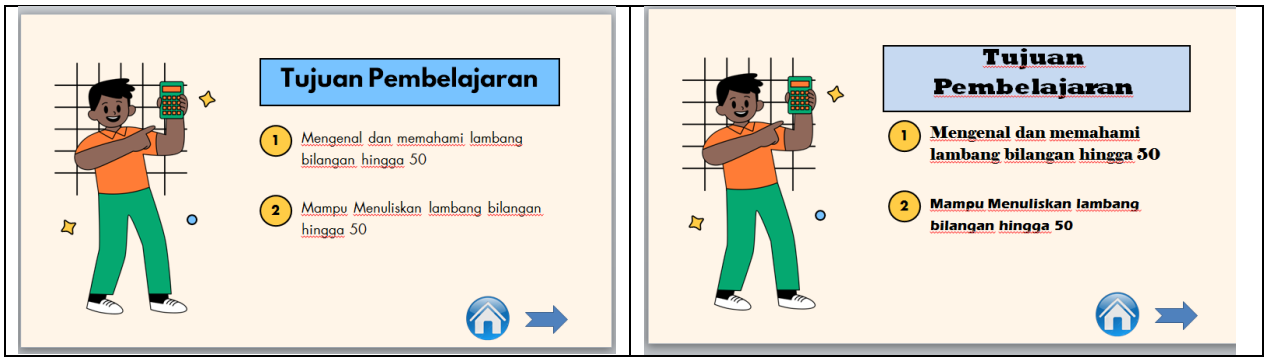

discussion

A. Overview of the Developed Product

The product developed in this study is an interactive digital learning media using the Wordwall platform for teaching whole number concepts to Grade 2 students at SD Negeri Balonggemek 1. The development process followed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) with the goal of producing media that are feasible, engaging, practical, and effective for mathematics learning.

The analysis stage revealed that conventional teaching methods led to low student engagement and difficulties in understanding abstract number concepts. Teachers and students indicated the need for more interactive and enjoyable learning activities. Therefore, the media was designed using curriculum-based content and Wordwall game features with child-friendly visuals and simple navigation, in line with multimedia and game-based learning theories.

Classroom implementation showed increased student participation and enthusiasm. Teachers reported higher student confidence, while students found the game-based activities enjoyable and easy to understand. Expert validation categorized the media as highly feasible in terms of design and content.

Despite its effectiveness, implementation challenges included limited access to digital devices, dependence on internet connectivity, and varying levels of teacher digital literacy. Overall, the Wordwall-based learning media is feasible and has the potential to enhance engagement and understanding of whole number concepts when supported by adequate infrastructure and teacher readiness.

B. Analysis of Media Attractiveness

The attractiveness of learning media is crucial in determining students' engagement during the learning process. Based on questionnaire results from Grade 2 students at SD Negeri Balonggemek 1, the Wordwall-based media obtained an average score of 94.3%, categorized as very attractive. This shows that students were drawn to the visuals, animations, colors, and interactive games presented in the media.

The high level of engagement was largely due to the child-friendly visual design, bright color schemes, and interactive game formats such as quizzes, match-up games, and spinning wheels that made learning enjoyable. This finding aligns with Astiti, Jaya, and Zainal (2025), who noted that animation- and game-based media significantly enhance student motivation and participation. Thus, the Wordwall media functioned not only as a learning aid but also as an educational recreational tool that stimulates interest in mathematics.

Students responded positively to the clarity of instructions and the appropriateness of the content with their curriculum. Overall, the Wordwall-based media fulfilled the attractiveness criteria with scores above 80%, meaning no revisions were needed. It successfully created an interactive and enjoyable learning experience that reduced boredom in the classroom.

This engagement is consistent with game-based and multimedia learning theories, which emphasize the role of interactive elements and simple language in increasing motivation and reducing cognitive load. However, implementation constraints were identified, including limited access to digital devices, dependence on internet connectivity, and varying levels of teacher digital literacy.

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C. Analysis of Media Practicality

Practicality refers to the ease with which learning media can be used by teachers and students during instruction. Trial results showed that the Wordwall-based media was perceived as highly practical, with a practicality score above 90%. Beyond the quantitative results, qualitative feedback indicated that teachers found the media easy to access, requiring no installation and compatible with both laptops and smartphones. Teachers also reported that the media could be integrated directly into lessons without additional preparation time.

From the students perspective, clear navigation and a simple interface allowed them to operate the media independently. Students stated that the instructions were easy to follow and that the game-based activities helped them complete tasks without confusion. These findings align with usability and technology acceptance theory, which emphasize that ease of use and clarity increase users' willingness to adopt digital learning tools.

The flexibility of the media enabled its use in both face-to-face and online learning settings, supporting previous findings by Ditania Oktariyanti, Aren Frima, and Riduan Febriandi (2021) that Wordwall is practical and accessible for classroom use. However, several implementation constraints were identified, including dependence on digital devices, stable internet connectivity, and varying levels of teacher digital literacy. Teachers noted that limited access to devices and insufficient training could hinder optimal use of the media.

The media's practicality was supported by its fast response, consistent layout, and organized menus (home, instructions, objectives, materials, games, and worksheets), which facilitated lesson planning for teachers and structured learning for students. Overall, the Wordwall media proved to be easy to use, efficient, and adaptable to classroom conditions.

D. Analysis of Media Effectiveness

The effectiveness of the Wordwall-based media was measured through pretest and posttest results, which showed an increase in average scores from 81.8 to 84, with all students exceeding the Minimum Mastery Criterion (KKM = 75). Beyond test scores, qualitative feedback indicated that students felt more confident, motivated, and actively engaged in solving problems during lessons. Teachers observed that students who were usually passive participated more willingly and responded enthusiastically to game-based activities.

The score improvement demonstrates that the media not only attracted students visually but also enhanced their cognitive abilities in grasping fundamental mathematical concepts. Students became more active, confident in answering questions, and better able to solve problems as they learned in an enjoyable context. Students reported that the colorful and interactive format made abstract number concepts easier to grasp, while teachers highlighted that the media helped achieve learning objectives in a more engaging way.

These results are consistent with Kusumastuti and Mahmudah (2025), who found that game-based learning can significantly improve students' conceptual understanding and collaboration. Similarly, Aeni et al. (2022) concluded that using Wordwall as an interactive learning medium increases learning outcomes and motivation in elementary education.

The effectiveness of this media can be seen in three key indicators:

1. A significant improvement in learning outcomes after using the media.
2. An increase in learning motivation, reflected through enthusiasm and active participation.
3. The alignment of media content with learning objectives, supporting the achievement of curriculum-based competencies.

Based on the results of validity, practicality, and effectiveness tests, it can be concluded that the Wordwall-based learning media for whole number material in Grade 2 at SD Negeri Balonggemek 1 is highly feasible, practical, and effective for use in elementary mathematics learning.

Conclusion

Based on the research and development results, it can be concluded that the Wordwall-based learning media was successfully developed and is suitable for use as a mathematics learning aid for whole numbers in second grade elementary schools. This media was deemed highly suitable by material and media experts due to its attractive appearance, ease of use, and appropriateness to the cognitive development level of elementary school students.

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The development process, conducted using the ADDIE model, resulted in media that is not only valid in content and design but also practical in its classroom application. Teachers and students responded positively to the use of this media, as it created a more lively and enjoyable learning environment.

Furthermore, the trial results showed an improvement in student learning outcomes after using the Wordwall media. Students became more enthusiastic and active in learning activities and more easily understood the concept of whole numbers. Thus, the Wordwall media can be an innovative alternative in mathematics learning that encourages active participation and increases student motivation.

Practical implications for teachers include integrating the Wordwall media into lessons for 30–45 minutes per session, using devices such as laptops, tablets, or smartphones with internet access, and providing initial guidance for students unfamiliar with digital game-based learning. Teachers with limited digital literacy may benefit from brief training or tutorials to optimize media use.

Overall, the Wordwall-based media provides an innovative, interactive, and technology-enhanced approach to mathematics learning, supporting active participation, enhancing learning outcomes, and offering advantages over non-digital instructional methods.

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