

## Development of WING Media (Wordwall Interactive Games) for Cube and Rectangular Prism Concept

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**Abstrak** Pembelajaran matematika sering kali dipersepsikan sulit dan kurang menarik oleh peserta didik karena proses belajar yang masih berpusat pada guru, strategi yang kurang bervariasi, serta keterbatasan media pembelajaran. Kondisi tersebut menyebabkan suasana kelas menjadi pasif dan pemahaman materi terhambat. Penelitian ini bertujuan untuk mengembangkan dan menganalisis kelayakan serta kepraktisan media WING (*Wordwall Interactive Games*) pada materi bangun ruang. Metode penelitian yang digunakan adalah *Research and Development* (R&D) dengan model ADDIE. Subjek penelitian melibatkan 28 peserta didik kelas VA SD Negeri Tembong 1, dengan rincian 12 peserta didik pada uji coba kelompok kecil dan seluruh siswa pada uji coba kelompok besar. Teknik pengumpulan data meliputi observasi, wawancara, validasi ahli, dan angket respon peserta didik. Hasil penelitian menunjukkan bahwa media WING memperoleh kriteria sangat layak dengan skor validasi ahli media sebesar 95,4% dan ahli materi sebesar 96,4%. Selain itu, hasil uji kepraktisan melalui angket respon peserta didik memperoleh skor sebesar 87% dengan kategori sangat praktis. Dengan demikian, media WING valid dan praktis digunakan sebagai media pembelajaran matematika untuk materi kubus dan balok.

**Kata kunci:** matematika, kubus dan balok, wordwall

**Abstract.** *Mathematics learning is often perceived as difficult and less engaging by students due to teacher-centered instruction, less varied teaching strategies, and limited learning media. These conditions cause classroom activities to become passive and hinder students' understanding of the material. This study aims to develop and analyze the feasibility and practicality of WING (Wordwall Interactive Games) media on the topic of three-dimensional shapes. The research method used was Research and Development (R&D) with the ADDIE model. The research subjects involved 28 fifth-grade students of SD Negeri Tembong 1, consisting of 12 students in the small-group trial and all students in the large-group trial. Data collection techniques included observation, interviews, expert validation, and student response questionnaires. The results showed that the WING media achieved a "highly feasible" criterion, with a media expert validation score of 95.4% and a material expert validation score of 96.4%. In addition, the practicality test results based on student response questionnaires obtained a score of 87%, categorized as "highly practical." Therefore, the WING media is valid*

and practical to be used as a mathematics learning medium for the topic of cube and rectangular principles.

**Keywords:** *mathematics, cube and rectangular prism, wordwall*

## INTRODUCTION

Advances in science and technology have brought significant changes to various aspects of life, particularly in education. Technological advancements not only facilitate easy access to information but also open up opportunities for innovation that can improve the quality of the learning process. Technology in education serves as a crucial tool to support learning activities, enrich information sources, and facilitate more effective and adaptive learning tailored to student needs (Indriani et al., 2022). Therefore, the ability to optimally utilize technology is becoming an increasingly relevant requirement in the context of modern education.

Learning in elementary school plays a strategic role as a foundation for students' intellectual, social, and emotional development. At this stage, students begin to learn basic concepts that will be useful for future advanced studies. Therefore, the way students learn in elementary school must be well-planned to build a solid foundation of understanding, skills, and mindsets (Dhani & Cahya, 2023).

Mathematics is a field that plays a significant role in developing students' critical thinking skills. This is because mathematics serves not only as a mathematical science but also as a vehicle for developing logical, systematic, and analytical thinking skills in students (Lubis et al., 2025).

However, the reality on the ground shows that mathematics learning is often considered difficult and uninteresting by students. This is related to the *teacher-centered learning approach*, where the teacher is more dominant in explaining concepts, while students tend to be passive in the learning process. The lack of variety in learning strategies and the limited media used make it difficult for students to understand abstract concepts in mathematics. This condition impacts students' motivation to learn, which is due to a negative perspective regarding mathematics as difficult (Jannah et al., 2023).

To achieve quality learning processes and outcomes in accordance with curriculum demands and societal expectations, teachers play a central role as designers, implementers, and assessors of learning (Anggraini, 2021). Teachers

need to ensure that learning is conducted with the aim of increasing knowledge and is presented in an engaging manner that fosters active student participation. The use of learning media plays a crucial role in the delivery of material, providing a concrete and more easily understood picture. Learning media serves as a tool that can increase the effectiveness and optimization of the learning process (Aulia & Oktaviarini, 2025).

In line with advances in digital technology, learning media has also undergone changes. Digital-based media can present attractive, interactive visual displays, and are closer to the characteristics of today's technology-savvy students (Rahmawati & Atmojo, 2021). Therefore, teachers need to choose media that considers student needs, ease of access, and suitability for learning objectives (Wulandari et al., 2023). Unfortunately, many teachers still rely on traditional media such as whiteboards, resulting in less varied learning. In fact, today's generation of students are digital natives who are more responsive to interactive and technology-based learning media (Salsabila et al., 2023).

One promising medium for increasing learning effectiveness is educational *games*. Learning media that integrate games have the potential to create a fun atmosphere while encouraging students to achieve (Arifah et al., 2022). Educational *games* combine fun with learning and effectively draw students into the learning experience, keeping them focused and engaged. With a "learning through play" approach, educational *games* are expected to help students understand the material more easily and enjoyably. Furthermore, *games...* Education is also designed to stimulate thinking power and increase concentration for its users (Rinaldi et al., 2023).

Based on observations and interviews conducted by researchers in class VA at Tembung 1 Public Elementary School, located in Cipocok Jaya District, Serang City, Banten, it is increasingly clear that innovation in learning media is needed. Observations indicate that mathematics learning still uses limited learning media and learning resources, namely the blackboard and the teacher's knowledge sources. This condition makes learning monotonous and does not actively engage students. Students experience difficulties when working on math problems due to the lack of comprehensive explanations of the steps to solve them. Furthermore, the perception that mathematics is a difficult subject further reinforces students' low learning motivation. Furthermore, when

learning is teacher-centered, students tend to make less effort to seek additional information independently. This condition indicates that mathematics learning needs to be improved by providing more varied, interactive, and technologically advanced media. Therefore, technology-based learning media innovation offers a crucial way to improve the quality of learning and attract students' interest in learning.

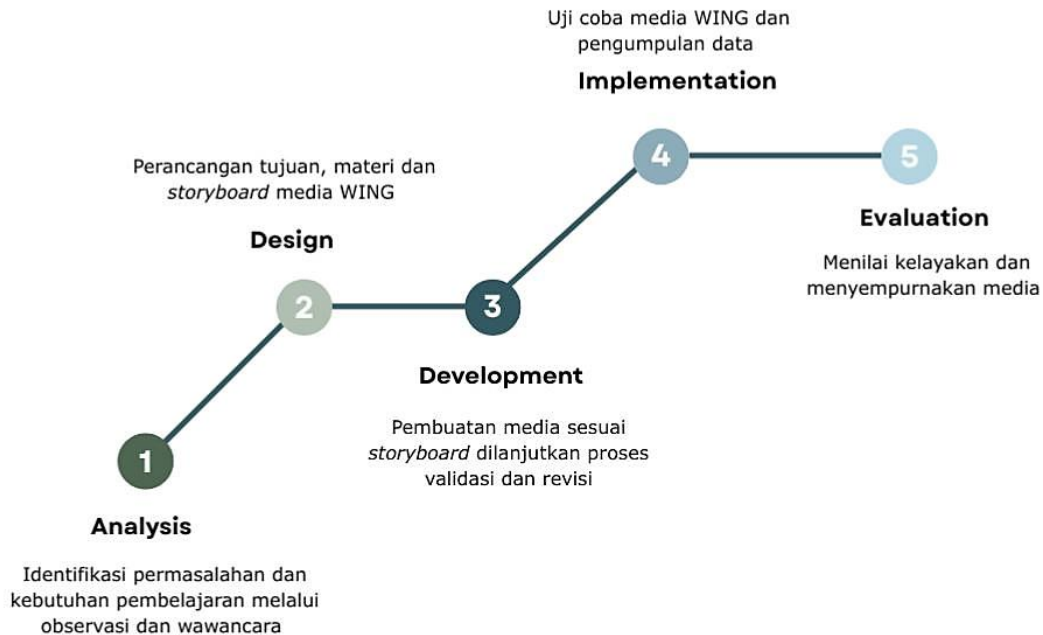
In line with this urgency, various previous studies have shown that the use of interactive digital media in elementary schools, particularly the *Wordwall platform*, has great potential in improving the quality of mathematics learning. *Wordwall*-based media not only helps students understand the material more easily but also contributes to reducing mathematics learning anxiety and increasing learning comfort ( Ilahi et al., 2022 ). Furthermore, the use of *Wordwall* has been proven to foster student enthusiasm, so that they become more active and involved in the learning process ( Nisa & Susanto, 2022 ). The development of a *Wordwall*-based educational *game* on spatial geometry also showed excellent results, both in terms of feasibility, practicality, and effectiveness in improving learning outcomes ( Wildan et al., 2023 ). These findings indicate that *Wordwall* is a medium that is not only visually appealing but also effective in supporting conceptual understanding and increasing student learning motivation, thus having great potential for development in mathematics learning in elementary schools.

Although various studies have shown that *wordwall-based media* are effective and suitable for use in mathematics learning, media development for spatial geometry still has several limitations. One relevant study is the development of GAULL (*Wordwall Educational Game*) by Wildan et al. (2023), which integrates a *wordwall game* with a Canva-based interactive *PowerPoint presentation* for spatial geometry. The results of this study indicate that the developed media has a high level of validity, practicality, and effectiveness. However, GAULL media emphasizes the game aspect as a means of evaluation and practice, while the presentation of the material in *PowerPoint* has not been fully designed contextually and structured to help students build conceptual understanding gradually before entering the game activity. In addition, the examples presented do not specifically link the concepts of cubes and cuboids to real-life situations that are close to the students' lives.

Based on these findings, this research aims to develop WING (*Wordwall Interactive Games*) media that combines Canva-based interactive *PowerPoint* and *PowerPoint applications* integrated with cube and block *wordwall games* in a single learning flow through *hyperlink mapping*. The integration of *hyperlinks* in *PowerPoint* allows for easier and more interactive navigation of content choices. Thus, the novelty of this research lies in the development of learning media that not only presents *wordwall* as an evaluation tool or game, but also as part of a structured material delivery flow that starts from the definition, examples, properties, and nets of cube and block geometric shapes according to the needs of fifth grade elementary school mathematics learning.

### RESEARCH METHODOLOGY

This research uses the Research and Development (*R&D method*) with the ADDIE model, which consists of the stages of *Analysis, Design, Development, Implementation, and Evaluation*. The procedures in this research are presented in the following diagram.



**Figure 1.**

Research procedures with the ADDIE model

In this research, 28 students of grade 6 of Tembung 1 State Elementary School were selected as research subjects. Data collection techniques included

interviews, observations, expert validation questionnaires, and student response questionnaires. Observations and interviews were used to obtain initial data related to learning conditions and media needs, while the validation questionnaire was used to assess the appropriateness of the media by subject matter experts and media experts. The student response questionnaire was used to determine the level of practicality of the media after its use in learning.

The data obtained were analyzed using qualitative and quantitative analysis techniques. Qualitative data from observations and interviews were analyzed descriptively, while quantitative data from expert validation and student questionnaire responses were analyzed using percentage techniques with the following formula.

$$P = \frac{\text{Obtained score}}{\text{Maximum score}} \quad (\text{Wildan et al., 2023}).$$

Then the percentage results are categorized into the media validity criteria as follows (Kamila & Kowiyah, 2023).

**Table 1.**  
Validity Criteria

<b>Percentage</b>	<b>Criteria</b>
81% - 100%	Very worthy
61% - 80%	Worthy
41% - 60%	Not worthy
21% - 40%	Not feasible

## **RESULTS AND DISCUSSION**

### **Results**

The development of WING learning media was carried out according to the ADDIE process: *analysis, design, development, implementation, and evaluation*. The following details the process until the product meets expectations.

#### **1. Analysis Stage**

Analysis is the stage that serves as the primary foundation for understanding the background of relevant facts and conditions at the location

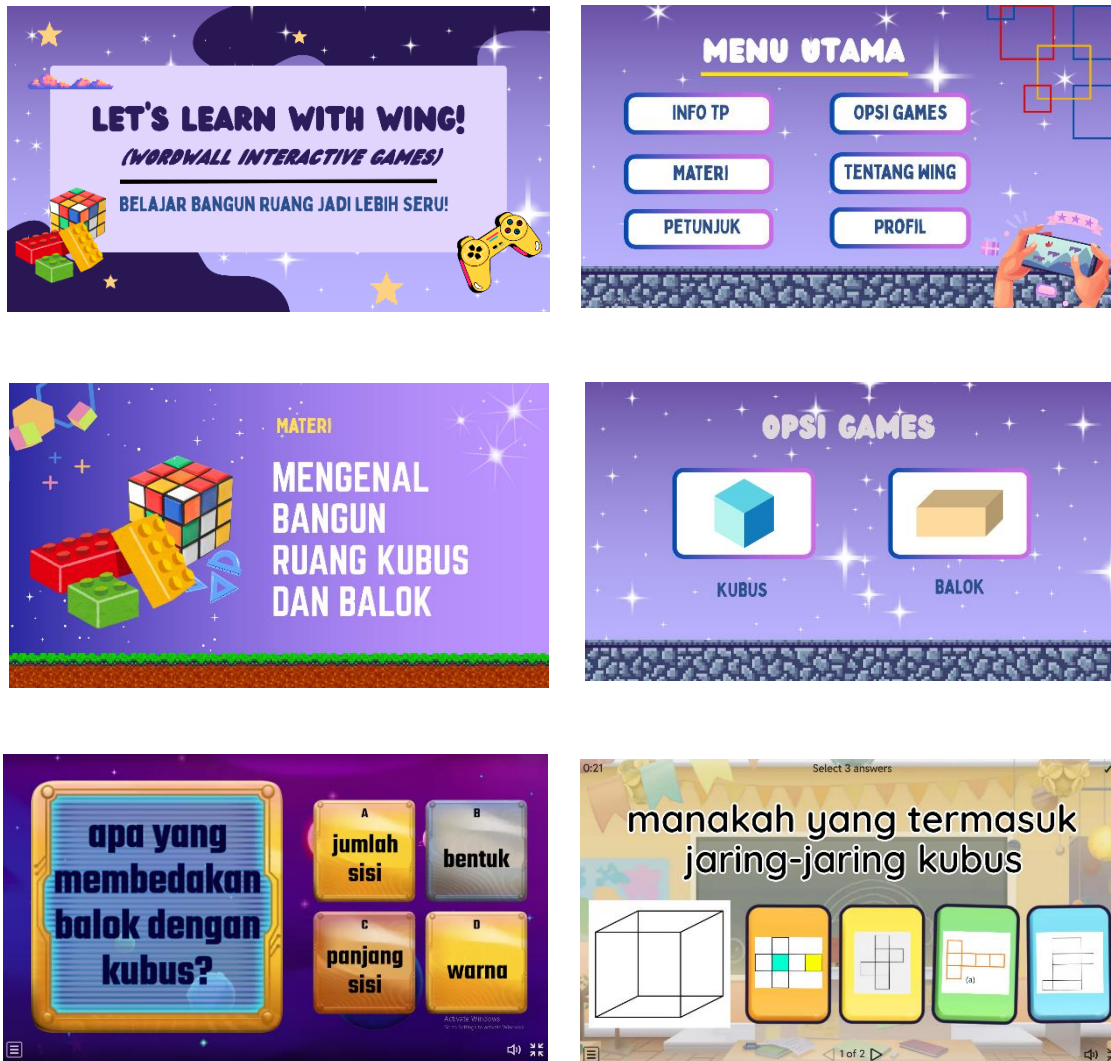
where this research is conducted. During the analysis stage, researchers collect data using observation, interviews, documentation, and research related to previous studies. The purpose of this analysis is to identify problems encountered during observations at the research location. The researcher then examines the factors that contribute to these problems.

Based on the results of the analysis stage conducted at Elementry School at Tembong 1 on class VA students, the researcher identified that problems were found in the learning process caused by the lack of teacher awareness to pay attention to students sitting at the back, then it was seen that class management related to seating layout was less strategic because it hindered students when paying attention to explanations from the teacher, learning media was not interactive for all students so that the class tended to be passive and monotonous, lack of use of learning resources because teachers only relied on their own knowledge. To follow up on the data found at the analysis stage, *a design stage was required.*

## 2. Design Stage

This stage is carried out after obtaining the results of the analysis to design solutions that refer to the problems found during the observation. Researchers chose to develop a learning media design, to be used as a solution that helps overcome problems from the findings during the analysis. The material used in the development of WING media ( *interactive wordwall game* ) in this study is about geometric shapes. After determining the learning material to be developed in WING media, researchers determined the learning objectives to be achieved by students, namely (1) students are able to analyze the differences between cube and cuboid geometric shapes through WING media displays correctly, (2) students are able to determine the nets of cube and cuboid geometric shapes through the correct use of WING media. Referring to the learning objectives that have been set, researchers created a WING learning media design by collaborating with the Canva application for *editing* and *the Wordwall application* to present interactive quizzes. By utilizing the Canva application, researchers created a menu display that can be directly directed to 6 options according to the desired page, including: TP info (Learning

Objectives), geometric shapes material, instructions, choose games, about WING, and profile.



**Figure 2.**

Initial design of WING media

### 3. Development Stage

The process of realizing the previously created design into a real product. All planning from the design phase, such as selecting the right materials for students and what they need to learn, the teaching approach used, and how testing and assessment will be carried out, is now displayed in the prototype. It started when the WING media was created through a *wordwall application* containing 20 multiple-choice questions on the theme of cube geometry in the *Quiz template* and 20 multiple-choice questions on the theme of cuboid geometry. Researchers began producing WING media on the *wordwall* platform

by inserting questions, attractive visual images of geometric geometry, and setting interactive features such as time and implementation techniques.

After the initial product draft is complete, a two-stage expert validation phase is conducted. The media is submitted to media experts to assess its appearance and usability, and to content experts to verify its mathematical concepts. The input and suggestions from these experts are then used as a basis for product revisions to refine the media before pilot testing. The validation results are presented in the following table.

**Table 2.**  
Results of media expert validation

No	Indicator	V1	V 2
1.	Media design according to the material	5	5
2.	Media design according to concept	5	5
3.	Media packaging according to material integration	3	5
4.	The media design is attractive to look at	5	5
5.	Media design presents real examples of material	3	5
6.	Media design presents the use of materials/concepts	5	5
7.	Selection of attractive colors in the media	4	5
8.	Unique media selection	5	4
9.	Contains integration of concepts with the environment.	5	5
10.	Attractive media display and easy to carry/move	5	5
11.	Given a title/media caption	5	5
12.	There are ways to use/care for the media	5	4
13.	Media presentation is able to develop students' interest in learning.	4	4
Total score		59	62
Percentage		90.8%	95.4%

**Table 3.**

Input and suggestions from media expert validators

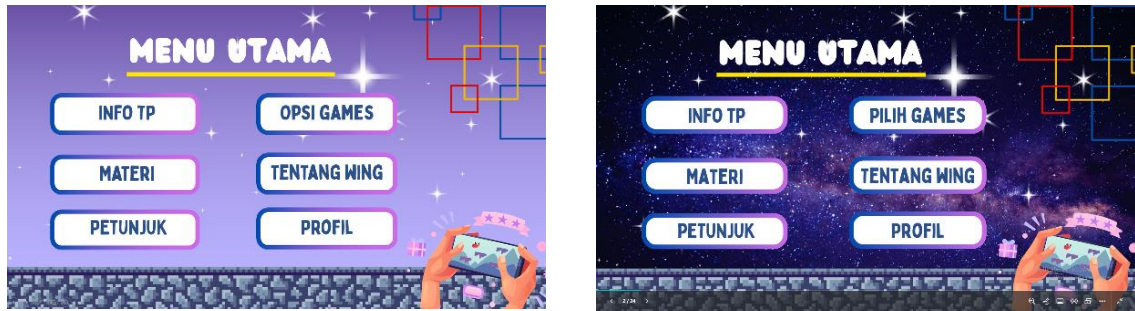
<b>Validator</b>	<b>Aspect</b>	<b>Indicator</b>
Firdaus, M.Pd.	Design	1. Complete the material with appropriate image icons. 2. Add real examples of contextual objects that correspond to cubes and blocks.
Denny Malik, S.Pd.	Design	1. Correct any typos in the diction. 2. Media and image visualizations are made more attractive and some icons are slightly smaller in size.

**Table 4.**

Subject matter expert validation

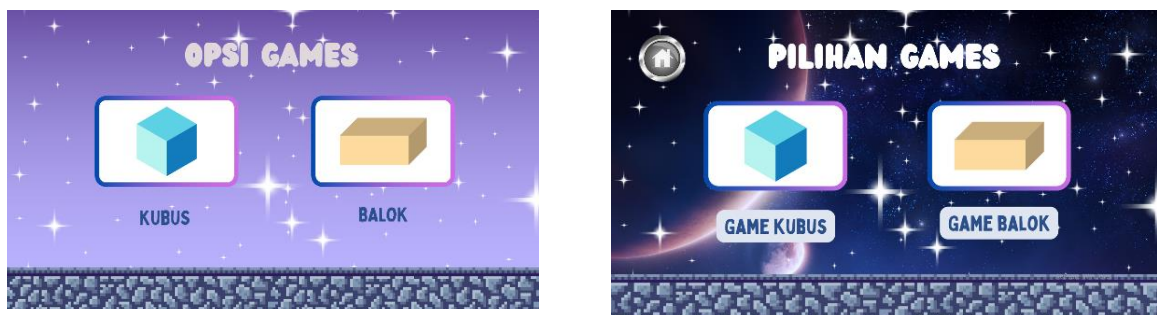
<b>No.</b>	<b>Aspect</b>	<b>Validation 1</b>	<b>Validation 2</b>
1.	Relevance	26	29
2.	Accuracy of Material	20	24
3.	Serving completeness	5	5
4.	Basic concepts of matter	4	5
5.	Suitability of presentation to demands student-centered learning	17	19
Total score		72	82
Percentage		84.7%	96.4%

Based on suggestions and input provided by validators during the first phase of the validation process, researchers have made several improvements to the visual appearance, contextual image icons, and more engaging templates. The changes in the media's appearance before and after the revisions can be seen in the following image:



**Figure 3.**

Main menu before and after revision



**Figure 4.**

Games page before revision

The image before shows bright visuals and after revision it is dark in color with a space theme and changes the vocabulary that can be easily understood by elementary school students.



**Figure 5.**

Wordwall page with various themes for cube material quizzes (class and *underwater themes* )



**Figure 6.**

Wordwall page with various themes for the block material quiz (space theme and magic library)

Students have different visual preferences. The variety of themes (from bright ones like *underwater* to darker ones like a magical library) ensures that the media isn't monotonous and is accessible to the diverse visual preferences of fifth-grade students, as opposed to the previously rigid presentations and presentations of questions using real-life or contextual images.

### 3. Implementation Stage

At this stage, the validated and revised WING (*Wordwall Interactive Games*) media was then implemented in small groups. This trial used a *game-based learning model* so that students could be actively involved through game activities, making the learning process more enjoyable and meaningful, and in accordance with the characteristics of the media developed in the form of interactive *games*.

The learning process was carried out according to the syntax of *game-based learning*. In the first stage, the researcher prepared the necessary facilities and infrastructure for using the WING media. In the second stage, the teacher explained the concept of cubes and cuboids using the material icons available in the WING media. Furthermore, in the third stage, students were given numbered sheets of paper to determine their turn to answer the quizzes available in the WING media.

In the fourth stage, students take turns to the front of the class according to their assigned numbers to operate the WING media by pointing directly at the projector screen with answers based on their understanding. Students whose answers are not correct will be given the opportunity to work on

additional questions through a 1-on-1 game of chance with other students whose answers are also incorrect. This activity creates a more active and competitive learning atmosphere. In the fifth stage, students are invited to summarize the learning material and then continue with a group reflection.

During the lesson, students appeared more active, enthusiastic, willing to try answering questions, and engaged in the learning process. They also showed interest in the visual media displays and quiz activities, which provided a playful learning experience.

Next, two weeks after the small group trial, a large group trial was conducted. This trial used the same learning model and game mechanics, with the difference being the number of students involved in the WING media implementation. After the small and large group trials, students were asked to complete a questionnaire to determine their response to the WING media.

**Table 4.**

Student Response Questionnaire Results

<b>Stages</b>	<b>Percentage</b>	<b>Practicality</b>
Small group trials	83%	Very practical
Large group trials	87%	Very practical

Based on the results of the student response questionnaire, the small group trial stage obtained a percentage of 83%, while the large group trial stage obtained a percentage of 87%. These percentages are in the range above 81% so that the WING media is included in the category of very practical for use in mathematics learning material on cube and cuboid space. These results indicate that the WING media received a positive response from students and was able to create a more interesting and interactive learning process.

#### 4. Evaluation Stage

The evaluation stage was carried out formatively and summatively to assess the quality of the WING media product based on feasibility and practicality criteria. Formatively, the evaluation process included validation by experts and continuous improvement since the development stage, where the media was declared very feasible with a media validation score of 95.4% and material validation score of 97.6%. This evaluation ensured that the resulting product was in accordance with the learning needs of grade V of SD Negeri

Tembong 1, both in terms of the accuracy of the cube and cuboid spatial concepts and the ease of navigation designed at the *design stage*.

Summatively, the evaluation was conducted through analysis of student responses during the implementation phase to measure the level of practicality of the media in the field. The increase in response scores from 83% in the small group trial to 87% in the large group trial stage indicated that the WING media was practical to use and capable of creating an interesting and interactive learning experience. The final results of the evaluation concluded that the development of the WING media had achieved its goal of producing a valid and practical learning media product to support the mathematics learning process of spatial geometry material in elementary schools.

## **Discussion**

Based on the research results, the development of WING (*Wordwall Interactive Games*) learning media on the material of cube and cuboid geometry was carried out based on the results of the needs analysis obtained through observations in class VA SDN Tembung 1. The results of the observation showed that the mathematics learning process was still dominated by teachers, the use of learning media was less interactive, and student involvement in learning was still low. These conditions caused the classroom atmosphere to be passive and monotonous so that students had difficulty in understanding the material of geometric geometry. Therefore, WING media was developed as a learning solution that was more innovative, interactive, and in accordance with the characteristics of elementary school students.

The design of this learning media is tailored to the needs of students and the learning conditions in the classroom. During the implementation stage, the seating layout is arranged differently from the usual pattern so that all students can be reached and actively engaged during the learning process. Furthermore, WING media combines elements of educational games through Wordwall quizzes, creating a more enjoyable and student-centered learning environment. This interactive classroom atmosphere provides a meaningful learning experience, fosters students' learning awareness, and increases their engagement in the learning process. This aligns with the opinion that a positive and supportive learning environment can increase student motivation and

engagement in learning (Habsy et al., 2023). Furthermore, the use of digital-based educational games can enhance student motivation and learning experiences through fun and challenging activities (Arifah et al., 2022).

The use of digital technology in WING media shows that mathematics learning can be packaged in a more interesting and relevant way to current developments. The use of technology-based media is one effort to create learning that is more adaptive to the needs of the 21st century. The development of digital technology and the demands of 21st-century skills require learning innovations that can overcome the weaknesses of conventional methods (Haq & Prasetyo, 2025). Thus, WING media is the right alternative to create a more modern, interactive, and student-centered mathematics learning atmosphere. This finding is also supported by research results showing that Wordwall-based educational game media can increase student engagement and help understand mathematical concepts more effectively (Aulia & Oktaviarini, 2025).

In addition to considering student needs, this study also emphasizes the importance of the validity testing stage in the learning media development process. Validity testing was conducted to ensure that the developed media met the feasibility standards in both media and material aspects. The validation results showed that the WING media obtained a very feasible category with a final score of 95.4% from the media expert validator and 96.4% from the material expert validator. These results indicate that the WING media has met the feasibility standards for use in mathematics learning on the topic of cube and cuboid. The feasibility of learning media is a crucial aspect in the development of learning tools because valid media will help teachers deliver material more systematically and easily understood by students (Anggraini, 2021). Furthermore, media development that pays attention to visual quality, material, and interactivity can also improve the effectiveness of mathematics learning in elementary schools (Lubis et al., 2025).

Validation by media experts focused on visual appearance, text design, layout, ease of use, and the implementation of interactive features in the learning media. The assessment showed that WING media has an attractive appearance and is able to increase student enthusiasm for learning. Digital media with attractive and interactive visuals can increase student attention and

focus during learning (Rahmawati & Atmojo, 2021). Furthermore, the use of Canva-based designs and interactive digital platforms has also been shown to support more engaging and communicative mathematics learning (Jannah et al., 2023).

Meanwhile, validation by material experts was conducted to assess the relevance of the material developed in the WING media, including conceptual accuracy, completeness of presentation, suitability of the material to learning objectives, and suitability of the media to the characteristics of elementary school students. The criticism and suggestions provided by the validators became evaluation materials in the process of refining the learning media before implementation in the classroom. Based on the validation results, the WING media was declared suitable for use in mathematics learning materials on cubes and cuboids. This finding supports the results of previous research which showed that the Wordwall media has a high level of validity and practicality, making it suitable for implementation in mathematics learning in elementary schools (Wildan et al., 2023). Furthermore, interactive Wordwall-based media can also help reduce mathematics learning anxiety in students (Ilahi et al., 2022).

The application of game-based learning in the cube and cuboid geometry material provides higher levels of interactive engagement through challenging activities and direct feedback. However, achieving these results requires a process of media revision and adjustment based on expert recommendations. Revisions made after the validation stage include improving the visualization of three-dimensional objects, improving user instructions, and refining the consistency of icons and media displays. This evaluation stage aligns with media development principles that emphasize the importance of continuous modification based on expert feedback to ensure the media's academic quality and practical relevance before wider implementation. The gradual evaluation and revision process is crucial in producing effective learning media that meets student needs (Kamila & Kowiyah, 2023). Furthermore, a systematic development approach also supports the creation of digital learning media that is more adaptive to developments in educational technology (Melisa, 2024).

The practicality of WING media is evident from the results of field trials and analysis of student responses, which indicate a very practical category. These results indicate that WING media is easy to use, engaging, and able to support

the learning process effectively. Learning media can help students understand material through direct interaction with learning objects, making the learning process more effective and meaningful (Rohim & Wardhani, 2024). With direct interaction through WING media, visualization of spatial geometry material helps students understand abstract mathematical concepts more concretely and easily. Interactive learning media can help students understand mathematical concepts through clearer and more engaging visual presentations (Indriani et al., 2022). Furthermore, interactive learning media can also improve students' mathematical representation skills through engaging visualizations and activities (Salsabila et al., 2023).

A fun learning experience through WING media can arouse students' curiosity, making them more active in the learning process. A supportive learning environment can make the learning process feel lighter and more enjoyable, thus fostering students' motivation to learn naturally (Habsy et al., 2023). WING media has been proven to increase students' enthusiasm and interest during learning. This shows that WING media functions not only as a visual aid but also as an instrument capable of creating an active and enjoyable learning environment. With its easy access and direct interaction, this media successfully transforms students' perceptions of mathematics material, previously considered difficult, into a more engaging and enjoyable learning experience. Interactively designed digital learning media can improve the quality of the teaching and learning process and make learning more effective and enjoyable for students (Wulandari et al., 2023). Furthermore, the application of a technology-based learning approach also supports the transformation of learning that is more relevant to the needs of 21st-century education (Haq & Prasetyo, 2025).

## **CONCLUSION**

Based on the results of research and development, the WING (*Wordwall Interactive Games*) learning media on the material of cube and cuboid geometry is declared valid and practical for use in mathematics learning in elementary schools. This is shown through the validation results of media experts of 95.4%, material experts of 96.4%, and the results of the practicality test of 87% with a very practical category. WING media is able to create a more interactive, fun,

and student-centered learning atmosphere so that it helps students understand the concept of geometry more concretely. Therefore, WING media is recommended as an alternative technology-based learning media that can be used by teachers to improve the quality of mathematics learning in elementary schools. In addition, further research is expected to develop similar media on other materials and test its effectiveness on learning outcomes and student motivation.

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