RANGE : Jurnal Pendidikan Matematika
e-ISSN :2685-2373

Volume 6, Nomor 2, Juli 2025, pp. 153-168

# Development of Nearpod Geometry Learning Media to Enhance Students' Visual-Spatial Ability

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Received: August 20th 2024. Accepted: September 17th 2024. Published: January 31st, 2025.

***ABSTRACT***

This research is motivated by the lack of relevant learning media for use in schools. Currently, the media used includes worksheets, textbooks, and minimal teaching aids. This study aim to develop a learning medium based on Neargo (Nearpod Geometry) that is valid, practical, and effective in enhancing students' spatial visual abilities in seventh grade geometry material. The method used is Research and Development (R&D) with the ADDIE model, the ADDIE model helps ensure that the learning process is well planned and executed, and it allows for continuous improvement based on feedback and evaluation results. The subjects of the study are seventh grade students at SMP Negeri 3 Sumber. Data collection techniques used are test and questionnaires, with qualitative and quantitative data analysis. The results of the material expert validation obtained a percentage of 86,67%, while the media expert validation obtained 90,83%. Student response questionnaires showed an average of 97%, and teacher response questionnaires showed a percentage of 95%, both categorized as very practical. The average N – Gain is 0,856 indicated a high improvement in the use of the developed learning media. Based on this analysis, it can be concluded that the Neargo learning media is valid, practical, and effective in improving students' spatial visualization abilities in geometry material within mathematics education. The innovative use of this learning media aims to address the limitations of conventional educational media and provide a more enjoyable and meaningful learning experience for students.

Keywords: geometry, learning media, nearpod, visual – spatial

***How to Cite***: Dewi.H., et al., (2025). Development of Nearpod Geometry Learning Media to Enhance Student's Visual – Spatial Ability. *Range: Jurnal Pendidikan Matematika*. 6 (2), 153-168.

## Introduction

Education is the key to the future of the Indonesia nation, with one of its goals being to enhance human resources through learning in schools (Okky et al., 2023). Education should create an atmosphere and process that allows students to actively develop their potential, including their visual-spatial skills, which are crucial for understanding mathematics, especially geometry (Anwar & Anis, 2020). Education lasts throughout life, to equip students with competence and social awareness. The aim is to develop children's potential to achieve the highest safety and happiness, both as individuals and members of society (Annisa, 2022). The majority of students still have a negative attitude towards mathematics, considering it difficult because it is related to numbers, formulas and calculations. In fact, mathematics is very important in everyday life, such as in transactions that require calculations (Naiheli et al., 2024).The

mathematics learning process involves a reciprocal relationship between educators and students. This includes thought patterns and ways of processing logic in the mathematics learning process. If learning mathematics is considered difficult, this can reduce students' interest in the learning process (Rahmayani & Amalia, 2020). Students are required to analyze mathematical problems and convert them into mathematical from. Problem solving skill involve high level mental processes, including visualization, imagination, abstraction and information association (Lestari & Andinny, 2023) Students can hone their critical thinking skills and increase their readiness to learn. Mathematics has many branches such as algebra, geometry, calculus and statistics. Building flat-sided spaces, part of geometry, is important in everyday life, so students need to understand geometric concepts (Nursyamsiah et al., 2020).

Students need to understand geometric concepts well so they can apply geometric skills, including spatial visualization, recognizing various flat and spatial shapes, and describing images (Alyusfitri et al., 2020). Spatial visual ability is the key to solving geometry problems that require high levels of visualization. Developing this ability is important in learning geometric figures so that students can understand geometric concepts correctly. Lack of visual spatial abilities can cause misconceptions, such as drawing diagonal planes instead of diagonal spaces on a cube. Therefore, research on visual spatial abilities is needed so that students can understand and solve geometric problems well (Bloom & Reenen, 2013). To address visual-spatial challenges, learning media such as Nearpod can be utilized. Nearpod offers a 3D feature that helps improve students' visual-spatial abilities by allowing them to interact with three-dimensional objects directly, which is crucial for understanding geometric concepts (Oktafiani & Mujazi, 2022).

Nearpod is a website-based learning media platform that can be accessed free of charge for both online and offline learning. This application allows direct or indirect interaction between educators and students. Nearpod's advantage lies in its ability to be accessed online or offline and its interesting features that improve the quality of learning, making it more interactive and effective. Research shows that Nearpod really helps teachers in designing learning to increase students' interest in learning, this media also has the potential to improve learning outcomes and students' visual spatial abilities (Oktaviani & Nurhamidah, 2023).

The rapid advancement of information technology in the modern 4.0 era can assist teachers in creating diverse and engaging learning media, contributing to the improvement and development of educational media quality (Syofyan & Muvidellatul Husni, 2023). Technological advances have the potential to be a solution in creating learning media that attracts student interest and helps students understand abstract mathematical concepts. Technology also makes it easier for teachers to deliver

material, the integration of graphics, animation and video in learning can increase students' understanding of the concepts being taught. The use of visual images has been proven to improve learning outcomes in remembering, recognizing, and connecting facts and concepts. It would be best if verbal explanations were more effective for learning that involves memory sequences, for this reason it is necessary to develop learning media that combines the advantages of visuals with the ability to facilitate sequential verbal memories (Alyusfitri et al.,2020). The use of learning media in teaching activities can increase students' interest and positively impact their motivation to learn (Febry et al., 2023).

Based on the results of observations made by researchers, improving the visual abilities of students at SMP Negeri 3 Sumber is still low. This can be proven from the percentage data on the results of class VII E students' exam results for the 2023/2024 academic year on spatial construction material where the questions contain spatial concepts. There is a student's daily test score regarding cubes and blocks which reaches an average score of 62.3, this shows that students' understanding of the material is still low. This can be caused by various factors, such as lack of time to study, difficulty in understanding concepts, or it can be caused by other factors such as lack of focus during learning. Therefore, research related to visual spatial abilities needs to be carried out, so that in the future students can better understand co-concepts.

## Methods

The research method used in this research is the Research and Development (R&D) method. According to Sugiyono in (Fitriya & Faizah, 2021), research and development is a research method that aims to produce products and test the effectiveness of these products. The learning media development model used in this research is the ADDIE (Analysis, Design, Development, Implementation and Evaluation) development model. The ADDIE model is a systematic learning design model that functions as a guide in developing effective, dynamic learning and supports learning itself in a structured and programmed manner with a systematic sequence of activities in an effort to solve learning problems related to learning resources in accordance with student needs and characteristics.

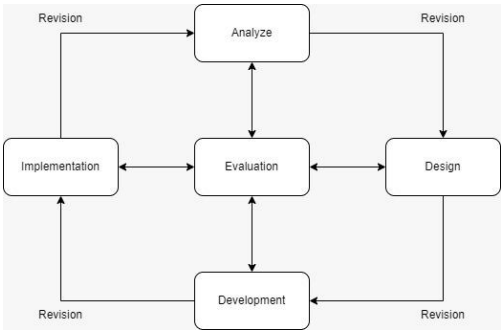



***Figure 1***. *Research and Design by ADDIE model*

Procedure the ADDIE model:

1. **Analysis**

   The analysis stage is conducted before researchers begin creating a learning medium, this stage is crucial for understanding student needs more effectively, in this research and development process, the analysis stage includes several key aspects curriculum analysis, syllabus analysis and user needs analysis

2. **Design**

   The design phase is essential for planning to achieve the goals optimally, this phase involves creating the basic structure of the learning media, aimed at enhancing students visual learning through Neargo based tools.

3. **Development**

   The development phase involves refining and finalizing the learning media created by the researcher, this includes turning initial designs into practical tools, testing them, and making improvements based on feedback to ensure they meet educational purpose and are effective for students

4. **Implementation**

   The implementation phase involves testing the learning media after it has been validated and revised, in this phase the researcher tests the media's effectiveness on a small scale, specifically with 8 students from class VII E at SMP Negeri 3 Sumber.

5. **Evaluation**

   The final phase is evaluation, which reviews all previous stages to identify and correct mistakes, this evaluation ensures that each stage of the Neargo learning media is effective and suitable for improving student's spatial visualization skills in the learning process.

This research took place from February to May 2024. Participants in this research involved two media experts, consisting of a mathematics education lecturer and an informatics engineering lecturer from the Muhammadiyah University of Cirebon, as well as three material experts, including a mathematics education lecturer from the Muhammadiyah University of Cirebon and a mathematics teacher from SMP Negeri 3 Sumber. The test subjects for this research were 8 students in class VII E. Data collection techniques include test instruments and questionnaires, with qualitative and quantitative data analysis. Qualitative analysis is used to describe data originating from suggestions and comments from experts in questionnaires, which are then used as material for further product improvements. Meanwhile, quantitative analysis is obtained from questionnaire assessment scores and student learning outcomes tests, with data in the form of descriptive percentages.

Media experts were given 15 statements, while material experts were given 16 statements. The purpose of distributing the assessment questionnaire is to assess whether the learning media being developed is suitable for use, as well as to determine student and teacher responses to the learning media. Analysis of validation assessments from media experts, material experts and feasibility is carried out using the following percentage formula:

$$\text{Percentage} = \frac{\sum X}{SMI} \times 100\% \quad (1)$$

Information:

ΣX = Total Score

SMI = Maximum Score

There is a percentage criterion for a material and media expert as follows:

***Table 1***. *Criteria for Percentage of Material and Media Experts*

| Percentage | Criteria |
|---|---|
| 77% - 100% | Very Valid |
| 55% - 77,5% | Valid |
| 32,5 – 55% | Invalid |
| 10% - 32,5% | Very Invalid |

There is an assessment indicator scale for each validation response that will fill in a questionnaire instrument after evaluating the media created in research (Yuhendri & P, 2020). There is an indicator scale as follows:

***Table 2***. *Indicator Scale*

| Indicator Variable | Score |
|---|---|
| Strongly agree | 4 |
| Agree | 3 |
| Disagree | 2 |
| Strongly disagree | 1 |

## Research Results and Discussion

### Research result

This research and development produced Neargo learning media. The main objective of this development is to evaluate the validity, practicality and effectiveness of Neargo in improving students' visual spatial abilities. The ADDIE model is used as a guide in the development process, which consists of five stages: analysis, design, development, implementation and evaluation.

This research aims to assess how Neargo can improve students' visual spatial abilities. Using the ADDIE model, this research includes five main stages, namely analysis, design, development, implementation and evaluation. Through these stages, the validity, practicality and effectiveness of Neargo are thoroughly tested and evaluated.

**Analyze**

The analysis stage is carried out before researchers start creating learning media. This stage is very important because it aims to understand students' needs better. This research and development, analysis stage includes several important aspects, namely curriculum analysis, syllabus analysis and user need analysis. Through curriculum analysis, researchers can ensure that the learning media developed is in accordance with applicable educational standards. Syllabus analysis helps researchers in designing relevant and well-structured content. Meanwhile, the user needs analysis aims to find out the preferences and difficulties faced by students, so that the resulting learning media is truly effective and meets their needs. Further explanation regarding the results of the curriculum and syllabus analysis can be found in table 3 as follows:

***Table 3.*** *Curriculum and Syllabus Analysis*

| Learning outcomes | Learning objectives |
|---|---|
| Students can construct and deconstruct three-dimensional shapes (cubes and rectangular prisms) and recognize spatial visualization (front, top, and side views) | • Students are able to deconstruct the properties of three-dimensional shapes, cubes, and rectangular prisms<br>• Students are able to construct/from the nets of three-dimensional shapes, cubes, and rectangular prisms<br>• Students are able to recognize a visualization of three-dimensional shapes, cubes, and rectangular prisms. |

**Design**

The design stage is very important for making plans so that goals can be achieved optimally. The design was carried out by creating a basic form of learning media which aims to improve students' visuals based on Neargo. This design research and development includes two main stages, namely data design and display design.

Data design focuses on collecting and processing relevant information to create effective learning media. Display design prioritizes the visual and interactive aspects of the media, ensuring that the resulting display is attractive and easy for students to use. These two stages complement each other to produce a product that is not only informative, but also interesting for students. Overall, the resulting learning design

stages can meet student needs and better support the student learning process. With careful planning and appropriate design, learning objectives can be achieved effectively and efficiently.

**Development**

Conclusion: The display on the slide includes various important elements to facilitate the learning process. These slides contain the learning title, material to be taught, learning objectives, Learning Achievements (CP), Learning Objectives (TP), learning videos, questions to clarify the concepts explained in the video, memory test to test students' memory. Apart from that, there is a learning media development profile. In designing slide displays, researchers pay attention to important aspects such as choosing an appropriate typeface, balancing the size of the text so that it is easy to read, choosing a text colour that contrasts with the background, and a background that supports visual comfort. All of these elements are carefully considered to support the material presented and ensure the learning media is interesting and not boring. Researchers also strive to create a harmonious and aesthetic appearance to increase the attractiveness and effectiveness of learning.

1. Student Login Display

   The login display for students is the first screen that appears when students click on the link or enter the code provided. At this initial stage there are two options available, namely entering using a link or entering using a code. After accessing the page via the link or code provided, the user will be directed to the home page of the learning media.

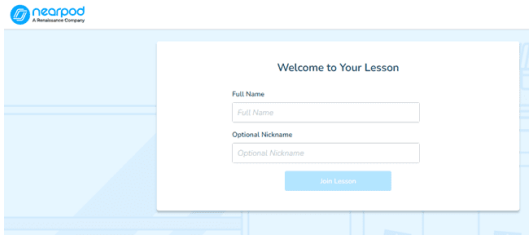



***Figure 2***. *Login View*

   This page is designed to simplify the login process and ensure that each student is correctly registered in the learning media. With these two columns, both mandatory and optional, the system can identify and organize students well, as well as provide flexibility for students in presenting students' personal information.

2. Learning Media Cover Display

When the user successfully logs in using the code or link that has been provided, students will see an initial display that displays the learning title. In this research, the learning media focused on geometry material specifically on cubes and blocks


***Figure 3**. Learning Media Cover Display*

3. Display of Learning Objectives

The learning objectives display displays details about the learning objectives and resources that will be used. Learning objectives include the knowledge expected by students as well as the desired learning outcomes. The learning objectives explain in detail the competencies that students must master after the learning process is complete, including understanding important concepts and the skills needed to master the material

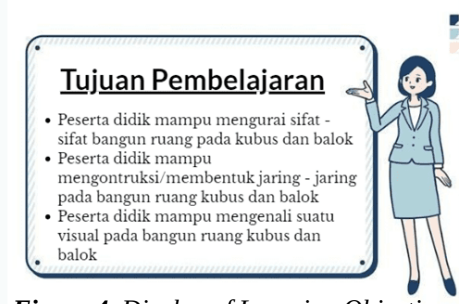



***Figure 4**. Display of Learning Objectives*

4. First Video View

In the first appearance, this video explains the basic concepts regarding cubes and blocks. This video aims to provide an in-depth understanding of the important elements of these two geometric

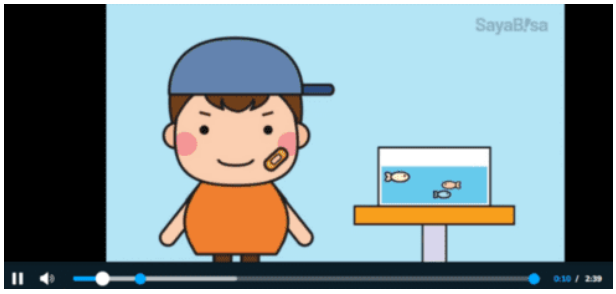



***Figure 5.** First Video View*

figures, namely corner points, edges and sides. This first video was taken from the YouTube account "I can"

5. Second Video View

   This second video display explains about nets regarding the geometric shapes of cubes and blocks. This video aims to provide an in-depth understanding of the nets of these two spatial shapes

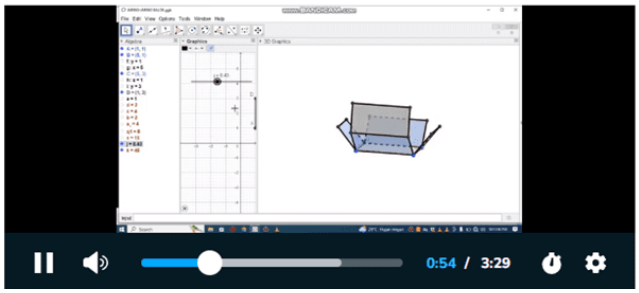



***Figure 6.*** *Second Video View*

6. Memory Test display

   This memory test display is designed to test students' memory abilities. When students open the first box a picture will appear and when they open the second box the first box closes again and so on. The aim of this memory test is to evaluate students' memory in a simple and interactive way

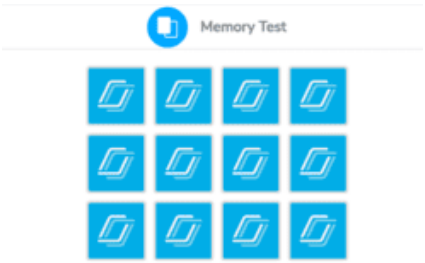



***Figure 6****. Memory Test Display*

7. Third Video View

   The display in this third video discusses the various types of diagonals found in cubes and blocks. This video explains in detail each type of diagonal in cubes and blocks, including side diagonals, room diagonals and plane diagonals

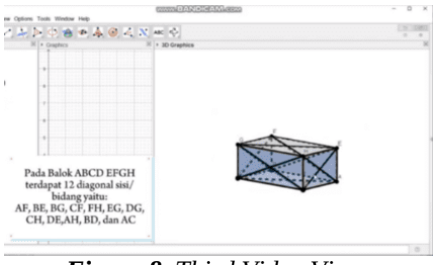



***Figure 8.*** *Third Video View*

8. Quizz View

   This quiz display is designed to evaluate students' understanding of the material that has been presented through learning media. This quiz contains two statements that focus on objects in everyday life. Students must identify which ones fall into the cube and cuboid geometric categories. This quiz aims to test the extent to which students understand the concepts that have been taught

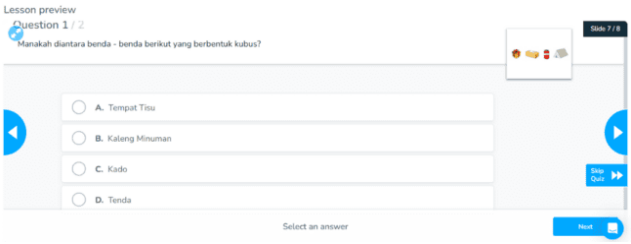



***Figure 9.*** *Quizz View*

9. 360° Visual View

   This visual display displays a block and cube shape that is automatically entered into Sketchfab. In this display, users can rotate cubes and blocks 360°, students can see from various directions, such as top, bottom, right, left, and the inside of the two shapes

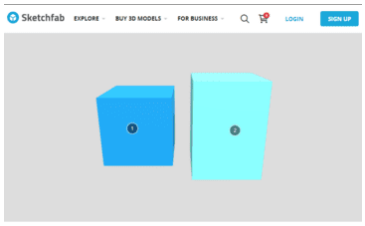



***Figure 10.*** *360° Visual View*

10. Researcher Profile Display

The researcher's profile display is a page that contains complete information about the development identity, including full name, student identification number (NIM), study program and university of origin. This profile aims to provide a clear picture of the educational background and identity of media development


***Figure 11.*** *Researcher Profile Display*

11. Closing View

This closing display is an automatic feature provided by Nearpod media, in which there is an introductory website about Nearpod itself.

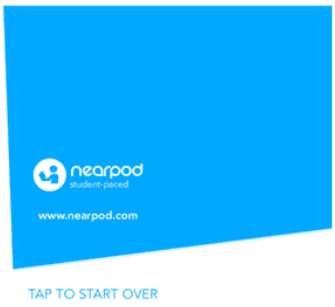



***Figure 12.*** *Closing View*

After the initial product is completed, the product is validated by a team of experts, consisting of material experts and media experts. Then the product is revised based on errors and suggestions for improvements from the expert team until the product is declared good and suitable for testing in the field.

This following a revision by a media expert:

***Table 4*** *Comments and Suggestions Display*

| Comments and Suggestions | Before Revision | After Revision |
|---|---|---|

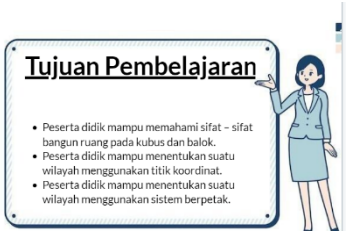
| | | |
|---|---|---|
| The front cover on page 2 should ideally display information related to the subject name, curriculum logo, institution's logo, and the author's name |  |  |
| The font size between the tittle and the content on slide 2 is not yet proportional |  |  |

***Table 5**. Assessment of the Quality and Validity of Learning Media*

| No | Validator | Total Score | Percentage | Criteria |
|---|---|---|---|---|
| 1. | Materials Expert | 208 | 86,67% | Very Valid |
| 2. | Media Expert | 109 | 90,83% | Very Valid |

Based on data from table 5, the percentage of validity from material experts is declared very valid with a total score of 208 and a percentage of 86.67% from 3 validators. Media experts also stated that this media was very valid with a total score of 109 and a percentage of 90.83% from 2 validators. Based on the results from expert validators, it can be concluded that Neargo learning media is "very valid" and suitable for use.

**Implementation**

The implementation stage was carried out to determine students' responses to the mathematics learning media that had been developed. Students and teachers will fill out a response questionnaire consisting of 10 statement items. The following are the assessment responses given by a small group consisting of 8 students.

***Table 6**. Data from Recapitulation of Student and Teacher Responses*

| No | Validator | Total Score | Percentage | Criteria |
|---|---|---|---|---|
| 1. | Student | 310 | 97% | Very Practical |
| 2. | Teacher | 38 | 95% | Very Practical |

Based on data from table 6, the percentage of student responses is very practical with a total score of 310 and a percentage of 97% from 8 respondents. The teacher's response also stated that this media was very practical with a total score of 38 and a percentage of 95% from 1 respondent. It can be concluded that Neargo learning media has received a good response from students and teachers.

**Evaluation**

In the ADDIE development model, the final stage is the evaluation stage. The results of this evaluation were obtained during the trial based on input from expert validators, a questionnaire on the practicality of teacher and student responses and the effectiveness of the media which was developed as follows:

***Table 7**. Recapitulation of Validator Results, Practicality and Effectiveness*

| Validator | | Practicality | | Effectiveness |
|---|---|---|---|---|
| Materials | Media | Teacher | Student | |
| 86,67% | 90,83% | 95% | 97% | 85,63% |

**Discussion**

The assessment of the learning media developed includes three aspects: validity, practicality and effectiveness. Based on this assessment, the learning media developed is classified as valid, practical and effective. The validity of learning media was measured using a validation sheet instrument, with material expert validation results reaching 86.67% and media experts 90.83%. These results show that the Neargo learning media is very valid and worthy of being tested. The learning media developed meets the predetermined criteria according to the indicators measured. This is in line with research by Fareza & Zuhdi, (2022),which explains that after the Neargo learning media is declared valid, it can be used at the trial stage to see the practicality of the learning media being developed.

The Neargo learning media developed is in the very practical category. This is proven by the responses of teachers and students. Based on the results of the teacher response questionnaire assessment, an average score of 95% was obtained, meeting the very practical criteria. Meanwhile, the results of the student response questionnaire assessment showed an average score of 97%, also meeting the very practical criteria. Student responses and teacher responses show that the learning media created is very practical. This is in line with research by (Az-Zahro & Panduwinata, 2023), which shows that the practicality of teaching materials can be seen from the ease of use and attractiveness of the teaching materials for users. Neargo learning media has been tested for validity and practicality. Next, the effectiveness of the Neargo learning media developed will be tested. Based on the results of the N-gain

calculation, a mean of 85.63% was obtained, which indicates a high increase. From these results, it can be concluded that the Neargo learning media developed is effective in learning mathematics.

Neargo learning media is designed to improve students' visual spatial abilities by connecting material to real world contexts. Research shows that Neargo improves student visualization by up to 96%, which is considered very good. Apart from helping understand the concept of building space, Neargo also increases student motivation and involvement in learning. Participatory learning with Neargo provides students with the opportunity to participate actively, in line with research by (Shafara Rizkiana et al., 2019) which shows that students' visual spatial abilities in geometry material increase.

## Conclusion

Based on the results of research and discussions that have been described at SMP Negeri 3 Sumber with small groups involving 8 students of class VII E, the results of learning media development show that: (1) The process of developing learning media uses the ADDIE stages which consist of (Analyze, Design, Development, Implementation and Evaluation), spatial visual ability using indicators according to (M Shafara et al., 2019) the percentage of each indicator of spatial visual ability has reached the very good category. with a percentage of 97% in the very good category; (3) The learning media developed was declared very valid with an average percentage of 90.83%, and the material received a percentage of 86.67% in the very valid category; (4) The learning media was declared practical with the average percentage assessment results from teacher responses of 95% and assessment of student responses of 97%, both fall into the "very practical" category; (5) the learning media developed is declared effective based on the average N - Gain test result of 0.8563 which is included in the "high" category, the average percentage result of the N - Gain test is 85.63% which is included in the "effective" category ".

## Recommendation

Based on the results obtained from this research, the researcher suggests that further research can develop Neargo-based learning media to improve visual spatial abilities in other materials as well as other cognitive abilities.

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