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Development Of Ludo Math Props To Improve Student Learning Interest In Logarithm Material

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Abstract

This study aimed to develop an educational game, LUDO MATH, to enhance students' interest in learning logarithms. Using a Research and Development (R&D) approach, the study applied the ADDIE model, which includes the phases of analysis, design, development, implementation, and evaluation. Data was collected through observation and interviews. Descriptive analysis portrayed the development of LUDO MATH from the analysis stage to the evaluation stage. Validation by subject matter experts showed that LUDO MATH achieved an 80% validation rate, classifying it as valid. Validation by media experts yielded a similar result, also categorized as valid. Practicality testing included assessments from both teachers and students. Teachers rated the game as 76.67% practical, while students rated it 84.55%, classifying it as very practical. To measure effectiveness, observations were conducted during the trial and supplemented with interviews with the participants. Based on the observation and interview results, it can be concluded that the LUDO MATH teaching aids successfully increased students' interest in learning logarithms. Furthermore, the results showed that the LUDO MATH learning media proved to be valid, practical, and effective, making it a viable alternative for teachers to increase students' interest in learning logarithms.

Keywords: Ludo Math, Learning Media, Logaritm

Pengembangan Alat Peraga Ludo Matematika Untuk Meningkatkan Minat Belajar Siswa Pada Materi Logaritma

Abstrak

Penelitian ini bertujuan untuk mengembangkan media pembelajaran berbentuk LUDO MATH yang dapat meningkatkan minat siswa dalam mempelajari materi Logaritma. Jenis penelitian ini adalah Research and Development (R&D) dengan menggunakan model pengembangan ADDIE yang meliputi tahapan analisis, desain, pengembangan, implementasi, dan evaluasi. Pengumpulan data dilakukan melalui observasi dan wawancara. Analisis deskriptif digunakan untuk menggambarkan hasil pengembangan LUDO MATH dari tahap analisis hingga evaluasi. Hasil validasi oleh ahli materi menunjukkan bahwa media pembelajaran LUDO MATH memperoleh persentase validasi sebesar 80%, yang termasuk dalam kategori valid. Validasi ahli media juga menunjukkan hasil yang sama, yaitu sebesar 80%, dalam kategori valid. Uji kepraktisan alat peraga dilakukan dengan penilaian dari guru dan siswa, di mana penilaian guru memperoleh persentase sebesar 76,67% dalam kategori praktis, sementara penilaian siswa memperoleh persentase sebesar 84,55% dalam kategori sangat praktis. Untuk mengukur efektivitas alat peraga, dilakukan observasi selama uji coba dan didukung oleh wawancara dengan subjek uji coba. Berdasarkan hasil observasi uji coba kelas terbatas dan wawancara, dapat disimpulkan bahwa alat peraga LUDO MATH berhasil meningkatkan minat belajar siswa pada materi Logaritma. Hasil penelitian menunjukkan bahwa media pembelajaran LUDO MATH terbukti valid, praktis, dan

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efektif, sehingga dapat menjadi alternatif media bagi guru untuk meningkatkan minat siswa dalam mempelajari Logaritma.

Kata kunci: Ludo Math, Media Pembelajaran, Logaritma

INTRODUCTION

Learning becomes more effective when supported by teaching aids, which play an important role in facilitating the achievement of competencies and serve as an intermediary to convey learning messages clearly and in a way that is easily understood by students. Aisyah et al. (2024) mentioned that the use of learning media is needed by teachers to support student understanding. The presence of educational media is an effective solution for fostering concept understanding and capturing students' attention. (Azzahra et al., 2024). Learning that prioritizes the use of educational media plays an important role in improving the quality of education, as it helps teachers make the teaching and learning process more effective, structured, and focused. Learning becomes more effective with teaching aids, as these tools help students understand the material more easily and clarify the concepts being taught. (Sengkey et al., 2023). In conclusion, effective learning is supported by the use of teaching aids and materials, as both play a crucial role in facilitating students' understanding and helping teachers create a more structured, clear, and focused learning process. As previously discussed, teaching aids are essential for creating effective learning environments, which is particularly important in mathematics education.

Mathematics is one of the core subjects in education, serving as a foundational skill across various fields in both educational and everyday contexts. (Zulmaulida & Saputra, 2024). Therefore, to study technology, science, or other disciplines, it is essential to understand and master the foundational science of mathematics. (Rahmaini & Ogylva Chandra, 2024). According to Siswono & Budayasa (2006), the ability to master and apply mathematics is a very important necessity for everyone. Therefore, people need mathematics as a tool to meet everyday needs and as a key component in learning. Additionally, mathematics helps develop a mindset that fosters critical and systematic thinking. Which is in line with research Fardani & Surya (2017) and Siswondo & Agustina (2021) where in everyday life students who already have critical thinking traits will have a personality that is so tough and not easily influenced or like to just follow along with the times, making students smarter in dealing with, giving attitudes, and

decisions and can even become part of the changing times. Recognizing the importance of mathematics in life, one must have a strong interest in learning and specific skills, such as understanding mathematical concepts, to effectively solve mathematical problems.

The importance of mathematics encourages students to be able to master the material well (Siswondo & Agustina, 2021). The ability to understand mathematical concepts involves understanding, interpreting, and relating a mathematical concept to various other concepts, as well as expressing it in mathematical form and developing problem-solving algorithms precisely, accurately, and efficiently in one's own words, which can be applied in everyday situations. (Sengkey et al., 2023). Here, the interest in learning specifically refers to an interest in a particular subject (Atikah & Jumrah, 2024). Logarithms are an important topic in mathematics that require a deep understanding of mathematical concepts. One practical use of logarithms in daily life is in determining earthquake magnitudes using the Richter scale, as well as in calculations involving large numbers. (Marwanti et al., 2022). This demonstrates that an understanding of logarithms is essential for students, both as foundational material for tackling more complex topics and for applications in other fields that rely on logarithmic concepts. Therefore, it is crucial for students to grasp concepts related to logarithms so they can apply or solve real-world problems effectively.

In reality, there are quite a lot of students who feel that they are experiencing obstacles in applying concepts in problems related to logarithms (Desriyati & Rahmi, 2021). This is because the main indicator for testing logarithmic understanding is the ability to find solutions using exponential and logarithmic functions. A lack of understanding of exponential functions and the properties of logarithms makes it challenging for students to solve problems related to logarithms. (Hananta, 2019). Similarly, problems related to the properties of exponents are among the topics that students find complex and challenging. (Gunawan & Fitra, 2021). Gunawan & Fitra (2021) further explained that the problems in learning logarithms are students' little interest in learning and the lack of use of interactive and innovative learning media.

To overcome obstacles in learning, teachers need to create meaningful teaching and learning activities that foster a strong understanding of the material, particularly through the use of educational media. This is in line with a study conducted by Puspitarini & Hanif (2019), where learning media has a function to be used as a means of providing material in learning activities (Puspitarini & Hanif, 2019). Interactive learning media can

enhance student engagement and provide meaningful learning experiences. (Wulandari, 2020). Games can serve as a form of educational media that teachers can use to support and encourage student creativity during learning. (Kamin et al., 2020). As one of the efforts to achieve this, the researcher wishes to develop the Ludo game as a learning media.

Previous studies have shown that Ludo media positively impacts students' interest, motivation, and engagement. In accordance with research Ulhusna et al. (2020) which states that the math ludo game stimulates students' interest in actively participating in the math learning process. In addition, Ludo games allow students to feel as if they are playing, which helps reduce tension and boredom. This Ludo game media can foster a pleasant learning atmosphere, enhance cognitive abilities, support physical and emotional development, and build positive student character. (Kore et al., 2020). The use of Ludo games is intended to make the learning atmosphere more engaging and to provide meaningful experiences that motivate students to become actively involved in the learning process. Aligned with previous research, this study aims to develop LUDO MATH, a Ludo game integrated with mathematics learning. Unlike prior studies, this research incorporates logarithmic content and introduces a QR feature to the Ludo media.

In contrast to previous studies, the LUDO MATH media developed in this research focuses on a more specific mathematical concept: logarithms. This media includes structured, clear game rules and a variety of questions tailored to students' ability levels. This differs from the Ludo media in previous studies, which lacked detailed game rules and included questions with only a limited range of difficulty. The LUDO MATH media also utilizes QR codes to display questions on the game board. The use of QR codes provides a more dynamic learning experience and enables digital integration without requiring complex additional hardware. LUDO MATH-based learning media with QR codes is more engaging and has the potential to increase student interest in learning mathematics independently and interactively.

RESEARCH METHODS

This research follows a Research & Development (R&D) approach using the ADDIE development model, which consists of the stages: Analyze, Design, Develop, Implement, and Evaluate. This method aims to build foundational learning performance,

specifically through the creation of learning product designs. The stages of the ADDIE development model are illustrated in Figure 1.

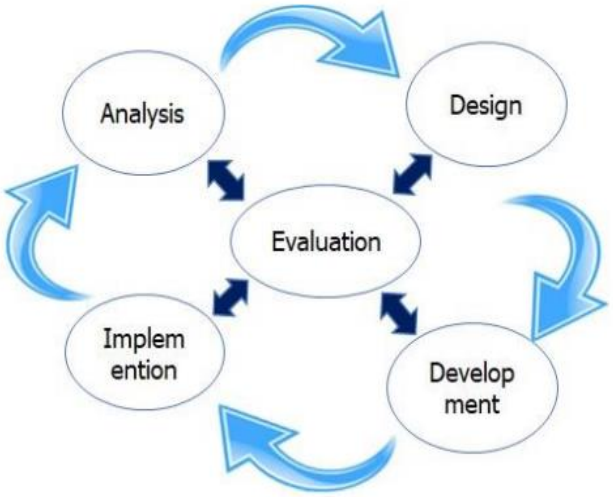

Figure 1. ADDIE stages

Source: (Dwitiyanti et al., 2020)

Figure 1, which illustrates the ADDIE stages, reveals that these stages provide systematic guidance in developing the LUDO MATH learning media. At the analysis stage, the researchers conducted two stages, namely performance analysis and needs analysis as the analysis stage process described Kamin et al. (2020). The analysis stage begins with a needs assessment to identify students' challenges and requirements in learning mathematics, particularly in logarithms. This analysis aims to determine the extent of students' difficulty in understanding logarithmic concepts and how teaching aids can increase their interest in learning. The results indicated a need for tools to enhance students' engagement and interest in learning. This is also in line with research by Inayahtur Rahma et al. (2023), where it is explained that the use of media in mathematics learning has a role in increasing students' interest in learning. The next stage is the design phase, which focuses on developing the concept of "Ludo Math" teaching aids tailored to students' learning interests. During this stage, the concept of the teaching materials or media is outlined in detail. (Cahyadi, 2019). Then at the development stage activities are carried out to create and modify teaching materials. The activities at this stage include preparing tools and materials, creating the media, and modifying existing media. Although this media has been used by other researchers, there are some differences. In previous studies, the media could only be accessed visually, without the use of cellphones

or other electronic devices. (Azizah & Fitrianawati, 2020). Meanwhile, the media created by the author requires a cellphone to display questions from QR codes attached to the Ludo board. After development, the teaching aids are validated by two media experts and two material experts. Once declared feasible, the implementation stage will be conducted and tested with high school students. The final stage, evaluation, involves making improvements to the media based on insights from previous stages. Any necessary enhancements are addressed to ensure the production of high-quality learning media.

The LUDO MATH media developed by researchers uses logarithmic concepts, as understanding logarithms is essential for students. Logarithms serve as prerequisite knowledge for tackling more challenging topics and are applied in various other fields. Therefore, a solid understanding of logarithmic concepts is crucial for students to apply and solve real-world problems in the future.

To test the practicality of the product, researchers used instruments in the form of teacher assessment sheets and student responses. Meanwhile, to see the effectiveness of the props, it is seen from the results of observations during the trial and supported by the results of interviews with the trial subjects. The subjects of this research included two mathematics teachers from a Senior High School in Palembang. While the students who were the subjects of this research were 2 students of class X Senior High School and carried out at one of the homes of these students. The data collection was carried out on March 27, 2024. To test the validity of the product, researchers used assessment sheets completed by media experts and material experts. In this research, media experts and material experts are lecturers who teach Mathematics Learning Media courses. The validity tests conducted by material experts, media experts, as well as the assessments by teachers and students, focus on three aspects: content and purpose quality, instructional quality, and technical quality. Each of the four assessment sheets includes several statements with scores based on a Likert scale, as shown in Table 1 below.

Table 1. Likert Scale

Score	Description
1	Strongly disagree
2	Disagree
3	Disagree
4	Agree
5	Strongly agree

Source: (Sugiyono, 2021)

In Table 1, the researcher uses a Likert scale to assess the validity of the learning media. The values obtained are then processed to determine their validity..

The number of statement items, along with the ideal maximum and minimum scores on each assessment sheet, is detailed in Table 2 below.

Table 2: Maximum and Minimum Ideal Scores on Each Assessment Sheet

	Number of statement items	S_{min}	S_{maks}
Material expert	11	11	55
Media expert	18	18	90
Teacher assessment	26	26	130
Student assessment	20	20	100

Table 2 presents the minimum and maximum scores for each assessment, which will be conducted by two material experts, two media experts, and two teachers. Based on the number of statement items, the ideal maximum score, and the ideal minimum score, several categories are established for each assessment sheet. The formula we use for material expert assessment sheets, media expert assessment sheets, teacher assessment sheets and student responses, is a formula that is in line with that used by (Hafiedz & Nurhamidah, 2023). The formula used is as follows.

$$P(s) = \frac{S}{N} \times 100\%$$

Description:

P (s) = Percentage of sub indicators

S = Total score for each sub-indicator

N = Total maximum score

Based on the calculation using the formula above, the criteria for the validity category are shown in table 3, and the criteria for the practicality category are shown in table 4.

Table 3. Criteria for Categorizing the Validity of Ludo Math

Score Interval	Category of Validity
$80\% \leq Skor \leq 100\%$	Very Valid
$60\% \leq Skor < 80\%$	Valid
$40\% \leq Skor < 60\%$	Valid Enough
$20\% \leq Skor < 40\%$	Less Valid
$0\% \leq Skor < 20\%$	Invalid

Table 3 provides a description of the categorization of the validity test results, which will be conducted by material and media experts.

Table 4. Criteria for Categorizing the Practicality of Ludo Math

Score Interval	Practicality Category
$80\% \leq Skor \leq 100\%$	Very Practical
$60\% \leq Skor < 80\%$	Practical
$40\% \leq Skor < 60\%$	Practical enough
$20\% \leq Skor < 40\%$	Less Practical
$0\% \leq Skor < 20\%$	Not Practical

Table 4 provides a description of the categorization of the practicality test results, which will be conducted by teachers and students. Meanwhile, in this study, indicators of interest in learning were used according to Rizko Saputra et al. (2024), where students' interest in learning can be seen from their feelings of enjoyment in activities learning, showing attention when learning, interest in learning, and engagement in learning.

The research instruments used in this study included questionnaires, observations, and interviews. Questionnaires assessed the validity and practicality of the "Ludo Matematika" teaching aids. Observations monitored students' activities during the experimentation process, recording their involvement and interactions with the props.. Meanwhile, interviews were conducted to explore students' interest in and understanding of logarithmic concepts after using the teaching aids. The data collected from these three instruments were analyzed to assess the effectiveness and quality of the teaching aids in supporting logarithmic learning.

The data analysis techniques used in this study were both descriptive quantitative and qualitative methods. Data from the validity and practicality questionnaires were analyzed by calculating the average score for each aspect of the assessment, including content quality and objectives, instructional quality, and technical quality.. The results of the validity tests conducted by material and media experts, along with practicality tests administered by teachers and students, were categorized using a Likert scale to determine the validity and practicality levels of the "Ludo Matematika" teaching aids. Observational data were analyzed descriptively to assess the levels of student participation and involvement during the learning process. Meanwhile, interview data were analyzed qualitatively to uncover students' perceptions of their interest in and understanding of logarithmic material. By combining the results of quantitative and qualitative analyses, the researcher can conclude the effectiveness of the teaching aids in enhancing students' interest in learning and comprehension of logarithms.

RESULTS AND DISCUSSION

Analyze Stage

There are two stages in the *analysis* section, namely performance analysis and need analysis (Kamin et al., 2020). The performance analysis stage is conducted to determine whether the identified performance issues require enhanced management or the introduction of new learning programs. Performance analysis aims to assess if there are challenges in the mathematics learning process, particularly with logarithmic material, that may need improvements in learning management or the addition of supplementary media. The results of the performance analysis indicate that many students struggle to understand the concept of logarithms, as this material is considered abstract and somewhat boring. The next step is the needs analysis stage, which aims to address the performance challenges of the subject under study.

Additionally, a needs analysis was conducted to identify the best solution to this problem, focusing on increasing students' interest and active participation in learning. Observations and interviews revealed that traditional learning methods focused solely on lectures and practice questions are less engaging for students, resulting in decreased motivation and limited conceptual understanding. Therefore, a more interactive medium is needed to actively involve students in the learning process.

Ludo was chosen as a solution due to its engaging game elements, which are expected to attract students' interest and reduce boredom in learning. The Ludo Math media is designed by integrating logarithmic concepts into the game, allowing students to interact directly with the material through game challenges. In addition, the competitive nature of the Ludo game is expected to encourage students to be more active and motivated in learning. Thus, Ludo Math media is expected to create a fun and effective learning atmosphere in helping students understand logarithm material.

Design Stage

This learning media adopts the rules of the Ludo game and was developed based on the design by Azizah and Fitrianawati (2020). LUDO MATH is designed to help students master the application of logarithmic properties in problem-solving, making it easier for them to remember and understand these properties within the context of logarithmic material.

The design stage of this research involves adapting the Ludo game concept to integrate logarithmic material. The Ludo board is equipped with QR codes linking to

logarithmic questions accessible to students, along with pawns, dice, a Google Drive link to answer keys, and logarithmic property cards as supplementary tools.. These property cards are designed to assist students in answering questions. Figure 1 shows the reference for the LUDO MATH media, Figure 2 presents the development design, and Figure 3 displays the Clue Card. Figures 4 and 5 show the QR codes and answer keys for the questions on the Ludo board.

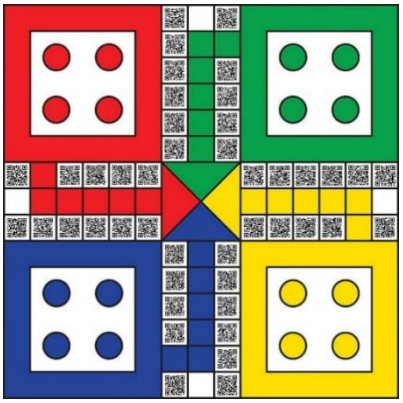

Figure 2. Design development of LUDO MATH Learning Media

Figure 2 illustrates the development of the LUDO MATH media board design by the researcher, which includes the addition of QR codes in line with (Azizah & Fitrianawati, 2020).

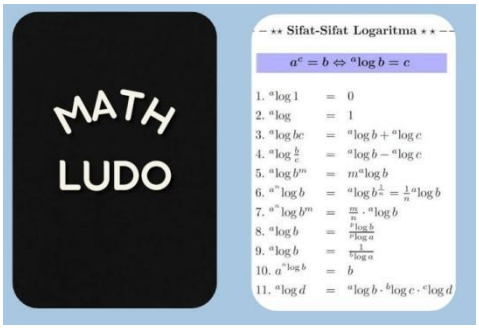

Figure 3. Clue card design

Figure 4 shows the design of the Clue card, which contains properties of logarithms and serves as a tool to help students answer questions provided by the researcher..

Figure 4. Question Qr on the Ludo board

Figure 5 contains a QR Code that contains questions about Logarithms

$^{6}\log(x^2 - 8) = {}^{4}\log(x^2 - 8)$

Jawaban

$x^2 - 8 = 1$

$x^2 = 9$

$x = \pm\sqrt{9}$

$x = \pm 3$

- $x = 3$
- $x = -3$

$hp = \{-3,3\}$

Figure 5. QR answer key to the question in figure 5 in G-Drive

Figure 6 is the answer key to the question on the QR Code.

Development Stage

At this stage, LUDO MATH teaching aids are made based on the design that has been prepared, starting from the design process, revision, production, to completion (Firda & Nurhadi, 2023). Before starting the production process, the concept of the LUDO MATH teaching aids was submitted to the lecturer for validation to receive valuable feedback and suggestions. Once validated by the lecturer, the teaching aids proceeded to the production stage. The production process for the LUDO MATH teaching aid begins with gathering the necessary tools and materials. These include scissors, glue, a chess board, two dice, snakes and ladders pawns, and photo paper. Once all tools and materials are prepared, the assembly of this teaching aid can begin. The creation of the LUDO MATH teaching aid followed the validated design. The manufacturing process involved several steps, including printing the LUDO MATH design and instruction card on photo paper, followed by trimming unnecessary parts with scissors.

The printed LUDO MATH design was then attached to the chessboard that had been provided. The prepared snakes and ladders pieces were also arranged on the board as part of the game. After all the steps are completed, the LUDO MATH teaching aids are ready to be used in learning activities. The outcomes of the LUDO MATH learning media development stage are displayed in Figure 7 and Figure 8 below. Figure 7 illustrates the overall result of the LUDO MATH learning media development, while Figure 8 presents the Clue Card used in this LUDO MATH game.

Figure 6. LUDO MATH Learning Media

Figure 7 is the result of the development of LUDO MATH learning media conducted by researchers.

Figure 7. LUDO MATH Clue Card

Figure 8 shows a CLUE CARD from the learning media developed by researchers, designed to assist students in answering questions accessed through the QR Code on the Ludo board. This stage represents the validation test, during which the quality of Ludo Math was evaluated for validity by two material expert validators and two media expert validators. (Firda & Nurhadi, 2023). The material expert validation sheet consists of 11 statement items measured on a Likert scale. For Ludo Math to be categorized as "very valid" according to the material expert, the average score must fall within the 80% range..$\leq Skor \leq$ 100%.

The results of the material expert's assessment of the validity of Ludo Math according to the material expert are attached in Table 5 below.

Table 5. Results of the Validity of Ludo Math by Material Experts

Validity Assessment		*Total Score*
Material Expert	Material Expert 1	47
	Material Expert 2	41
Average Score		44
Percentage of Average Score		80%
Category of Validity		**Very Valid**

Validation from media experts' opinions is based on 18 statement items measured on a 5-point Likert scale. For Ludo Math to meet the "very valid" category according to media experts, the average score percentage must fall within the 80% range.$\leq Skor \leq 100\%$. The results of expert assessments of the validity of Ludo Math according to media experts are attached in Table 6 below.

Table 6. Results of the validity of Ludo Math by Media Experts

Validity Assessment		Total Score
Media	Media Expert 1	77
Expert	Media Expert 2	67
Average Score		72
Percentage of Average Score		80%
Category of Validity		**Very Valid**

Following the validation test, this stage represents the practicality test, during which the quality of Ludo Math was evaluated for practicality by two math teachers and four students. (Firda & Nurhadi, 2023). The mathematics teacher assessment practicality sheet uses 18 statement items and uses 5 Likert scales. For Ludo Math to meet the practicality category according to the mathematics teacher, the average score percentage must fall within the 60% range. The results of the teacher's assessment of Ludo Math's practicality are shown in Table 7 below.

Table 7. Results of Practicality of Ludo Math by Mathematics Teachers

Practicality Assessment		Total Score
Teacher	Teacher 1	69
	Teacher 2	69
Average Score		69
Percentage of Average Score		76.67%
Practicality Category		**Practical**

Meanwhile, the practicality assessment from students' opinions includes 11 statement items measured on a 5-point Likert scale. For Ludo Math to meet the "very

practical" category according to students, the average score percentage must fall within the 80% range. The results of students' assessment of Ludo Math's practicality are shown in Table 8 below.

Table 8. Results of Practicality of Ludo Math by student experts

Practicality Assessment		Total Score
Students	Student 1	47
	Student 2	52
	Student 3	44
	Student 4	43
Average Score		46,5
Percentage of Average Score		84,55%
Practicality Category		**Very Practical**

Implementation Stage

After completing the development process of the learning media, the Implementation stage begins. The newly developed media will be tested in two ways. First, it will be presented directly at the learning media exhibition organized by the S3 Mathematics Education Study Program at Sriwijaya University.

University during the *Phi-Day* celebration. Following the presentation, a positive and enthusiastic response was received from many attendees, who were eager to learn more about the rules of the LUDO MATH game media and expressed interest in trying it firsthand. Many attendees commented positively, noting that LUDO MATH could be effectively used in learning settings due to its engaging and sufficiently challenging nature.

In addition to being presented at the exhibition, the LUDO MATH game media was also tested on a small scale directly with two high school students in face-to-face meetings held at one of the students' homes. Data collection took place on March 27, 2024. The purpose of this trial is to evaluate how interesting, enjoyable, and user-friendly the learning media is for students in increasing their interest in logarithmic mathematics. This research is currently at the small-scale trial stage, where the teaching aids are being tested on two high school students studying logarithmic material.

From the results of the trial, some information was obtained through interviews with the students as follows:

1. LUDO MATH can help remember properties, solve problems and deepen the Logarithm material.
2. LUDO MATH can help students in solving problems to make it easier.

3. Students prefer to learn using LUDO MATH rather than using conventional learning.
4. Students feel more-happy when learning Logarithms while using LUDO MATH.

From the results of the trial, some important information was obtained through observation of the students as follows:

1. The learners tested had already learned about mathematical geometry.
2. At the time of testing the learning media, both learners can use the learning media well by following the instructions.
3. Learners know how the learning media works.
4. Learners understand and can answer some of the questions on the Clue Card.
5. Learners understand the purpose of this learning media.

Based on information gathered from interviews and observations of students using the LUDO MATH learning media, it is evident that LUDO MATH can increase students' interest in learning. Students appear more joyful when engaging with the material, especially logarithms, and demonstrate enthusiasm in using LUDO MATH.

The trial process of LUDO MATH learning media can be seen through video documentation on the following link drive:
https://drive.google.com/drive/folders/1BZBxpY09pUscJr07W08SMHn0YMO3434S
The following documentation shows the implementation of Ludo Math learning media.

Figure 9. Implementation of LUDO MATH

Evaluation of the ludo mathematics teaching aids was carried out after a limited trial. Based on the results of the Ludo Math demonstration and interviews with twenty high school students, it was concluded that students stated that the "ludo math" teaching aid media was able to motivate students to learn more deeply because it used army pawns, a more complex and challenging flow at each level and was equipped with clear and detailed game rules. This is in accordance with the results of several studies which stated that ludo game-based mathematics learning media was able to support students'

motivation to learn mathematics independently (Jannah & Wiyatmo, 2018; Jawati, 2013). This is different from the development of ludo mathematics learning media by Yolanda & Iswendi (2019) which used standard pawns and dice so that ludo mathematics was less motivating for students to learn because its appearance was less attractive. Yuntari (2019), used Javanese script in the use of Ludo game-based learning media to make it less attractive to elementary school students.

Ludo Math teaching aids help to support learning outcomes in the cognitive domain, especially the ability to understand the concept and formula of logarithms of students. Khatimah et al., (2019) through the development of learning media that combines two types of games, namely dominoes and ludo, has a positive impact on the level of students' understanding of the concept of logarithms. Fitri & Wahyudin (2018) developed mathematics learning media based on the Ludo game using pawns run by students can improve students' mathematics learning outcomes.

CONCLUSION

The Ludo Math teaching aids developed were assessed as valid, based on validity tests conducted by two material experts and two media experts, both groups giving an average percentage score of 80%, categorizing the aids as very valid. Meanwhile, to evaluate the practicality and effectiveness of the teaching aids from the teachers' perspective, an average percentage score of 76.67% was obtained, categorizing them as practical. From the students' perspective, the teaching aids achieved an average percentage score of 84.55%, categorizing them as very practical. Additionally, based on interviews and observations, Ludo Math props have successfully increased student interest in learning, especially in logarithmic material. This is evident from students who prefer learning with Ludo Math props, which help them solve problems more easily and make learning more enjoyable. Thus, it can be concluded that the Ludo Math game media developed as teaching aids are proven to be valid, effective, and practical, and they successfully increase students' interest in learning. Based on the research results, it is recommended to further develop other materials to provide broader benefits. Additionally, future research should include a wider range of subjects from various schools and educational levels to obtain more representative results. Long-term testing is also necessary to assess the impact of teaching aids on enhancing learning outcomes and sustaining student interest over time.

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