Journal of Educational Sciences
Journal homepage: https://jes.ejournal.unri.ac.id/index.php/JES
P-ISSN 2581-1657
E-ISSN 2581-2203

# Development of Contextual Learning Media Lubaku (Calculation Hole) in Mathematics Learning at Elementary School

**Dini Aulia Apriansyah Putri*, Dita Prihatna Wati**
*Faculty Teacher Training of Education, University of Muhammadiyah Prof. Dr. Hamka, Jakarta, 13830, Indonesia*

**ARTICLE INFO**

*Article history*:

Received: 27 Sept 2025
Revised: 13 Oct 2025
Accepted: 25 Oct 2025
Published online: 05 Nov 2025

*Keywords:*

Development,
Lubaku Media (Calculation Hole),
Multiplication,
Division,
Squaring

* *Corresponding author:*

E-mail: dini.aulia@uhamka.ac.id

*Article Doi:*

https://doi.org/10.31258/jes.9.6.p.5536-5547



**A B S T R A C T**

This research aims to develop a contextual learning media called Lubaku (Calculation Hole) specifically designed to help fourth-grade students at Baru 06 Elementary School understand the concepts of multiplication, division, and squares. This research is classified as research and development using the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This research was conducted at Baru 06 Elementary School with a test group of 24 students from class IV B. Data collection techniques were carried out through validation questionnaires involving media experts, material experts, and response questionnaires from students. The data obtained were then analyzed using quantitative and qualitative approaches. The research results show that the Lubaku learning media has been successfully developed. Based on the validation results, this media received an average score of 96% and an average score of 96% from subject matter experts. Additionally, the response from students towards the Lubaku learning media was also very positive, with an average score of 88%. Therefore, overall, it falls into the "very feasible" category for use.

## 1. Introduction

Education plays a strategic role in building superior, adaptive, and globally-ready human resources. In the rapidly evolving era of globalization, education is required to be increasingly contextual and relevant to the needs of learners and the times. This is reflected in the Basic and Secondary Education Process Standards, which emphasize that learning must be effective, contextual, interactive, relevant to the needs and experiences of students, and conducted in a pleasant atmosphere (Permendikbud, 2016). Schools, as formal educational institutions, serve as the main venue for conducting the teaching and learning process based on the national curriculum. The Merdeka Curriculum, which is now implemented in Indonesia,

emphasizes differentiated learning by prioritizing the needs of students as the center of the learning process. This curriculum aims to facilitate the development of students' potential through adaptive materials, methods, and learning objectives (Romdhoni et al., 2023). The transformation of the curriculum of this nature demands the emergence of learning practices that are not only teacher-centered but also encourage student activity through meaningful interactions with various learning resources, as stipulated in Law No. 20 of 2003.

On the other hand, mathematics education plays an important role in shaping students' logical, critical, and systematic thinking. Mathematics learning at the elementary school level, especially on topics such as multiplication, division, and roots, is often considered difficult due to its abstract nature (Amanda, 2024). Basic arithmetic skills must be instilled from an early age so that students are not only able to memorize but also understand the underlying concepts (Wati et al., 2023). However, the reality on the ground still shows that mathematics learning often relies solely on memorization and has not fully honed students' reasoning skills. Based on the results of observations at Baru 06 Elementary School, several crucial issues were found in the fourth-grade mathematics learning. Students often make mistakes in answering questions because they do not yet understand the basic concepts, take a long time to complete the questions, and rely on aids such as calculators or excessive scribbling. Even, students often fail to connect the relationship between the concepts of multiplication, division, and roots, such as the understanding that a root is the opposite of a square. The low interest, confidence, and active involvement of students reinforce the finding that the existing learning media do not fully support optimal learning needs.

Various findings emphasize the need for innovative learning media that can connect the material with the real context around the students. (Mutia & Mulyawati, 2021) state that mathematics learning should be linked to daily experiences so that students can appreciate the practical value of mathematics in life. As a solution, (Wedayanti & Wiarta, 2022) emphasize the importance of contextual learning media to help students visualize abstract concepts more concretely, thereby increasing motivation, understanding, and learning engagement. One relevant approach is the development of contextual learning media based on traditional games or concrete aids. Several previous studies have proven the effectiveness of congklak media in helping students understand multiplication and division through educational play activities. However, the existing congklak media is still limited to just two arithmetic operations and has not yet integrated the concept of square roots, which is actually an important foundation for the next level of mathematics.

To address this challenge, the researchers developed Lubaku (Calculation Hole) as a contextual learning medium that combines the concepts of multiplication, division, and roots into one interactive aid. This media is expected to help students build a deeper understanding through structured play activities, so that math learning is no longer abstract and boring, but rather becomes a meaningful, enjoyable, and applicable learning experience. Previous studies have shown that congklak media effectively improves basic mathematics learning outcomes. (Sholihah et al., 2024) successfully developed Balinese congklak media for

multiplication and division materials with a very high feasibility level based on expert validation and practitioner testing. (Ahmad, 2021) proved that congklak media played with certain strategies can improve students' multiplication counting skills in Gorontalo. Meanwhile, (Maria, 2020) through Classroom Action Research at SD Katolik Wetakara also showed that learning with congklak media can improve multiplication and division learning outcomes while optimizing student activity. The fundamental similarity of those studies lies in the use of the traditional game congklak as a means of learning mathematics. However, the innovation presented by the researcher through Lubaku lies in the expansion of the material concepts up to square roots, the emphasis on concept mastery, and the use of the ADDIE development model (Analyze, Design, Develop, Implement, Evaluate) which allows the media to be developed in a more structured manner, tested iteratively, and refined based on evaluations.

Based on the background and current conditions, this research aims to develop the contextual learning media Lubaku (Calculation Hole) for mathematics learning in the 4th grade at Baru 06 Elementary School. This media is designed to facilitate students' understanding of the concepts of multiplication, division, and roots through enjoyable and interactive activities that are relevant to real life. With the presence of appropriate learning media, it is hoped that the teaching and learning process can become more interactive and productive, thereby enhancing students' understanding, learning motivation, and self-confidence. This research is expected to provide practical contributions for teachers in designing more contextual and effective mathematics learning, while also enriching references for innovative learning media based on traditional games that are adaptive to the demands of the Merdeka Curriculum.

## 2. Methodology

This research uses the Research and Development (RnD) method with the ADDIE development model. The RnD method was chosen because it focuses on the process of developing learning media, as well as testing the feasibility and effectiveness of the media in the field. This method begins with the research phase to identify problems and user needs, followed by the development phase to produce relevant innovative learning media. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This model is considered suitable for the development of learning media, as stated by (Rohaeni, 2020), because it allows for systematic product design.

The development model used in this study follows the ADDIE steps (Analysis, Design, Development, Implementation, Evaluation). In the Analysis stage, the researcher analyzes the competencies and characteristics of the students as well as the material that aligns with the learning outcomes. The Design phase includes setting competencies, teaching methods, and learning strategies. The Development phase focuses on the production of Lubaku (Calculation Hole) media. Next, during the Implementation phase, the media was tested in the classroom to assess its practicality and effectiveness. Finally, the Evaluation phase was conducted to refine

the media through formative evaluation, resulting in learning media that is valid, practical, and effective for use in the teaching and learning process.

In the development of the Lubaku (Calculation Hole) learning media, main materials such as wooden boards, plywood, sheet metal, plastic fiber, plastic cups, as well as colored paint and art paper for visual appearance are used. Assembly is done with the help of glue, nails, screws, hinges, and dacron, while magnets are added to make the media interactive. The visual design was created using the Canva application and printed with a printer. The manufacturing process also requires simple tools such as brushes, scissors, saws, stationery, and thinner to support the stages of cutting, painting, and assembling components.

The data in this study were collected through several techniques, namely observation, validation questionnaires, and field trials conducted in class IV at SDN Baru 06 Pagi. The observation technique was used to directly observe the learning process when students used the Lubaku (Calculation Hole) media. Through this observation, the researcher obtained information regarding the level of enthusiasm, attention, and student responses to the developed media. Additionally, a validation questionnaire was given to content experts and media experts to obtain their assessment of the content, appearance, and usability of the learning media. The results of the validation questionnaire were used as the basis for revising the product to better meet learning needs. Next, field trials were conducted to determine the practicality and effectiveness of the media in real learning situations. This trial also aims to assess the extent to which the Lubaku media can help students understand mathematical concepts in a fun and interactive way.

The validation results data were analyzed using descriptive percentage techniques to determine the feasibility level of the developed learning media. This technique is used because it can clearly and measurably represent the results of expert assessments in percentage form. The percentage calculation formula is applied to calculate the scores given by the experts for each assessment aspect, including content, appearance, and practicality of the media. The resulting percentage values are then interpreted based on feasibility criteria, such as very feasible, feasible, quite feasible, less feasible, or not feasible. Through this analysis, researchers can determine the extent to which the Lubaku (Calculation Hole) media meets the standards of good learning media quality. Additionally, the results of the field trials were analyzed qualitatively by considering the students' responses, the constraints that emerged during the usage process, and suggestions for improvement from both teachers and students to refine the media.

The main instrument in this study is a validation questionnaire filled out by three parties: content experts, media experts, and practitioners or classroom teachers. This questionnaire is systematically designed to assess various aspects of the feasibility of the developed media. Each statement in the questionnaire is based on relevant assessment indicators that align with learning objectives and student characteristics. The instrument uses a Likert scale with a score range of 1 to 5, where a score of 1 indicates very poor assessment and a score of 5 indicates very good assessment. The aspects evaluated include the suitability of the material with

the curriculum, the clarity of the display design, the ease of use of the media by the students, as well as its visual appeal and interactivity. The data obtained from this questionnaire serves as the basis for the researcher in determining the feasibility level and making revisions to the media before it is tested in the field.

The feasibility validation of the media was conducted by content experts and media experts using a questionnaire instrument developed based on certain assessment aspects. The instrument contained several indicators including the suitability of the content with the curriculum, clarity of appearance, accuracy of color and image use, and the ease of use of the media by students. Each indicator was assessed using a Likert scale with a score range of 1 to 5, where the highest score indicates an excellent rating. The validation data from the experts was then analyzed using descriptive percentage techniques to determine the feasibility level of the developed learning media. The analysis was conducted by calculating the average score obtained and converting it into a percentage as the basis for determining the media eligibility criteria presented in Table 1.

$$P = \frac{f}{N} x\ 100\%$$

Explanation:
f = Frequency for which the percentage is being sought
N = Number of Cases (number of frequencies/number of individuals)
P = Percentage

Table 1. Validity and Practicality Percentage Scale

| Percentage Range | Category |
|---|---|
| 76%-100% | Very Feasible |
| 51%-75% | Feasible |
| 26%-50% | Less Feasible |
| 0%-25% | Not Feasible |

## 3. Results and Discussion

### *Test Data Presentation*

This research was carried out by utilizing the Lubaku (Calculation Hole) learning media in Mathematics instruction for fourth-grade students at Baru 06 Elementary School. The study aimed to develop and test an innovative media designed to make mathematical concepts easier and more engaging for students. The testing process was divided into two stages, involving a total of 33 students, consisting of 9 students for small group testing and 24 students for large group testing. During the trials, students interacted directly with the Lubaku media under the supervision of the researcher and classroom teacher. The research was systematically conducted through five stages of the ADDIE model, namely Analyze, Design, Development, Implementation, and Evaluation. Each stage played a crucial role in ensuring that

the developed media met the required standards of validity, practicality, and effectiveness in real classroom situations.

1) Analysis Stage Results

The analysis stage in this research began with observing the needs and characteristics of the 4th-grade students at Baru 06 Elementary School. The observation results showed that the students still struggle to understand basic mathematical concepts, especially in multiplication, division, and squares, and tend to take longer, rely on aids, and lack confidence. Because the students are at the stage of concrete operational development, there is a need for contextual, visual, and interactive learning media to support their understanding in an enjoyable manner. Based on those needs, the Lubaku (Calculation Hole) media was developed, designed in a three-dimensional form, easy to use, and capable of linking mathematical concepts with real-life situations. Material analysis is conducted by aligning the learning outcomes and objectives, which include the topics of multiplication, division, and squares. From the manufacturing side, this media utilizes the Canva application to design visual elements, wood as the basic framework, art paper for question cards, colorful wood paint, 4 mm zinc plate as the attachment board, and magnets for attaching numbers and symbols. In terms of specifications, Lubaku (Lubang Kalkulasi) is a three-dimensional wooden board measuring 60 cm × 50 cm with ten counting holes, a zinc plate cover board, counting holes for congklak seeds, miniature magnetic numbers and symbols, colored and laminated question cards, and mini spatial shapes to enhance material visualization. Additionally, this media is equipped with a user manual, storyboard, and flowchart as supporting materials so that teachers can implement the media easily and systematically in the classroom.

2) Design Phase Results

The design phase in this research includes the planning of creating the Lubaku (Calculation Hole) media based on contextual elements through several important steps. The researcher created a flowchart to map the overall media creation process and made a storyboard as a visual guide to ensure the production process is directed. Additionally, question cards were created in the form of story problems with three subjects: multiplication (blue), division (red), and squares (green), each in different colors to make it easier for students to solve the problems. A media usage guidebook was also prepared so that teachers can understand how to operate the media practically in the classroom. Finally, numbers and symbols are designed with attractive images using the Canva application, making them unique and capable of fostering students' interest in learning.

3) Development Stage Results

The development stage represents the realization phase of the previously created media design plan. At this stage, the researcher begins producing the Lubaku (Calculation Hole) media according to the specifications determined during the design process. The main structure of the media is made of wood, chosen for its

durability and ease of shaping, while the miniature figures and mathematical symbols are designed to be colorful and visually appealing to students. Additionally, art paper is used to create small three-dimensional shapes and question cards that enhance learning activities. Each component is carefully assembled to ensure the media is safe, durable, and easy to use. Overall, this stage aims to produce a learning tool that is contextual, interactive, and capable of enhancing students' understanding of mathematical concepts through hands-on experience as seen in figure one through ten.


Figure 1. Front View

Figure 2. Side View


Figure 3. Interior View


Figure 4. Question Screen Display

Figure 5.

Figure 6. Number Miniature

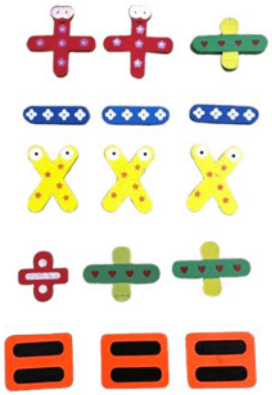


Figure 7. Symbol Miniature

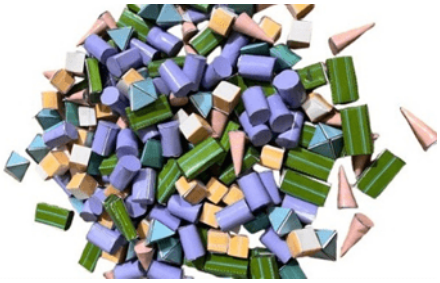


Figure 8. Miniature of a Three Dimensional Shape

Figure 9. Question Card


Figure 10. Media Usage Guide

### *Validation and Revision of Learning Media*

After the Lubaku (Calculation Hole) media is completed, validation is carried out by subject matter and media experts to ensure product feasibility before implementation. The validation results, including suggestions and feedback, are used as the basis for revisions to make the media more optimal and suitable for field use. Validation by subject matter experts aims to assess the feasibility and suitability of the material within the contextual media. Subject matter experts provide evaluation and suggestions regarding the content of the material and the question cards in the guide book. This validation was carried out by one lecturer and two teachers as shown in Table 2.

Table 2. Results of Expert Material Validation

| Aspect | Percentage | Overall | Category |
|---|---|---|---|
| Relevance of Media Content the Material | 100% | 96% | Very Feasible |
| Accuracy and Suitability Of the Material | 92% | | |

The quality of Lubaku's media showed excellent results based on expert validation. In terms of content suitability, the media scored 100%, and in terms of material accuracy, it scored 93%, both of which are categorized as very good. The material is well-structured, aligns with learning achievement indicators, and effectively supports the learning process. Overall, the expert validation results show an average media quality score of 96%, placing it in the very good category and confirming that the content is consistent with the Learning Module. The validation process was conducted before the media was implemented, aiming to identify potential shortcomings and necessary improvements. The assessment focused on aspects such as physical appearance and supporting media components, and was conducted by three media expert lecturers who provided constructive feedback for improvement. The validation results are presented in Table 3.

Table 3. Results of Media Expert Validation

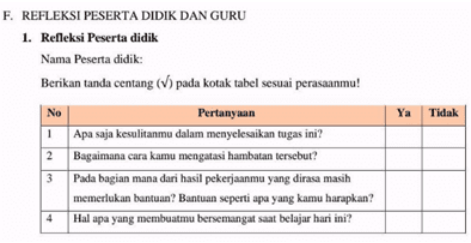
| Aspect | Percentage | Overall | Category |
|---|---|---|---|
| Physical Appearance Media | 95% | 96% | Very Feasible |
| Supporting Media Components | 97% | | |

The quality of the Lubaku (Calculation Hole) media received an excellent rating from media experts. In terms of physical appearance, this media received a score of 95%, indicating that the design, colors, and neatness of its presentation are already attractive and suitable for elementary school students. Meanwhile, in terms of supporting components, the media scored 97%, signifying that every part of the media functions well, is easy to use, and supports learning activities. Both aspects fall into the very good category and are considered appropriate for the content being taught. Overall, media experts gave an average rating of 96%, indicating that Lubaku media is suitable for use, visually appealing, and easy for students to operate in the mathematics learning process.

Based on the advice of media and content experts, several revisions were made to the learning media product developed to optimize results and ensure it meets suitability standards. Revisions from media experts included adding the creator's identity to the learning media, with the aim of providing clarity about the media's origin and developer. This suggestion also aims to ensure the product's authenticity and ease of recognition by users. Meanwhile, the material expert provided input to make changes to the answer column in the reflection section of the learning module, so that students can more easily understand the instructions and fill in the answers correctly. These two types of revisions were made as a form of improvement before the Lubaku media was implemented in field trials. The revised results from both experts can be seen in the following figure one to four.


Figure 1. Media before Revision


Figure 2. Media after Revision



F. REFLEKSI PESERTA DIDIK DAN GURU

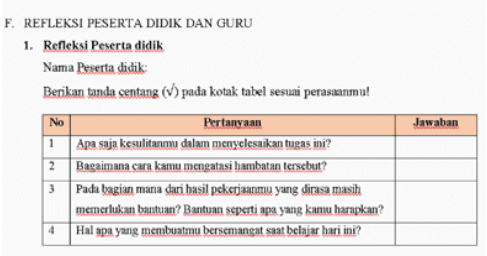
1. **Refleksi Peserta didik**

Nama Peserta didik:

Berikan tanda centang (√) pada kotak tabel sesuai perasaanmu!

| No | Pertanyaan | Ya | Tidak |
|---|---|---|---|
| 1 | Apa saja kesulitanmu dalam menyelesaikan tugas ini? | | |
| 2 | Bagaimana cara kamu mengatasi hambatan tersebut? | | |
| 3 | Pada bagian mana dari hasil pekerjaanmu yang dirasa masih memerlukan bantuan? Bantuan seperti apa yang kamu harapkan? | | |
| 4 | Hal apa yang membuatmu bersemangat saat belajar hari ini? | | |

Figure 3. Material before Revision



F. REFLEKSI PESERTA DIDIK DAN GURU

1. **Refleksi Peserta didik**

Nama Peserta didik:

Berikan tanda centang (√) pada kotak tabel sesuai perasaanmu!

| No | Pertanyaan | Jawaban |
|---|---|---|
| 1 | Apa saja kesulitanmu dalam menyelesaikan tugas ini? | |
| 2 | Bagaimana cara kamu mengatasi hambatan tersebut? | |
| 3 | Pada bagian mana dari hasil pekerjaanmu yang dirasa masih memerlukan bantuan? Bantuan seperti apa yang kamu harapkan? | |
| 4 | Hal apa yang membuatmu bersemangat saat belajar hari ini? | |

Figure 4. Material after Revision

4) Implementation Phase Results

After the Lubaku (Calculation Hole) media was declared feasible by the experts, the next step carried out was the implementation stage in the actual classroom setting. This stage involved applying the developed learning media directly to students in order to evaluate its practicality and effectiveness during the learning process. The main objective of this phase was to observe students' responses toward the use of the Lubaku media, including their level of engagement, enthusiasm, and understanding of mathematical concepts. The implementation also aimed to identify any potential obstacles or difficulties encountered by students while interacting with the media. Through this stage, the researcher was able to collect real-time data on how the media functioned in a classroom environment and assess whether it successfully supported active and meaningful learning experiences.

Table 4. Group Test Results

| Group Test | Number of Students | Percentage | Category |
|---|---|---|---|
| Small | 9 Students | 88% | Very Feasible |
| Large | 24 Students | 89% | |

The implementation stage was conducted in the fourth-grade class at Baru 06 Elementary School by utilizing the Lubaku (Calculation Hole) learning media along with student response questionnaires. This stage aimed to measure the practicality and feasibility of the media when applied in an actual classroom environment. During the small group trial, which involved 9 students, the media obtained a feasibility score of 88%, categorized as very feasible. Subsequently, a large group trial was carried out with 24 students, resulting in a slightly higher feasibility score of 89%, also within the very feasible category. These results indicate that the

Lubaku media is easy to use, engaging, and effective in supporting mathematics learning activities for elementary students. Overall, the implementation process provided valuable feedback for further refinement and validation of the developed media.

5) Evaluation Stage Results

After the implementation of the Lubaku (Calculation Hole) media, if any deficiencies are still found, a re-evaluation stage is necessary. This evaluation ensures that the media is equipped with a user guide, creator's identity, varied question cards, reflection answer columns, materials aligned with learning objectives, and two final evaluation questions based on HOTS so that it can be used optimally by students. Through this evaluation stage, the researcher can address shortcomings based on feedback from the implementation results, ensuring that the Lubaku media is truly ready for classroom use and capable of helping students understand multiplication, division, and squares in a contextual, engaging, and effective manner.

## 4. Conclusion

The development of the Lubaku (Calculation Hole) media for Mathematics learning in the fourth grade at Baru 06 Elementary School was conducted through the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. This process produced a contextual learning media that assists students in understanding mathematical concepts such as multiplication, division, and square numbers in an interactive way. The feasibility of the media was rated as very feasible by both media experts and subject matter experts, indicating that the product meets quality and practicality standards. In addition, student responses during classroom implementation were highly positive, showing enthusiasm and engagement while using the media. These responses suggest that the Lubaku media can effectively enhance students' learning interest, strengthen conceptual understanding, and create a more enjoyable and meaningful mathematics learning experience.

## References

Ahmad, T. Y. (2021). Pengaruh Media Congklak dan Motivasi terhadap Keterampilan Menghitung Perkalian pada Siswa Kelas III di SDN 1 Limboto Kab. Gorontalo. *Prosiding Seminar Nasional Pendidikan …*, *November*, 313–329. http://ejurnal.pps.ung.ac.id/index.php/PSNPD/article/view/1078

Amanda, D. R. (2024). Analisis Penggunaan Media Pembelajaran Berbasis Media Visual terhadap Hasil Belajar Bahasa Indonesia Siswa. *Jurnal Pendidikan, Bahasa dan Budaya*, *3*(2), 185–199.

Maria, K. (2020). Meningkatkan Hasil Belajar Siswa Kelas II dengan Menggunakan Media Congklak di SD Katolik Wetakara. *Jurnal Ekonomi,*

*Sosial & Humaniora*, *01*(12), 67–77. https://jurnalintelektiva.com/index.php/jurnal/article/view/378

Mutia, W. S., & Mulyawati, I. (2021). Pengembangan Media Pembelajaran Matematika pada Materi Bangun Ruang melalui Animasi Power Point Terhadap Siswa Kelas V Sdn Parung Panjang 06. *Elementary School: Jurnal Pendidikan dan Pembelajaran Ke-SD-An*, *8*(2), 351–360. https://doi.org/10.31316/esjurnal.v8i2.1514

Permendikbud. (2016). Permendikbud Menteri Pendidikan dan Kebudayaan Nomor 22 Tahun 2016. *Https://Peraturan.Bpk.Go.Id/Details/224242/Permendikbud-No-22-Tahun-2016*, 1–15.

Rohaeni, S. (2020). Pengembangan Sistem Pembelajaran dalam Implementasi Kurikulum 2013 Menggunakan Model Addie pada Anak Usia Dini. *Instruksional*, *1*(2), 122. https://doi.org/10.24853/instruksional.1.2.122-130

Romdhoni, M. A., Hasibuan, H. R., & Basri, H. (2023). Tantangan implementasi kurikulum merdeka … Challenges of implementing the independent curriculum in Islamic Religious Education learning at SMP Negeri 24 Medan. *TARBAWY: Indonesian Journal of Islamic Education*, *10*(2), 115. https://ejournal.upi.edu/index.php/tarbawy/index

Sholihah, D. M., Rahayu, D., & Handayani, M. S. (2024). Pengembangan Media Congklak Bali pada Materi. *Jurnal Ilmiah Matematika Realistik*, *5*(1), 1–10.

Wati, D. P., Fatayan, A., Iqbal Aproyanto, & Sartika Ayu. (2023). *The Relationship between the Use of the Kahoot Application and Mathematics Learning Outcomes in the Online Learning Process for Elementary School Students*. *5*, 1554–1558. https://kahoot.com/

Wedayanti, L. A., & Wiarta, I. W. (2022). Multimedia Interaktif Berbasis Problem Based Learning pada Muatan Matematika Kelas IV SD. *MIMBAR PGSD Undiksha*, *10*(1), 113–122. https://doi.org/10.23887/jjpgsd.v10i1.46320

How to cite this article:

Putri, D. A. A., & Wati, D. P. (2025). Development of Contextual Learning Media Lubaku (Calculation Hole) in Mathematics Learning at Elementary School. *Journal of Educational Sciences*, *9(6)*, 5536-5547.