



Gamification Preferences in Learning Multiplication: A Need Analysis Among Elementary School Students

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Abstract

Multiplication operation material is often a challenge for some students. Various factors are the causes of students' difficulties in understanding multiplication operations, one of which is the lack of variety in the use of learning media that is able to visualize the concept of multiplication in a concrete and interesting way that is able to bridge the abstract concept of multiplication. The research aims to identify specific needs for learning media and serve as a guideline for developers in designing learning media that is more innovative, effective, and in accordance with the needs of students. This research uses a qualitative method. The research time will be carried out in the range of May 2025. The population of this study is focused on teachers and students in grade IV, which totals 28 students. This study applied data collection techniques that included interviews with teachers and students, as well as the submission of a closed questionnaire on the Guttman scale. The data analysis technique used is descriptive analysis. The results of the analysis show that students need digital learning media that is interactive, visual-centric, has game features, is contextual, relevant, able to provide feedback, and media that can accommodate concrete, varied, and collaborative media needs. Therefore, it is concluded that to increase students' understanding of the concept of multiplication, the media that can be developed are multimedia-based digital applications and concrete learning media based on learning kits.

1. Introduction

Mathematics plays a fundamental role in the cognitive development of elementary school students, forming an important foundation for understanding more complex concepts at the next level of education. The material of number multiplication operations is often a challenge for some students. This problem is global, various countries around the world also face significant difficulties in the case of elementary school students having difficulty understanding and mastering multiplication. Various international studies such as TIMSS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) show that there is a variation in students' abilities in mathematics, one of which is multiplication (Mullis et al., 2020; OECD 2023). Although the PISA report does not explicitly test aspects of multiplication separately such as elementary school exams, it does show implicitly related to students' ability in multiplication. The PISA 2022 report shows the difference in mathematical literacy skills between participating countries. Countries such as Singapore, Macau, and Taiwan rank top with scores well above the OECD average, while many other countries (including Indonesia) are still below average (OECD, 2023). Various national studies also show that many students in Indonesia still have difficulty in understanding the basic concept of mathematical multiplication. Based on research (Kusumasari & Sary, 2021), it indicates that the causes of difficulties experienced by grade 3 elementary school students in learning mathematics, especially in the material of multiplication calculation operations, include several things, namely lack of skills in doing calculations, using the wrong method or process, difficulty in determining the place value of numbers, unclear or difficult to read writing, and lack of understanding of the use of mathematical symbols.

This phenomenon of difficulty is reflected in the various mistakes made by students when solving multiplication problems, indicating a potential gap between the teaching methods applied and the learning needs of students. While there are some common problems with multiplication in school, students may have trouble understanding that multiplication involves repeating a certain number of one number (multiplier) as much as another number (Rejeki et al., 2024). Students can

make calculation mistakes because they are not focused or do not understand the concept of multiplication well. This error can occur when multiplying larger numbers or when students try to remember the fact of multiplication. That's why suggesting that a strong conceptual understanding is more important than simply memorizing. (Putri et al., 2023). Memorizing multiplication tables is often a significant challenge for elementary school students. This is because there are many multiplication facts that they must remember, and the similarity of numbers in some facts can interfere with memory and cause confusion, making the learning process more difficult (Dotan & Zviran-Ginat, 2022). This is in line with previous research, which states that some students may have difficulty applying the concept of multiplication in solving mathematical problems. Highlight the importance of students' ability to transfer the understanding of multiplication into a real-world problem-solving context. This can include formulating equations, calculating the results of multiplication, and identifying relevant information (Ilukena et al., 2020).

Various factors are the causes of students' difficulties in understanding multiplication operations, one of which is the lack of variety in the use of learning media that is able to visualize the concept of multiplication in a concrete and interesting way that is able to bridge the abstract concept of multiplication. In line with the statement (Fatmawati, 2014) that the numeracy ability of children aged 7 to 11 years is at a concrete operational stage, so it is very important to facilitate children at this age with learning media so that they can easily understand the mathematics operation material that will be taught by the teacher, given the characteristics of their cognitive development that still require physical representation. Therefore, it is very important to create learning media that helps the teaching and learning process and improves students' numeracy skills. Students can gain a better understanding of the material by using creative learning media such as teaching aids or digital media. (Daulay et al., 2024). This shows that there are challenges in the implementation of more innovative and media-centered learning practices. In this regard, the role of the media has become increasingly important due to the paradigm shift in the world of national education which no longer makes teachers the center of learning. Student-centered learning is the main focus, making students more actively involved in the learning process. Students not only receive knowledge but also communicate and convey messages, demanding a medium that is able to facilitate active interaction and exploration. Some of the functions of media in learning include helping students learn more effectively, speeding up their learning process, maximizing the quality of learning, and making abstract things concrete, thus reducing the possibility of misunderstanding in students (Dilla, 2023).

Departing from the background and empirical phenomena that have been described in depth regarding the challenges in learning multiplication operations at the elementary school level, this study focuses on systematic efforts to answer fundamental questions that have significant implications for the mathematics learning process in the classroom. The formulation of the problem to be answered is about the identification of specific needs for mathematics learning media that can facilitate the improvement of conceptual understanding and skill development in number multiplication operations in the fourth grade of elementary school students. The formulation of this specific problem aims not only to identify the types of media in general, but also to delve deeper into the design attributes, levels of interactivity, visual representation, and pedagogical elements that are most relevant and responsive to students' learning needs in understanding and mastering multiplication operations.

2. Method

This research uses a qualitative method, a method chosen to explore in depth the perspectives and experiences of students related to the needs of mathematics learning media. The study was conducted in May 2025, allowing researchers to comprehensively collect data through various stages. The population of this study is focused on grade IV students of Lesanpuro State Elementary School 1 for the 2024/2025 school year, which totals 28 students. The selection of grade IV is based on the consideration that at this level, the understanding of mathematical concepts begins to develop more complex, so that the identification of learning media needs is crucial to support an effective teaching and learning process.

This study applied data collection techniques that included semi-structured interviews with teachers and students, as well as the submission of closed questionnaires to all grade IV students and teachers. In which the broad areas of interest, sometimes including sub-questions, are defined. This

student learning media needs analysis questionnaire consists of 15 statement items designed to reveal students' preferences regarding the use of media in mathematics learning. The closed-loaded Guttman scale with dichotomous answer options (Yes or No) is chosen to produce clear and easily analyzed data on whether or not there is a need for certain aspects of the media. The questionnaire submitted contains indicators related to media needs, such as preferences for visual, audio, and interactive media, as well as the identification of obstacles faced or challenges by students in understanding mathematics material without media support. The data analysis technique used is descriptive analysis that focuses on the results of the questionnaire. The data collected from the questionnaire was processed and analyzed to produce a clear picture of the needs of mathematics learning media from the perspective of grade IV students of Lesanpuro State Elementary School 1.

3. Results and Discussion

3.1. Preliminary Study Interview Results

The research aims to identify the need for accessible learning media in mathematics learning. The researcher conducted interviews directly with the classroom teachers. The results of interviews and questionnaires with grade IV teachers of Lesanpuro State Elementary School 1 show that there are some students who have difficulty understanding the concept of number multiplication. Students experience mathematical misconceptions with the specification of difficulty understanding basic multiplication facts, applying the concept of multiplication to larger numbers, and solving story problems related to multiplication. Based on the statements obtained, it was found that the learning media that are often used by teachers are textbooks, whiteboards, and multiplication tables. In addition, teachers also use ICT-based learning media, such as learning videos or pictures presented to students using projectors provided by the school.

The class teacher explained that the learning media available for multiplication materials was less effective. The obstacle faced is that teachers have difficulty providing interesting, interactive, and relevant learning media for multiplication materials. There is no use of concrete teaching aids to support learning. Then there are the types of media possibilities expressed by teachers, which have the potential to be effective in teaching basic concepts of multiplication such as manipulative props, pictures or illustrations that show multiplication as repeated addition, educational games or quizzes that can provide feedback to students, and animated videos that explain the concept of multiplication.

3.2. Preliminary Study Questionnaire Results

The questionnaire of needs for students was distributed to 28 grade IV students of Lesanpuro State Elementary School 1. The questionnaire consists of 15 statements designed to determine students' compliance with learning media for misconceptions of mathematical number multiplication operations.

Table 1. Student Questionnaire Results

No	Indicators	Results
1	Interest in Math	100%
2	Challenges in Multiplications	52%
3	Use of Aids	67%
4	Color Visual Preferences	85%
5	Learning through Games	89%
6	Experience with Digital Media	93%
7	Use of Video Media	74%
8	Availability of Digital Media	85%
9	The Use of Digital Media to Solve Math Problems	70%

10	Interest in Interactive Applications or Websites	93%
11	Student Preferences for Instant Feedback	96%
12	Real/Concrete Object Preferences	85%
13	Group Learning	74%
14	Relevance to Everyday Life	74%
15	Variations of Learning Media	81%

The results of the questionnaire show that:

3.2.1. Interest in Multiplication

A total of 89% of students like learning about multiplication. This data shows that in general, multiplication is not a subject that is avoided or disliked, but rather has its own appeal to most students.

3.2.2. Challenges in Multiplication

The results showed that 52% of students said that multiplication of numbers was difficult. Although many have an interest in multiplication, there are still more than half of the students who find it difficult to learn multiplication.

3.2.3. Use of Aids by Teachers

A total of 67% of students stated that teachers often use pictures or other aids when explaining multiplication. This shows that the teacher has made an effort to visualize the material, however, as seen in point 2, this effort has not completely overcome the student's difficulties.

3.2.4. Color Visual Preferences

A total of 85% of students stated that it is easier to understand multiplication if there are colored images when the material is explained. This data confirms the importance of engaging and colorful visualizations in the learning process.

3.2.5. Learning through Games

A total of 89% of students like learning multiplication by playing or using games. This indicates that students have an interest in learning with a gamification approach or learning while playing.

3.2.6. Digital Media

As many as 93% of students stated that they had seen videos or animations explaining multiplication and 74% of students preferred to learn multiplication with videos or pictures rather than just listening to explanations of the material. This data confirms that students are familiar with digital content and have a strong preference for audiovisual media.

3.2.7. Access and Use of Digital Devices

As many as 85% of students have a computer or mobile phone that can be used for studying, and 70% of students have worked on multiplication problems on a computer or mobile phone. The availability of devices and the experience of using digital devices for learning shows that the basic infrastructure for digital learning is adequate among students.

3.2.8. Interest in Interactive Applications or Websites

93% of students are interested if there is an application or website on a mobile phone or laptop that can help when learning multiplication and 96% of students like it if there is a multiplication question exercise on a computer or mobile phone that immediately tells the correct answer and the wrong answer.

3.2.9. Real Object References

As many as 85% of students prefer to learn using real objects. Despite the strong preference for digital media, this data reminds us that concrete learning with physical objects remains highly relevant and preferred by students. The use of real objects can help students build a stronger conceptual understanding.

3.2.10. Group Learning

A total of 74% of students prefer to learn multiplication in groups. This shows that collaboration and social interaction are important aspects of learning for students.

3.2.11. Relevance in Everyday Life

74% of students stated that multiplication lessons would be easier and more fun if they were accompanied by examples in everyday life. This shows that students like contextual learning that is relevant to their experience.

3.2.12. Variations of Learning Media

A total of 81% of students are more enthusiastic if they learn multiplication using different media.

Based on the results of the questionnaire obtained, it can be stated that most of the fourth grade students of Lesanpuro State Elementary School 1 stated that they have a high interest in multiplication learning but face difficulties in understanding the concept, so they really need varied, interactive, visual (colored), game-based, and use digital technology such as applications or websites that provide instant feedback. In addition, students also like learning approaches that involve real objects, are done in groups, and are relevant to daily life to make multiplication learning easier and fun.

3.3 Review of the Relevant Literature on the Implications of Media

Design and Development

Based on the questionnaire data, the development of multiplication learning media for grade IV students of Lesanpuro State Elementary School 1 must consider several key implications. First, the media developed must be inherently engaging and motivating. This is in line with accessible learning media, which provides an inclusive learning environment and facilitates active participation, can go a long way in increasing students' learning motivation by presenting engaging and relevant material. Accessible learning media can encourage student engagement and provide opportunities for students to learn independently with the support of technology (Rahmawati et al., 2023). There are 89% of students who like multiplication and another 89% like learning through games. This demands the adoption of a strong gamification approach, where elements of game, challenge, and reward can be integrated in learning. In addition, learning media with the concept of gamification. Gamification is the process of using game methods and approaches to solve problems outside of the game. It is often facilitated using digital platforms, aiming to solve problems, increase engagement, and motivate individuals towards their goals (Christopoulos & Mystakidis, 2023).

This approach encourages users to adopt desired behaviors by making technology or learning materials more engaging. Gamification aims to improve certain skills, such as meeting learning objectives, increasing student engagement, maximizing learning, encouraging socialization, and supporting behavior change. Gamification is used to attract and encourage individuals digitally because the medium used for gaming is digital devices such as computers, mobile phones, tablets, etc. Gamification can increase creativity, acquire new abilities, or change behavior is the purpose of using gamification as a method of motivation (Ayu et al., 2024). In line with previous experimental research, investigate how specific gamification elements (such as points, badges, leaderboards) affect intrinsic motivation and learning outcomes. These findings suggest that certain elements of play can improve motivation and learning performance (Sailer et al., 2017).

Second, media must harness the power of visual and interactive, given that 85% of students understand more easily with color images and 74% prefer videos or images to verbal explanations.

With 93% of students having seen a video/animation and 85% having access to a digital device, this opens up a great opportunity to create an interactive app or website that is rich in visuals, animations, and video-based scenarios. The instant feedback feature (preferred by 96% of students) is also crucial for self-paced learning and comprehension correction. Learning media has a significant influence on improving student learning outcomes. Easily accessible learning media such as animations, images, and videos can help students visualize difficult concepts and understand and remember information better. The interactivity of this learning media has interactive elements that allow students to actively participate in the learning process through quizzes, simulations, and games. Greater accessibility of learning media that can be easily accessed through electronic devices such as computers, tablets, and gadgets. It gives students the opportunity to learn anytime and anywhere without time limits (Rahmawati et al., 2023).

The benefits of images as visual media can be attractive to students. Visuals with various colors will be more attractive and can arouse students' interest and attention. Pictures can also make it easier for students to understand. An abstract explanation can be helped by pictures so that students can more easily understand what is meant (Intansari, 2017). Visualization can be a powerful tool for thinking and learning in mathematics, as it can help students understand abstract concepts and make connections between mathematical ideas (Schoenherr et al., 2024). In line with the principle that visual representation can bridge the gap between concrete and abstract thinking in elementary school-age students. Therefore, innovation in the development of learning media that combines concrete, interactive digital elements, and interesting visualizations plays a crucial role in improving the quality of mathematics learning at the elementary school level. Hal ini dapat sehubungan penelitian teori kognitif pembelajaran multimedia, dimana gambar, video, dan animasi yang dipadukan dengan teks atau narasi dapat meningkatkan pembelajaran, terutama jika elemen-elemen tersebut dirancang secara interaktif dan sesuai dengan cara kognitif manusia. People can learn more deeply from words and pictures than from words alone (Mayer & Fiorella, 2022).

Third, the media needs to bridge abstract concepts with students' realities. Although multiplication is considered difficult by 52% of students, 74% say it would be easier if there were examples of everyday life. Therefore, the media must present real and relevant context through scenarios or simulations, while integrating the use of real objects (preferred by 85% of students) to reinforce concrete understandings before moving on to abstract concepts. The researcher argues that, based on the analysis and problem solving carried out in the field, the use of hands-on activity media, also known as hands-on hands-on activities, can improve the multiplication learning outcomes of elementary school students. Instead of delving straight into an abstract concept, the use of hands-on interaction with concrete manipulatives allows students of all mathematical levels to begin instruction on a level playing field. Accessibility for students is of utmost importance: students must be able to connect and engage with the mathematical concepts through direct, hands-on participation (Jones & Tiller, 2017).

Fourth, the media must support diversity of learning styles and collaboration. Given that 74% of students prefer group learning and 81% are more enthusiastic about varied media, these interactive media should be designed to be flexible in use, both individually and in group activities. This could mean a multiplayer mode or a feature that encourages discussion between students. Collaborative learning has more influence than individual learning (Du et al., 2022). Elementary school students' motivation to learn science increases substantially through web-based collaborative learning. Significant differences are seen when collaborative strategies are integrated, offering greater motivation increases than just the use of a web environment. In addition, this web-based platform facilitates the understanding of dissolution concepts at the micro level, allowing students to effectively address their misconceptions. In addition, web-based collaborative learning strategies for sharing opinions and discussing with peers (Chin-Fei & Chia-Ju, 2012). For us, contextualised media enables the user to create, retrieve, and use digital media in a relevant real-world context for

notification, documentation, problem solving, reflection, communication and a variety of other learning activities. Teachers can relate subject matter content to real world situations. Therefore, the students are motivated to make connections between knowledge and its applications to their lives as family members, citizens, and workers and engage in the hard work that learning requires (Khaefiatunnisa, 2015).

The results of development research by (Widiyanti & Anugraheni, 2022) show that the development of digital game-based learning media can increase students' motivation and enthusiasm during the learning process. The research developed an android-based learning media for mathematical calculation operation materials that were designed interactively with animated displays, quizzes, and a variety of features such as timers, number of scores, and game levels. The media developed has validation results from material experts of 91%, then there are validation results from media experts of 92% and have validation results from teachers as practitioners of 77%. The development of android-based learning media that has been tested by material experts, media experts, and practitioners or teachers received an average score percentage of 87% included in the very valid category. So that learning media is suitable for use in the mathematics learning process in elementary schools, providing an interesting and relevant alternative to technological developments and the learning preferences of today's students.

Research related to the development of learning media by (Djamil et al., 2024) where the researcher developed a learning media in the form of multiplication cards for second-grade elementary school students. The development of multiplication card learning media, showing very positive results, indicates the great potential of concrete media in facilitating the understanding of multiplication concepts at the early elementary school level. The media developed meets very high standards for use in the learning process. The assessment of kapera media reached 85.71% from material experts and 100% from media experts, showing that this media is very feasible to use from the perspective of content and visual design. In addition, teachers' responses to the use of this media reached 91.42%, which was classified as very good, and students' responses to the use of this media reached an average percentage of 94.48%, which was also classified as very good. These results show that the multiplication card medium is not only technically and materially appropriate, but is also enthusiastically accepted by teachers and students, reflecting its appeal and effectiveness in classroom learning practices. In addition, research conducted by (Rahmadani, 2022) uses concrete learning media in the form of learning kit media. The researcher developed a learning kit consisting of various mathematical teaching aids for fractional materials. The application of learning kit media shows that the results can increase student learning creativity, especially in fractional materials. There was a result of an increase in learning completeness in the first cycle by 67.85% and then in the second cycle by 89.28%. This substantial improvement indicates that the use of props in learning kits not only helps students understand fractions more deeply, but also triggers motivation and a more creative way of thinking in solving math problems. These findings underscore the importance of exploring and implementing learning media that are more in line with the needs and learning styles of elementary school students.

3.4 Conclusion

Based on the results of the research, it can be concluded that to improve the understanding of fourth grade students of SDN Lesanpuro 1 about the concept of multiplication operations, it is necessary to develop comprehensive learning media. The implications of these findings suggest that current teaching approaches may not fully meet students' learning needs in understanding abstract multiplication. Therefore, effective solutions include two main types of media that carry the concept of gamification in the learning process: multimedia-based digital learning media and concrete learning kit-based learning media.

For digital learning media, an interactive application is needed that not only presents an animated visualization of multiplication material, but also comes with an educational quiz game and an instant feedback feature that helps students identify and correct their mistakes independently. As well as concrete learning media in the form of learning kits that can accommodate the needs of physical media to facilitate the understanding of abstract concepts of multiplication. The concrete media developed led to the development of turnboard media, sticky numbers, and role-playing props to support varied, collaborative, and relevant learning to daily life

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References

- Ayu, A. F., Puspitasari, A., Hidayati, N., Andikos, A. F., Dharmasraya, S., Barat, S., Indonesia, U. P., Motivation, L., & Belajar, M. (2024). Model Pembelajaran Gamifikasi dalam Meningkatkan Motivasi Belajar Siswa Melalui Teknologi. *Isedu: Islamic Education Journal*, 2, 81–85. <https://doi.org/10.59966/isedu.v2i2.1270>
- Chin-Fei, H., & Chia-Ju, L. (2012). Exploring the Influences of Elementary School Students' Learning Motivation on Web- Based Collaborative Learning. *US-China Education Review*, 6, 613–618. <http://files.eric.ed.gov/fulltext/ED535487.pdf>
- Christopoulos, A., & Mystakidis, S. (2023). Gamification in Education. *Informatologia*, 48(3–4), 198–204.
- Daulay, W. H., Pulungan, F., Karlina, M., & Sofiyah, K. (2024). Permasalahan Matematika yang Ada di Sekolah Dasar. *Jurnal Ilmiah Multidisiplin Terpadu*, 8(11), 318–324.
- Dilla, W. P. (2023). Analisis Kebutuhan Media Pembelajaran pada Sekolah Dasar di Palangka Raya. *Sangkalemo : The Elementary School Teacher Education Journal*, 2(1), 24–29. <https://doi.org/10.37304/sangkalemo.v2i1.7611>
- Djamil, F., Husain, R., & Aries, N. S. (2024). Pengembangan Media Kapera (Kartu Perkalian) pada Siswa Kelas II. *Damhil Education Journal*, 4(2), 149–158. <https://doi.org/10.37905/dej.v4i2.2510>
- Dotan, D., & Zviran-Ginat, S. (2022). Elementary Math in Elementary School: The Effect of Interference on Learning the Multiplication Table. *Cognitive Research: Principles and Implications*, 7(1). <https://doi.org/10.1186/s41235-022-00451-0>
- Du, X., Chen, C., & Lin, H. (2022). The Impact of Working Memory Capacity on Collaborative Learning in Elementary School Students. *Frontiers in Psychology*, 13(December), 1–12. <https://doi.org/10.3389/fpsyg.2022.1027523>
- Fatmawati, N. (2014). Peningkatan Kemampuan Berhitung Melalui Pendekatan Realistic Mathematic Education. *Jurnal Pendidikan Usia Dini*, 8(2), 325–336. <https://doi.org/10.21009/JPU.082.012>
- Ilukena, A. M., Utete, C. N., & Kasanda, C. (2020). Strategies Used by Grade 6 Learners in the Multiplication of Whole Numbers in Five Selected Primary Schools in the Kavango East and West Regions. *International Education Studies*, 13(3), 65. <https://doi.org/10.5539/ies.v13n3p65>
- Intansari, R. (2017). Penggunaan Media Gambar Untuk Meningkatkan Keterampilan Bercerita Siswa Kelas IV SD Negeri 2 Tanjung Senang Bandar Lampung
- Jones, J. P., & Tiller, M. (2017). Using Concrete Manipulatives in Mathematical Instruction. *Dimensions of Early Childhood*, 45(1), 18–23. <http://libproxy.boisestate.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1150546&site=ehost-live>
- Khaefiatunnisa. (2015). The Effectiveness of Contextual Teaching and Learning in Improving Students' Reading Skill in Procedural Text. *Journal of English and Education*, 3(1), 80–95.
- Mayer, R. E., & Fiorella, L. (2022). The Cambridge Handbook of Multimedia Learning. *The Cambridge Handbook of Multimedia Learning*, February 2022. <https://doi.org/10.1017/9781108894333>
- Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). TIMSS 2019 International Results in Mathematics. OECD. (2023). Pisa 2022 Results. In *Factsheets: Vol. I*. <https://www.oecd-ilibrary.org/education/pisa-2022-results-volume->

i_53f23881-en%0Ahttps://www.oecd.org/publication/pisa-2022-results/country-notes/germany-1a2cf137/

- Putri, B. A., Zamhari, A., Laily, I., Resti Paramita, D., & Furwanti, E. (2023). Application of Multiplication Method Using Multiplication Board to Elementary School Students. *Educenter : Jurnal Ilmiah Pendidikan*, 2(2), 252–257. <https://doi.org/10.55904/educenter.v2i2.766>
- Rahmadani, R. (2022). Penerapan Media Kit Matematika dalam Pembelajaran Matematika untuk Meningkatkan Kreativitas Belajar Siswa Kelas V SD Karya Bhakti II Helvetia Tahun Pelajaran 2021/2022.
- Rahmawati, R., Mulyono, A., Fauziana, R., & Yusup, Q. S. (2023). Analisis Kebutuhan Media Pembelajaran yang Aksesibel untuk Meningkatkan Hasil Belajar Siswa dalam Pembelajaran Matematika. *Genta Mulia: Jurnal Ilmiah Pendidikan*, 159–169.
- Rejeki, S., Purnomo, Y. W., Maulida, M. A., 'Aini, Y. N., & Asyifa, D. A. N. (2024). Improving Primary School Students' Multiplication Ability using "Smart Suitcase" Media Assisted by Mathematical Worksheets. *Pedagogical Research*, 9(3), em0211. <https://doi.org/10.29333/pr/14635>
- Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How Gamification Motivates: An Experimental Study of the Effects of Specific Game Design Elements on Psychological Need Satisfaction. *Computers in Human Behavior*, 69, 371–380. <https://doi.org/10.1016/j.chb.2016.12.033>
- Schoenherr, J., Strohmaier, A. R., & Schukajlow, S. (2024). Learning with Visualizations Helps: A Meta-Analysis of Visualization Interventions in Mathematics Education. *Educational Research Review*, 45(January), 100639. <https://doi.org/10.1016/j.edurev.2024.100639>
- Widiyanti, M., & Anugraheni, I. (2022). Pengembangan Media Pembelajaran Berbasis Android "Opera Juragan" pada Materi Operasi Hitung di Sekolah Dasar. *Edukatif : Jurnal Ilmu Pendidikan*, 4(4), 5480–5485. <https://doi.org/10.31004/edukatif.v4i4.3243>