

# Augmented Reality for Mathematics Learning: Could We Implement It in Elementary School?

Totok Victor Didik Saputro<sup>1\*</sup>, Pebria Dheni Purnasari<sup>2</sup>, Winda Lidia Lumbantobing<sup>3</sup>,  
Yosua Damas Sadewo<sup>4</sup>

Primary Education, Institut Shanti Bhuana  
Bukit Karmel No. 1, Bengkayang, West Kalimantan, Indonesia  
<sup>1\*</sup>[totok.victor@shantibhuana.ac.id](mailto:totok.victor@shantibhuana.ac.id), <sup>2</sup>[pebria.dheni@shantibhuana.ac.id](mailto:pebria.dheni@shantibhuana.ac.id),  
<sup>3</sup>[winda.tobing@shantibhuana.ac.id](mailto:winda.tobing@shantibhuana.ac.id)

Doctoral Program in Educational Technology, Universitas Negeri Jakarta  
R. Mangun Muka Raya Street No. 11, Jakarta, Indonesia  
<sup>4</sup>[yosuadamassadewo\\_9902921035@mhs.unj.ac.id](mailto:yosuadamassadewo_9902921035@mhs.unj.ac.id)

Article received: 19-11-2023, received: 11-12-2023, published: 30-01-2024

## Abstrak

Teknologi berkembang pesat dan diantaranya diterapkan di bidang pendidikan. Namun, faktanya masih banyak guru yang belum mampu mengimplementasikan teknologi dan media pembelajaran digital dalam pembelajaran di kelas. Augmented reality menjadi salah satu alternatif media pembelajaran untuk diimplementasikan dalam pembelajaran matematika. Penelitian ini bertujuan menganalisis pemanfaatan augmented reality dalam pembelajaran matematika di sekolah dasar. Analisis dilakukan dengan pendekatan penelitian scoping review dengan batasan pada hasil artikel yang dipublikasikan selama 3 tahun terakhir. Tahap scoping review menggunakan kerangka Aksey dan O'Malley. Artikel diambil dari hasil publikasi artikel pada Jurnal Terindeks SINTA dengan kata kunci "Augmented Reality" ATAU "Pembelajaran Matematika" ATAU "Sekolah Dasar". Hasil eksplorasi dianalisis menggunakan kerangka Preferred for Reporting of Items for Systematic Review and Meta-Analysis (PRISMA). Hasil penelitian menyatakan bahwa augmented reality dapat diimplementasikan untuk pembelajaran matematika di sekolah dasar mengacu pada karakteristik augmented reality yang diadaptasi pada gaya belajar siswa sekolah dasar, tantangan penerapan augmented reality, dan dampak belajar siswa.

**Kata Kunci:** Augmented Reality; Pembelajaran Matematika; Sekolah Dasar

## Abstract

Technology is developing rapidly and some of it is being applied in the field of education. However, the fact is that there are still many teachers who are not able to implement digital learning technology and media in classroom learning. Augmented reality is then an alternative learning media that can be implemented in learning mathematics in elementary schools. This study aims to analyze the use of augmented reality in learning mathematics in elementary schools. The analysis was carried out using a scoping review research approach with limitations on the results of published articles for the last 3 years. The scoping review stage used Aksey and O'Malley's framework. The articles were taken from the results of article publication in the National Science and Technology Index Indexed Journal (SINTA) using the keywords "Augmented Reality" OR "Mathematics Learning" OR "Elementary School". The outcomes of this exploration were then analyzed using the Preferred for Reporting of Items for Systematic Review and Meta-Analysis (PRISMA) framework. The result of this study stated that augmented reality can be implemented for mathematics learning in elementary schools referring to the characteristics of adapted augmented reality on the learning styles of elementary school students, the challenges of implementing augmented reality, and the students' learning impacts.

**Keywords:** Augmented reality; Elementary school; Mathematics learning

## I. INTRODUCTION

In this era, technology is advancing at an extraordinary pace. It has undergone a significant transformation and has had a major influence in various fields such as transportation, communication, health, and education (Ibrokhimovich, 2022; Lampropoulos et al., 2022). The development of this technology is inseparable from the progress of science. In this condition, the science of education is very influential for all aspects of this life. In the field of education, science is the main aspect in developing and implementing technology in learning (Fernandez-Batanero et al., 2022). This technology plays an important role for the continuity of learning. Learning that has utilized technology has an impact on an interesting and fun learning process for students. Students can be more active in exploring the learning concepts that are being taught.

At the elementary school level, learning becomes more captivating with the use of technology (Heggart & Yoo, 2018; Hermita et al., 2021). The learning pattern of elementary school students, which is synonymous with *learning while playing*, is very relevant to the use of technology in learning. Students will focus more on learning by utilizing technology. This means that technology has a big role in learning in elementary schools. This technology makes it easier for students to understand learning material. Technology can help students' understanding by facilitating student learning styles such as visual, auditory, and kinesthetic learning styles (Iqbal et al., 2022; Tomczyk & Eger, 2020; Trista & Rusli, 2020).

The diverse student learning styles are a challenge for teachers in providing learning

in the classroom (Jatmiko & Putra, 2022; Sánchez-Cruzado et al., 2021). The teacher must prepare a learning method that is able to facilitate the student's learning style. When this condition becomes a teacher's problem in creating learning that is engaging and in accordance with the characteristics of students. It is imperative for teachers to be able to choose the technology that is currently being implemented in elementary school education. Technology that can facilitate and enhance students learning by taking into account of their unique characteristics and learning styles.

The next challenge arises in the process of using technology in learning in elementary schools. Teachers with low technological knowledge make the implementation of the application of technology in learning less effective (Gunawan & Suhardi, 2019; Suryatin & Sugiman, 2019; Triwahyuningtyas et al., 2022). Before implementing any technology into the learning process, it is crucial for teachers to first master how to use it effectively. The impact of the teacher's lack of mastery in using technology in learning will result in poor time management, learning materials that are not delivered effectively, and students not being focused on learning (Ekayogi, 2023; Saputro et al., 2023; Surur, 2022).

Technology in learning in elementary schools is certainly needed. This technology makes it easier for teachers to provide explanations of the material being taught. Augmented reality is one of the learning technologies that can be implemented in the mathematics learning process in elementary schools (Sungkono, Apiati, &

Santika, 2022). Augmented reality can facilitate all student learning styles consisting of visual, auditory, and kinesthetic learning styles (Firmansyah et al., 2021; Iqbal et al., 2022; Wahab & Nuraeni, 2020). This learning technology assists teachers in visualizing the concept of learning mathematics in elementary schools so that students can understand the material easily. An attractive appearance allows students to participate actively in learning (Pichardo et al., 2021; Sreylak et al., 2022; Tetik & Özer, 2022).

The scoping review approach was selected to examine issues related to the implementation of augmented reality as a learning medium in mathematics education at the elementary school level. This scoping review helps address the research questions by identifying and analyzing previous studies, with a focus on new insights related to the implementation of augmented reality in elementary school mathematics education. The review also emphasizes challenges associated with technological readiness and resources in implementing augmented reality learning media in elementary school mathematics instruction. Consequently, the findings of this study provide recommendations for educators to implement augmented reality as an alternative technology-based learning medium in elementary school mathematics education.

Based on the problems described above, this study aims to identify whether augmented reality learning technology can be implemented in learning mathematics in elementary schools. The implementation of how augmented reality in education is

reviewed is taken from various aspects, including how its unique characteristics can be effectively utilized to enhance the learning process, what challenges will arise in the application of augmented reality, and how its impact on the affective and cognitive development of elementary school students in learning mathematics.

## II. METHOD

This study aimed to analyze the use of augmented reality in learning mathematics in elementary schools. Scoping review was used as the approach in this study. The stages of this scoping review research refer to Arksey and O'Malley's framework which includes 5 stages, namely 1) Identification of research questions; 2) Identification of relevant research; 3) Included Studies; 4) Collation of the data; and 5) Reporting the results (Arksey & O'Malley, 2005).

### A. Identification of research questions

This scoping review research focuses on discussing the implementation of augmented reality in mathematics learning in elementary schools. To ensure that the literature review is in accordance with the research topic, research questions are formulated to facilitate the process of exploring published articles. The results of the identification of research questions are as follows.

1. What are the characteristics of augmented reality that are suitable for learning mathematics in elementary schools?
2. What are the challenges of implementing augmented reality in learning mathematics in elementary schools?

3. How does the impact of the application of augmented reality on student learning outcomes in learning mathematics in elementary schools?

**B. Identification of relevant research**

Relevant research was needed to execute the process of analyzing the literature review. This relevant research helps researchers answer identified research questions. The boundaries used in this study are the results of the last 3 years published in the National Indexed Science and Technology Index (SINTA) Journal. Article searches using the keywords "Augmented Reality", "Mathematics Learning", and "Elementary School".

**C. Included Studies**

The exploration results of published articles were then selected in order to obtain articles that would be used in the scoping review analysis process. The process of selecting this article used the Preferred Reporting of Items for Systematic Review and Meta-Analysis (PRISMA) framework (Moher et al., 2009). The Figure 1 is the result of searching articles related to the use of augmented reality in learning mathematics in elementary schools.

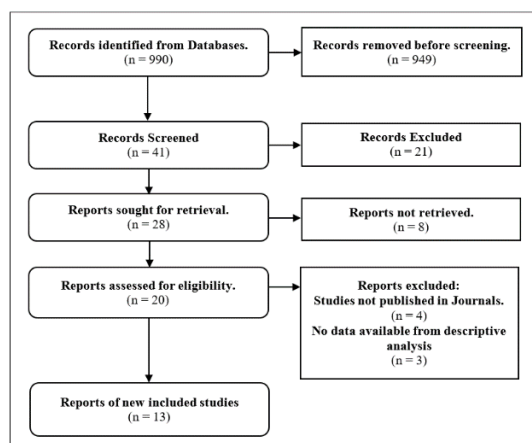


Figure 1. PRISMA Diagram

Based on Figure 1, there were 990 results of exploratory articles taken from research

published in the SINTA database. Of all these articles, there were 13 articles that are appropriate to the topic of discussion and will then be analysed to describe the questions in this research scoping review. The articles that had been analysed had then adapted onto the content of the research topic. The article selection criteria are presented in Table 1.

Table 1.  
Selection Criteria

Relevant Studies	Irrelevant Studies
Articles Published in 2021-2023	Articles Published before 2021
Augmented Reality	All form of learning media beside Augmented Reality
Elementary School	Secondary School and higher education
Mathematics Learning	Science learning, chemistry learning, language learning, economic learning, sport learning and social learning

**D. Collating the Data**

Collating the data was the next stage of scoping review research. This stage contains information on article analysis consisting of the author's name, type of publication, and research results. The results of collating the data are presented as follows.

1. Authors: Rozi et al. (2021); Topics: The Development of learning media based on augmented reality
2. Authors: Tlyasari & Sulisworo (2021); Topics: The Development of AR playing cards based on augmented reality technology as a mathematics learning multimedia
3. Authors: Firdaus (2021); Topics: The use of MBB AR media in improving the literacy skills and character of slow leamer students
4. Authors: Larasati & Widyasari (2021); Topics: The application of augmented

- reality-based learning media to increase students' mathematical understanding in terms of learning styles
5. Authors: Jannah & Oktaviani (2022); Topics: The effect of using augmented reality media on digital numeracy literacy skills in learning mathematics data presentation material
  6. Authors: Priyadi (2022); Topics: Game base augmented reality cards as learning support media
  7. Authors: Lubis et al. (2022); Topics: Augmented reality pictorial storybook: How does it influence on elementary school mathematics anxiety?
  8. Authors: Yang et al. (2022); Topics: The design of mathematics learning media using augmented reality technology
  9. Authors: Amrina et al. (2023); Topics: The Development of augmented reality-based mathematics learning media to improve student competency
  10. Authors: Umri et al. (2023); Topics: Evaluation of augmented reality building space as a learning media for Grade IV of elementary school students
  11. Authors: Ekayogi (2023); Topics: The Implementation of problem-based learning assisted by augmented reality media to improve learning outcomes and independence
  12. Authors: Pratama et al., (2023); Topics: The introduction of augmented reality technology in the learning of geometric shapes and plane shapes
  13. Authors: Hariyono et al. (2023); Topics: Ethnomathematics-based group investigation using augmented reality for solving mathematical problems

## E. Reporting the results

The last stage in this research was to do results report. Reporting the results is discussed in the body of the article, namely results and discussion.

## III. RESULT AND DISCUSSION

The application of augmented reality in the learning process has become a common topic. Even so, applying this technology in elementary school, especially in teaching mathematics, still poses a challenge for educators. These results were reviewed based on the number of published articles that are in accordance with the research topic of this scoping review. This scoping review focused on discussing the characteristics of augmented reality that are appropriate for learning mathematics in elementary schools, the challenges of implementing augmented reality in learning mathematics in elementary schools, and the impact of applying augmented reality on student learning outcomes in learning mathematics in elementary schools.

### A. AR Characteristics that are Suitable in Elementary Mathematics Learning

Augmented reality is a learning technology that can be accessed using mobile phones and laptops. This augmented reality can assist teachers in creating interesting learning so that students can participate more actively in learning mathematics in elementary schools. The main characteristics of augmented reality were strongly related to learning process in elementary schools, such as augmented reality that can combine the real world and the virtual world, it can also provide information interactively, and can present

learning topics in three dimensions (Priyadi, 2022). The characteristics of augmented reality were a reference for teachers in developing learning media that can facilitate the learning styles of elementary school students.

The diverse characteristics of students were a challenge for teachers in implementing augmented reality in learning process. Students with a visual learning style tend to focus on the visual appearance of this augmented reality. Rozi et al. (2021) stated that the 3D visual appearance helps students understand the concept of learning mathematics easily. This visual appearance increased student learning interest (Hapsari et al., 2022; Lubis et al., 2022). Students become more enthusiastic in participating in learning mathematics. Students' curiosity in using augmented reality applications and exploring learning concepts is higher. The results of this analysis indicated that augmented reality that was implemented for learning mathematics in elementary schools must be able to present the concept of learning mathematics which was visualized in three dimensions. Elementary school students who were already active in using mobile phones both to play games and study independently, would make it easier for students to explore learning using augmented reality applications independently. Students could learn math concepts while playing. The concept outlined in the use of augmented reality must be able to represent real conditions in the real world that are well visualized in this application.

Judging from the auditory learning style, augmented reality implemented in

mathematics learning in elementary schools must present other aspects besides three-dimensional visualization. Another aspect of this relied on the type of sounds or words that are created from this augmented reality application. Augmented reality must be able to provide opportunities for students with an auditory learning style to be able to listen to the concepts of learning mathematics clearly and interestingly. Students with an auditory learning style would absorb information more quickly through what they hear. That is, augmented reality can provide information about mathematical concepts more interactively. Firmansyah et al. (2021) stated that students become more enthusiastic in learning if the learning applications implemented contain music and other types of sounds so that students can learn while playing. Another form was by inviting students to sing together with the help of an augmented reality application (Nanda et al., 2022).

Kinesthetic learning style was another learning style that students have. This learning style made students want to learn by taking direct action to understand the concept of learning mathematics. Students with this learning style tend to be able to understand learning mathematics with direct examples. Augmented reality helps students in carrying out the exploratory learning process well. Through mobile phones or laptops, students can be directed independently to carry out the learning process using augmented reality applications. Astuti et al. (2020) stated that students can look for contextual forms that are appropriate to spatial learning materials and visualize them using augmented reality

applications. Students become aware of real forms and types of spatial shapes that have been adapted to real-world contexts.

### **B. Challenges on Applying AR in Elementary Mathematics Learning**

The application of augmented reality in learning mathematics in elementary schools is very necessary. It was undeniable that the implementation of learning by implementing augmented reality technology had faced several obstacles. The challenge of implementing augmented centered on the teachers and students themselves. For teachers, a special challenge rested on the teacher's knowledge of augmented reality in learning mathematics. Teachers must understand the functions and utilization of this application well so that it can be applied in an appropriate and right manner in teaching mathematics in elementary schools. Wahyu et al. (2020) stated that there are still many teachers who have not been able to apply technology in learning properly. This condition was experienced by most teachers who were adjusted to implementing conventional learning or teacher learning centered. The impact of the teacher's lack of knowledge in using augmented reality applications were 1) the effectiveness cannot be guaranteed in learning mathematics; 2) the level of accuracy of the concept of learning mathematics is not adequately facilitated; and 3) Limited range of augmented reality in learning mathematics in elementary schools (Mailizar & Johar, 2021; Rahmatullah et al., 2022; Triwahyuningtyas et al., 2020).

In this era, teachers are required to be able to apply technology in learning process.

Therefore, it is crucial for teachers to possess the ability to adapt quickly to the ever-evolving landscape of technology in education. Teachers with well-knowledge on the use of augmented reality in learning mathematics in elementary schools would find it easier to provide mathematics learning for elementary school students and vice versa. The next challenge leaned on the learning process. utilizing augmented reality applications in learning mathematics in elementary schools. Teachers must be extra to accompany students in learning so that students can focus on exploring mathematical concepts well. When dealing with younger students who may have tendency to play instead of focusing on their studies, teachers must provide continuous supervision to ensure they stay on track and remain engaged in the learning process. The level of students' understanding on the use of different learning media was also a challenge for teachers. Students who had not mastered the use of digital technology would have difficulty operating augmented reality learning media in learning mathematics in elementary schools. This condition forced teachers to provide extra assistance so that students can learn optimally. If this condition is not carried out properly, it may result on the waste of learning time.

Examined from the other side, students will focus more on exploring learning using this digital learning media. Students with high abilities in the use of technology will be able to learn well and maximally related to the use of augmented reality in learning mathematics. However, students with low abilities will experience learning difficulties

because they have never or have not been able to master the use of digital technology in learning mathematics.

Taking a different viewpoint, digital learning tools can aid students in discovering and enhancing their learning experience. Students who are proficient in using technology can greatly learn math and effectively has the tech-savvy benefits through augmented reality. However, students who have limited knowledge of technology might encounter obstacles in using digital media for math education, as they have never or have not been able to master the use of digital technology in learning mathematics.

### **C. Students' Learning Impact**

This augmented reality learning media became an important aspect of learning. Students can explore learning mathematics experience more optimally. As the center was no longer on the teacher, students were able to learn independently. Augmented reality in learning mathematics in elementary schools was developed according to the characteristics and learning styles of elementary school students themselves. A study by Amrina et al. (2023) showed an increase in student learning outcomes in learning mathematics, especially geometric material. Students were enthusiastic in participating in learning. Students became more active and are not afraid to ask questions in class (Hapsari et al., 2022). Students' curiosity increased in participating in learning mathematics in class. Students could also study anywhere, unlimited by class time only. Students' problem-solving abilities were also facilitated by the operation of augmented reality in learning mathematics

in elementary schools. Students were able to use mathematical concepts well to make contextual problem solving (Sreylak et al., 2022). The content of the material presented visually with a 3D display made it easier for students to understand mathematics learning material in elementary schools. The results of this study stated that the use of augmented reality in learning mathematics in elementary schools was able to facilitate students' affective and cognitive.

### **IV. CONCLUSION**

This scoping review presented that augmented reality can be implemented in learning mathematics in elementary schools. This condition was caused by the characteristics of augmented reality that are in accordance with students' learning styles. Augmented reality can facilitate students with a visual learning style by combining problems in the real world and virtual worlds that are visualized in three dimensions so that learning mathematics in elementary schools becomes more interesting and meaningful. Based on the auditory learning style, augmented reality which was developed with sound or sound displays can make students focus and enthusiastic in participating in learning mathematics. Abide by the kinesthetic learning style, students can learn directly related to mathematical concepts in elementary schools as augmented reality was able to support students to actively participate in exploring mathematical concepts. Students can get closer to the real world which has been adapted to mathematics learning materials in elementary schools. To obtain maximum



results in the application of augmented reality, it is required for teacher to have good knowledge related to the use of augmented reality in learning mathematics, teachers must be a master in operating augmented reality applications, and teachers must be able to accompany students in the process of exploring mathematics learning using augmented reality applications. The impact of augmented reality application is also well implemented on student learning outcomes. Students become more active in participating in learning, they become enthusiastic, and have a high eagerness on learning. Learning also becomes more engaging and effective so that the concept of learning mathematics can be conveyed more easily and optimally.

## REFERENCES

- Amrina, Z., Sari, S. G., Alfino, J., & Mahdiansyah, M. (2023). Pengembangan Media Pembelajaran Matematika Berbasis Augmented Reality untuk Meningkatkan Kompetensi Mahasiswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 7(1), 380–391. <https://doi.org/10.31004/cendekia.v7i1.1932>
- Astuti, A. P., Mawarsari, V. D., Purnomo, H., & Sedyono, E. (2020). The Use of Augmented Reality-Based Learning Media To Develop the Technology Literacy of Chemistry Teachers in the 21st Century. *The 3rd International Conference on Mathematics and Sciences Education (ICoMSE) 2019*.
- Ekayogi, I. W. (2023). Penerapan Problem Based Learning Berbantuan Media Augmented Reality untuk Meningkatkan Hasil dan Kemandirian Belajar. *Jurnal Didaktika Pendidikan Dasar*, 7(1), 181–196. <https://doi.org/10.26811/didaktika.v7i1.1126>
- Fernandez-Batanero, J. M., Montenegro-Rueda, M., & Fernandez-Cerero, J. (2022). Use of Augmented Reality for Students with Educational Needs: A Systematic Review (2016-2021). *Societies*, 12(36), 1–11.
- Firmansyah, F. H., Sari, I. P., Permana, F. C., & Rinjani, D. (2021). Development of Interactive Learning Multimedia for Mathematics Subjects for Grade 5 Elementary Schools. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/1987/1/012017>
- Gunawan, A., & Suhardi, S. (2019). Thematic-Integrative-Based Pictorial Book for Improving the Understanding Reading Skills of Elementary School Students. *Jurnal Prima Edukasia*, 7(2), 150–161. <https://doi.org/10.21831/jpe.v7i2.14993>
- Hapsari, I. P., Saputro, T. V. D., & Sadewo, Y. D. (2022). Mathematical Literacy Profile of Elementary School Students in Indonesia: A Scoping Review. *Journal of Educational Learning and Innovation (ELIA)*, 2(2), 279–295. <https://doi.org/10.46229/elia.v2i2.513>
- Heggart, K. R., & Yoo, J. (2018). Getting the Most from Google Classroom: A

- Pedagogical Framework for Tertiary Educators. *Australian Journal of Teacher Education*, 43(3), 140–153. <https://doi.org/10.14221/ajte.2018v43n3.9>
- Hermita, N., Putra, Z. H., Alim, J. A., Tang, J., Wijaya, T. T., Li, L., Pereira, J., & Tamur, M. (2021). The Hungry Ant: Development of Video-Based Learning on Polyhedron. *International Journal of Interactive Mobile Technologies*, 15(17), 18–32. <https://doi.org/10.3991/ijim.v15i17.23099>
- Ibrokhimovich, F. J. (2022). Teaching Mathematics in Elementary School: Issues and Solutions. *Eurasian Journal of Learning and Academic Teaching*, 4, 84–87. <https://doi.org/https://geniusjournals.org/index.php/ejlat/article/view/397>
- Iqbal, M. Z., Mangina, E., & Campbell, A. G. (2022). Current Challenges and Future Research Directions in Augmented Reality for Education. *Multimodal Technologies and Interaction*, 1–29.
- Jatmiko, H. T. P., & Putra, R. S. (2022). Refleksi Diri Guru Bahasa Indonesia Dalam Pembelajaran Berdiferensiasi di Sekolah Penggerak. *Lingua Franca: Jurnal Bahasa, Sastra, Dan Pengajarannya*, 6(2), 224–232. <https://doi.org/10.30651/lf.v6i2.14701>
- Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2022). Augmented Reality and Gamification in Education: A Systematic Literature Review of Research, Applications, and Empirical Studies. *Applied Sciences*, 1–43.
- Lubis, A. H., Dasopang, M. D., Ramadhini, F., & Dalimunthe, E. M. (2022). Augmented Reality Pictorial Storybook: How Does It Influence on Elementary School Mathematics Anxiety? *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, 12(1), 41–53. <https://doi.org/10.25273/pe.v12i1.12393>
- Mailizar, & Johar, R. (2021). Examining Students' Intention to Use Augmented Reality in A Project-Based Geometry Learning Environment. *International Journal of Instruction*, 14(2), 773–790. <https://doi.org/10.29333/iji.2021.14243a>
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Annals of Internal Medicine*, 151(4), 264–269.
- Nanda, L. K. S., Trisniawati, T., & Muanifah, M. T. (2022). Development of Android-Based Augmented Reality 3D Card Media for Elementary School Students. *AlphaMath: Journal of Mathematics Education*, 8(1), 88–98. <https://doi.org/10.30595/alphamath.v8i1.12920>
- Pichardo, J. I., López-Medina, E. F., Mancha-Cáceres, O., González-Enrriquez, I., Hernández-Melián, A., Blázquez-Rodríguez, M., ... & Borrás-Gené, O. (2021). Students and teachers using mentimeter: Technological innovation to face the challenges of the covid-19 pandemic and post-pandemic in higher education. *Education Sciences*, 11(11), 667.

- Priyadi, G. (2022). Game Base on Augmented Reality Card Sebagai Media Penunjang Pembelajaran. *Autentik: Jurnal Pengembangan Pendidikan Dasar*, 6(2), 174–181. <https://doi.org/10.36379/autentik.v6i2.198>
- Rahmatullah, A. S., Mulyasa, E., Syahrani, S., Pongpalilu, F., & Putri, R. E. (2022). Digital era 4.0: The Contribution to Education and Student Psychology. *Linguistics and Culture Review*, 6, 89–107. <https://doi.org/10.21744/lingcure.v6ns3.2064>
- Rozi, F., Kurniawan, R. R., & Sukmana, F. (2021). Pengembangan Media Pembelajaran Pengenalan Bangun Ruang Berbasis Augmented Reality Pada Mata Pelajaran Matematika. *JIPi: Jurnal Ilmiah Penelitian Dan Pembelajaran Informatika*, 6(2), 436–447. <https://doi.org/10.29100/jipi.v6i2.2180>
- Sánchez-Cruzado, C., Santiago Campi3n, R., & S3nchez-Compa3a, M. T. (2021). Teacher Digital Literacy: The Indisputable Challenge After Covid-19. *Sustainability (Switzerland)*, 13(4), 1–29. <https://doi.org/10.3390/su13041858>
- Saputro, T. V. D., Silvester, & Purnasari, P. D. (2023). The Characteristics of Mathematics Daily Test Items. *Journal of Learning Improvement and Lesson Study*, 3(1), 42–49. <https://doi.org/10.24036/jlils.v3vi1i.52>
- Sreylak, O., Sampouw, F., Didik Saputro, T. V., & Lumbantobing, W. L. (2022). Mathematics Concept in Elementary School: A Bibliometric Analysis. *Journal of Educational Learning and Innovation (ELIA)*, 2(2), 268–278. <https://doi.org/10.46229/elia.v2i2.512>
- Sungkono, S., Apiati, V., & Santika, S. (2022). Media Pembelajaran Berbasis Teknologi Augmented Reality. *Mosharafa: Jurnal Pendidikan Matematika*, 11(3), 459-470.
- Surur, A. M. (2022). Application of Monopoly Media to Improve Readiness for Class VI Students in Facing the National Examination of Mathematics Learning. *International Journal of Professional Development, Learners and Learning*, 4(1), 1–6. <https://doi.org/10.30935/ijpdll/11419>
- Suryatin, S., & Sugiman, S. (2019). Comic Book for Improving the Elementary School Students' Mathematical Problem-Solving Skills and Self-Confidence. *Jurnal Prima Edukasia*, 7(1), 58–72. <https://doi.org/10.21831/jpe.v7i1.10747>
- Tetik, T., & 3zer, D. A. (2022). Supporting The Writing Skills of Primary Scholl Third Grade Gifted Students with Activity-Based Digital Storytelling: Action research. *European Journal of Education Studies*, 9(9), 333–368. <https://doi.org/10.46827/ejes.v9i9.4475>
- Tomczyk, & Eger, L. (2020). Online Safety as A New Component of Digital Literacy for Young People. *Integration of Education*, 24(2), 172–184. <https://doi.org/10.15507/1991-9468.099.024.202002.172-184>

Trista, S., & Rusli, A. (2020). HistoriAR: Experience Indonesian History Through Interactive Game and Augmented Reality. *Bulletin of Electrical Engineering and Informatics*, 9(4), 1518–1524.

<https://doi.org/10.11591/eei.v9i4.1979>

Triwahyuningtyas, D., Ningtyas, A. S., & Rahayu, S. (2020). The Problem-Based Learning E-Module of Planes Using Kvisoft Flipbook Maker for elementary school students. *Jurnal Prima Edukasia*, 8(2), 199–208.

Triwahyuningtyas, D., Setiawan, O. Y., & Mahmuda, N. E. (2022). E-Module of Cube and Beam Based on Inquiry for Five Grade Students of Elementary School. *Jurnal Prima Edukasia*, 10(2), 138–148.

<https://doi.org/10.21831/jpe.v10i2.48194>

Wahab, I., & Nuraeni, N. (2020). The Analysis of Students' Learning Style. *Scope of English Language Teaching, Literature and Linguistics*, 3(1), 41–46.

<https://doi.org/10.46918/seltics.v3i1.509>

Wahyu, Y., Suastra, I. W., Sadia, I. W., & Suarni, N. K. (2020). The Effectiveness of Mobile Augmented Reality Assisted Stem-Based Learning on Scientific Literacy and Students' Achievement. *International Journal of Instruction*, 13(3), 343–356.

<https://doi.org/10.29333/iji.2020.13324a>

## AUTHOR'S BIOGRAPHY

### Totok Victor Didik Saputro, M.Pd.



Lecturer at Bachelor of Primary Education Study Program, Institut Shanti Bhuna, Bengkayang, West Kalimantan, Indonesia; Studied Bachelor of Mathematics Education Study Program at Sanata Dharma University, Yogyakarta,

graduated in 2017; Studied Master of Mathematics Education Study Program at Yogyakarta State University, graduated in 2020.

### Pebria Dheni Purnasari, S.Pd., M.Pd.



Lecturer at Bachelor of Primary Education Study Program, Institut Shanti Bhuna, Bengkayang, West Kalimantan, Indonesia; She is doing her Doctoral Program of Primary Education at Yogyakarta State University, started in August

2023; Studied Bachelor of Primary Education Study Program at Universitas Kristen Satya Wacana, graduated in 2012; Studied Master of Primary Education Study Program at Universitas Negeri Semarang, graduated in 2018.

### Winda Lidia Lumbantobing, S.Pd., M.Pd.



Lecturer at Bachelor of Primary Education Study Program at Institut Shanti Bhuna, Kalimantan Barat, Indonesia; Studied Bachelor of Primary Education Study Program at Universitas Negeri Medan,

graduated in 2016; Studied Master of Primary Education Study Program at Yogyakarta State University, graduated in 2018.

### Yosua Damas Sadewo, S.Pd., M.Pd.



Lecturer at Bachelor of Primary Education Study Program, Institut Shanti Bhuna, Bengkayang, West Kalimantan, Indonesia; He is doing his Doctoral Program of Educational Technology at Universitas Negeri

Jakarta, started in August 2022; Studied Bachelor of Primary Education Study Program at Universitas Kristen Satya Wacana, graduated in 2012; Studied Master of Primary Education Study Program at Universitas Kristen Satya Wacana, graduated in

2015.