Jurnal Elementaria Edukasia
Volume 7, No 4, Desember 2024, 3209-3220
DOI: 10.31949/jee.v7i4.11015

p-ISSN 2615-4625
e-ISSN 2655-0857

Analysis of Learning Needs for Mathematics Geometry Material for Grade V Elementary School

Dinda Maemunah *
** Magister Educational Technology, Faculty of Education, State University of Jakarta*
E-mail: Dinda_1110822019@mhs.unj.ac.id
Cecep Kustandi **
*** Educational Technology, Faculty of Education, State University of Jakarta*
E-mail: cecep_kustandi@unj.ac.id
Iva Sarifah ***
**** Educational Technology, Faculty of Education, State University of Jakarta*
E-mail: ivasarifah@unj.ac.id

Submitted: 2024-08-18
Revised: 2024-09-18
Accepted: 2024-12-04

ABSTRACT
This research is motivated to identify learning problems related to mathematics learning and recognize the causes, as well as identify alternative forms of innovation that can be used as solutions to overcome these problems, where spatial ability is one of the factors for the success of learning mathematics in spatial geometry material. In implementing the learning process to achieve this success, a learning design is needed that can improve students' spatial abilities. This research is part of research and development, namely the Successive Approximation Model (SAM1) needs analysis stage. Data collection was carried out by observation, interviews and distributing questionnaires via google form. The questionnaire presented has a needs analysis component that includes deficiencies and desires. Based on the results of observations and interviews, it was seen that many students had not been able to solve questions or cases related to spatial geometry, the use of various learning media, especially those related to modern technology to support students' spatial abilities, only some students were motivated to participate in mathematics classes, in mathematics learning it was good but not optimal, and did not always use different learning media. Learning materials should not only be transferred from the teacher to the students' minds, but must be constructed in the students' minds themselves in such a way that real experiences are given to students. Based on these results, it is clear that students need to preserve the learning system. Learning mathematics on spatial geometry requires learning activities that are provided by integrating the learning design of the experiential learning model.
***Keywords**: needs analysis, spatial geometry, learning*

ABSTRAK
Penelitian ini dilatarbelakangi untuk mengidentifikasi permasalahan belajar yang terkait dengan pembelajaran matematika dan mengenali penyebabnya, serta mengidentifikasi alternatif bentuk inovasi yang dapat dijadikan solusi mengatasi permasalahan tersebut, dimana kemampuan spasial menjadi salah satu faktor keberhasilan pembelajaran matematika materi bangun ruang. Dalam pelaksanaan proses pembelajaran untuk mencapai keberhasilan tersebut, maka diperlukan desain pembelajaran yang dapat meningkatkan kemampuan spasial siswa. Penelitian ini merupakan bagian dari penelitian dan pengembangan yaitu tahap analisis kebutuhan *Successive Approximation Model* (SAM1). Pengumpulan data dilakukan dengan observasi, wawancara dan penyebaran angket lewat *google forms*. Kuesioner yang disajikan memiliki komponen analisis kebutuhan yang meliputi kekurangan dan keinginan. Berdasarkan hasil observasi dan wawancara terlihat banyak siswa yang

belum mampu menyelesaikan soal-soal maupun kasus yang berkaitan dengan bangun ruang, masih minimnya pemanfaatan berbagai media pembelajaran khususnya yang berkaitan denga teknologi modern untuk mendukung kemampuan spasial siswa, hanya separuh siswa yang termotivasi untuk berpartisipasi dalam kelas matematika, dalam pembelajaran matematika sudah baik namun kurang optimal, dan tidak selalu menggunakan media pembelajaran yang berbeda. Materi pembelajaran hendaknya tidak sekadar ditransfer dari guru ke dalam pikiran siswa, tetapi harus dikonstruksikan dalam pikiran siswa itu sendiri sedemikian rupa sehingga diberikan pengalaman nyata kepada siswa. Berdasarkan hasil tersebut, terlihat jelas bahwa siswa memerlukan peralihan sistem pembelajaran. Pembelajaran matematika materi bangun ruang memerlukan kegiatan pembelajaran yang diberikan dengan mengintegrasikan desain pembelajaran model *experiential learning.*
Kata Kunci: analisis kebutuhan, bangun ruang, desain pembelajaran

INTRODUCTION

Mathematics has been one of the core subjects since the first year of school, but it turns out to be one of the most difficult subjects in the world and is a subject that is related to students' lives (Teo Lian Wan and Abdullah 2023); Intan et al., 2022). One of the compulsory subjects in elementary school aims to train students to think critically and creatively so that students can survive in changing, uncertain and competitive conditions (Anitra, 2021; Heryanto et al., 2022; Kurnia et al., 2022). Mathematics has many diverse materials, one of the important materials for basic education is geometry (Bata and Anggipranoto 2023). There are two materials for geometry in elementary school, namely spatial shapes and flat shapes (Fajarwati and Irianto 2021).

In principle, learning geometry means learning visual patterns that can train students to improve their thinking skills using visual media (Syafril et al., 2021). Geometry is an important part of the mathematics curriculum and provides great opportunities for students to develop their spatial skills (Kurt et al., 2023). There are several reasons to study geometry, namely: (1) geometry teaches logical precision, a person must be careful; (2) the purpose of teaching geometry is to support other sciences; (3) through learning geometry, a person will gain broader knowledge and insight to appreciate the beauty of the shapes around them; (4) studying geometry encourages scientific thinking (Kusnadi et al., 2023).

Spatial ability is very important as a basic skill in solving geometry problems (Raharjo et al., 2023). By strengthening students' spatial skills and senses, teachers can build a comprehensive understanding of geometry and improve their ability to solve mathematical problems (Teapon & Kusumah, 2023). Spatial skills provide a broader ability to utilize higher-order thinking skills that are considered valuable in the analysis, synthesis, and evaluation needed to solve problems and tend to influence students' attitudes, as well as obtain better learning outcomes (Nindi et al., 2023; Odeyemi, 2023).

From a methodological perspective, the use of technology makes classroom learning more interesting and more acceptable to students (Salsabila et al., 2023). Regulation of the Ministry of Education and Culture Number 65 of 2013 stipulates that every teacher is required to apply information and communication technology in an integrated, systematic, and effective manner depending on the situation and conditions (Sari et al., 2023). According to Law Number 14 of 2005 concerning teachers and lecturers, it is explained that academic competence is the teacher's ability to manage educational activities related to students, including understanding academic knowledge or principles, understanding students, curriculum development, implementation of learning, utilization of learning technology, evaluation of learning

outcomes and development of students to realize their various potentials (Rian Utama et al., 2020). Therefore, by utilizing existing technological developments, it is necessary to develop the mathematics learning process, including the presentation and development of mathematics learning support to help students understand the subject (Yunanda Pradiani et al., 2023).

Although technology makes learning interesting, the success of learning is not only influenced by technology, but also requires a learning model so that students are more focused (Rusli et al., 2023; Lasambu et al., 2023). Many studies have shown that experiential learning provides opportunities for learners to develop the ability to apply theory in real-life situations (contextualizing knowledge) (Radović et al., 2023). Direct experience is considered as direct participation in activities that can cause initial reactions, visual impressions, and emotional responses (Yulianti, 2021).

Previous research shows that in teaching and learning activities, students tend to be uninterested in learning mathematics for various reasons, one of which is the use of less than optimal learning media in learning. Mathematics lessons tend to be avoided and complaints often arise that mathematics lessons only make students dizzy, and there is still a lack of IT-based learning media (Dinayusadewi & Agustika, 2020; F. Murni et al., 2022; Heryadi et al., 2023). According to research on the analysis of student difficulties in the material on shapes conducted by (Chintia et al., 2021), there are four factors, including (1) lack of caution in reading, understanding, and answering questions; (2) lack of students' spatial abilities in imagining flat-sided spatial shapes; (3) students are accustomed to working on routine questions and are found in examples.

Although previous studies have provided perspectives in finding solutions to identify and solve learning problems, it is still not easy to get a complete picture of how to analyze learning problems. Thus, this study focuses on the learning needs analysis stage to identify learning problems related to mathematics learning and identify their causes, as well as identify alternative forms of innovation that can be used as solutions to overcome these learning problems. This research is important to do because the effectiveness of the learning stages depends on the results of learning activities in order to produce effective solutions to the learning problems that occur.

METHODS

The study involved 30 fifth grade students and mathematics teachers at SDIT Almarjan to identify and find solutions to mathematics learning problems. Data collection techniques were carried out by distributing questionnaires using Google Forms and interviews with mathematics teachers. The questionnaire presented has a needs analysis component that includes deficiencies and desires (Macalister & Nation, 2019). The needs questions consist of learning model components such as learning structure, reaction principles, social systems, and supporting factors (Joyce, Weil & Calhoun, 2009). There are 30 questions, including learning frameworks (18 items), reaction principles (3 items), reaction systems (3 items), and supporting factors (6 items). In addition, open questions regarding the proposals for each component were also asked.

Table 1. Criteria Category

Average of Percentage	Category
3.25 – 4.00	Strongly Needed (SN)

2.49 – 3.24	Needed (N)
1.73 - 248	Less Needed (LN)
1.00 – 1.72	Not Needed (NN)

The data obtained were then analyzed by researchers to identify a list of learning problems related to mathematics learning and their causes, then formulate alternative solutions that can be used to overcome the problems that occur. This research is part of research and development, namely the Successive Approximation Model (SAM 1) needs analysis stage (Allen, 2017).

Data acquisition analysis using qualitative descriptive, namely reviewing and summarizing the data collected and has been tested for validity through a validation process by several experts in their fields. Observations, interviews with teachers, and distributing questionnaires to students were carried out by researchers to collect research data. The stages of this research were by conducting observations in class V, then conducting interviews with class V homeroom teachers to see the learning needs required along with the obstacles experienced during learning. Data testing in the educational environment includes learning models and learning media, with a focus on student involvement and interaction during the process.

Table 2. Interview Instrument

Question Indicator	Question
Learning Frameworks	1. Learning is done online or offline 2. Mathematics learning is carried out face-to-face 3. In learning, teachers provide direction and introduction to the implementation of learning 4. In learning, students make presentations 5. In learning, students discuss 6. In learning, students study the material completely through the learning resources used 7. In learning, students learn and explore information from YouTube and websites independently 8. In learning, students apply concepts and practical examples obtained based on the material provided by the teacher 9. Students in learning read library sources from Google, science websites, and others 10. In learning, teachers assess students 11. In learning, students are given post-tests 12. In learning, students carry out self-assessments and peer assessments 13. Students are given remedial 14. Students need real-world learning 15. In learning using technology 16. Students like learning using technology 17. he learning method used during learning is effective in understanding the material 18. What subjects do students have low average scores

Reaction Principles	1. Does the teacher act as a facilitator? 2. Does the teacher act as a motivator? 3. Does the teacher act as an evaluator?
Reaction System	1. There is interaction between teachers and students in learning 2. There is interaction between teachers and groups of students in learning 3. There is interaction between groups of students and groups of students
Supporting Factors	1. Learning materials are presented in the form of learning videos using various applications 2. Learning materials are provided in the form of YouTube links Learning materials 3. Given in the form of book website links

RESULTS AND DISCUSSION

Needs are classified into three categories: needs, deficiencies, and wants (Macalister & Nation, 2019). These three components are a set of techniques needed to assess students' needs when studying spatial construction material. In other words, these three components are used to identify students' needs for the experiential learning model that students need when studying spatial building material. The first is need. Students must master or require the need to study spatial construction material. Second is deficiency. Deficiencies refer to deficiencies in current mathematics learning. The third is desire. What do you want to learn? Students have their own opinions about what they feel is useful for them. Information about what students want will be very useful for designing experiential learning model learning designs that students need when studying spatial construction material.

Necessities

In learning mathematics, spatial material requires spatial abilities to be able to understand the material. Spatial ability is one of the factors for the success of learning mathematics in spatial geometry material. In implementing the learning process to achieve this success, a learning design is needed that can improve students' spatial abilities. According to experiential learning theory, for the teaching and learning process to be effective, a student must have four abilities (Nurcahyandi and Purwaningrum 2022). Concrete experience (feeling) is an open and adaptable learning stage. At this stage, the learning situation must encourage students to be sensitive to themselves and to others. Reflective observation (watching) is a learning stage in the form of observing, listening and looking at problems from different perspectives to find a meaning in learning. In this stage, careful observations are made so that students understand ideas or situations related to the material. Teachers can relate it to problems seen from different points of view and rely on thoughts, feelings and judgment. Abstract conceptualization (thinking) is a learning stage where students carry out logical analysis based on observations that have been made to come up with a new idea or concept. Active experimentation (doing) is a learning stage where students carry out learning with actions that emphasize practical applications in real life contexts. At this stage students carry out experiments on the concepts they have previously developed. Therefore, it is very important in developing the learning design of the experiential learning model for spatial geometry material because this model is a

student-centered learning model that involves students in concrete activities that enable them to experience what they are learning to produce meaning in the teaching and learning process.

Lack

Shortcomings are the second component of needs analysis. Deficiencies in previous mathematics learning at SDIT Almarjan were used as a reference in this research. Data was collected from students through a questionnaire with open questions. The results are as follows. First, students who study mathematics on solid geometry often have difficulty in determining the net of flat-sided solid geometry. In fact, students are very close to this material because there are so many objects around them that are in the form of solid geometry. Second, many students have not been able to solve problems or cases related to solid geometry. One of the causes of less than optimal learning of mathematics on solid geometry is that students do not understand the concept of mathematics or misunderstand the concept of mathematics. Several studies showing similar things confirm this situation (Kurniani Ningsih et al., 2021; Al Husna et al., 2021; Nisa et al., 2021); Farhana et al., 2022; Najoan et al., 2023). Third, learning does not always use different learning media. Learning media that is often used only uses videos from YouTube, shown on television as a learning facility in the classroom. This is in line with research conducted by (Dinayusadewi & Agustika, 2020; Heryadi et al., 2023). Fourth, the methods used are usually only in the form of discussions and always use lecture methods so that students move very little in class which makes students quickly feel bored. Learning materials should not just be transferred from the teacher to the students' minds, but must be constructed in the students' minds themselves in such a way that they are given real experience to the students.

Wants

The third component is desire. Desire is defined as what is needed in learning mathematics using the experiential learning model learning design to be developed. Each student has their own opinion about the ideal learning they want. Based on the research results, the following data were obtained.

Table 3. Learning Structure

No.	Statement	Score	Category
1.	Learning to face learning	3.39	SN
2.	Mathematics learning is carried out face-to-face	3.37	SN
3.	In learning, teachers provide direction and introduction to the implementation of learning	3.13	N
4.	In learning, students make presentations	3.79	SN
5.	In learning, students discuss	3,42	SN
6.	In learning, students study the material completely through the learning resources used	3.60	SN
7.	In learning, students learn and explore information from YouTube and websites independently	2.93	N
8.	In learning, students apply concepts and practical examples obtained based on the material provided by the teacher	3.35	SN
9.	Students in learning read library sources from Google, science websites, and others	2.90	N

10.	In learning, teachers assess students	3.35	SN
11.	In learning, students are given post-tests	3.24	N
12.	In learning, students carry out self-assessments and peer assessments	3.45	SN
13.	Students are given remedial	3.27	SN
14.	Students need real-world learning	3.50	SN
15.	In learning using technology	3.55	SN
16.	Students like learning using technology	3.35	SN
17.	he learning method used during learning is effective in understanding the material	3.60	SN
18.	What subjects do students have low average scores	3.56	SN

Based on the table above, students with a total average score of 4.42 need learning activities that are provided by integrating learning designs that provide students with real experiences. The very needed category dominates the assessment of 18 question items. There are 14 question items that are classified as very needed, and 4 questions that are considered necessary. Based on the results of the questionnaire, it is clear that students need a transition from monotonous learning designs to learning designs that provide real experiences, considering that the student learning process is important. The learning design needed can be adjusted to the school environment. Furthermore, we look at the components of the learning design that are built from the results of the study, we can see many things that are known. Judging from the learning structure, the learning structure in mathematics subjects can be determined according to the stages of cognitive development learning theory. According to Piaget in his theory of cognitive learning, children aged 7 to 12 years who are elementary school students still like to play, and creative and innovative teachers use physical or real learning media to help students understand mathematics logically (D. Murni et al., 2023).

From the questionnaire that formed open questions, information was also obtained regarding the learning structure that students wanted for the development of this learning design. First, students want maximum explanations regarding spatial theories. Second, in learning mathematics, concrete objects are very much needed. Third, there is a discussion with the park to discuss the material. Fourth, there is an assessment from friends and teachers.

Table 4. Principle of Reaction

No.	Statement	Score	Category
1.	Does the teacher act as a facilitator	3.80	SN
2.	Does the teacher act as a motivatir	3.69	SN
3.	Does the teacher act as an evaluator	3.75	SN

It is known that the questions presented in the questionnaire were responded by students with the category of being very much needed in the second component, namely the reaction principle. The total value of all is 3.74. Based on the table above, students want their lecturers to act as facilitators, motivators, and evaluators. These three responsibilities play an important role in maximizing mathematics learning, both in terms of process and results.

Table 5. Reaction System

No.	Statement	Score	Category
1.	There is interaction between teachers and students in learning	3.80	SN

2.	There is interaction between teachers and groups of students in learning	3.77	SN
3.	There is interaction between groups of students and groups of students	3.68	SN

In the third component, namely the reaction system, it is known that in student learning, students want interaction between students and teachers, groups with teachers, and between learning groups. Overall, the reaction system in the development of learning designs is very much needed by students, which is 3.75.

Table 6. Supprting Factor

No.	Statement	Score	Category
1.	Learning materials are presented in the form of learning videos using various applications	3.71	SN
2.	Learning materials are provided in the form of YouTube links Learning materials	3.77	SN
3.	Given in the form of book website links	4.48	SN

The last component in the development of this learning design is the support system. Overall, the support system in the development of learning design is very much needed by students is 3.98, which means it is very important and necessary in the learning process. In the scope of education as an object that can be manipulated, seen, heard, read, or discussed, learning media is something that can help convey messages, stimulate the thoughts, feelings, attention, and will of students and facilitate the learning process consciously, focused, and controlled (Miarso, 2016; Pribadi, 2017; Prawiradilaga, 2019). One of the learning media that can be used to keep students active through direct experience, arouse interest in learning, improve spatial abilities, and the ability to solve mathematical problems is using augmented reality (Meilindawati et al., 2023; Herman et al., 2023; Muhammad et al., 2022). The use of augmented reality (AR) in teaching is one example of technology that is adapted for learning to improve students' readiness to understand learning materials (Amir et al., 2020). Several literatures have used AR technology to help students learn new concepts (Liono et al., 2021). The use of AR with smartphones will bring added value in terms of greater mobility (Ouali et al., 2022). Thanks to this augmented reality technology, students can still see an object as it is but in virtual form (Kristina et al., 2023). In geometry lessons, augmented reality is used to visualize geometric objects in the hope that it can help students more easily understand each element of geometric shapes such as line segments, nodes, planes, sides, etc. (Dinayusadewi & Agustika, 2020).

Overall, the research findings show that students in learning mathematics on spatial geometry material require an experiential learning model learning design. Given the importance of what students gain during the learning process, the experiential learning model is a learning model that prioritizes students' direct experience (Nugraha et al., 2021). This learning model provides students with different learning situations in the form of participation in direct experiences designed by the teacher (Iman et al., 2021). David Kolb identified four stages of the experiential learning model that guide a person's orientation in the learning process: namely concrete experience, reflective observation, abstract conceptualization, and active experimentation (Endah Wulandari & In, 2023). Students are encouraged to acquire new

skills and competencies in the real world by gaining knowledge about general roles in various situations, locations, and environments (Saymita et al., 2023). Therefore, learning according to this model can motivate students to participate in various activities to solve problems creatively (Nurlita, 2021). Several studies also show that the experiential learning model is better than learning that does not use the experiential learning model, can make students active, and challenge their thinking skills to construct knowledge and understand lesson concepts because the learning process is oriented towards student activities (student centered) (Yuliani et al., 2021; Sagitarini et al., 2020).

Based on the data above, learning mathematics on spatial geometry requires learning activities that are provided by integrating the learning design of the experiential learning model. Based on these results, it is clear that students need a shift in the learning system. The learning system needed can be adjusted to the school environment. Furthermore, students strive for learning with complete stages starting from recognizing spatial geometry, discussions about spatial geometry, and prism and pyramid nets using flashcard learning media combined with augmented reality.

CONCLUSION

Based on the results and previous discussions, it can be concluded that there are learning problems related to the identified learning models and learning media, including, half of the students who are motivated to participate in mathematics classes because students do not understand mathematical concepts, do not always use different learning media. The methods used are usually in the form of discussions and always use lecture and question and answer methods. The identified learning problems cause students to lack understanding of the material on spatial figures. Therefore, to overcome these problems, it is necessary to design a learning design as an alternative solution that can be chosen to improve students' understanding and interest in learning mathematics on spatial figures.

SUGGESTION

Learning design is intended to help teachers implement more meaningful learning, so this development research should be continued at the design stage to help the learning process to be more memorable and meaningful for students, the implementation of learning to the maximum, and other efforts to help teachers more easily determine the media.

REFERENCES

Al Husna, L., MZ, Z. A., & Rian Vebrianto. (2021). Studi Eksploratif Problematika Pembelajaran Matematika Di Sekolah Dasar Di Tanah Datar. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *6*(1), 1–12. https://doi.org/10.31943/mathline.v6i1.159

Allen, M. (2017). *Leaving ADDIE for SAM: Moving beyond content-centered design* (Vol. 1).

Amir, M. F., Fediyanto, N., Rudyanto, H. E., Nur Afifah, D. S., & Tortop, H. S. (2020). Elementary students' perceptions of 3Dmetric: A cross-sectional study. *Heliyon*, *6*(6), e04052. https://doi.org/10.1016/j.heliyon.2020.e04052

Anitra, R. (2021). Pembelajaran Kooperatif Tipe Jigsaw dalam Pembelajaran Matematika di Sekolah Dasar. *JPDI (Jurnal Pendidikan Dasar Indonesia)*, *6*(1), 8. https://doi.org/10.26737/jpdi.v6i1.2311

Bata, J., & Anggipranoto, E. V. B. (2023). Pengembangan Aplikasi Virtual Reality untuk Pembelajaran Bangun Ruang Kelas V Sekolah Dasar menggunakan Model ADDIE. *JIIP* -

Jurnal Ilmiah Ilmu Pendidikan, *6*(2), 826–832. https://doi.org/10.54371/jiip.v6i2.1536

Bintoro, H. S., Sumaji, Wanabuliandari, S., Purwaningru, J. P., Rahayu, R., & Ulya, H. (2023). Kepraktisan Aplikasi Berbasis Android Bermuatan Ethnomathematics untuk Mengembangkan Kemampuan Spasial. *Jurnal Karya Pendidikan Matematika*, *10*(2). https://doi.org/https://doi.org/10.26714/jkpm.10.2.2023.1-11

Chintia, M., Amelia, R., & Fitriani, N. (2021). Analisis Kesulitan Siswa Pada Materi Bangun Ruang Sisi Datar. *Jurnal Pembelajaran Matematika Inovatif*, *4*(3). https://doi.org/10.22460/jpmi.v4i3.579-586

Dinayusadewi, N. P., & Agustika, G. N. S. (2020). Development Of Augmented Reality Application As A Mathematics Learning Media In Elementary School Geometry Materials. *Journal of Education Technology*, *4*(2), 204. https://doi.org/10.23887/jet.v4i2.25372

Endah Wulandari, P., & In, A. (2023). Mathematical Problem Solving in E-Learning Based on David Kolb's Learning Style. *Jurnal Matematika Kreatif-Inovatif*, *14*(1), 123–135. https://doi.org/10.15294/kreano.v14i1.40463

Fajarwati, M. I., & Irianto, S. (2021). Pengembangan Media Animaker Materi Keliling dan Luas Bangun Datar Menggunakan Kalkulator di Kelas IV SD UMP. *EL-Muhbib: Jurnal Pemikiran Dan Penelitian Pendidikan Dasar*, *5*(1), 1–11. https://doi.org/10.52266/el-muhbib.v5i1.608

Farhana, S., Aam Amaliyah, Agustini Safitri, & Rika Anggraeni. (2022). Analisis persiapan guru dalam pembelajaran media manipulatif matematika di sekolah dasar. *Educenter : Jurnal Ilmiah Pendidikan*, *1*(5), 507–511. https://doi.org/10.55904/educenter.v1i5.171

Herman, H., Zalukhu, A., Hulu, D. B. T., Zebua, N. S. A., Manik, E., & Situmorang, A. S. (2023). Augmented Reality (AR) pada Geogebra Meningkatkan Kemampuan Spasial dan Pemecahan Masalah Matematis pada Materi Dimensi Tiga. *Journal on Education*, *5*(3), 6032–6039. https://doi.org/10.31004/joe.v5i3.1368

Heryadi, Y., Rahmani, A., Arti, N. S., Guru, P., & Dasar, S. (2023). Pengembangan Alat Permainan Edukatif Ular Tangga Dalam Pembelajaran Matematika Materi Bangun Ruang. *Journal Mathematics Education Sigma [JMES]*, *4*(2), 26–34. https://doi.org/10.30596/jmes.v4i2.16151

Heryanto, H., Sembiring, S. B. S., & Togatorop, J. B. T. (2022). Analisis Faktor Penyebab Kesulitan Belajar Matematika Siswa Kelas V Sekolah Dasar. *JURNAL CURERE*, *6*(1), 45. https://doi.org/10.36764/jc.v6i1.723

Iman, S., Fatha, M., & Juliyana, S. (2021). Efektivitas Pembelajaran Permainan Role-Playing Berbasis Pengalaman Untuk Meningkatkan Keterampilan Berbicara Bahasa Inggris Siswa Sekolah Dasar. *Alim | Journal of Islamic Education*, *3*(1), 105–118. https://doi.org/10.51275/alim.v3i1.205

Intan, D. N., Kuntarto, E., & Sholeh, M. (2022). Strategi Guru untuk Mencapai Tujuan Pembelajaran pada Pembelajaran Matematika di Sekolah Dasar. *Jurnal Basicedu*, *6*(3), 3302–3313. https://doi.org/10.31004/basicedu.v6i3.2287

Kristina, Fatih, M., & Alfi, C. (2023). Pengembangan Media 3D Berbasis Augmented Reality Menggunakan PBL Materi Penggolongan Hewan untuk Meningkatkan Self Esteem Siswa Kelas V SD. *Jurnal Pemikiran Dan Pengembangan Sekolah Dasar (JP2SD)*, *11*(1), 59–72. https://doi.org/10.22219/jp2sd.v11i1.25677

Kurnia, D., Nandita, B., Kesumawati, N., Ariani, N. M., Masri, M., Kashardi, K., & Ristontowi, R. (2022). Peningkatan Motivasi Belajar Melalui Edukasi Pentingnya Belajar Matematika dalam Kehidupan di Sekolah Dasar. *Jurnal Ilmiah Mahasiswa Kuliah Kerja Nyata (JIMAKUKERTA)*, *2*(3), 538–545. https://doi.org/10.36085/jimakukerta.v2i3.3920

Kurniani Ningsih, S., Amaliyah, A., & Puspita Rini, C. (2021). Analisis Kesulitan Belajar Matematika Pada Siswa Kelas II Sekolah Dasar. *Berajah Journal*, *2*(1), 44–48. https://doi.org/10.47353/bj.v2i1.48

Kurt, G., Önel, F., & Çakıoğlu, Ö. (2023). An investigation of Middle School Students Spatial Reasoning Skills. *Lnternational Electronic Journal of Elementary Education*, *16*(1), 123–141. https://doi.org/10.26822/iejee.2023.319

Kusnadi, D., Barumbun, M., & Fauzan, B. A. (2023). Kemampuan Spasial Siswa Sekolah Dasar Melalui Teori Van Hiele pada Pembelajaran Matematika. *JURNAL MATHEMATIC PAEDAGOGIC*, *7*(2), 146–157. https://doi.org/10.36294/jmp.v7i2.3100

Lasambu, S. R., Zakaria, P., & Oroh, F. A. (2023). Meningkatkan Hasil Belajar Siswa Menggunakan Model Pembelajaran Kooperatif Tipe STAD Berbantuan Media Pembelajaran CERDAS Pada Materi Bangun Ruang Sisi Datar Di Kelas VIII SMP Negeri Daerah Kotabunan. *Jurnal Edukasi Matematika Dan Sains*, *12*(1), 1–14. https://doi.org/http://doi.org/10.25273/jems.v12i1.17930

Liono, R. A., Amanda, N., Pratiwi, A., & Gunawan, A. A. S. (2021). A Systematic Literature Review: Learning with Visual by The Help of Augmented Reality Helps Students Learn Better. *Procedia Computer Science*, *179*, 144–152. https://doi.org/10.1016/j.procs.2020.12.019

Meilindawati, R., Zainuri, Z., & Hidayah, I. (2023). Penerapan Media Pembelajaran Augmented Reality (Ar) Dalam Pembelajaran Matematika. *JURNAL E-DuMath*, *9*(1), 55–62. https://doi.org/10.52657/je.v9i1.1941

Muhammad, I., Marchy, F., Rusyid, H. K., & Dasari, D. (2022). Analisis Bibliometrik: Penelitian Augmented Reality Dalam Pendidikan Matematika. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *11*(1), 141. https://doi.org/10.25273/jipm.v11i1.13818

Murni, F., Marjo, H. K., & Wahyuningrum, E. (2022). Pengaruh Penggunaan Media Manipulatif Pada Pembelajaran Matematika dan Kepercayaan Diri Terhadap Hasil Belajar Siswa Kelas III Sekolah Dasar. *ELSE (Elementary School Education Journal) : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *6*(2), 438. https://doi.org/10.30651/else.v6i2.13434

Najoan, R. A. ., Tahiru, Y. S., Kumolontang, D. F., & Tuerah, R. M. (2023). Penerapan Model Problem based Learning untuk Meningkatkan Hasil Belajar Matematika Siswa Sekolah Dasar. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *5*(2), 1268–1278. https://doi.org/10.31004/edukatif.v5i2.5005

Nindi, M., Agustin, Rafaely, Subarinah, S., Soeprianto, H., & Arjudin. (2023). Analisis Kemampuan Spasial Siswa Pada Materi Bangun Ruang Sisi Datar Ditinjau Dari Gaya Belajar Di Kelas VIII SMPN 6 Mataram Tahun Ajaran 2022/2023. *Pendas*, *09*(01), 1380–1392. https://doi.org/https://doi.org/10.23969/jp.v8i1.8033

Nisa, A., MZ, Z. A., & Vebrianto, R. (2021). Problematika Pembelajaran Matematika di SD Muhammadiyah Kampa Full Day School. *El-Ibtidaiy:Journal of Primary Education*, *4*(1), 95. https://doi.org/10.24014/ejpe.v4i1.11655

Nugraha, J., -, S., & -, M. (2021). Pengembangan Modul Seni Musik Berbasis Experiential Learning untuk Meningkatkan Kemampuan Bermain Musik pada Mata Pelajaran Seni Budaya dan Prakarya Siswa Sekolah Dasar. *El-Ibtidaiy:Journal of Primary Education*, *4*(2), 189. https://doi.org/10.24014/ejpe.v4i2.13830

Nurcahyandi, Z. R., & Purwaningrum, J. P. (2022). Penerapan Teori Belajar David Kolb dalam Pembelajaran Matematika Materi Koordinat Kartesius. *SIGMA: JURNAL PENDIDIKAN MATEMATIKA*, *14*(1), 1–9. https://doi.org/10.26618/sigma.v14i1.6888

Odeyemi, B. S. D. (2023). An Assessment of Parental Involvement on Public Secondary School Adolescents' Academic Performance in Sciences, in Lagos State, Nigeria. *Edukasiana: Jurnal Inovasi Pendidikan*, *3*(1), 1–14. https://doi.org/10.56916/ejip.v3i1.472

Ouali, I., Ben Halima, M., & Wali, A. (2022). Augmented Reality for Scene Text Recognition, Visualization and Reading to Assist Visually Impaired People. *Procedia Computer Science*, *207*(Kes), 158–167. https://doi.org/10.1016/j.procs.2022.09.048

Prawiradilaga, D. S. (2019). *Wawasan teknologi pendidikan*. Kencana.

Pribadi, B. A. (2017). *Media & teknologi dalam pembelajaran*. Prenada Media.

Radović, S., Hummel, H. G. K., & Vermeulen, M. (2023). The mARC instructional design model for more experiential learning in higher education: theoretical foundations and practical guidelines. *Teaching in Higher Education*, *28*(6), 1173–1190. https://doi.org/10.1080/13562517.2021.1872527

Raharjo, S., Purmanna, A., Purbaningrum, K. A., Ramayanti, R., & Muhti, D. M. C. (2023). Pengembangan Media Pembelajaran Berbasis Software Geogebra pada Kubus untuk Mengembangkan Kemampuan Spasial Siswa. *MAJAMATH: Jurnal Matematika Dan Pendidikan Matematika*, *6*(1), 57–68. https://doi.org/10.36815/majamath.v6i1.2560

Rian Utama, Syahbuddin, & Much. Noeryoko. (2020). Analisis Desain Rencana Pelaksanaan Pembelajaran (RPP) pada Mata Pelajaran Sejarah di SMA Negeri 1 Sanggar. *Jurnal Pendidikan IPS*, *10*(1), 53–59. https://doi.org/10.37630/jpi.v10i1.375

Rusli, R., Nalanda, D. A., Tarmidi, A. D. V., Suryaningrum, K. M., & Yunanda, R. (2023). Augmented reality for studying hands on the human body for elementary school students. *Procedia Computer Science*, *216*(2020), 237–244. https://doi.org/10.1016/j.procs.2022.12.132

Salsabila, U. H., Insani, A. P. S., Mustofa, H., Kalma, M. E. Z., & Iqbal Wibisono, M. (2023). Teknologi Pendidikan: Pemanfaatan Teknologi dalam Pendidikan Pasca Pandemi. *Jurnal Dimensi Pendidikan Dan Pembelajaran*, *11*(1), 79–88. https://doi.org/10.24269/dpp.v11i1.6173

Santi, A., Kurniawan, K., & Abidin, Y. (2023). Analisis Kebutuhan Desain Model Pembelajaran Komunitas Sosial untuk Meningkatkan Keterampilan Menulis Teks Eksposisi di SMK. *Diglosia: Jurnal Kajian Bahasa, Sastra, Dan Pengajarannya*, *6*(2), 549–558. https://doi.org/10.30872/diglosia.v6i2.673

Sari, S. G., Rozimela, Y., & Yerizon, Y. (2023). Praktikalitas Pengembangan Pembelajaran Flipped Classroom berbantuan Media Interaktif pada Materi Bangun Ruang Kelas V Sekolah Dasar. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(2), 1020–1028. https://doi.org/10.31004/cendekia.v7i2.2233

Saymita, P., Aryaningrum, K., & Selegi, S. F. (2023). Pengaruh Pemanfaatan Lingkungan Melalui Model Experiential Learning Terhadap Hasil Belajar Siswa kelas V SD. *JPDI (Jurnal Pendidikan Dasar Indonesia)*, *8*(1), 27. https://doi.org/10.26737/jpdi.v8i1.3750

Syafril, S., Asril, Z., Engkizar, E., Zafirah, A., Agusti, F. A., & Sugiharta, I. (2021). Designing prototype model of virtual geometry in mathematics learning using augmented reality. *Journal of Physics: Conference Series*, *1796*(1), 012035. https://doi.org/10.1088/1742-6596/1796/1/012035

Teapon, N., & Kusumah, Y. S. (2023). Analisis Kemampuan Spatial Siswa Sekolah Menengah Pertama Berdasarkan Teori Hubert Maier. *Proximal: Jurnal Penelitian Matematika Dan Pendidikan Matematika*, *6*(2), 236–245. https://doi.org/10.30605/proximal.v6i2.2796

Teo Lian Wan, C., & Abdullah, N. A. (2023). Using CUBES strategy in a remote setting for primary mathematics word problems. *Jurnal Elemen*, *9*(1), 132–152. https://doi.org/10.29408/jel.v9i1.6864

Yasifati Hia, & Nainggolan, E. K. B. (2023). Pengembangan Media Pembelajaran Interaktif GeoGebra dalam Kemampuan Spasial Bangun Ruang Sisi Datar Kubus dan Balok di SMPN 1 Sunggal. *Jurnal Ilmiah Pendidikan Holistik (JIPH)*, *2*(1), 29–54. https://doi.org/10.55927/jiph.v2i1.2801

Yunanda Pradiani, N. P. W., Turmuzi, M., & Fauzi, A. (2023). Pengembangan Media Pembelajaran Pop-Up Book Materi Bangun Ruang Pada Muatan Pembelajaran Matematika Kelas V Sekolah Dasar. *Jurnal Ilmiah Profesi Pendidikan*, *8*(3), 1456–1469. https://doi.org/10.29303/jipp.v8i3.1503