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Mathematics Teachers' Perceptions Towards Geometry Teaching Methods in Relation to Technological Transformations

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Abstrak

Penelitian ini bertujuan untuk mendeskripsikan persepsi guru matematika terhadap konsep geometri serta pembelajarannya dengan transformasi teknologi pada SMP Kalimantan Barat. Tantangan integrasi teknologi dalam pengajaran geometri masih sering dihadapi guru, terutama dalam konteks pengajaran yang membutuhkan visualisasi dan pemahaman spasial yang mendalam. Metode penelitian yang digunakan adalah penelitian kualitatif dengan pendekatan deskriptif. Pengumpulan data dilakukan dengan membagikan tes melalui pada 127 guru, sementara analisis data dilakukan secara deskriptif kualitatif. Hasil penelitian menunjukkan persepsi guru matematika terhadap konsep geometri dikaitkan dengan transformasi teknologi pada jenjang SMP Kalimantan Barat. Terdapat kecenderungan bahwa konsep geometri diajarkan cukup dengan keterampilan guru apa adanya, tidak begitu melibatkan IT, dengan persepsi bahwa IT lebih memerlukan waktu dan usaha yang gigih. Selain itu, terdapat kecenderungan melakukan pembelajaran alami, di mana pembelajaran dilakukan sebatas pemahaman siswa tanpa upaya untuk memastikan bahwa materi geometri sesuai dengan kebutuhan kontekstual. Dalam hal ini, IT tidak begitu diaplikasikan dalam pembelajaran.
Kata Kunci: Cara Pembelajaran; Konsep Geometri; Persepsi; Transformasi Teknologi.

Abstract

This research aims to describe mathematics teachers' perceptions of geometry concepts and their learning with technological transformation in West Kalimantan junior high schools. The challenge of technology integration in teaching geometry is often faced by teachers, especially in contexts requiring visualization and deep spatial understanding. The research method used is qualitative with a descriptive approach. Data collection was done by distributing tests to 127 teachers, while data analysis was done qualitatively. The results showed teachers' perceptions of geometry and technological transformation at the junior high school level in West Kalimantan. There is a tendency that geometry is taught with the teachers' existing skills, without involving IT, due to the perception that IT requires more time and effort. Additionally, learning tends to focus on student understanding without ensuring the geometry material aligns with contextual needs, resulting in minimal application of IT in learning.
Keywords: Geometry Concept; Learning Method; Perception; Technology Transformation.

I. INTRODUCTION

Of the four interviewed teachers, one provided a fairly conducive response. This teacher revealed that the teaching strategy for geometry is somewhat different from non-geometry (Yulia & Nasution, 2024). Making students understand geometry requires appropriate visuals or targeted manual or digital media (Arwadi & Sidjara, 2023; Hajizah & Salsabila, 2024). Setyaningrum (2016) stated that information and communication technology (ICT) integration in mathematics class face many challenges yet it is possible to do. Additionally, students nowadays are already very familiar with technology or digital devices. This implies that teachers should be able to utilize and adapt to such advancements in digital technology.

Meanwhile, the other two interviewed teachers expressed their confusion regarding how to teach geometry, stating that many geometry concepts are not effectively conveyed (Aini & Suryowati, 2022; Ningsih et al., 2023). The digital transformation implemented in learning has both positive and negative aspects. On the positive side, learning can occur without limitations of time, distance, and COVID-19 protocols. However, on the negative side, one of the drawbacks is the weakened teacher control over students' learning methods.

Rizka et al.'s (2021) study concluded that mathematics teachers' perceptions of online learning interaction based on gender, teaching experience, and educational institution were categorized as poor. This is because during online learning, the learning process is not directly monitored by teachers, limiting interactions between teachers and students and preventing them from seeing the actual condition of the students.

Gusnanto (2021) stated that online learning has its drawbacks alongside its advantages. Online learning requires adequate instant feedback, adjustments to teaching materials that are not as flexible as when teaching directly in the classroom (Zay & Kurniasih, 2023), and learning from home requires high levels of honesty and discipline (Dewi & Afriansyah, 2022). He understands that home conditions have the potential to disrupt a person's concentration while studying. Arief continued, learning at home can also lead to feelings of isolation, as students do not meet and interact socially with other students. This makes it increasingly difficult to identify underachieving students.

Based on the above exposition of teachers' perceptions of online learning, it appears that it is not running optimally. This is one reason for researchers to conduct an in-depth study on mathematics teachers' perceptions of the digital transformation they are experiencing. Therefore, the researcher is interested in conducting a more in-depth study on Mathematics Teachers' Perceptions Towards Geometry Concepts and Their Teaching Methods in Relation to Technological Transformations in Junior High Schools in West Kalimantan.

Rivai and Mulyani (2013: 76) defines perception as a process undertaken by individuals to organize and interpret their sensory impressions in order to give meaning to their environment. Based on the above opinions, it can be concluded

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that perception is a response that can be taken from experiences about an object, event, and its relationship so that it can infer information, interpret messages, and give meaning to its environment. In this study, perception is focused on a teacher's response.

Teacher perception has characteristics as stated by Marliani (2010:79), the characteristics of perception include: (1) The process of organizing various experiences experienced by teachers; (2) The process of connecting past experiences with new ones; (3) The process of selecting information; (4) The process of theorizing and rationalizing; (5) The process of interpreting or giving meaning to verbal and nonverbal messages; (6) The process of interaction and communication of various internal and external experiences; and (7) Making conclusions or decisions, understandings, and forming the shape of individual perceptions.

According to Moedjiono (in Majid 2017: 8), Learning strategy is a teacher's activity to think about and strive for the consistency of aspects of the components that form a learning system, for which the teacher uses certain tactics. Meanwhile, according to Dick and Carey (in Majid 2017: 7), Learning strategy consists of all components of learning materials and procedures or stages of learning activities used by teachers in order to help students achieve certain learning objectives. In line with the above opinion, according to Majid (2017: 8), Learning strategy is a plan of action (a series of activities) that includes the use of methods and the utilization of various resources or strengths in learning. Based on the three opinions, it can be concluded that a learning strategy is a comprehensive approach in a learning system that is a general guideline and framework of activities to achieve general learning objectives, which is elaborated from a certain philosophical or learning theory perspective. In this case, a learning strategy can be interpreted as a plan that contains a series of activities designed to achieve specific educational goals.

Research on mathematics teaching, especially geometry, increasingly emphasizes the importance of technology integration in the classroom, despite significant challenges. Setyaningrum (2016) pointed out that the application of ICT in mathematics learning has challenges but it can still be done, especially since students today are very familiar with technology. The study by Rizka et al. (2021) found that teacher-student interaction in online learning tends to be limited, which hinders teaching effectiveness, especially in materials such as geometry that require visual and spatial understanding. In addition, Gusnanto (2021) explains that distance learning can reduce the quality of feedback and student engagement, while the benefits of traditional classes, such as direct supervision by teachers, are reduced. Amidst these debates, there are still many pedagogical concerns regarding the impact of technological transformation on learning outcomes and the role of teachers.

However, while there have been several studies related to online mathematics learning in general, research that specifically focuses on mathematics

teachers' perceptions of geometry teaching methods in the context of technological transformation in Indonesia, particularly in West Kalimantan, is limited. Existing studies have not deeply explored the unique challenges of teaching geometry - an area that requires specialized tools and media to facilitate spatial understanding. This gap suggests a need for research that can provide specific strategies for teaching geometry in a classroom environment that continues to evolve technologically.

This research offers a new perspective by focusing specifically on mathematics teachers' perceptions of geometry teaching methods in the face of technological transformation, with a focus on West Kalimantan. By examining the perceptions, challenges, and strategies used by teachers, this research provides specific insights into how digital tools are applied or constrained in the geometry curriculum. In contrast to previous research that only addresses the challenges of online learning in general, this research focuses more on geometry as a subject that relies heavily on visual and spatial tools. This approach not only fills a gap in the literature regarding the adaptation of digital technologies for specific areas in mathematics, but also contributes to professional development and better instructional strategies for teachers in West Kalimantan and similar contexts.

II. METHOD

The research method used is a qualitative descriptive method. This study aims to gain a deep understanding of the perceptions of junior high school mathematics teachers in West Kalimantan regarding geometry concepts and their teaching, examined from the perspective of digital transformation. Given the research objective, a descriptive approach is considered appropriate. According to Nawawi (2012: 67), a descriptive approach is a problem-solving procedure that is investigated by describing the condition of the research subject/object (a person, institution, community, etc.) at the present time based on apparent facts or as they are. This research is a survey study. As explained by Nazir (2005: 56), a survey study aims to obtain data that is consistent with facts in the field, whether about social, economic, educational, or political institutions of a group or a region.

According to Arikunto (2013: 188), the research subject is the subject that is aimed to be studied by the researcher. The subjects in this study are mathematics teachers from 300 schools. Furthermore, all of these subjects were given a written test through the Google Forms application. According to Arikunto (2013: 189), the research object is everything that is the focus of observation because the researcher wants information about it. The object in this study is geometry and its learning.

The research procedure is designed to make the research steps more directed and systematic. The procedures carried out in this study are as follows: (1) Preparation stage; (2) Implementation stage, and (3) Final stage. Data collection techniques are the most strategic step in research, as the main purpose of research is to obtain data. Careful selection and arrangement of data collection techniques and tools have a significant impact on the objectivity of

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research results. In other words, the right data collection technique in a study will enable the achievement of a valid and reliable problem-solving, which in turn will allow the formulation of objective generalizations (Nawawi, 2015: 100). The data collection techniques used in this study are the test technique and direct communication technique. The test technique in this study is a written test. The written test used in this study is a test that explores geometric concepts. The direct communication technique is a way of collecting data through oral questions conducted by giving a set of oral questions or statements in the form of a dialogue. In this study, the direct communication technique is in the form of an interview.

The data analysis technique used in this research is qualitative descriptive analysis. Data obtained through written tests were analyzed with the following steps: 1) Data reduction, which is the process of simplifying and organizing data to fit the research objectives. 2) Presentation of data, after being reduced, the data is presented in the form of tables or narratives to facilitate the identification of existing patterns or relationships. 3) Drawing conclusions, based on patterns and themes found in the data, conclusions are drawn to answer research questions.

III. RESULT AND DISCUSSION

This study used a questionnaire containing 20 questions to collect information about the misconceptions experienced by junior high school teachers in learning geometry, their scientific attitudes, and how to overcome misconceptions and optimize scientific attitudes by utilizing the role of information technology (IT).

A. Description of Junior High School Teachers' Misconceptions in Geometry Teaching

This questionnaire includes six questions that describe the misconceptions of junior high school teachers in learning geometry, including the volume of space, (question number 15), diagonal space and plane (question number 16), material that is difficult to understand (question number 17), as well as the comparison of sides between flat and space buildings (question number 18). The results of the answers can be seen in the following Table 1.

Table 1.
Distribution of Expected Answers for Questions 15 to 18

Number	A	B	C	D	Expected Answers
15	114	36	11	10	A
16	68	88	9	6	A
17	39	64	56	12	-
18	17	43	72	39	C

Question number 15 assessed respondents' understanding of the volume of a box-shaped space. Of the 127 respondents, 66.7% chose the correct answer a, indicating a good understanding of the concept of volume. However, 21% chose b and 6.4% chose c, indicating a common misconception that volume is seen in terms of the surface area or outer sides of the box, rather than the space it can occupy. This is often caused by misperceptions in recognizing three-dimensional objects when represented in two dimensions (Syahbana et al., 2022; Kurniawati et al., 2021). Ashlock (2008)

explains that this kind of misconception is a form of generalization due to shallow understanding. Deepening the concept of volume and building space is important to reduce misconceptions in teachers and students (Rahmawati & Putra, 2020; Nugraha et al., 2023).

Question number 16 tested the respondents' understanding of the diagonal space and plane of the cube. Out of 127 respondents, 51.5% chose the wrong answer b, even though answer a was the most appropriate. This error shows that most teachers have misconceptions in understanding the difference between space diagonals (lines connecting opposite corner points in space) and plane diagonals (lines connecting opposite corner points in one plane) (Rahmawati & Fadillah, 2023). For example, in choice b, the answer order is reversed between space and plane diagonals, leading to confusion (Nugraha et al., 2023). This misconception is a form of generalization, which occurs due to a superficial understanding of complex geometric concepts (Syahbana et al., 2022; Kurniawati et al., 2021).

Question number 17 was given to find out the most difficult mathematics material for respondents to understand. 127 respondents identified geometry as the most difficult math material to understand, with the majority choosing option b (37.4%). This difficulty is thought to be because geometry concepts, although close to everyday life, are difficult to understand in the abstract, which often leads to misconceptions. These misconceptions can occur in both students and teachers, and sometimes become inherited beliefs. According to recent research, difficulties in understanding geometry can be exacerbated by the lack of use of visual media (Smith, 2021) and contextual approaches (Li & Jones, 2020). Teaching geometry based on manipulatives and visual technology has been shown to be effective in reducing misconceptions (Chen et al., 2023; Taylor, 2022).

Question number 18 evaluated the understanding of the concept of cube and square dimensions, where option c (correct answer) received the most responses (42.1%). Common misconceptions were seen in respondents who chose options a, b or d, which equated the shape of the sides of a cube and a square. These misconceptions are categorized as generalization misconceptions, which often result from a superficial understanding of dimensional differences (Huang et al., 2023; Patel & Singh, 2022). Recent research highlights the need for dimensional exploration-based learning to address these misconceptions (Johnson et al., 2021; Kim, 2020).

B. Description of the Scientific Attitudes of Junior High School Teachers in Geometry Learning

This questionnaire includes seven questions that contain information about the scientific attitudes of junior high school teachers in learning geometry, namely curiosity (question numbers 6, 7, and 12), being critical (question numbers 6, 7, and 11), discovery and creativity (question numbers 8, 9, 10, and 11), objective (question numbers 9 and 10), open-minded (question numbers 7, 11, and 12), and based on evidence (question numbers 8

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and 10). The results of the answers can be seen in the following Table 2.

Table 2.
Distribution of Expected Answers for Questions 6 to 9

Number	A	B	C	D	Expected Answers
6	6	18	59	88	D
7	42	24	26	79	D
8	24	49	40	58	D
9	23	108	40	0	B

Question number 6 measures teachers' scientific attitude towards innovative information, testing curiosity and critical attitude. Most respondents (51.5%) chose answer d, which shows a high scientific attitude in seeking innovative information enthusiastically and critically. However, respondents who chose b and c showed a less enthusiastic and less critical attitude in seeking information, which could affect the accuracy of the information obtained (Anwar, 2009; Tursinawati, 2017). Respondents who chose a showed a lack of curiosity and critical attitude, just waiting for information to come without actively seeking or verifying the truth of the information.

Question number 7 measures teachers' scientific attitudes towards new mathematics learning, testing curiosity, critical thinking and open-mindedness. Answer d (46.2%) shows a high scientific attitude in seeking information openly and critically, using digital media to update knowledge. Options b and c show a high degree of curiosity but lack of openness to multiple perspectives, while option a shows a lack of critical thinking and open-mindedness (Airasian & Gay, 2022; Cross & Nussbaum, 2021).

Question number 8 measures scientific attitudes towards the application of mathematical theories in everyday life. Option c (62%) shows a scientific attitude based on evidence, although it does not utilize IT to enrich perspectives. Options b and d showed more creative processing of information with evidence, while option a showed a lack of invention and creativity. Creativity and evidence need to be combined to enrich research and decision-making (Baker & Nelson, 2023; Johnson et al., 2021).

Question number 9 assesses an objective and evidence-based attitude in data processing. Option b (63.2%) shows an objective attitude, using original data without manipulation even if it is unfavorable. Options c, a and d indicate data processing that risks manipulating data to meet specific needs, potentially damaging the integrity of the data. Being objective and evidence-based is essential in legitimate research and reporting (Wang et al., 2023; Glover & Bradshaw, 2021).

Question number 10 measures scientific attitudes in learning decision-making, focusing on discovery, creativity, objectivity and evidence. Option d (61.4%) shows a high scientific attitude in making decisions based on facts, even if they are not favorable. Option c indicates decision-making that prioritizes student convenience, while options a and b indicate disregard for evidence and facts in decision- making (Lee & Park, 2022; Smith & Johnson, 2023).

The importance of scientific attitudes in learning mathematics, especially geometry, cannot be underestimated. Information

obtained by teachers and students must be confirmed and processed properly in order to produce accurate and reliable conclusions. In this process, teachers need to develop six main aspects of scientific attitudes: curiosity, critical thinking, discovery and creativity, objectivity, open-mindedness, and evidence-based (Anwar, 2009; Airasian & Gay, 2022). These scientific attitudes are crucial in processing and analyzing data to make decisions based on facts and evidence, not just perceptions.

Based on the analysis of 127 junior high school teachers, it was found that many teachers experienced misconceptions in understanding geometry. The Misconceptions detected tend to be generalizations and specializations, which are rooted in errors in understanding geometric concepts such as volume, diagonal space, and dimensions of space (Rahmawati & Fadillah, 2023; Syahbana et al., 2022). For example, many teachers still identify the volume of the box with the surface area or confusion in distinguishing the diagonal space and plane in the cube (Kurniawati et al., 2021). This shows that misconceptions often arise from a superficial understanding of more complex concepts.

Suyanto (2005) revealed that geometry is the recognition of shape, area, and volume, which should be built from real experience and observation of geometric objects. The understanding formed from this process is highly dependent on the quality of information received and the ability to process it critically. When the information received is inaccurate or incomplete, the understanding formed will be misleading and potentially lead to misconceptions.

This study also shows a significant relationship between scientific attitude and the utilization of information technology (IT) in learning. Teachers who are more open and critical in seeking information and utilizing IT tend to have higher scientific attitudes. Research by Smith (2021) and Chen et al. (2023) highlighted that the use of visual media and technology in geometry learning can reduce misconceptions by providing clearer representations that are easily understood by students.

However, educational background, teaching experience and teaching location do not seem to significantly affect teachers' scientific understanding or attitudes. This suggests that individual factors such as habits in utilizing IT and scientific attitudes determine the quality of learning and concept understanding more than background factors. This is in line with the findings of Cross & Nussbaum (2021), who suggested that open and critical attitudes in mathematics learning are strongly influenced by the habit of integrating technology in the learning process.

Thus, to overcome misconceptions and improve teachers' scientific attitudes in learning geometry, there needs to be maximum utilization of IT. Visual and manipulative technologies, as well as learning approaches based on dimensional exploration, can be an effective solution in reducing misconceptions that often occur (Taylor, 2022; Li & Jones, 2020).

IV. CONCLUSION

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In junior high schools in West Kalimantan, math teachers' perceptions of geometry concepts related to technological transformation show a tendency to teach geometry with existing methods without significantly involving IT advances. This is due to the view that implementing IT requires more time and effort. As a result, the approach used tends to be limited to students' basic understanding without ensuring the geometry materials are contextually appropriate. As a result, TI has not been widely applied in geometry learning.

To improve the research instrument, it is recommended to include a variety of questions to capture more diverse perspectives. In addition to administering the questionnaire to all research subjects, interviews with participants who are representative of the population should also be conducted. This approach can provide deeper insights into the causes of teachers' misconceptions and scientific attitudes.

The conclusion of this study shows that most mathematics teachers in junior high schools in West Kalimantan tend to teach geometry without optimally utilizing IT, due to the view that IT requires extra time and effort. Therefore, IT has not been widely applied in geometry learning. These findings provide important insights for the improvement of IT utilization in mathematics education, namely the challenges teachers face in integrating IT into their teaching, as well as the need to improve teachers' understanding of the potential of IT in supporting clearer and more contextual visualization and understanding of geometry concepts. In addition, the development of training programs that focus on the integration of IT in geometry teaching can be designed. This training can help teachers to use IT more effectively, which in turn can improve the quality of teaching and students' understanding of geometry concepts. Optimal use of IT can reduce student misconceptions, improve the quality of mathematics education, and prepare students with relevant skills in the digital era.

REFERENCES

Aini, N., & Suryowati, E. (2022). Mengeksplor Penalaran Spasial Siswa dalam Menyelesaikan Soal Geometri Berdasarkan Gender. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(1), 61-72.

Airasian, P., & Gay, L. R. (2022). *Educational Research: Competencies for Analysis and Applications*. Upper Saddle River, NJ: Prentice Hall.

Anwar, M. (2009). *Metode Penelitian Pendidikan*. Bandung: PT Remaja Rosdakarya.

Arikunto, S. (2013). *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta: PT Rineka Cipta.

Arwadi, F., & Sidjara, S. (2023). The Pedagogical Content Knowledge of Mathematics Pre-Service Teachers on Geometry Topic in Universitas Negeri Makassar. *Mosharafa: Jurnal Pendidikan Matematika*, *12*(4), 759-770.

Ashlock, R. B. (2008). *Error patterns in computation: Using error patterns to improve instruction*. Columbus: Merrill. Baker, T., & Nelson, R. (2023). *Innovation in Education*. Cambridge: Cambridge University Press.

Chen, X., Li, M., & Zhao, Q. (2023). Effectiveness of Visual Media in Reducing Geometry Misconceptions: An Empirical Study. *Journal of Mathematics Education Research, 35*(2), 89–103.

Cross, T., & Nussbaum, M. (2021). Fostering Critical Thinking in Education Through Digital Media. *Journal of Educational Technology, 14*(2), 122–135.

Dewi, R. P., & Afriansyah, E. A. (2022). Pembelajaran Matematika Berbasis Aplikasi Google Classroom pada Materi Bangun Ruang Sisi Datar. *Plusminus: Jurnal Pendidikan Matematika*, *2*(1), 39-52.

Glover, P., & Bradshaw, L. (2021). The importance of objectivity in educational data analysis. *Journal of Research in Education, 45*(3), 167–181.

Gusnanto. (2021). Persepsi Guru Matematika Terhadap Pembelajaran Daring. *Jurnal Aksioma, 10*(4), 2119-2128.

Hadari Nawawi. (2012). *Penelitian Terapan*. Yogyakarta: Gajah Mada University Press.

Hajizah, M. N., & Salsabila, E. (2024). Analisis Kesalahan Mahasiswa dalam Menyelesaikan Masalah Geometi Analitik Berdasarkan Newman's Error Analysis. *Plusminus: Jurnal Pendidikan Matematika*, *4*(1), 191-198.

Huang, T., Wu, L., & Zhu, S. (2023). Understanding Dimensional Misconceptions in Solid and Plane Geometry among Middle School Students. *Mathematics Education Review, 28*(2), 211–228.

Johnson, E., Lavoie, J., & Kim, T. (2021). Dimensional Explorations in Geometry: A Pathway to Correct Conceptual Misunderstandings. *Contemporary Issues in Mathematics Education, 36*(3), 93–108.

Johnson, K., Pritzker, K., & Smith, L. (2021). Developing Creative and Critical Thinking Skills in Educators. *Journal of Teacher Education, 66*(1), 53–67.

Kim, H. (2020). Generalization Misconceptions in Spatial Reasoning: Educational Implications. *Journal of Educational Research in Mathematics, 15*(4), 217–229.

Kurniawati, A., Wahyuni, S., & Dewi, A. R. (2021). Misconception Analysis on Volume and Surface Area of Space Figure Concept Among Elementary School Students. *Journal of Physics: Conference Series, 1783*(1), 012023.

Lee, S., & Park, S. (2022). Using Data for Decision-making in Education: A Critical Review. *Journal of Educational Policy, 28*(3), 108–121.

Li, Y., & Jones, A. (2020). Contextual Approaches in Geometry Education: Enhancing Understanding Through Real-World Applications. *International Journal of STEM Education, 7*(4), 145-160.

Marliani. (2010). *Psikologi Pendidikan*. Bandung: Alfabeta.

Miftah, T. (2014). *Perilaku Organisasi: Konsep Dasar dan Aplikasinya*. Jakarta: PT Raja Grafindo Persada.

Moedjiono, A. (2017). *Strategi Pembelajaran*. Jakarta: PT Rineka Cipta. Nazir, M. (2005). *Metode Penelitian*. Jakarta: Ghalia Indonesia.

Ningsih, Y. L., Fitriasari, P., Octaria, D., & Kesumawati, N. (2023). Assessing Students' Higher Order Thinking Skills in Geometry: A Rasch

Analysis. *Plusminus: Jurnal Pendidikan Matematika*, *3*(3), 411-424.

Nugraha, D., Sukmawati, E., & Faisal, M. (2023). Misconceptions in Learning Geometry among Elementary Teachers. *International Journal of Learning and Teaching, 16*(3), 123–130.

Patel, R., & Singh, N. (2022). The Role of Depth in Teaching Three-dimensional Geometry Concepts to Adolescents. *Mathematics and Science Education Journal, 14*(1), 55–70.

Rahmawati, S., & Putra, R. (2020). Pentingnya Pemahaman Konsep Volume dalam Pendidikan Matematika. *Jurnal Pendidikan Matematika, 15*(2), 125-135.

Rizka, J., Padrul, J., & Marsiyam. (2021). Persepsi Guru Matematika terhadap Pembelajaran Daring. *Jurnal Aksioma, 10*(4), 2119-2128.

Rahmawati, S., & Fadillah, M. (2023). Improving geometric conceptual understanding through targeted learning. *Mathematics Education Research, 12*(1), 27–34.

Setyaningrum, W. (2016). Teachers' Perception Towards ICT in Mathematics Class: A Case Study in Yogyakarta Secondary Schools. In *Proceedings of the 3rd International Conference on Research, Implementation, and Education of Mathematics and Science* (pp. 45-50). Yogyakarta: Universitas Negeri Yogyakarta.

Smith, L. (2021). Exploring Challenges in Teaching Abstract Geometric Concepts. *Educational Studies in Mathematics, 46*(1), 21–35.

Sugiyono. (2015). *Metode Penelitian Kuantitatif, Kualitatif*, dan R&D. Bandung: Alfabeta.

Sukardi, D. K. (2004). *Pengantar Pelaksanaan Program Bimbingan dan Konseling di Sekolah*. Jakarta: PT Reneka Cipta.

Suyanto. (2005). *Dasar-dasar Geometri*. Jakarta: Penerbit Gramedia.

Susanto, A. (2013). *Teori Belajar dan Pembelajaran di Sekolah Dasar*. Jakarta: Prenadamedia.

Syahbana, M., Arista, Y., & Sutanto, T. (2022). Challenges in Understanding Three-dimensional Geometry. *Educational Perspectives in Mathematics, 14*(2), 98–110.

Taylor, R. (2022). Using Technology in Geometry Instruction to Prevent Misconceptions. *Mathematics Teaching in the Middle School, 27*(1), 32–44.

Tursinawati, D. (2017). *Panduan Praktis Pengembangan Diri*. Yogyakarta: PT Pustaka Terampil.

Uno, H. B. (2009). *Profesi Kependidikan*. Jakarta: Bumi Aksara.

Wang, L., Zhan, H., & Sun, X. (2023). Data integrity in educational research: Best practices for reliability and validity. *Educational Measurement and Evaluation, 42*(5), 404–417.

Yulia, P., & Nasution, E. Y. P. (2024). Geometry and Islamic Values: Validity of Teaching Materials Based on Modified Project-Based Learning Model. *Mosharafa: Jurnal Pendidikan Matematika*, *13*(1), 113-124.

Zay, D. A., & Kurniasih, M. D. (2023). Exploring Math Anxiety Towards the Students' Computer Self-Efficacy in Learning Mathematics. *Mosharafa:*

Jurnal Pendidikan Matematika, *12*(1), 113-124.

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