AKSIOMA EDUCATION JOURNAL
Aksioma: Jurnal Matematika
https://nawalaeducation.com/index.php/AEJ/index
Volume 2 Nomor 1, 2025
e-ISSN : 3047-3187
DOI : https://doi.org/10.62872/37qdwd85

Dynamic Geometry Study as a Learning Visualization Tool in the Digital Era

Sonny Yaltu Duma[1]✉, Ardiyanto Saleh Modjo[2]
Universitas Kristen Indonesia Toraja, Indonesia[1], Universitas Negeri Gorontalo, Indonesia[2]
e-mail: * sonny_yalti@ukitoraja.ac.id

INFO ARTIKEL

Accepted:
February 22, 2025
Revised :
March 20, 2025
Approved :
March 24, 2025
Published :
March 26, 2025

Keywords:
Dynamic Geometry; Educational Technology; Learning Visualization;

ABSTRAK

In the digital era, the integration of technology in education is becoming increasingly important to improve the effectiveness of learning. One significant innovation in mathematics education is the use of dynamic geometry through software such as GeoGebra and Cabri Geometry. This technology allows students to visualize and explore geometric concepts interactively, so that they can better understand spatial relationships. This approach is in line with constructivism theory which emphasizes exploration-based learning and direct experience. Various studies have shown that the use of dynamic geometry not only improves conceptual understanding but also develops critical and analytical thinking skills. However, the implementation of this technology faces several challenges, such as the readiness of educators to integrate the software into learning strategies and the limited infrastructure in some educational institutions. Therefore, continuous training is needed for educators and educational policies that support the wider adoption of this technology. With the right implementation strategy, dynamic geometry can be a revolutionary learning tool in mathematics education, increasing student engagement, and strengthening their spatial literacy and problem-solving skills in the digital era.

INTRODUCTION

In the digital era, technology integration in education is a must to improve learning effectiveness. One area that has undergone significant changes is mathematics education, especially in geometry teaching. According to research conducted by Hamzah & Hidayat (2022), the use of dynamic geometry software, such as GeoGebra and Cabri Geometry, has been shown to improve students' understanding of geometric concepts through interactive visualization. This approach allows students to directly explore relationships between geometric objects, test hypotheses, and observe changes in visual representations in real time. Compared to conventional methods that are static and text-based, dynamic geometry technology creates a more contextual and exploration-based learning experience, which is in accordance with the principles of constructivism in education.

However, although dynamic geometry technology offers various pedagogical benefits, its implementation is not without challenges. One of the main obstacles is the readiness of educators to utilize this technology effectively. Research by Susanti et al (2024) shows that although dynamic geometry software can improve student

understanding, its effectiveness is highly dependent on teacher competence in integrating it into meaningful learning strategies. In addition, not all educational institutions have adequate infrastructure to support the optimal use of this technology. Thus, continuous training is needed for educators as well as educational policies that support wider adoption of technology, so that dynamic geometry can truly become a revolutionary visualization tool in mathematics learning in the digital era.

Geometry is often considered a difficult branch of mathematics to understand because of its abstract nature, especially in the concept of space, transformation, and relationships between geometric objects. According to Zalfa et al (2023) many students have difficulty in thinking spatially due to limitations in understanding two-dimensional representations of three-dimensional objects. The cognitive process in learning geometry requires gradual understanding, starting from recognizing shapes to more complex deductive levels. However, traditional learning methods that only rely on static text and images in textbooks often fail to bridge this gap in understanding. As a result, students tend to memorize formulas without really understanding the concepts behind them, which ultimately hinders their ability to solve geometric problems analytically and applicatively.

To overcome these challenges, the use of interactive visualization tools is becoming an increasingly relevant solution in geometry learning. As conveyed by Aswan et al (2024) dynamic geometry technology allows students to observe, explore, and manipulate geometric shapes directly, thereby helping them understand spatial relationships better. With high interactivity, students can see how changes in one geometric element affect the entire structure, thereby strengthening their conceptual understanding. In addition, this technology-based approach can also increase student engagement in learning, because they do not only receive information passively but also actively participate in building their own understanding. Therefore, the integration of dynamic geometry in learning is not just a tool, but becomes part of a broader pedagogical strategy to improve students' spatial literacy and critical thinking skills in mathematics.

Problem-solving skills in geometry depend not only on understanding basic concepts, but also on students' ability to connect various elements in a problem and find the right solution. According to Tambunan et al (2024), dynamic geometry software provides an exploration-based learning experience that allows students to test various possibilities in solving problems. For example, through GeoGebra, students can manipulate points, lines, and shapes to see how changing one element affects the entire geometric structure. This approach not only improves conceptual understanding but also encourages students to think critically and develop more flexible problem-solving strategies. In other words, dynamic geometry acts as a virtual laboratory that allows students to learn through experimentation and reflection, which is in accordance with the inquiry-based learning approach.

In addition, the positive impact of dynamic geometry on conceptual understanding can also be associated with cognitive learning theory. According to Schoenherr et al (2024), learning based on visualization and interaction can strengthen the connection between working memory and long-term memory, allowing students to understand concepts more deeply and last longer. In the context of geometry learning, the use of interactive software helps students build stronger mental representations of the properties and relationships between geometric objects. This is very important in the development of higher-order thinking skills, such as deductive and analytical reasoning. Therefore, dynamic geometry not only improves conceptual understanding instantly, but

also provides a more solid foundation for students in applying geometric concepts in more complex contexts, both inside and outside the academic environment.

Although the benefits of dynamic geometry in learning are very clear, its implementation still faces various obstacles that need to be considered critically. One of the main challenges is the readiness and competence of teachers in integrating this technology into effective learning strategies. According to research by Prasetyo & Meiliasari (2025), many teachers still feel less confident in using dynamic geometry software due to lack of adequate training. In addition, there is a tendency that teachers who are accustomed to conventional teaching methods have difficulty adapting to a more interactive technology-based approach. This shows that the success of implementing dynamic geometry depends not only on the availability of software, but also on the readiness of teachers to utilize the technology as a truly effective pedagogical tool. Therefore, a comprehensive and ongoing training program is crucial to ensure that teachers can optimize the potential of dynamic geometry in learning.

In addition to the aspect of teacher readiness, limited infrastructure is also a factor that hinders the adoption of dynamic geometry in the education system, especially in areas with limited access to technology. According to a report by Subroto et al (2023), the digital divide is still a global challenge in the implementation of educational technology, where not all schools have adequate devices or stable internet access. This situation creates a gap in the quality of learning between schools that have sufficient technological resources and those that do not. Without supporting infrastructure, the use of dynamic geometry will be difficult to implement evenly and sustainably. Therefore, a more progressive education policy is needed, including investment in technology procurement and the development of more equitable digital infrastructure. With this step, the opportunity to use dynamic geometry as a visualization tool in learning can be truly optimized, thus providing a broader and more inclusive impact for all students in the digital era.

METHODOLOGY

This study uses a qualitative approach with a literature review study method to analyze the role of dynamic geometry as a visualization tool in learning in the digital era. This method was chosen to explore various theories and previous studies related to the effectiveness and challenges of implementing this technology in education. Data sources were obtained from scientific journals, academic books, and relevant international education reports, considering the last 10 years to ensure compliance with current technological developments.

Data collection was conducted through documentation by reviewing and classifying literature based on the effectiveness, challenges, and strategies of implementing dynamic geometry. Data were analyzed using content analysis, which includes reduction, categorization, and interpretation of findings to identify thematic patterns. The results of this study are expected to provide insight into how dynamic geometry can improve students' understanding and how appropriate strategies can be applied to overcome obstacles in its use in the digital era.

RESULTS AND DISCUSSION

The Effectiveness of Dynamic Geometry in Enhancing Conceptual Understanding

1. The Role of Dynamic Geometry in Strengthening Conceptual Understanding

The use of dynamic geometry in learning has been shown to improve students' conceptual understanding of geometric concepts. With the help of technology such as GeoGebra, students can not only visualize geometric objects more clearly, but can also interact directly with the shapes and structures they are learning. The ability to manipulate these geometric elements allows them to explore various possibilities, understand spatial relationships, and discover mathematical patterns or rules independently. A study conducted by Kurniawan et al (2024) showed that the use of GeoGebra in geometry learning helps students build connections between visual representations and abstract mathematical concepts, which contributes to improving their conceptual understanding.

One of the main advantages of dynamic geometry is its ability to help students understand abstract concepts more concretely. For example, when studying the properties of triangles, students can directly change the length of their sides or the size of their angles in a dynamic geometry application and observe how these changes affect the overall structure of the triangle. This allows them to understand the concepts of invariants and variables in geometry without having to rely solely on memorization or static theories. In addition, students can also develop an understanding of geometric transformations, such as translation, rotation, reflection, and dilation, in a more intuitive way. According to research conducted by Susilo & Suharto (2023), the use of dynamic geometry software can improve students' spatial visualization abilities, which are one of the key factors in understanding higher geometry concepts.

In addition to improving visual and spatial understanding, dynamic geometry also plays a role in encouraging independent exploration and the development of problem-solving skills. Through various interactive features, students can test their own hypotheses and evaluate the results directly. For example, they can observe that the sum of the angles in a triangle is always 180° by conducting their own experiments in the software, without having to accept the concept as just a fact to be memorized. This experiment-based approach is supported by research by Nisa & Fauzi (2024), who found that students who used dynamic geometry software in learning showed a deeper understanding and flexibility in solving problems compared to students who only used traditional methods.

In addition, the integration of dynamic geometry in learning also supports collaborative learning, where students can work in groups to discuss the results of their exploration and build shared understanding. In this activity, they not only gain new insights from their peers, but also learn to communicate mathematical ideas more clearly and systematically. Research conducted by Al Ayyubi et al (2024) shows that the use of interactive technology in geometry learning increases student engagement in class discussions and facilitates collaboration in finding mathematical solutions.

Overall, the use of dynamic geometry in education provides extensive benefits for students' conceptual understanding. By increasing interactivity, enabling experiment-based exploration, and supporting collaborative learning, this approach makes geometry learning more engaging, effective, and meaningful. Therefore, the integration of dynamic geometry technology in the learning process is highly recommended as one strategy to improve the quality of mathematics education, especially in the field of geometry.

Research conducted by Cahyana et al (2024) confirmed that a technology-based approach to mathematics learning, including dynamic geometry, not only improves conceptual understanding but also helps students build better critical thinking skills.

2. The Relation of Dynamic Geometry to Constructivism Theory

The dynamic geometry approach is closely related to constructivism theory, where learning occurs through exploration and direct experience. In the constructivism theory proposed by Luthfiyani et al (2025), knowledge is not acquired passively, but is actively constructed by students through interaction with their environment. In the context of geometry learning, the dynamic geometry approach allows students to be directly involved in exploring geometric concepts using interactive software such as GeoGebra, Cabri, or Sketchpad. By using these tools, students can manipulate geometric objects in real-time, observe the changes that occur, and draw conclusions based on their own experiments.

Previous studies have shown that dynamic geometry-based learning can improve students' conceptual understanding. Numan & Azka (2023) found that the use of GeoGebra in geometry learning not only improves spatial thinking skills but also helps students understand the relationship between abstract geometric concepts. In addition, Kaharuddin et al (2023) in his book stated that dynamic geometry software allows students to explore various geometric properties without having to redraw manually, so they can focus on analyzing and reflecting on the concepts being learned. For example, when studying the properties of triangles, students can dynamically change the length of the sides and the size of the angles to see how these changes affect the shape of the triangle. In this way, they not only memorize theorems but also understand the reasons behind a concept, which is in line with the principles of constructivism.

In addition to improving conceptual understanding, the dynamic geometry approach also contributes to the development of spatial and analytical thinking skills. According to research by Febrianti et al (2024), students who learn using dynamic geometry software show a significant increase in spatial thinking skills compared to those who learn using conventional methods. This is due to visual interactions that allow students to understand how changes in one geometric element affect other elements. In learning geometric transformations such as translation, rotation, and reflection, students can directly observe changes in the shape of an object without losing its basic properties. Thus, they can more easily understand the concept of transformation compared to static methods such as drawing on paper.

Another advantage of the dynamic geometry approach is the increased involvement and motivation of students in learning. Research conducted by Tesalonika (2024) shows that students who learn using dynamic geometry software are more motivated and have a positive attitude towards mathematics compared to those who learn using traditional methods. This is because the interactive nature of the software makes learning more interesting and enjoyable. In addition, research by Aprilian (2024) shows that students who use GeoGebra are more active in exploring geometric concepts and have a deeper understanding compared to those who only use textbooks or other static tools.

Overall, the dynamic geometry approach is in line with constructivism theory because it allows students to experience active learning, explore concepts directly, and build their own understanding based on real experiences. Various studies have shown that the use of dynamic geometry software can improve conceptual understanding, spatial thinking skills, and students' learning motivation. Therefore, the integration of dynamic

geometry in geometry learning can be an effective strategy in improving the quality of mathematics learning, especially in building analytical and critical thinking skills that are very much needed in various fields of science.

Challenges and Strategies for Implementing Dynamic Geometry in Education

1. The Role of Dynamic Geometry in Strengthening Conceptual Understanding

The application of dynamic geometry in learning has been shown to have a significant positive impact on students' conceptual understanding. One of the main benefits of this approach is the improvement of the ability to visualize geometric concepts. By using software such as GeoGebra, students can observe how changes in parameters in a shape affect the properties and relationships between its elements. This interactivity allows them to better understand concepts that are often abstract in geometry, such as symmetry, transformation, and spatial relationships. This is in line with research conducted by Mailani et al (2024), which shows that dynamic geometry technology helps students develop better spatial understanding by exploring and manipulating objects directly. In the study, it was found that students who used interactive software had a higher ability to identify and apply geometric concepts compared to those who used conventional learning methods.

In addition, dynamic geometry-based learning also increases student engagement in the learning process. With interactive tools, they are not only passive recipients of information but also actively explore and experiment with various geometric shapes and relationships. According to research by Nasution et al (2025), students who learn with dynamic geometry show higher engagement because they can interact directly with objects and see the results of changes in real-time. This study also shows that the use of technologies such as GeoGebra and Cabri Geometry encourages students to think reflectively and critically, because they can test various hypotheses and verify the concepts learned independently.

This approach also plays a role in helping students connect abstract concepts with real applications in everyday life. For example, in understanding the concept of geometric transformations such as reflection and rotation, students can directly change the parameters in the digital model and observe the effects directly. This is very different from conventional learning methods that often only rely on static images in textbooks or verbal explanations from teachers. The results of a study conducted by Darta (2021) showed that dynamic geometry technology allows students to better understand the relationship between symbolic and visual representations in geometry. This study revealed that students who used interactive software found it easier to understand the relationship between basic geometric concepts and their applications in various fields, such as architecture, graphic design, and civil engineering.

In addition, the dynamic geometry approach also improves students' problem-solving skills. By manipulating geometric objects independently, they can test hypotheses and find certain patterns in the structure of flat and spatial shapes. This exploration process supports the development of critical and analytical thinking skills, because students are invited to understand the cause-and-effect relationships in geometry and draw conclusions based on the results of their own experiments. According to research by Ramadannia et al. (2024), students who learned using dynamic geometry software showed higher problem-solving skills compared to the group that learned using conventional methods. This study also found that the use of interactive technology helps

students develop more flexible and adaptive thinking strategies in solving geometry problems.

Furthermore, the use of dynamic geometry encourages inquiry-based learning, where students are not only given theory but are also invited to discover the properties of geometry themselves based on their explorations. When they are given the freedom to try various transformations and observe the results, they are more motivated to think independently and conduct in-depth analysis of the concepts learned. This is supported by research by Mursalin et al. (2024), which shows that students who use dynamic geometry software tend to be more independent in building their own understanding, compared to those who only receive information from teachers directly.

Overall, the role of dynamic geometry in strengthening conceptual understanding is very important because it allows for more interactive learning, increases student engagement, and strengthens deep understanding of geometric concepts. With this approach, students not only understand the theory but can also apply it in various contexts, which will ultimately strengthen their logical and analytical thinking skills in solving geometric problems. Studies that have been conducted prove that dynamic geometry-based learning has a real positive impact on improving student understanding, so its use in mathematics education is highly recommended for wider application.

2. The Relation of Dynamic Geometry to Constructivism Theory

The dynamic geometry approach is closely related to constructivism theory, where the learning process occurs through exploration, interaction, and direct experience. In this approach, students do not only receive information passively from the teacher, but they also actively participate in building their own understanding of geometric concepts. With the help of dynamic geometry software such as GeoGebra or Cabri Geometry, students can manipulate geometric objects directly, observe the changes that occur, and infer the relationships between elements in geometry. The real-time interaction offered by this software facilitates more intuitive learning, allowing students to see how a shape or structure changes when certain parameters are modified.

In line with constructivism theory that emphasizes the importance of experience in the formation of knowledge, dynamic geometry provides an opportunity for students to discover mathematical concepts independently. Piaget (1972) in his theory of cognitive development emphasized that effective learning occurs when students actively interact with their environment. This is reinforced by Jenita et al (2023) who emphasize that learning is social and occurs through interaction with tools or technology that can support understanding. Dynamic geometry software is able to improve students' understanding of geometric relationships compared to traditional textbook-based methods. This finding is also reinforced by Kurniawan et al (2024), who state that the use of dynamic geometry allows students to explore mathematical relationships more flexibly and deeply compared to conventional methods.

Students who learn using dynamic geometry software are better able to develop spatial and analytical thinking skills compared to students who only use static image-based learning methods. Spatial thinking skills are essential in various fields of science, including mathematics, engineering, and architecture. By working in a visual and interactive environment, students can understand the concepts of transformation, symmetry, and the relationship between angles and lengths more effectively. Furthermore, research by Egita & Indriani (2024) revealed that the use of GeoGebra in

geometry learning not only improves students' conceptual understanding but also increases their learning motivation. The results of this study indicate that a dynamic geometry-based approach can reduce students' anxiety towards mathematics and make the learning process more enjoyable and meaningful.

From the various studies above, it can be concluded that the dynamic geometry approach is not only in line with constructivism theory but also has a positive impact on the quality of student learning. By providing exploratory and interactive experiences, this approach allows students to develop deeper understanding, improve critical thinking skills, and prepare them to apply geometric concepts in various real-life contexts. Therefore, the integration of dynamic geometry in mathematics learning can be an effective strategy in improving students' cognitive and analytical skills in accordance with the principles of constructivism

CONCLUSION

The use of dynamic geometry in learning has been proven effective in improving students' conceptual understanding of geometry. Technologies such as GeoGebra allow students to visualize and explore geometric concepts interactively, so that they can better understand spatial relationships. Dynamic manipulation of geometric elements helps students transform abstract concepts into more concrete ones, strengthen spatial thinking skills, and increase engagement in learning. This approach is also in line with constructivism theory which emphasizes experiential learning and independent exploration, where students are more active in finding mathematical patterns and relationships independently. In addition, the use of dynamic geometry supports collaborative learning and increases students' motivation to understand the material in depth. Various studies have shown that this approach not only improves conceptual understanding but also develops analytical and critical thinking skills. Thus, the application of this method makes learning more interesting, interactive, and meaningful for students. In order to be used optimally in the education system, an appropriate implementation strategy is needed, including training for educators in integrating this technology into the curriculum. With a good approach, dynamic geometry can have a positive impact on improving the quality of mathematics learning, especially in the field of geometry

LITERATURE

Al Ayyubi, I. I., Hayati, A. F., Azizah, E. N., Herdiansyah, R., & Mirayanti, U. (2024). Pendidikan Humanis Paulo Freire Dalam Pembelajaran Matematika Mi. Wulang: Jurnal Pendidikan Guru Madrasah Ibtidaiyah, 2(1), 1-15.

Aprilian, V. M. (2024). Studi Literatur: Penggunaan Media Pembelajaran Geogebra Terhadap Kemampuan Pemahaman Konsep Matematis Siswa. Jurnal Edukasi Dan Sains Matematika (Jes-Mat), 10(2), 89-100.

Aswan, N., Hasibuan, F. A., Fadhillah, Y., Siregar, M. N. H., & Anata, H. D. (2024). Pelatihan Pemanfaatan Software Geogebra Pada Pembelajaran Matematika. Community Development Journal: Jurnal Pengabdian Masyarakat, 5(1), 378-385.

Cahyana, N., Rustiani, S., Djafar, S., & Nurdin, N. (2024). Literature Review: Lembar Kerja Peserta Didik (Lkpd) Matematika Berbasis Geogebra. Journal Of Education Research, 5(4), 4391-4399.

Darta, D. (2021). Peranan Representasi Dalam Pembelajaran Matematika Di Sekolah. Jurnal Symmetry, 2(2), 261-272.

Egita, D., & Indriani, R. (2024). Penerapan Aplikasi Geogebra Dalam Pembelajaran Geometri Untuk Meningkatkan Pemahaman Konsep Pada Siswa Sma. Journal Of Human And Education (Jahe), 4(5), 485-489.

Febrianti, D. A., Tambunan, E. E. B., Tarigan, G. H., Lestari, J. A., Tampubolon, S. T. V., & Siregar, B. H. (2024). Peningkatan Kemampuan Spasial Siswa Smp Negeri 17 Kelas Ix Melalui Penerapan Rme Berbantuan Media Interaktif Geogebra Pada Materi Transformasi Geometri. Jagomipa: Jurnal Pendidikan Matematika Dan Ipa, 4(3), 553-561.

Hamzah, N. A. H., & Hidayat, R. (2022). Peranan Perisian Geogebra Dalam Pendidikan Matematik: Sorotan Literatur Bersistematik. Jurnal Pendidikan Sains Dan Matematik Malaysia, 12(2), 24-38.

Jenita, J., Harefa, A. T., Pebriani, E., Hanafiah, H., Rukiyanto, B. A., & Sabur, F. (2023). Pemanfaatan Teknologi Dalam Menunjang Pembelajaran: Pelatihan Interaktif Dalam Meningkatkan Kualitas Pendidikan. Community Development Journal: Jurnal Pengabdian Masyarakat, 4(6), 13121-13129.

Kaharuddin, A., Arsyad, N., & Asdar, M. P. (2023). Media Hologram 3d Dalam Pembelajaran Geometri Untuk Meningkatkan Keterampilan Proses Sains. Pustaka Learning.

Kurniawan, A. A., Cahyaningsih, D., Sari, M., Ramadhaniyah, M., Yukans, S. S., Kurniadi, E., & Utari, R. S. (2024). Motivasi Belajar Siswa Gen-Alpha Dalam Pembelajaran Geometri Berbantuan Geogebra. Plusminus: Jurnal Pendidikan Matematika, 4(3), 521-532.

Luthfiyani, P. W., Rajab, K., & Masyhuri, M. (2025). Pendekatan Konstruktifisme Dalam Psikologi Belajar Berbasis Nilai-Nilai Islam. Hamalatul Qur'an: Jurnal Ilmu Ilmu Alqur'an, 6(1), 20-36.

Mailani, E., Pasaribu, E., Ketaren, M. A., Utami, N. D., Situmorang, N., & Simatupang, T. A. R. (2024). Kurva Geometri Dalam Pembelajaran Matematika Di Sekolah Dasar: Teori, Penerapan, Dan Pengembangan Model Pembelajaran. Jurnal Intelek Insan Cendikia, 1(9), 5414-5423.

Mursalin, M., Fonna, M., Elisyah, N., Ali, M., Armita, D., & Mursyidah, M. (2024). Pelatihan Penerapan Gamifikasi Dalam Pembelajaran Matematika Untuk Mahasiswa Calon Guru Smk. Jurnal Solusi Masyarakat Dikara, 4(1), 30-37.

Nasution, H. Q., Rahmah, K., Syafitri, N. M., & Simanullang, M. C. (2025). Kemampuan Pemahaman Konsep Deret Tak Hingga Menggunakan Augmented Reality Pada Aplikasi Geogebra Di Universitas Negeri Medan. Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 6(1), 352-360.

Nisa, M. R., & Fauzi, A. H. (2024, December). Pendekatan Pembelajaran Campuran Dalam Matematika: Integrasi Media Tradisional Dan Digital Pada Pengembangan Keterampilan Holistik. In Proceedings Of Annual Conference On Education (Vol. 1, No. 1, Pp. 243-252).

Numan, M., & Azka, R. (2023). Kesulitan Siswa Dalam Menyelesaikan Masalah Geometri. Polynom: Journal In Mathematics Education, 3(2), 49-55.

Prasetyo, R. B., & Meiliasari, M. (2025). Analisis Literatur Tentang Media Pembelajaran Berbasis Digital Dalam Meningkatkan Efektivitas Belajar Matematika. Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 6(1), 74-86.

Ramadannia, C., Nasrullah, A., Yendra, N., Sukmawati, S., & Ratnasari, S. (2024). Implementasi Geogebra Pada Numbered Head Together Terhadap Kemampuan

Pemecahan Masalah Matematis Dan Keaktifan Belajar Siswa Smp. Jpmi (Jurnal Pembelajaran Matematika Inovatif), 7(1), 261-272.

Schoenherr, J., Strohmaier, A. R., & Schukajlow, S. (2024). Learning With Visualizations Helps: A Meta-Analysis Of Visualization Interventions In Mathematics Education. Educational Research Review, 100639.

Subroto, D. E., Supriandi, S., Wirawan, R., & Rukmana, A. Y. (2023). Implementasi Teknologi Dalam Pembelajaran Di Era Digital: Tantangan Dan Peluang Bagi Dunia Pendidikan Di Indonesia. Jurnal Pendidikan West Science, 1(07), 473-480.

Susanti, A., Jainuri, M., & Asyhar, R. (2024). Transformasi Pendidikan Matematika Di Era Teknologi: Kajian Filsafat Tentang Implikasi Iptek. Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 5(3), 2214-2231.

Susilo, B. E., & Sutarto, H. (2023). Geometri: Manfaat, Pembelajaran Dan Kesulitan Belajarnya. Bookchapter Pendidikan Universitas Negeri Semarang, (6), 81-106.

Tambunan, M., Rais, H., & Agustini, D. A. R. (2024). Eksplorasi Kemungkinan Penggunaan Wolframalpha Sebagai Alat Bantu Pembelajaran Matematika Di Kalangan Mahasiswa Perguruan Tinggi. Studia Ulumina: Jurnal Kajian Pendidikan, 1(1), 32-43.

Tesalonika, B. B. G. M. (2024). Penerapan Model Project Based Learning (Pjbl) Berbantuan Aplikasi Quizizz Terhadap Pemahaman Matematis Siswa Sdn 255 Griya Bumi Antapani (Doctoral Dissertation, Fkip Unpas).

Zalfa, R. A., Ayuning, R. P., & Rustini, T. (2023). Pengembangan Spatial Literacy Untuk Meningkatkan Pembelajaran Geografi Di Sekolah Dasar. Dirasah: Jurnal Studi Ilmu Dan Manajemen Pendidikan Islam, 6(1), 173-182..