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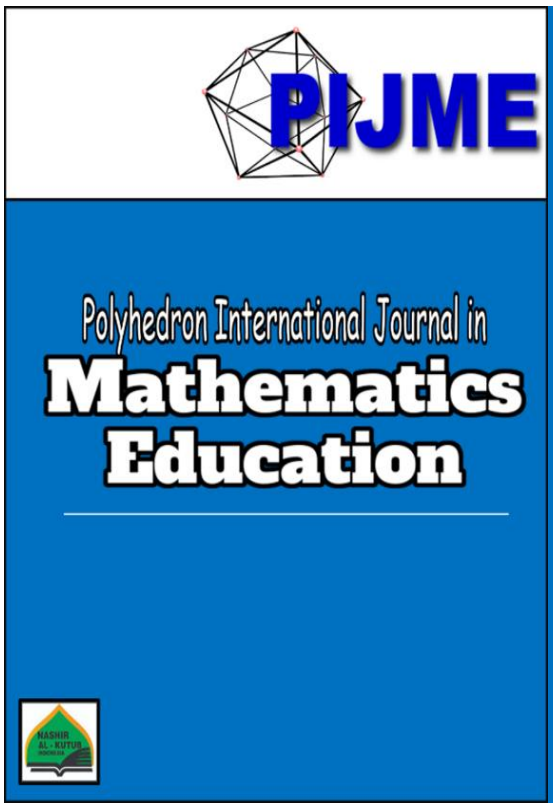

Utilization of GeoGebra software in mathematics learning: A literature systematic review

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Original Article

Utilization of GeoGebra software in mathematics learning: A Literature Systematic Review

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Abstract
The research aimed to investigate the utilization of GeoGebra software in mathematics education, focusing on how it is integrated into teaching and learning. Employing a systematic literature review method, this study synthesized findings from various academic sources. The results indicated several significant points regarding GeoGebra's application in education. First, GeoGebra software has been effectively used across various mathematical topics, including geometry, algebra, calculus, and other related areas. Its flexibility makes it a valuable tool for visualizing complex concepts and enhancing students' understanding. Second, the utilization of GeoGebra spans both high school and college levels, showing its wide acceptance in diverse educational settings. The software has proven beneficial for learners at different academic stages, allowing them to explore mathematical concepts interactively. Third, the use of GeoGebra has demonstrated positive impacts on students' learning outcomes. It enhances engagement, fosters better comprehension of abstract ideas, and significantly improves students' higher-order thinking skills, such as problem-solving, critical thinking, and creative reasoning. Furthermore, the study revealed that GeoGebra had been widely used in various regions of Indonesia, particularly in the western parts, indicating growing interest in integrating ICT tools in mathematics education. Teachers and educators in these regions have adopted the software to facilitate more dynamic and interactive learning environments. In conclusion, the findings of this study highlight the effectiveness of GeoGebra in improving students' learning outcomes and mathematical thinking skills. Its potential for fostering a deeper understanding of mathematics and enhancing cognitive abilities makes it a valuable resource for educators.

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1. Introduction

Problems in mathematics education are not only limited to low student activity and motivation but also encompass limitations in critical and analytical thinking skills. These challenges push educators

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to seek appropriate solutions to enhance the quality of learning, as traditional teaching methods often fail to engage students effectively (Supriyadi & Taban, 2024; Isnawan & Alsulami, 2024). One of the significant issues faced is the difficulty in making abstract mathematical concepts relatable and understandable (Fauzan et al., 2020). This challenge affects students' ability to fully comprehend and apply these concepts in real-life situations. Therefore, finding a solution that fosters student engagement and understanding is crucial. One of the promising approaches is utilizing digital technology, which can create a more interactive and engaging learning environment where students can actively participate and develop higher-order thinking skills (HOTS). By integrating technology, students are encouraged to explore, experiment, and think critically about mathematical concepts (Amaliah et al.,2020).

GeoGebra, as software that supports the visualization and exploration of mathematics, serves as an effective tool in addressing these challenges (Hidayatsyah, 2021; Kustiawati, 2017). It offers a dynamic platform where students can engage with mathematical concepts through visual representations, making abstract ideas more accessible. With its interactive features, GeoGebra allows students to manipulate geometric shapes, perform algebraic simulations, and solve various mathematical problems more intuitively (Abadi, 2020; Abadi & Hidayati, 2020). This hands-on approach not only makes learning more enjoyable but also helps students in retaining information better. Using GeoGebra helps students transform the way they view and understand abstract concepts, making them more concrete and easier to grasp (Annajmi, 2016). Moreover, GeoGebra promotes student-centered learning, where students can explore the material independently with minimal guidance from teachers, thus fostering learning autonomy (Ifanda et al., 2017; Tarsiyah, 2020). This self-directed learning approach is essential for developing critical thinking and problem-solving skills in students.

Another advantage of using GeoGebra in mathematics education is its flexibility, which can be accessed both online and offline (Alicie, 2018). This flexibility makes it adaptable to various learning environments, whether in a traditional classroom setting, during remote learning, or even as a supplemental tool for self-study. The software's accessibility across different platforms ensures that it can be utilized by students and teachers regardless of their location or technological infrastructure. This capability makes GeoGebra an excellent choice to support mathematics education at different levels, from secondary schools to universities (Fitriyani & Sugiman, 2014). Additionally, its user-friendly interface allows teachers and students to integrate the software into their learning processes without the need for extensive technical knowledge. This ensures that GeoGebra can be seamlessly adopted in both face-to-face and online learning environments, providing a versatile solution to enhance mathematics instruction.

Research conducted by Septian et al. (2023) shows that the use of GeoGebra significantly contributes to improving students' mathematical representation skills. This highlights that GeoGebra is not only a learning aid but also a tool that can transform how students think and deeply understand mathematics. By visualizing mathematical concepts, students can better comprehend the relationships between variables and processes, leading to improved cognitive abilities. This type of interactive learning is particularly beneficial for students who may struggle with traditional forms of instruction, as it offers them an alternative way to engage with the subject matter. As a result, GeoGebra has the potential to bridge gaps in understanding and promote a deeper, more meaningful learning experience.

As technology in education continues to advance, educators and researchers must keep exploring the potential of GeoGebra and similar software to enhance the quality of mathematics education. The questions raised in this study will help broaden the understanding of GeoGebra's role in mathematics learning and how this technology can be further optimized in the future. Furthermore, continuous research and development in this area can lead to innovations that improve both the teaching and learning experience, creating a more inclusive and effective educational environment for students of all learning styles.

2. Method

The method used in this research was the systematic literature review method. A systematic literature review is a research method and process carried out by identifying, critically assessing, collecting, and analyzing data from relevant research to gather empirical evidence to answer specific research questions or hypotheses (Snyder, 2019). In this study, the authors searched for articles on using

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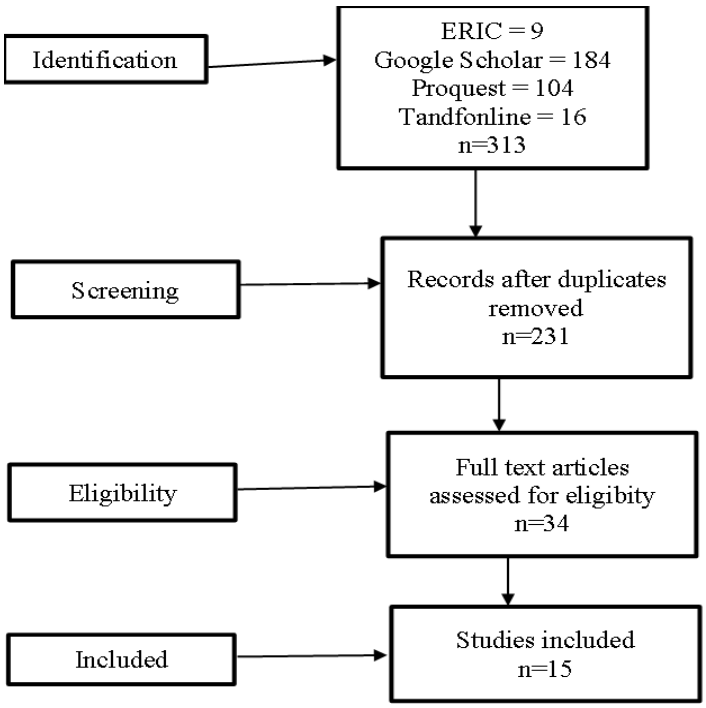
Geogebra in mathematics learning in the Neliti database, focusing on those published over the last 5 years, from 2020 to 2024. The process of searching for articles analyzed in this study is illustrated in the following Figure 1.

Figure 1
Preferred Reporting Items for Systematic Reviews and Meta-Analyses



The image presented is a flowchart illustrating the article selection process using the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) method, widely used in systematic literature review-based research. The flowchart outlines the steps from identification, screening, and eligibility assessment, to the final inclusion of studies for analysis. Below is a detailed explanation of each stage depicted in this diagram:

a). Identification

In this stage, literature searches were conducted across multiple databases. The diagram shows that a total of 313 articles were retrieved from four main sources:

- ERIC (9 articles)
- Google Scholar (184 articles)
- ProQuest (104 articles)
- Tandfonline (16 articles)

These articles were identified based on keywords relevant to the research topic. This step aims to gather as many potentially relevant articles as possible, without initially evaluating their suitability in detail. The result of this stage is an initial pool of 313 articles.

b). Screening

After gathering articles from various sources, the next step is to remove duplicate articles. Duplication occurs when the same article is found in multiple databases or when an article has been downloaded more than once during the search process. In this step, the number of articles is reduced from 313 to 231 after duplicates are removed. This screening step is crucial because duplicate articles can introduce bias in the analysis and lead to redundant information. This process ensures that each article considered for analysis is unique.

c). Eligibility Assessment

From the 231 remaining articles, only 34 were deemed eligible for further assessment. At this stage, articles are evaluated based on predefined inclusion and exclusion criteria. These criteria may include factors such as the type of study, the methodology used, the publication year, and the relevance of the topic to the research question. This eligibility assessment involves reading the abstracts, conclusions, or even the full text if necessary, to determine whether the article is truly relevant and suitable for analysis in the systematic literature review. In many cases, articles that are irrelevant or do not meet the criteria are excluded at this point.

d). Included Studies

After passing the eligibility assessment, only 15 articles from the 34 assessed were included in the final analysis. These articles represent the most relevant studies that met all the inclusion criteria set by the researchers. The included studies will be analyzed in-depth, either qualitatively or quantitatively, depending on the review methodology used.

3. Results and Discussion

The use of GeoGebra in mathematics education has seen a notable rise in recent years, as research continues to underscore the positive impact of educational technologies in the classroom. This is evident from a systematic review of 313 articles from the Neliti.com database that explored the role of GeoGebra in teaching mathematics. However, only 15 of these articles met the strict criteria for further analysis, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology, which is designed to ensure a high-quality review process. These selected studies provide a detailed and comprehensive insight into the diverse ways GeoGebra is being applied in educational contexts.

a. Distribution of Articles Based on Publication Year

The data shows a spike in publications related to GeoGebra usage in 2020, with 18 articles published during that year alone. This surge coincides with the onset of the COVID-19 pandemic, which disrupted traditional in-person teaching and forced a rapid shift to online and distance learning. GeoGebra became an essential tool for mathematics educators who needed to maintain engagement and teaching effectiveness in virtual classrooms. Its ability to create interactive, dynamic, and visually engaging lessons made it a go-to choice during this period of global educational upheaval.

The pandemic undeniably acted as a catalyst for the broader adoption of educational technologies. Teachers who had relied on face-to-face instruction were suddenly required to pivot to alternative methods that could still deliver high-quality education remotely. GeoGebra, with its intuitive interface and capability to integrate various branches of mathematics such as geometry, algebra, calculus, and statistics, quickly became a popular option for educators. Its ability to visually represent complex mathematical concepts interactively allowed teachers to continue delivering effective lessons in an online environment, contributing to its widespread use (Mutiarawati et al., 2019).

b). Impact of Technological and Informational Advancements on GeoGebra Utilization

The increasing use of GeoGebra during and after the pandemic is part of a larger trend of technological advancements reshaping education. As noted by Nurhayati et al. (2021), the integration of technology into teaching practices has revolutionized how mathematics is taught and learned. GeoGebra exemplifies this trend by offering an interactive platform that allows students and teachers to visualize and manipulate abstract mathematical concepts in real-time. This multisensory approach to learning caters to diverse learning styles and fosters a deeper understanding of mathematics.

GeoGebra's integration also aligns with global educational reforms focused on promoting 21st-century skills such as critical thinking, problem-solving, and creativity. Educational policymakers worldwide recognize the need to equip students with these skills to navigate an increasingly technology-driven world. GeoGebra supports these objectives by encouraging students to explore and engage with mathematical ideas in ways that promote critical thinking and higher-order thinking skills (HOTS). It provides a space where students can interactively investigate mathematical relationships, thus deepening their conceptual understanding.

c). Utilization of GeoGebra Across Educational Levels

GeoGebra's versatility makes it suitable for a wide range of educational levels, from junior high school to university settings. While much of the literature focuses on GeoGebra's application in teaching

geometry and algebra, the software's capabilities extend to other areas such as calculus, trigonometry, and statistics. This flexibility positions GeoGebra as a valuable tool for teaching a wide variety of mathematical concepts across different levels of complexity.

A major advantage of GeoGebra is its capacity to facilitate interactive learning. It enables students to manipulate shapes, equations, and visual transformations, making abstract concepts more accessible and understandable. By allowing students to experiment and observe mathematical relationships firsthand, GeoGebra promotes active learning and deeper engagement with mathematical principles. This dynamic interaction is key to helping students develop a more intuitive grasp of complex mathematical concepts.

d). Benefits of GeoGebra in Mathematics Education

Multiple studies have highlighted the benefits of using GeoGebra in mathematics education. Dwijayani (2020) reports that GeoGebra enhances students' learning outcomes, improves problem-solving skills, and boosts both motivation and interest in mathematics. It also helps students communicate their understanding of mathematical concepts more effectively by allowing them to visualize and articulate these ideas clearly.

A significant benefit of GeoGebra is its support for the development of higher-order thinking skills (HOTS) such as analysis, evaluation, and synthesis. These skills are crucial for solving more advanced mathematical problems and for fostering a deeper understanding of the subject. By providing students with opportunities to interactively explore mathematical concepts, GeoGebra encourages critical thinking and helps students approach problems from multiple perspectives.

Moreover, GeoGebra has been shown to improve students' problem-solving abilities. The software allows students to break down complex mathematical problems into more manageable parts, facilitating better understanding and more effective problem-solving strategies (Maisyrah et al., 2019). This not only enhances students' mathematical abilities but also builds their confidence in tackling difficult tasks, reinforcing their overall learning experience.

e). GeoGebra's Role in Enhancing Learning Outcomes

One of the most profound impacts of GeoGebra in education is its ability to improve student learning outcomes. Several studies indicate that students who use GeoGebra in their lessons perform better in mathematics, particularly in subjects such as geometry and algebra. The software's dynamic visualizations make abstract concepts more concrete, leading to improved comprehension and higher academic achievement.

GeoGebra also ensures completeness in learning by promoting a deeper understanding of mathematical concepts beyond rote memorization or surface-level learning (Marika et al., 2019). Students are encouraged to actively engage with the material, leading to a more thorough understanding of mathematical principles. For instance, in geometry, students can manipulate shapes and observe the outcomes of transformations, allowing them to grasp concepts that might be difficult to understand through traditional teaching methods alone (Nuritha & Tsurayya, 2021).

In addition to fostering understanding, GeoGebra encourages students to develop higher-level thinking skills, which are essential not only for academic success but also for real-world problem-solving (Muqtada et al., 2018). By challenging students to apply mathematical concepts in new and creative ways, GeoGebra helps students build the cognitive tools necessary for tackling complex problems and understanding intricate mathematical relationships.

f). Recommendations for Educators

Given the demonstrated benefits of GeoGebra in mathematics education, it is strongly recommended that educators at all levels—elementary, secondary, and tertiary—incorporate the software into their teaching practices. According to Nasution et al. (2022), GeoGebra makes mathematics more engaging and interactive, which helps keep students motivated and interested in the subject.

GeoGebra also offers teachers the flexibility to tailor their instruction to the specific needs and abilities of their students. The software can be used to create personalized learning experiences that accommodate different learning styles and skill levels. This adaptability is especially beneficial in diverse classrooms, where students may have varying levels of proficiency in mathematics or different preferences for how they engage with the material.

By integrating GeoGebra into their lessons, educators can provide students with a dynamic, visually stimulating, and interactive learning environment that fosters deeper understanding and higher-order thinking. As education continues to evolve, tools like GeoGebra will play an increasingly important role in helping students develop the skills they need to succeed in the 21st century.

g). GeoGebra's Role in Fostering Equity in Education

An additional benefit of GeoGebra is its potential to promote equity in education. Since the software is free and accessible to anyone with an internet connection, it helps bridge the gap between students in under-resourced schools and those with more access to educational technologies. By providing all students with the opportunity to engage with advanced mathematical tools, GeoGebra helps level the playing field and supports the development of mathematical skills in a wider population.

The accessibility of GeoGebra has also contributed to its global spread, with teachers and students around the world using the software to enhance their mathematics education. This widespread adoption demonstrates GeoGebra's versatility and appeal as a tool that can support diverse educational needs and contexts.

4. Conclusion

There have been many studies and publications on the use of Geogebra software in learning mathematics. Geogebra software can be utilized or used especially in Geometry and Algebra materials and other materials. The utilization of Geogebra software has been widely done both at the high school and college levels. However, it has not been utilized for elementary school level. In addition to improving learning outcomes and learning completeness, Geogebra utilization can also improve students' higher order thinking skills (HOTS). Geogebra software has been utilized in various regions in Indonesia, especially Western Indonesia. For Central and Eastern Indonesia, Geogebra software is still rarely used in learning mathematics. Furthermore, the development of Geogebra software in learning mathematics has been widely carried out. Therefore, the use of Geogebra software in learning mathematics is highly recommended.

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Declarations

Author contributions: Author 1: wrote, looked for references, and prepared research questions; Writer 2: Write and look for references about research methods; Author 3: Provide input on research and review and validation

Conflict of Interest:

The authors declare no conflict of interest.

Additional Information

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5. References

Abadi, M. K. (2020). Respon Mahasiswa Terhadap Pemanfaatan Aplikasi Geogebra pada Materi Aplikasi Integral. *Jurnal Pendidikan Matematika, 3*(1), 34–45. https://doi.org/10.21043/jpm.v3i1.7154

Abadi, M. K., & Hidayanti, N. (2020). Pengembangan Modul Integral Menggunakan Geogebra berbasis revolusi 4.0. *Jurnal Didactical Mathematics, 2*(3), 128–136. https://media.neliti.com/media/publications/453758-none-08a9d2e0.pdf

Alicea, A. (2018). Pengembangan Video Pembelajaran Berbasis Kontekstual Berbantu Prezi Dan Geogebra Pokok Bahasan Segitiga Dan Segiempat Di SMP. *AKSIOMA : Jurnal Matematika dan Pendidikan Matematika, 7*(2), 32–40. https://doi.org/10.26877/aks.v7i2.1417

Amaliah, R., Rahmawati, R., & Nasir, A. M. (2020). Pengaruh Pembelajaran Berbasis Information and Communication Technology (ICT) terhadap Hasil Belajar Geometri Peserta Didik Kelas X SMK Kebangsaan Indonesia Maros. *Equals*, *3*(2), 101–112. https://doi.org/10.46918/equals.v3i2.758

Annajmi. (2016). Peningkatan Kemampuan Representasi Matematik Siswa SMP Melalui Metode Penemuan Terbimbing Berbantuan Software Geogebra Di SMP N 25 Pekanbaru. *Jurnal Ilmiah Edu Research*, *5*(2), 67–74. https://e-journal.upp.ac.id/index.php/EDU/article/view/1199/pdf_44

Dwijayani, N. M. (2020). Meningkatkan Kemampuan Pemecahan Masalah Mahasiswa dengan Menggunakan Geogebra. Jurnal Pendidikan Matematika, 11(1), 110–116. http://ojs.uho.ac.id/index.php/jpm

Fahmi, A., Syahputra, E., & Rajagukguk, W. R. (2017). Model Pembelajaran Berbasis Masalah Berbantuan Geogebra Di Kelas Viii Smp N 1 Samudera. *Jurnal Paradikma, 10*(2), 27–39. https://doi.org/10.24114/paradikma.v10i3.8987

Fauzan, G. A., Agina, S., & Setiawan, W. (2020). Analisis Kemampuan dan Kesulitan dalam Menyelesaikan Soal Berpikir Logis Matematik Siswa SMP dengan Penggunaan Geogebra. *Jurnal Cendekia : Jurnal Pendidikan Matematika, 4*(1), 53–63. https://doi.org/10.31004/cendekia.v4i1.169

Fitriyani, W., & Sugiman. (2014). Pengembangan Perangkat Pembelajaran Teorema Pythagoras Dengan Pendekatan Ideal Berbantuan Geogebra. *Jurnal Riset Pendidikan Matematika, 1*(2), 268–283.

Hidayatsyah, H. (2021). Kemampuan Pemecahan Masalah Siswa Menggunakan Model Problem Based Learning Berbantuan Geogebra. *Jurnal Cendekia : Jurnal Pendidikan Matematika, 5*(1), 458–470. https://doi.org/10.31004/cendekia.v5i1.534

Ifanda, A. R., Sugiarni, R., Sugiarni, E., & Muharromah, N. N. (2017). Meningkatkan Kemampuan Spasial Matematis Siswa Dengan Pendekatan Saintifik Berbantuan Geogebra di Lingkungan Pesantren. *UNION: Jurnal Ilmiah Pendidikan Matematika, 5*(3), 219–228. https://doi.org/10.30738/.v5i3.1217

Isnawan, M. G., & Alsulami, N. M. (2024). Didactical design for online learning in ordering fractions. *International Journal of Didactic Mathematics in Distance Education*, *1*(1), 1–12. https://doi.org/10.33830/ijdmde.v1i1.7653

Kustiawati, D. (2017). Pembelajaran Geometri Berbantuan Software Geogebra Terhadap Kemampuan Komunikasi Matematik Siswa. *JIPMat, 1*(2), 113–120. https://doi.org/10.26877/jipmat.v1i2.1237

Maisyrah, Syahputra, E., & Mulyono. (2019). Pengembangan Media Pembelajaran Matematika Berbasis Problem Based Learning Berbantuan Geogebra untuk Meningkatkan Kemampuan Berpikir Kreatif dan Disposisi Matematis Siswa. *Jurnal Pendidikan Matematika, 12*(2), 28–38. http://digilib.unimed.ac.id/id/eprint/38888

Mandailina, V., Al Musthafa, S., & Pramita, D. (2016). Kombinasi Media Delphi dan Geogebra Dalam Pembelajaran Dimensi Tiga. *Paedagoria, 14(*2), 65–72. https://doi.org/10.31764/paedagoria.v7i2.32

Marika, D. O., Haji, S., & Herawaty, D. (2019). Pengembangan Bahan Ajar dengan Pendekatan Pembelajaran Santifik Berbantuan Geogebra Untuk Meningkatkan Kemampuan Spasial. *Jurnal Pendidikan Matematika Raflesia*, *4*(2), 153–163. https://ejournal.unib.ac.id/index.php/jpmr/article/view/9777/4807

Muqtada, M. R., Irawati, S., & Qohar, A. (2018). Reciprocal Teaching assisted by GeoGebra to Improve Students Mathematical Communication. *Jurnal Pendidikan Sains*, *6*(4), 100–109. http://journal.um.ac.id/index.php/jps/article/view/11803

Mutiarawati, I. S., Supandi, S., & Rahmawati, N. D. (2019). Efektivitas Model Pembelajaran CPS Berbantuan Media Geogebra terhadap Kemampuan Pemecahan Masalah Matematis. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika, 1*(4), 24–29. https://doi.org/10.26877/imajiner.v1i4.3849

Nasution, A. U., Syahputra, E., & Ahyaningsih, F. (2022). Pengembangan Model Pembelajaran Berbasis Matematika Realistik Berbantuan GeoGebra Untuk Meningkatkan Kemampuan Pemecahan

Masalah Matematis Siswa SMP Al Azhar Medan. *Didactical Mathematics*, *6*(2), 1623–1635. https://doi.org/10.31949/dm.v4i1.2362

Novilanti, F. R. E., & Suripah, S. (2021). Alternatif Pembelajaran Geometri Berbantuan Software GeoGebra di Masa Pandemi Covid-19. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(1), 357–367. https://doi.org/10.31004/cendekia.v5i1.538

Nurhayati, N., Zuhra, F., & Salehha, O. P. (2021). Penerapan Model Pembelajaran Project Based Learning Berbantuan Geogebra Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Pendidikan Matematika (Jupitek)*, *4*(2), 73–78. https://doi.org/10.30598/jupitekvol4iss2pp73-78

Nuritha, C., & Tsurayya, A. (2021). Pengembangan Video Pembelajaran Berbantuan Geogebra untuk Meningkatkan Kemandirian Belajar Siswa. *Jurnal Cendekia : Jurnal Pendidikan Matematika, 5*(1), 48–64. https://doi.org/10.31004/cendekia.v5i1.430

Sudirman, S., & Susandi, A. D. Geometry Representation Abilities: What is The Impact of Using The 6E-Instructional Model Integrated with Augmented Reality?. *PAEDAGOGIA*, *27*(1), 52-62. https://doi.org/10.20961/paedagogia.v27i1.83957

Supriyadi, E., & Taban, J. G. (2024). Knowledge mapping of Computational Thinking and Science, Technology, Engineering, and Mathematics (CT+STEM). *International Journal of Didactic Mathematics in Distance Education*, *1*(1), 24–36. https://doi.org/10.33830/ijdmde.v1i1.7599

Tarsiyah. (2020). Upaya Mempertahankan Hasil Belajar Matematika Siswa Kelas VIII SMP Negeri 1 Pandaan Dengan Memanfaatkan Aplikasi Geogebra Selama Pandemi Covid-19 Tahun Ajaran 2019 / 2020. *LIKHITAPRAJNA: Jurnal Ilmiah*, 22(2), 102-112.