Prima Magistra: Jurnal Ilmiah Kependidikan
Volume 7 – Number 3, July 2026, pp 556-565
https://doi.org/10.37478/jpm.v7i3.5758
Open Access: https://e-journal.uniflor.ac.id/index.php/JPM/article/view/5758

ISSN 2721-8112 (print)
ISSN 2722-4899 (online)

GEOGEBRA IN ACTION: ENHANCING PROBLEM SOLVING IN ALGEBRA THROUGH DYNAMIC MATHEMATICS SOFTWARE

Naharia Safitri[1], Ali Shodikin[2]*, Ismail[3]
[1,2,3,4]Universitas Negeri Surabaya, Surabaya, Indonesia
*Corresponding Author: alishodikin@unesa.ac.id

Article History
Received : 15/06/2025
Revised : 12/10/2025
Accepted : 01/01/2026
Keywords:
Mathematics, GeoGebra, Algebra, Problem-solving, Pólya stages.

Abstract. Mathematics learning in junior high schools often faces challenges in developing algebraic problem-solving skills because the concepts are abstract and symbolic. This study investigates the impact of GeoGebra on junior high school students' algebraic problem-solving skills, analyzed through Polya's problem-solving stages. The research method used is qualitative with a case study approach on two eighth-grade students. Data were collected through observations, interviews, and analysis of student work documents, both before and after using GeoGebra. The results showed that with conventional methods, students could solve the problem correctly, but only part of the Polya stages were achieved and the rest were not written in full. Meanwhile, the use of GeoGebra allows students to display all stages of Polya in a more systematic and structured manner, from understanding the problem to re-examining the solution. GeoGebra also provides visualization in the form of images, which increases student engagement and understanding of algebraic concepts. Thus, GeoGebra effectively improved junior high school students' problem-solving skills.

How to Cite: Safitri, N., Shodikin, A., & Ismail, I. (2026). GEOGEBRA IN ACTION: ENHANCING PROBLEM SOLVING IN ALGEBRA THROUGH DYNAMIC MATHEMATICS SOFTWARE. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 7(3), 556-565. https://doi.org/10.37478/jpm.v7i3.5758

Correspondence address:
Jl. Ketintang, Ketintang, Kec. Gayungan, Kota Surabaya.
alishodikin@unesa.ac.id

Publisher:
Program Studi PGSD Universitas Flores. Jln. Samratulangi, Kelurahan Paupire, Ende, Flores.
primagistrauniflor@gmail.com

INTRODUCTION

Mathematics learning with interactive software has increased in recent years (Aliu et al., 2025; Istikomah et al., 2024; Ndagijimana et al., 2024). One software that is quite popular among educators and researchers is GeoGebra. Students can investigate mathematical ideas graphically and interactively with GeoGebra, a learning tool that integrates aspects of geometry, algebra, and calculus into one platform (Louise et al., 2024; Martínez-Miraval et al., 2024). This technology has enhanced students' comprehension of mathematical subjects, such as linear equations and analytical geometry, by providing more tangible visual representations (Haspekian et al., 2024; Lindenbauer et al., 2024; Listiani et al., 2024; Nasrullah et al., 2025).

Algebra is a fundamental branch of mathematics that is essential for understanding complex concepts in various fields of science. However, due to the symbolic and abstract nature of algebra, many junior high school students still struggle to understand its concepts (Aliu et al., 2025; Rosyidi et al., 2024). This has an impact on students' ability to solve mathematics problems related to algebra (Batiibwe, 2024; Bouanfir et al., 2024; Moukhliss et al., 2023). Several studies show that conventional learning methods, such as practice questions and lectures, tend to be ineffective in creating meaningful understanding, especially in the context of problem-solving and critical thinking (Carriazo-Regino et al., 2024; Lo et al., 2024; Türkoğlu & Yalçınalp, 2024).

In addition to improving students' mathematical visualization, GeoGebra aids their critical thinking process by exploring problem-solving strategies (Barros et al., 2024; Kramarenko et al., 2024; Louise et al., 2024). Furthermore, GeoGebra also allows students to build connections between algebraic concepts and visual representations, and enables them to use simulations to double-check their answers (D'Azevedo Breda et al., 2024; Jiménez-Vilcherrez et al., 2023).

Studies conducted by Louise et al. (2024) and Yerizon et al. (2023) show that exploratory learning using GeoGebra in junior high school can help students become more actively involved in finding solutions to problems. Furthermore, research Arbain & Shukor (2015), Baye et al. (2021), Caligaris et al. (2015), Louise et al. (2024), and Reis & Ozdemir (2010) shows that GeoGebra helps students learn deep visual reasoning when solving mathematical problems.

Although many studies have examined the usefulness of GeoGebra in mathematics learning, few studies have specifically investigated how GeoGebra can help junior high school students solve algebraic problems based on Polya's critical thinking stages.

Previous studies have shown that GeoGebra aids mathematics learning. Khoeriah et al. (2024) found that using GeoGebra in problem-based learning worksheets can improve students' problem-solving skills and metacognitive awareness. In addition, it was found that the use of GeoGebra interactive media helped students solve story-based math problems related to systems of equations (Farihah et al., 2022). Similarly, there is evidence that GeoGebra can improve students' problem-solving skills and learning independence through guided discovery learning (Hadi & Faradillah, 2022). Several international studies support these findings, showing that GeoGebra improves students' understanding of mathematical concepts and higher-order thinking skills (Carriazo-Regino et al., 2024; Misrom et al., 2020). However, most studies focus on high school or geometry, with few discussing the use of GeoGebra in algebra learning in junior high school.

The purpose of this study is to address this gap by expanding the use of GeoGebra in algebra learning and examining how it impacts students' problem-solving skills and learning outcomes in junior high school. Therefore, this study aims to investigate how the use of GeoGebra can help students understand algebraic concepts and improve their problem-solving skills, as well as compare its effectiveness with conventional methods. Specifically, this study aims to: (1) examine how GeoGebra can improve students' ability to solve algebraic problems, and (2) compare students' learning outcomes before and after using GeoGebra.

RESEARCH METHODS

This research uses a qualitative approach with a case study research type. This type was chosen because researchers wanted to obtain authentic, in-depth, and detailed data about students' thought processes in solving algebra problems using GeoGebra and conventional methods. Through a qualitative approach, all facts, both oral and written, obtained from observable sources and other related documents, are then described as they are, studied, and presented concisely to answer research questions. The subjects in this study were two students in one of Surabaya's junior high schools who were studying algebraic material. The selection of subjects was carried out by purposive sampling, which is based on the criteria that students already have a basic understanding of algebra and have access to GeoGebra. Although limited in scope, the in-depth analysis of two purposively selected students enabled detailed observation of problem-solving behaviors with and without GeoGebra support.

This study used observation and interviews as data collection methods. Data analysis was conducted through thematic analysis, which identified students' critical thinking processes when solving algebra problems based on Polya's stages (Purnomo et al., 2024), both before and after using GeoGebra. The tools used included interview guidelines, observation, and document analysis the interview guide aimed to see how students used GeoGebra and compare it with conventional methods. Observation was used to see how students used GeoGebra to understand algebraic concepts and compare it with conventional methods. In addition, the researcher analyzed students' work based on Polya's stages to evaluate and assess their answers before and after using GeoGebra. The goal is to determine whether the problem-solving process carried out by students is in accordance with Polya's stages or not. In addition, it aims to compare how students solve problems using and without GeoGebra. Based on the data collected, this study will identify how students' critical thinking skills improve when using GeoGebra to solve algebra problems and compare this method with the conventional methods they usually use.

RESULTS AND DISCUSSION

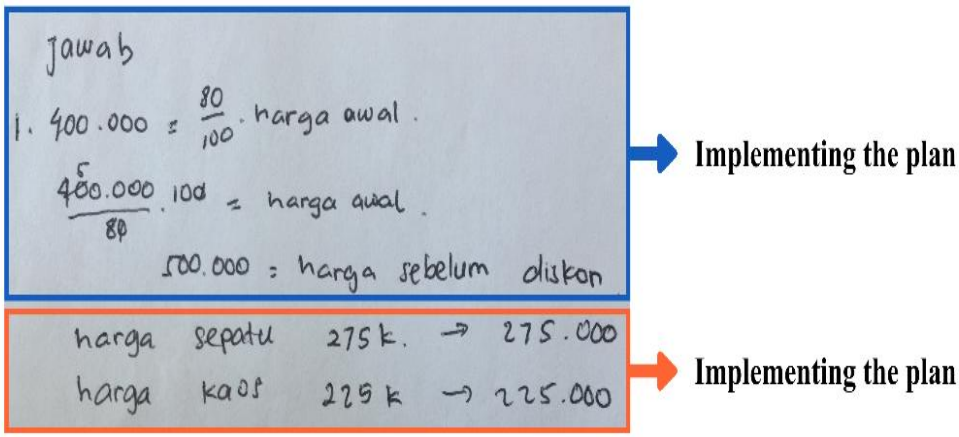
Critical thinking skills are the ability that students have to use various ways or solutions in solving problems, including math problems. In this activity, students are asked to solve algebraic problems related to calculating prices. This activity is often done by students without realizing it when buying discounted items or bundled packages. The following are problems answered by

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

students using conventional methods and with the help of Geogebra, which are then analyzed based on the solution steps:

> A store gives a 20% discount on all items. Tika bought two items, namely shoes and T-shirts, whose prices before the discount were x and y rupiah. The amount paid after the discount is Rp400,000. In addition, the price before the discount for the shoes is Rp50,000 more expensive than the T-shirt. What was the price of shoes and shirts before the discount?

1. Problem-Solving without Using Geogebra



$$400000 = \frac{80}{100} \cdot price\ before\ discount$$

$$\frac{400000 \cdot 100}{80} = price\ before\ discount$$

$$500000 = price\ before\ discount$$

$$price\ of\ one\ t-shirt = 225000$$

$$the\ price\ of\ one\ shoe = 275000$$

Figure 1. The results of student work with the initials ADR

In Figure 1, students do not reach the first stage of Polya's problem-solving model, namely understanding the problem. Students do not write down important information presented in the problem and do not mention what is known or asked. Students also do not develop problem-solving plans or strategies such as modeling or mathematical modeling. Although students do not reach the Polya stages of understanding the problem and planning the solution, students can still solve the problem. This means that students only reach the Polya stage of implementing the plan but with an unwritten plan. Students also do not re-examine the results obtained, so the Polya stage of checking back has not been achieved. During an interview with ADR students after working on problems without using GeoGebra, the student explained his thought process as follows.

Researcher : "How did you find the result that the price of the shirt before the discount was 225000 and the shoes before the discount was 275000?"
ADR : "I tried. 500000 is 250000 if divided by two. Now if the shoes are 50 thousand more expensive than the shirts, then the price of the shoes is 275000 and the shirts are 225000."
Researcher : "Are you sure about your answer?"
ADR : "I'm sure it's correct."
Researcher : "Why?"
ADR : "Because if you add 275000 and 225000, the result is 500000 and if you discount

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

it by 20 percent, it becomes 400000."

Polya's stages of understanding the problem, planning the solution, and checking back were only revealed through interviews.

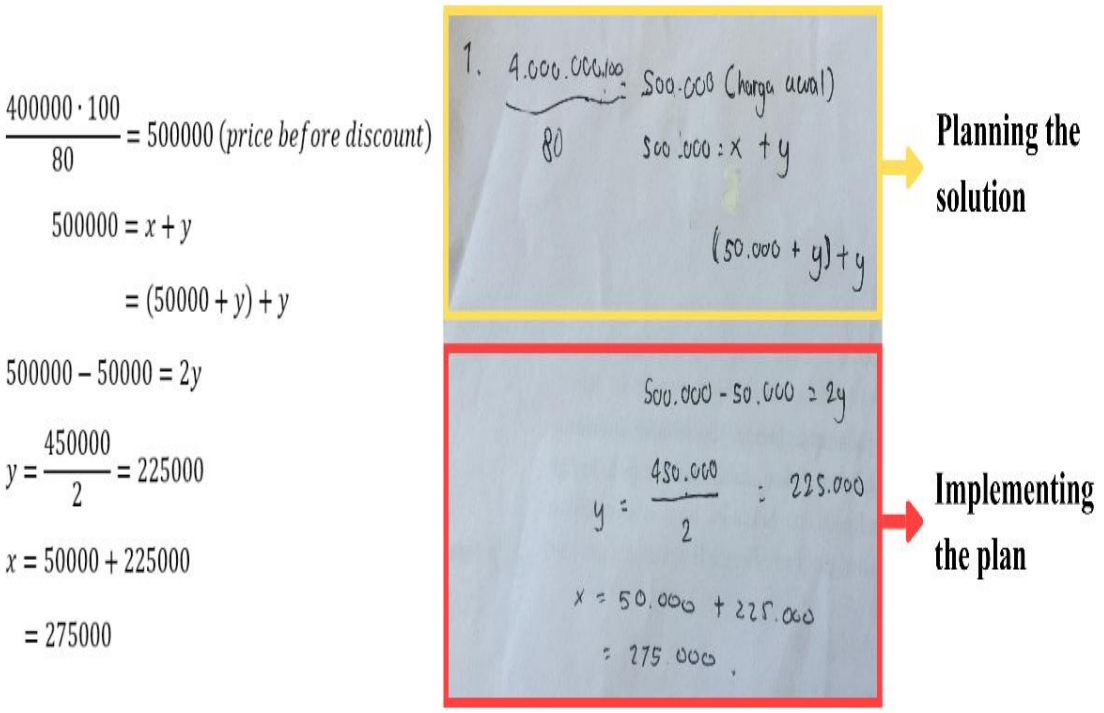


Figure 2. Results of student work with initials PIJ

In student PIJ's work in Figure 2, it can be seen that Polya's stage of understanding the problem has not been achieved. This is because the student did not write down the important information given about the problem. Students also do not include known or asked. For the second Polya stage, namely planning the student's strategy, it has been partially achieved by memorizing x and y. However, it is not clear what x is and what y is. However, it is not clear what x is and what y is because it is not written explicitly. From the planning of the strategy, students can carry out the plan at the third Polya stage properly and correctly so that this stage has been achieved. However, PIJ students also did not include the last Polya stage, namely checking back. During the interview with PIJ students, the following questions were answered.

Researcher : "How did you find the results of 225000 and 275000?"
PIJ : "As known in the problem, I suppose x is the initial price of the shoes and y is the initial price of the shirt before the discount. Because shoes are 50000 more expensive than shirts, I wrote y + 50000 for shoes and y for shirts, I added them up so that I got 2y + 50000 and y is 225000. To find the value of x I added the results of y and 50000 to get x is 275000."
Researcher : "Are you sure about your answer?"
PIJ : "Yes, I am sure."
Researcher : "How can you be sure of the results you have obtained?"
PIJ : "275000 when added with 225000 is 500000. 20% of 500000 is 100000. means the discounted price of shoes and shirts is 500000-100000 = 400000. In accordance with what is known."

The stages of understanding the problem, planning the solution and checking back were only revealed during the interview. Including the x and y memorization which is not explicitly written on the answer sheet.

2. Solution Using Geogebra

After students work on problems without using GeoGebra, they are asked to work with GeoGebra. The initial appearance of GeoGebra is as shown in Figure 3.

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

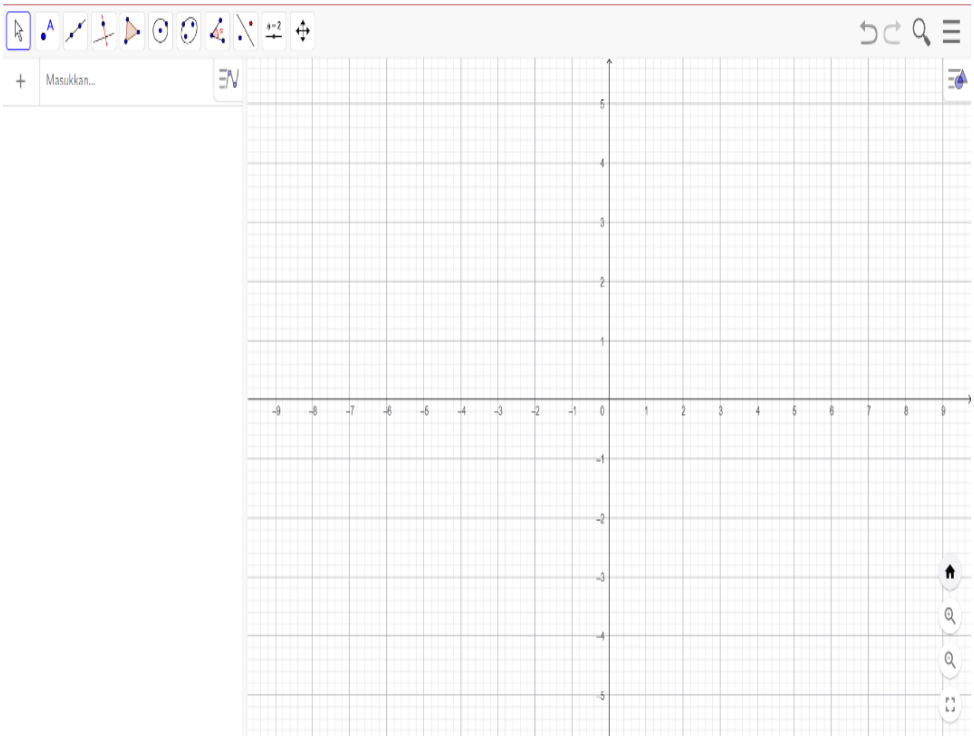


Figure 3. Geogebra Initial Display

First, they wrote down important information from the given problem such as known and asked using text features as shown in Figure 4. This step reflects the first Polya stage, namely understanding the problem.

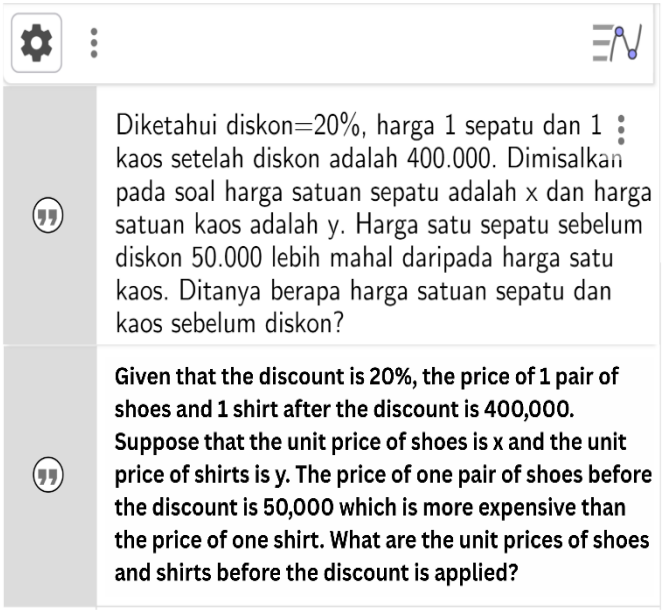


Figure 4. Understanding the problem

Next, students modeled the problem using the mathematical equation 80% (x + y) = 400,000, which describes the total price of shoes and shirts after a 20% discount. This equation is then visualized as a graph using GeoGebra. With the line representation of the model, students can see the intersection point on the x-axis and y-axis that shows the total price before the discount, as shown in Figure 5.

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

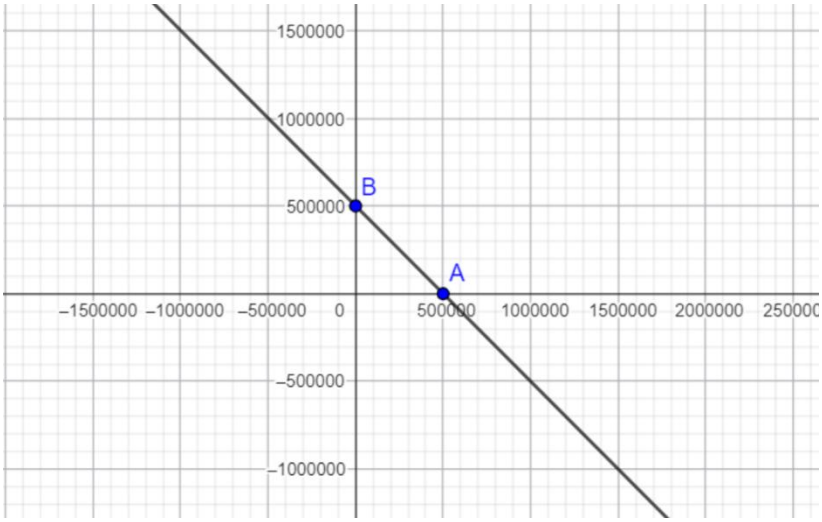


Figure 5. Planning a solution and Implementing the plan

To develop the next strategy, students modeled the relationship between the price of shoes and shirts with the equation x = y + 50000. The two equations are visualized and the intersection point is identified using GeoGebra's intersection point feature as shown in Figure 6. This intersection point gives the value C(275000,225000) which means x = 275000 and y = 225000. So the price of the shoes is Rp275,000 and the cost of the T-shirts is Rp225,000 before the discount. This shows the stages of planning and executing the strategy.

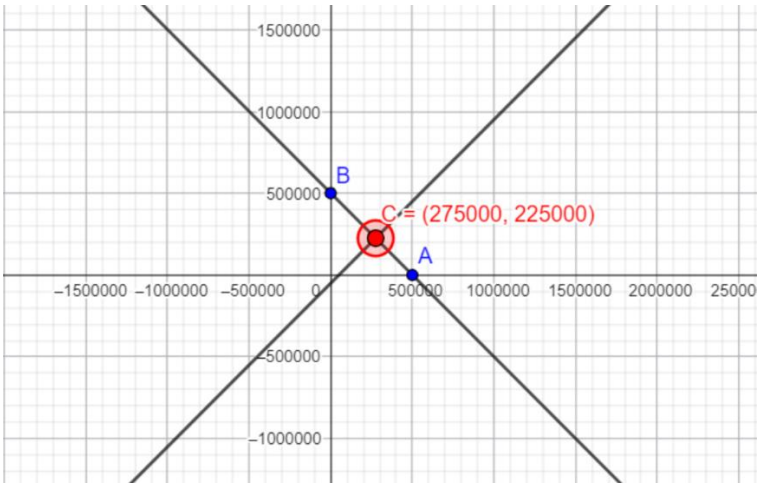


Figure 6. Planning a solution and Implementing the plan

As a rechecking stage, students use the input feature in GeoGebra as shown in Figure 7, input a = 275000+225000 with a is the initial price. Then input b = 20% a with b as the discount value. Then input c = a - b with c as the price of shoes and shirts after the discount. We get c = 400000 which is the same as known in the problem. So it can be concluded that the solution of the price of shoes before discount = 275000 and the price of t-shirts before discount = 225000 is correct.

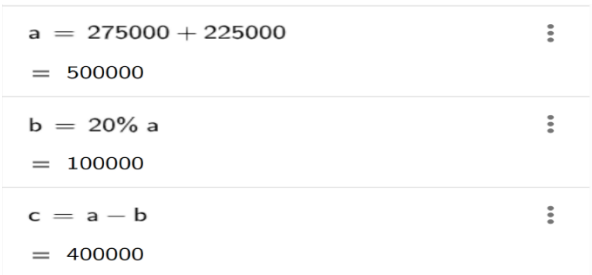


Figure 7. Rechecking the answer

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

With the help of GeoGebra, all stages of Polya are facilitated in a structured manner starting from understanding the problem, planning a solution, implementing the plan, to checking back shown in Figure 8.

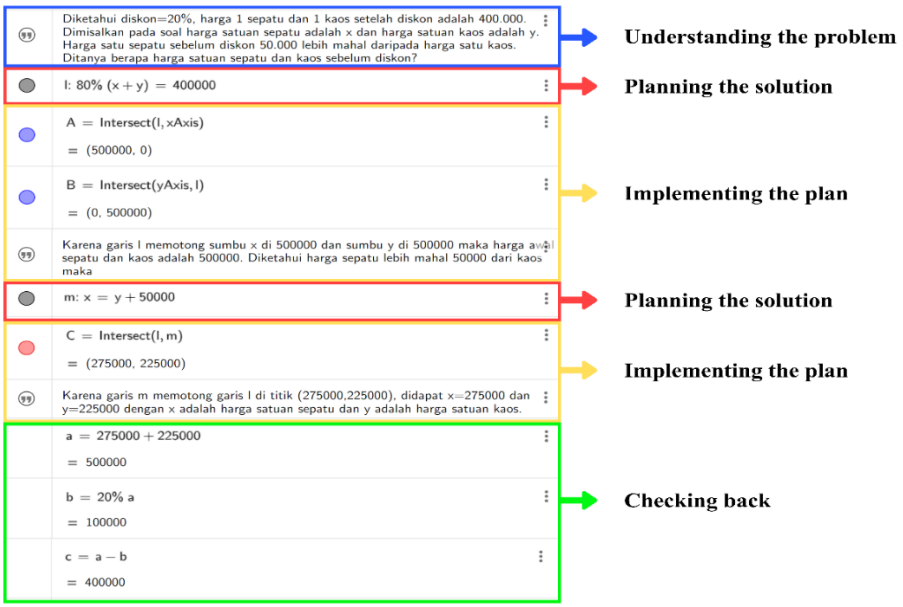


Figure 8. Identification of Polya's stages in solving using Geogebra

When students were allowed to solve the same problem using geogebra, they showed high enthusiasm and were more interested in following the solution steps. During the interview after using geogebra, PIJ students explained that with the help of GeoGebra, it is easier because it is less dizzy to calculate and can be seen from the intersection line and the intersection point after the mathematical modeling is entered into GeoGebra.

3. Comparison of Conventional and Geogebra-Assisted Methods

Based on these two methods, it can be seen that both conventional and Geogebra-assisted methods equally direct students to solve problems correctly. To compare student learning outcomes at each Polya stage before and after using GeoGebra, the following is the achievement of Polya's stages by two subjects (ADR and PIJ) presented in Table 1.

Table 1. Achievement of Polya's stages

Polya's Stages	ADR (Conventional)	PIJ (Conventional)	ADR and PIJ (GeoGebra)
Understanding the Problem	not achieved	not achieved	reached
Planning a solution	not achieved	reached	reached
Implementing the Plan	reached	reached	reached
Rechecking the answer	not achieved	not achieved	reached

The table shows that GeoGebra helps both subjects achieve all four stages of Polya's problem-solving process. Students typically focus only on calculations and ignore the initial stages, such as understanding the problem and planning a strategy, when working on problems. However, when using GeoGebra, both students can record important information, create mathematical modeling strategies, and verify their answers with visualizations and automatic calculations.

These results support research by Aliu et al. (2025), Arbain & Shukor (2015), Farihah et al. (2022), and Misrom et al. (2020), which emphasizes that GeoGebra is better than conventional methods for helping students understand mathematical concepts. Furthermore, these results support research by Barros et al. (2024), Batiibwe (2024), Bouanfir et al. (2024), and Listiani et al. (2024), which shows that students can construct more structured solutions visually by using algebraic properties in GeoGebra. In line with these findings, this study shows how students can

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

track strategies and solutions with the help of graphical visualizations and intersection points in GeoGebra, which indicates that GeoGebra helps develop students' visual reasoning through the exploration of graphical representations. With GeoGebra, students find it easier to find solutions and track steps.

This study has the advantage of combining observation, interview, and document analysis techniques to obtain a comprehensive picture of students' thinking processes. In addition, GeoGebra proved to be an effective tool in supporting problem-solving-based learning in junior high schools, especially in algebra. However, this study has limitations in the number of subjects which are only two people, so the results cannot be widely generalized. In addition, students' technology skills also affect the effectiveness of using GeoGebra, so preliminary training is needed so that the use of this software is optimal in classroom learning.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the analysis, it can be concluded that the use of GeoGebra has a positive influence on students' algebraic problem-solving skills. GeoGebra helps students perform all stages of Polya in a complete and structured manner, starting from understanding the problem, planning strategies, and re-examining the solution. Compared to conventional methods, students who used GeoGebra showed significant improvement in their learning outcomes, particularly in their ability to plan strategies and verify their own answers. This shows that GeoGebra not only facilitates the visualization process but also strengthens students' critical thinking process in solving mathematical problems. Researchers suggest that further research be conducted with a larger number of subjects or in the form of quasi-experiments to measure improvements in learning outcomes quantitatively. In addition, in order to optimize the use of GeoGebra in the classroom, technical training is needed for teachers and students to maximize the functions and features of GeoGebra in improving problem-solving skills.

REFERENCES

Aliu, E. R., Jusufi Zenku, T., Iseni, E., & Rexhepi, S. (2025). The advantage of using GeoGebra in the understanding of vectors and comparison with the classical method. *International Electronic Journal of Mathematics Education*, *20*(2), em0824. https://doi.org/10.29333/IEJME/16007

Arbain, N., & Shukor, N. A. (2015). The Effects of GeoGebra on Students Achievement. *Procedia - Social and Behavioral Sciences*, *172*, 208–214. https://doi.org/10.1016/J.SBSPRO.2015.01.356

Barros, F. E., Alves, F. R. V., Catarino, P. M. M. C., & de Sousa, R. T. (2024). The construction of figured numbers in GeoGebra software using algebraic properties. *Mathematics Enthusiast*, *21*(1), 203–224. https://doi.org/10.54870/1551-3440.1624

Batiibwe, M. S. K. (2024). Application of interactive software in classrooms: a case of GeoGebra in learning geometry in secondary schools in Uganda. *Discover Education*, *3*(1), 1–14. https://doi.org/10.1007/S44217-024-00291-8

Baye, M. G., Ayele, M. A., & Wondimuneh, T. E. (2021). Implementing GeoGebra integrated with multi-teaching approaches guided by the APOS theory to enhance students' conceptual understanding of limit in Ethiopian Universities. *Heliyon*, *7*(5), e07012. https://doi.org/10.1016/J.HELIYON.2021.E07012

Bouanfir, D., Abid, M., & Wahbi, B. El. (2024). Impact Of Using Mathematics Learning Software On Pupils Problem Solving And Converting Semiotic Registers Of Numerical Functions. *International Journal on "Technical and Physical Problems of Engineering" (IJTPE) Issue*, *58*, 391–401. Retrieved from https://www.iotpe.com/IJTPE/IJTPE-2024/IJTPE-Issue58-Vol16-No1-Mar2024/55-IJTPE-Issue58-Vol16-No1-Mar2024-pp391-401.pdf

Caligaris, M. G., Schivo, M. E., & Romiti, M. R. (2015). Calculus & GeoGebra, an Interesting Partnership. *Procedia - Social and Behavioral Sciences*, *174*, 1183–1188. https://doi.org/10.1016/J.SBSPRO.2015.01.735

Carriazo-Regino, Y., Hurtado-Carmona, D., & Bermudez-Quintero, A. (2024). Improving

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

trigonometric competency with GeoGebra: a quasi-experimental study in a high school. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(5), 2876–2889. https://doi.org/10.11591/IJERE.V13I5.28995

D'Azevedo Breda, A. M. R., da Silva Trocado, A. E. B., & Dos Santos Dos Santos, J. M. (2024). The Intersection Curve of an Hyperbolic Cylinder with a Torus Sharing the Same Center. *International Electronic Journal of Geometry*, *17*(2), 336–347. https://doi.org/10.36890/IEJG.1318186

Farihah, U., Rachmawati, N., & Hariati, A. (2022). Pengaruh Media Interaktif Geogebra Terhadap Kemampuan Menyelesaikan Soal Cerita Matematika pada Materi SPLDV. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 2985. https://doi.org/10.24127/ajpm.v11i4.5948

Hadi, W., & Faradillah, A. (2022). Implementation Of Geogebra Online Based On Guided Inquiry To Increase Problem Solving Ability And Student Learning Independence. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(2), 882. https://doi.org/10.24127/ajpm.v11i2.5000

Haspekian, M., Kieran, C., Drijvers, P., Bråting, K., & Tabach, M. (2024). Algebra Education and Digital Resources: A Long-Distance Relationship? In *Springer International Handbooks of Education: Vol. Part* (pp. 439–470). Springer Nature. https://doi.org/10.1007/978-3-031-45667-1_16

Istikomah, E., Suryadi, D., Prabawanto, S., & Nurlaelah, E. (2024). Geogebra in Real-Life: Important Tips to Support Student Creative Thinking in Mathematics. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *49*(2), 248–263. https://doi.org/10.37934/ARASET.49.2.248263

Jiménez-Vilcherrez, J. K., Velásquez-Fernández, F. M., Acevedo-Ruiz, A. M., Velezmoro-León, R., & Ipanaqué-Chero, R. (2023). Use of GeoGebra in Learning to Solve the Problem of Calculating the Root of a Nonlinear Equation. *Lecture Notes in Networks and Systems*, *447*, 753–760. https://doi.org/10.1007/978-981-19-1607-6_67

Khoeriah, N., Mahmudi, A., & Sudrajat, S. (2024). Pengembangan LKS Berbasis PBL Berbantuan Geogebra Untuk Meningkatkan Kemampuan Pemecahan Masalah Dan Kesadaran Metakognitif Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *13*(1), 65. https://doi.org/10.24127/ajpm.v13i1.8534

Kramarenko, T. H., Pylypenko, O. S., & Moiseienko, M. V. (2024). Enhancing mathematics education with GeoGebra and augmented reality. *CEUR Workshop Proceedings*, *3844*, 117–126. Retrieved from https://ceur-ws.org/Vol-3844/paper03.pdf

Lindenbauer, E., Infanger, E. M., & Lavicza, Z. (2024). Enhancing mathematics education through collaborative digital material design: Lessons from a national project. *European Journal of Science and Mathematics Education*, *12*(2), 276–296. https://doi.org/10.30935/scimath/14323

Listiani, T., Jaya Saragih, M., & Tong Chong, S. (2024). The Use of GeoGebra in Teaching Analytical Geometry. *International Research Journal of Multidisciplinary Scope (IRJMS)*, *5*(3), 652–660. https://doi.org/10.47857/irjms.2024.v05i03.0790

Lo, C. K., Ng, D. T. K., & Ng, F. (2024). Observing Mathematical Properties in the Virtual World: An Exploratory Study of Online Independent Learning of Locus Concepts. *International Journal of Science and Mathematics Education*, *22*(1), 37–58. https://doi.org/10.1007/S10763-024-10466-2

Louise, M., De, A. N., Mark, P., Tolentino, A. C., Alva, M., Aberin, Q., Garciano, A. D., Carlo, J., Mallari, F., De Las Penas, A. N., Anthony, M., Tolentino, C., Aberin, M. A. Q., Sarmiento, J. F., Marie, D., Verzosa, B., & De Las Peñas, A. N. (2024). GeoGebra Applets for Fostering Conceptual Understanding in Algebra. *Mathematics Faculty Publications*. https://archium.ateneo.edu/mathematics-faculty-pubs/308

Martínez-Miraval, M. A., García-Cuéllar, D. J., & Poveda, W. E. (2024). Exploring problem solving strategies in integral calculus with GeoGebra: a collaborative approach. *Formacion Universitaria*, *17*(2), 161–172. https://doi.org/10.4067/S0718-50062024000200161

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Misrom, N. S., Abdurrahman, M. S., Abdullah, A. H., Osman, S., Hamzah, M. H., & Fauzan, A. (2020). Enhancing students' higher-order thinking skills (HOTS) through an inductive reasoning strategy using geogebra. *International Journal of Emerging Technologies in Learning*, *15*(3), 156–179. https://doi.org/10.3991/ijet.v15i03.9839

Moukhliss, M., Latifi, M., Ennassiri, B., Elmaroufi, A., Abouhanifa, S., & Achtaich, N. (2023). The Impact of GeoGebra on Algebraic Modeling Problem-Solving in Moroccan Middle School Students. *Journal of Educational and Social Research*, *13*(1), 57–70. https://doi.org/10.36941/jesr-2023-0006

Nasrullah, A., Aminah, M., Umalihayati, Rahmadani, K., Widodo, S. A., & Husni, M. (2025). Blended learning in mathematic: the fusion of GeoGebra and Edmodo for enhanced problem-solving abilities. *International Journal of Evaluation and Research in Education (IJERE)*, *14*(1), 423–432. https://doi.org/10.11591/IJERE.V14I1.27713

Ndagijimana, J. B., Mukama, E., Lakin, L., Khan, S., Munyaruhengeri, J. P. A., Dushimimana, J. C., Habimana, O., Manirakiza, P., Musengimana, J., & Mushimiyimana, H. (2024). Contributions of GeoGebra software within the socio-cultural proximity on enhancing students' conceptual understanding of mathematics. *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2436296

Purnomo, E. A., Sukestiyarno, Y. L., Junaedi, I., & Agoestanto, A. (2024). Stages of Problem-Solving in Answering HOTS-Based Questions in Differential Calculus Courses. *Mathematics Teaching Research Journal*, *15*(6), 116–145. Retrieved from https://files.eric.ed.gov/fulltext/EJ1417849.pdf

Reis, Z. A., & Ozdemir, S. (2010). Using Geogebra as an information technology tool: parabola teaching. *Procedia - Social and Behavioral Sciences*, *9*, 565–572. https://doi.org/10.1016/J.SBSPRO.2010.12.198

Rosyidi, A. H., Sari, Y. M., Fardah, D. K., & Masriyah, M. (2024). Designing mathematics problem-solving assessment with GeoGebra Classroom: proving the instrument validity. *Journal of Education and Learning (EduLearn)*, *18*(3), 1038–1046. https://doi.org/10.11591/EDULEARN.V18I3.21191

Türkoğlu, H., & Yalçınalp, S. (2024). Investigating problem-solving behaviours of university students through an eye-tracking system using GeoGebra in geometry: A case study. *Education and Information Technologies*, *29*(12), 15761–15791. https://doi.org/10.1007/S10639-024-12452-1

Yerizon, Arnellis, Tasman, F., & Widjaja, W. (2023). Enhancing Junior High School Students' Reasoning of Linear Equations Using GeoGebra Software. *International Journal of Interactive Mobile Technologies*, *17*(18), 16–32. https://doi.org/10.3991/ijim.v17i18.41441

Copyright (c) 2026 Naharia Safitri, Ali Shodikin, Ismail. This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.