Mandalika Mathematics and Education Journal
Volume 7 Nomor 2, Juni 2025
e-ISSN 2715-1190| |p-ISSN 2715-8292
DOI: http://dx.doi.org/10.29303/jm.v3i1.9457

Students' Algebraic Thinking Profile at Technology-Assisted Learning in Mathematics That Enhances Their Critical Thinking

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Abstract
This study aims to examine the effectiveness of the Prepospec learning model, which is assisted by Google Sites, in enhancing students' critical thinking skills and to explore its impact on their algebraic thinking ability. The material learned in this study was the linear equation and its gradient. Mixed methods were used in this study. The quantitative part was used to determine the effectiveness of the Prepospec learning model assisted by Google Sites on students' critical thinking skills, while the qualitative part was used to characterize their algebraic thinking ability. The results of this study indicate that integrating the Prepospec model learning in mathematics learning, especially when assisted by Google Sites as a digital platform, has enhanced students' critical thinking skills more effectively than conventional Problem-Based Learning (PBL) approaches. Furthermore, based on the analysis, students who experienced the Prepospec learning model assisted by Google Sites showed better performance in algebraic thinking ability. This is shown by their performance in each indicator of algebraic thinking ability.

Keywords: The Prepospec Learning Model; Google Sites; critical thinking; algebraic thinking

Abstrak
Penelitian ini bertujuan untuk menguji efektivitas model pembelajaran Prepospec berbantuan Google Sites dalam meningkatkan kemampuan berpikir kritis siswa serta mengeksplorasi dampaknya terhadap kemampuan berpikir aljabar siswa. Materi yang dipelajari dalam penelitian ini adalah persamaan linier dan gradiennya. Metode penelitian yang digunakan dalam penelitian ini adalah metode campuran (*mixed methods*). Metode kuantitatif digunakan untuk mengetahui sejauh mana efektivitas model pembelajaran Prepospec berbantuan Google Sites terhadap kemampuan berpikir kritis siswa, sedangkan metode kualitatif digunakan untuk menggambarkan perkembangan kemampuan berpikir aljabar siswa pada kelas tersebut. Hasil penelitian ini menunjukkan bahwa integrasi model Prepropspec dalam pembelajaran matematika, khususnya ketika berbantuan Google Sites sebagai platform digitalnya dapat meningkatkan kemampuan berpikir kritis siswa dengan lebih baik dibandingkan pendekatan Pembelajaran Berbasis Masalah konvensional. Selain itu, berdasarkan analisis yang dilakukan, siswa yang mengikuti model pembelajaran Prepospec menunjukkan kinerja yang lebih baik dalam kemampuan berpikir aljabar. Hal ini terlihat dari pencapaian mereka pada setiap indikator kemampuan berpikir aljabar.

Kata Kunci: Model Pembelajaran Prepospec; Google Sites; kemampuan berpikir kritis; kemampuan berpikir aljabar

1. INTRODUCTION

Education nowadays must serve to help every participant face every challenge in their life. One of the biggest challenges for students in the digital age is getting information correctly proportionally from any media. The information overload demands critical thinking to survive that challenge. Because of that, the learning activity in the class must encourage the students' critical thinking, including mathematics learning. Students must be able to clarify, assess, and draw inferences from the incoming information in the right way. In addition, the learning process in the 21st century should be designed in such a way that students can develop their thinking skills, including critical thinking skills ((Fuadi et al., 2021; Suparman et al., 2022).

The efforts to improve students' critical thinking skills have been carried out continuously, as a responsible service of education. Recently, a meta-analysis study showed that Problem-Based Learning (PBL) serves as a promising method to improve students' mathematical critical thinking, with technology-assisted PBL showing better achievement than conventional PBL (Fuadi et al., 2021). At the same time, the integration of technology in the learning activity, especially in mathematics, has consistently increased over the years. This increase surely needs teacher direction such that the technology integration can serve as a better way to fulfill students' needs for their thinking skills. Research suggests that the integration of technology enhances students' ability to analyze, evaluate, and solve complex mathematical problems (Fuadi et al., 2021). In the other study, technology-assisted learning models have been shown to improve students' critical thinking and problem-solving abilities, as well as their motivation and engagement in mathematics learning (Pasaribu et al., 2023; Saputra et al., 2024). These technology-supported instructional models also support the development of self-regulated learning, which further contributes to students' mastery of critical thinking skills (Nashrullah et al., 2023). These approaches not only make learning more engaging but also provide dynamic representations and immediate feedback, which are crucial for fostering critical thinking in mathematical contexts such as algebra (Angraini & Nurmaliza, 2022).

There are some learning models that have been designed to accommodate the integration of technology in mathematics learning, such that the planned activities can run effectively. One of those learning models is the Preprospec learning model. The Preprospec learning model is a constructivist-based learning approach. This model consists of four stages: Prepare, Problem Solving, Presentation, Evaluation, and Conclusion, with each stage incorporating ICT tools (Dewi et al., 2020). Through the process of independently constructing their own knowledge and the provision of scaffolding—aimed at helping students develop an accurate understanding of mathematical concepts—the model supports optimal cognitive development. As a result, the learning process becomes student-centered, providing students with greater opportunities to enhance their mathematical critical thinking abilities (Dewi et al., 2023).

One platform that can be used in the Prepospec learning model is Google Sites. Google Sites, as a user-friendly website creation platform, provides a unique opportunity for educators to create interactive and collaborative learning environments that can significantly enhance students' engagement with mathematical concepts. One of the key features of Google Sites is its accessibility; it is free to use and can be accessed from any device with internet connectivity. This accessibility is crucial in promoting equitable learning opportunities, allowing students from diverse backgrounds to engage with mathematical content regardless of their location or resources. Furthermore, the platform's intuitive interface enables educators to design and implement customized learning experiences that cater to the diverse needs of their students, so the students can fulfill the learning objectives in a better way because they can build their own learning environment based on their own pace (Nurdin et al., 2023). Google Sites can also serve as a repository for diverse resources that support mathematics learning. Educators can curate a range of materials, including instructional videos, interactive simulations, and problem-solving tasks, all of which can be easily organized and accessed by students.

In addition to critical thinking, the development of algebraic thinking is a key focus in mathematics education. Through the Prepospec learning model, which is assisted by Google Sites, we can build a learning environment for students that allows any conceptual representation, including geometric representation. Research has shown that this representation could develop students' algebraic thinking (Apsari et al., 2020). Other dynamic visualizations that are enabled in Google Sites also give a possibility to influence students' ability to recognize patterns, construct algebraic expressions, and solve equations, which directly build students' algebraic thinking (Arabaci et al., 2024; Cruz & Londoño, 2023). Furthermore, these approaches encourage mathematization and modeling, bridging the gap between abstract algebraic concepts and real-world applications, and leading to measurable improvements in students' algebraic thinking skills.

Although research has shown that technology-assisted learning can enhance students' critical thinking and mathematical abilities, there remains a notable question about what kind of technology and learning design supports these findings. On the other hand, there is still also a lack of qualitative insights regarding the detailed profiles of students' algebraic thinking, specifically how technology integration shapes the development of algebraic thinking aspects, like the ability to generalize, modelling skill, relational thinking, functional thinking, and dynamic thinking within algebra, or the challenges they face when engaging with algebraic concepts using technology. Most existing studies focus on the overall impact of technology-assisted learning or problem-based learning on critical thinking and general mathematics achievement, but few provide an in-depth analysis of the specific characteristics, processes, or progression of students' algebraic thinking in technology-rich environments.

Based on this background, this article aims to examine the effectiveness of the Prepospec learning model, which is assisted by Google Sites, in enhancing students' critical thinking skills and exploring its impact on their algebraic thinking ability. By synthesizing current empirical evidence, the article wants to inform educators and policymakers about the potential of technology integration to support students' cognitive development and mathematical proficiency in the 21st century.

2. METHOD

This research was a mixed-method study. The quantitative method was used to determine the effectiveness of the Prepospec Learning Model assisted by Google Sites on students' critical thinking skills, while the qualitative method was used to characterize their algebraic thinking ability. The quantitative phase involved 64 students from eighth grade, selected using cluster random sampling to form experimental and control groups (Arifa et al., 2024; Nashrullah et al., 2023; Pradana & Noer, 2023; Saputra et al., 2024). The experimental group, which was the class that used technology-assisted learning, received mathematics instruction using the Prepospec model learning assisted by Google Sites, while the control group experienced the PBL model learning. The subjects were 8th-grade students from SMP Negeri 2 Wiradesa.

Critical thinking skills and algebraic thinking abilities were measured using validated essay tests as utilized in prior research (Arifa et al., 2024; Nashrullah et al., 2023; Pasaribu et al., 2023; Pradana & Noer, 2023; Saputra et al., 2024). The instruments were tested for validity, reliability, and item difficulty. Both groups completed an earlier mathematics competencies test to establish a baseline of the students' thinking skills. After the intervention, both groups completed a posttest to determine the effectiveness of the learning in enhancing students' critical thinking skills and to analyze their algebraic thinking ability. The material used in the tests was the linear equation and its gradient. This fitted the material learned in the class during the research.

The research instrument for the algebraic thinking test included four aspects of algebraic thinking ability, i.e., modelling and abstraction, relational and dynamic thinking, functional thinking, and generalization (Blanton & Kaput, 2005; Lew, 2004; Lins & Kaput, 2004; Maudy et al., 2018; Rusyid et al., 2024). The test instrument had been validated by an expert and a practitioner who is a mathematics teacher. The description of each aspect is shown in Table 1, while the tasks in algebraic thinking ability are shown in Figure 1.

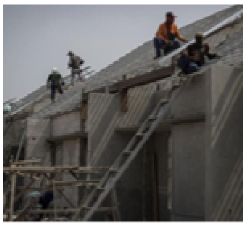
Quantitative data were analyzed using statistical tests, i.e., one-sample proportion z-test, independent samples t-test, and two-proportion z-test to determine the effectiveness of technology-assisted learning on critical thinking skills. The qualitative phase focused on characterizing students' algebraic thinking ability. Data were collected through classroom observations, student work samples, which followed the approaches in related studies

(Jupri et al., 2021; Rusyid et al., 2024). Qualitative data were analyzed using descriptive and thematic analysis. Students' responses were coded to identify patterns in algebraic thinking aspects, i.e., modelling and abstraction, relational and dynamic thinking, functional thinking, and generalization (Blanton & Kaput, 2005; Lins & Kaput, 2004; Maudy et al., 2018; Rusyid et al., 2024). The analysis aimed to capture the depth and nature of students' algebraic reasoning as influenced by the Prepospec model learning assisted by Google Sites.

Table 1. Algebraic Thinking Ability Aspects

Algebraic Thinking Aspects	Description	Task Number
Modelling and Abstraction	Representing real-life problems mathematically, identifying core structures	1
Relational and Dynamic Thinking	Understanding relationships between quantities and how they change	2, 3
Functional Thinking	Studying how inputs relate to outputs through functions	4
Generalization	Recognizing patterns and forming general rules	5

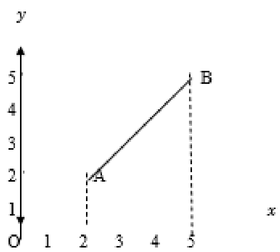
1. Perhatikan gambar berikut.



Sumber : www.cnnindonesia.com

Pak Sugi akan membenahi atap rumah yang bocor dengan bantuan tangga. Ia menyandarkan tangga dengan jarak antara ujung bawah tangga dan dinding sejauh 5 meter serta jarak antara ujung atas tangga dan lantai 3,5 meter. Tentukan kemiringan tangga yang digunakan oleh pak Sugi?

2. Tentukan persamaan g jika garis lurus g melalui $(1, 3)$ dan sejajar garis h: $4x - 3y + 7 = 0$.
3. Tentukan persamaan garis yang tegak lurus dengan garis $y = 2x - 8$ dan melalui titik $G(3,2)$.
4. Perhatikan gambar berikut.



a. Tentukan gradien dari garis di atas.

b. Persamaan garis yang melalui titik A dan B.

5. Diketahui suatu persamaan garis $3y + 6x = -15$. Tentukan gradien (kemiringan) garis tersebut.

Figure 1. Tasks in Algebraic Thinking Ability Tests

Findings from both quantitative and qualitative phases were integrated to provide a comprehensive understanding of how the learning affects students' critical thinking and algebraic thinking abilities. The mixed-methods design allowed for triangulation and deeper insight into the instructional impact.

3. RESULTS AND DISCUSSIONS

3.1 The Effectiveness of The Prepospec Model Learning to Enhance Students' Critical Thinking Skills

Before giving treatment to both classes, the mean equality test was conducted to determine whether there is a significant difference in the average scores between the experimental and control classes before the treatment. This test was performed using an independent samples t-test, which showed that there is no significant difference in the average initial mathematical ability between the experimental and control classes. Then, after the treatment, a mathematical critical thinking test was conducted for both classes. The results of the mathematical critical thinking test are shown in Table 2.

Table 2. Mathematical Critical Thinking Test Results

Class	Data	Results
Experimental Class	Average	79,28
	Variance	62,66
	Highest Score	92
	Lowest Score	60
Control Class	Average	74,66
	Variance	83,20
	Highest Score	88
	Lowest Score	52

In the normality test, the significance values were found to be greater than 0,05. Therefore, the initial data from both classes comes from normally distributed populations. In the homogeneity test, the significance value was 0,386, which is greater than 0,05. It means that the initial data from both classes are homogeneous, meaning there is no significant difference in variances between the experimental and control classes.

In statistical analysis for data on mathematical critical thinking skills, there were three hypothetical tests, i.e., one-sample proportion z-test, independent samples t-test, and two-proportion z-test. The first hypothesis aimed to determine whether students' mathematical critical thinking ability through the Preprosec learning model, assisted by Google Sites, had reached classical completeness (> 75%). Based on the calculation, the calculated z-value was 2,45, and the table z-value was 1.64. Therefore, it can be concluded that the percentage of students' mathematical critical thinking ability in the experimental class using the Preprosec learning model assisted by Google Sites had achieved classical completeness. The second hypothesis aimed to compare the average test scores of students' mathematical critical thinking ability between the experimental class using the Preprosec learning model assisted by Google Sites and the control class using the Problem-Based Learning (PBL) model. The last hypothesis aimed to compare the proportion of students who achieved learning completeness in mathematical critical thinking ability between the experimental class and the control class. Based on the calculation results, the calculated z-value was 1,798, and the table z-value was 1,64. Therefore, it can be concluded that the proportion of students who achieved learning completeness in mathematical critical thinking ability through the Preprosec learning model assisted by Google Sites was higher than that through the Problem-Based Learning (PBL) model.

Other research consistently showed that technology-assisted learning in mathematics can significantly enhance students' mathematical critical thinking skills (Akbar et al., 2025; Pasaribu et al., 2023; Saputra et al., 2024). Meta-analyses revealed that technology-assisted problem-based learning (PBL) yields a greater improvement in mathematical critical thinking than conventional PBL, with moderate to large effect sizes (Fuadi et al., 2021; Suparman et al., 2022). Online platforms, mobile learning, and multimedia resources not only make abstract concepts more accessible but also motivate students to participate actively and collaborate, further supporting the development of higher-order thinking skills (Arofah et al., 2016; Evendi et al., 2022; Nashrullah et al., 2023). These tools help students visualize problems, test hypotheses, and receive immediate feedback, all of which are crucial for cultivating critical thinking. In other words, the evidence strongly supports the integration of technology in mathematics education as an effective strategy to enhance students' critical thinking abilities.

In this study, integrating Google Sites into the Prepospec Learning Model has been shown to effectively enhance students' mathematical critical thinking skills. Studies demonstrate that even PBL models assisted by Google Sites not only achieve higher levels of critical thinking compared to conventional methods but also reach classical completeness, meaning a majority of students meet or exceed critical thinking benchmarks (Nurdin et al., 2023; Safaatullah et al., 2025). The use of Google Sites allows for the creation of interactive, digital teaching materials that are valid, practical, and efficient, supporting students in analyzing, interpreting, and evaluating mathematical problems (Istiqomarie et al., 2023; Nurdin et al., 2023). The platform's flexibility enables teachers to design content that is accessible, visually engaging, and supportive of collaborative learning, all of which contribute to the development of critical thinking skills. Overall, the evidence suggests that Google Sites is a valuable tool for mathematics educators aiming to foster critical thinking, especially when paired with active, student-centered learning strategies.

3.2 Students' Algebraic Thinking Profile

In this study, students' algebraic thinking was viewed through their answers to the algebraic thinking test, which included the algebraic thinking indicators, i.e., representation, generalization, relational thinking, functional thinking, and modelling. Based on the indicators, the algebraic thinking test result in the experimental class is shown in Table 3.

Based on Table 3, students in the experimental class showed a higher percentage than the control class in each aspect. The highest difference between the experimental class and the control class was shown in the generalisation aspect. In the aspect of modelling and abstraction, the experimental class and the control class showed a lower difference than in other aspects. In the following sections, we address findings and discussions for each type of task.

Table 3. The Algebraic Thinking Test Result Based on The Indicators

Algebraic Thinking Aspects	Task Number	Percentage (%)	
		Control Class	Experimental Class
Modelling and Abstraction	1	63,33	71,29
Relational and Dynamic Thinking	2, 3	54,33	70,32
Functional Thinking	4	41,33	68,71
Generalization	5	50,33	85,81

3.2.1. Modelling and Abstraction Aspect

In both classes, the results of the tests showed that there is no significant difference between the experimental class and the control class in the modelling and abstraction aspect (task 1). Students tend to translate the components in the problem into a symbol to determine the solution. Some students use a formal symbol that they earn from the learning, but there are also students who use their own symbol and language to do an abstraction. Figure 2 shows a representative example of students' written work for solving task number 1. The first student tried to make a mathematical model using formal symbols, like m, Δx, and Δy, while the second student used an informal symbol in their own language to mathematically solve the problem. Symbol sense and pattern sense are particularly influential; students lacking these skills may have trouble understanding and using algebraic symbols or recognising underlying structures in problems (Somasundram, 2021). In the context of modelling, most of the students knew what was questioned in the text, and they tried to solve the problem by mathematising it.

Based on task results and observation, students with high scores in mathematical critical thinking tend to perform better in the modelling and abstraction aspects. Research shows that students' success in modelling tasks is closely linked to their critical and deductive reasoning abilities, with higher-level thinkers demonstrating fewer obstacles in abstraction and model construction (Agoestanto et al., 2020; Chimoni et al., 2023). Based on observation, there are also findings that students in the experimental class could perform better because they were allowed to explore the materials independently and to see the representation of the problem clearly. These findings suggest that targeted support—such as scaffolding and exposure to diverse representations—can help students overcome modelling and abstraction challenges, ultimately strengthening their algebraic thinking (Agoestanto et al., 2020; Erbilgin & Gningue, 2023; Nurhayati et al., 2017).

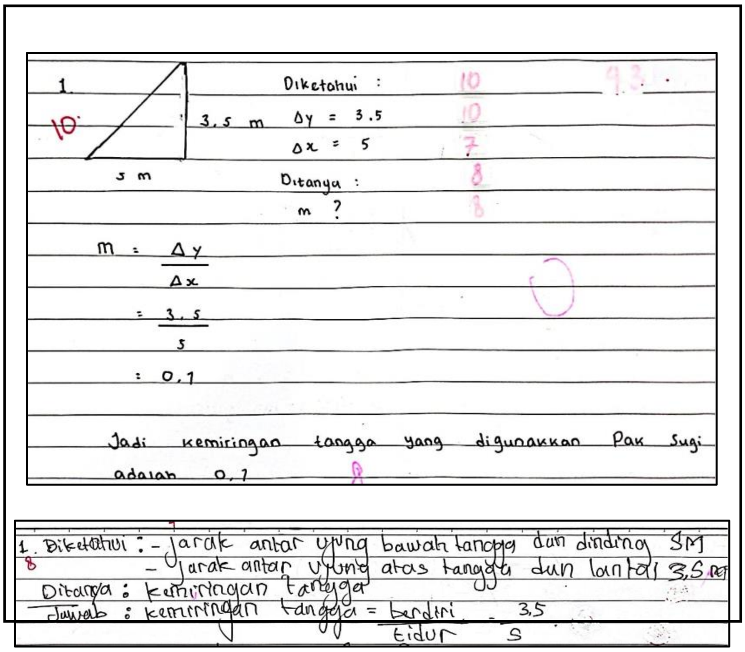


Figure 2. Examples of Students' Written Work on Task 1

3.2.2. Relational and Dynamic Thinking

Tasks 2 and 3 allowed us to see the relational and dynamic thinking of students through their written work. In solving tasks 2 and 3, some students used a strategy to find the gradients of the equations by changing the equations into the explicit form, while other students used a formula to find those gradients. In order to find the final equation, most students have shown a relational sense when deriving the equations. Figure 3 shows examples of students' written work for tasks 2 and 3. On the left side, the student solved task 2 by finding the gradient using the formula m=a/b, where a is the coefficient of x and b is the coefficient of y. The student also succeeded in deriving the equation, which means there is no problem with her relational sense. On the right side, the student failed to find the gradient because she didn't change the equation into the right general form. This means that there was a lack in her dynamic thinking because she couldn't see the equation in the other form correctly.

Relational thinking involves recognizing and using relationships between numbers and operations, such as understanding the equal sign as a symbol of equivalence rather than just a signal to compute, and applying properties like compensation and associativity to solve problems flexibly (Andini & Prabawanto, 2021; Kızıltoprak & Köse, 2017; Nainggolan, 2022; Stephens & Ribeiro, 2012). Dynamic thinking, which includes the ability to reason about changing quantities and patterns, supports students in generalizing and modeling algebraic relationships, is often observed in students who can flexibly shift between representations and strategies (Pitta-Pantazi et al., 2020; Safitri & Masduki, 2023). Technology-assisted learning has a positive effect on students' relational and dynamic thinking within algebraic thinking. Google Sites in this study enable students to explore multiple representations, manipulate algebraic objects, and visualize relationships, which directly supports relational thinking by making mathematical structures and equivalence more explicit and accessible. This tool also fosters dynamic thinking by allowing students to experiment with changing variables and observe the effects in real time, thus deepening their understanding of patterns, functions, and generalizations. Based on other research, collaborative and reflective activities facilitated by technology also help students articulate and justify their reasoning, strengthening both relational and dynamic aspects of algebraic thinking (Eriksson & Eriksson, 2020; Filho et al., 2021). Overall, integrating technology into algebra instruction provides students with powerful tools to develop, visualize, and communicate relational and dynamic mathematical ideas more effectively than traditional methods alone.

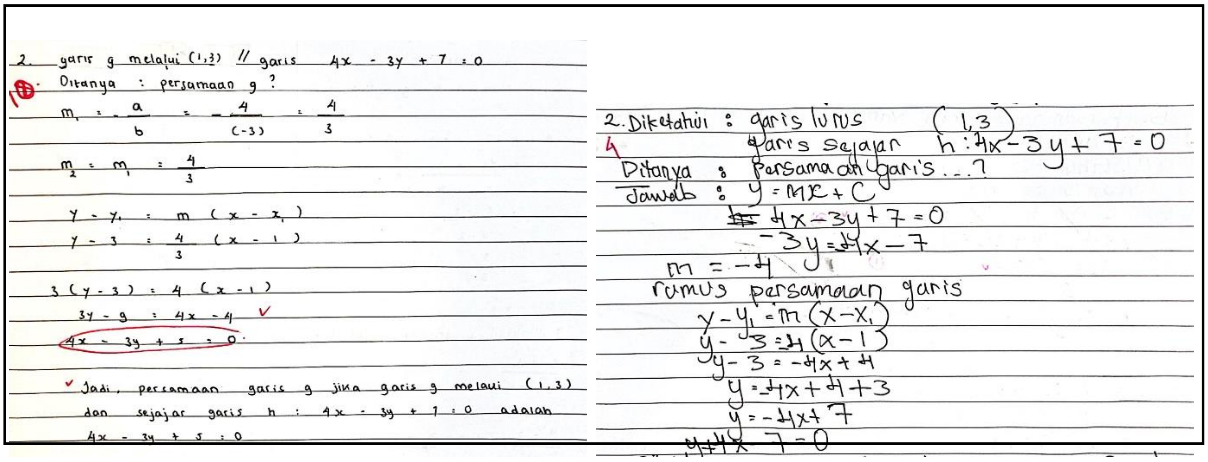


Figure 3. Examples of Students' Written Work on Tasks 2 and 3

3.2.3. Functional Thinking

In the functional thinking aspect, the experimental class showed a better result than the control class. Students in the experimental class were allowed to explore the various representations, such as video and graph, of the gradient and linear equation concepts through Google Sites. Figure 4 shows that students in the experimental class succeeded in solving task 4 by determining the coordinates of given points first. After that, they could find the equation of the line using the gradient that they determined first or using the formula to build an equation with two points given.

Technology-assisted learning has a significant positive impact on students' functional thinking within algebraic thinking. Digital tools and interactive environments, such as educational software and web-based resources, enable students to explore functions, variables, and relationships through multiple representations—graphical, symbolic, and descriptive—which deepens their understanding and supports generalization of functional relationships (Filho et al., 2021; Mustaffa et al., 2017). Google Sites in this study fostered collaborative and constructive learning. It allowed students to see the graph as a representation and manipulate variables. Further, visualizations enhance students' ability to generalize and represent functions explicitly (Wilkie & Clarke, 2016).

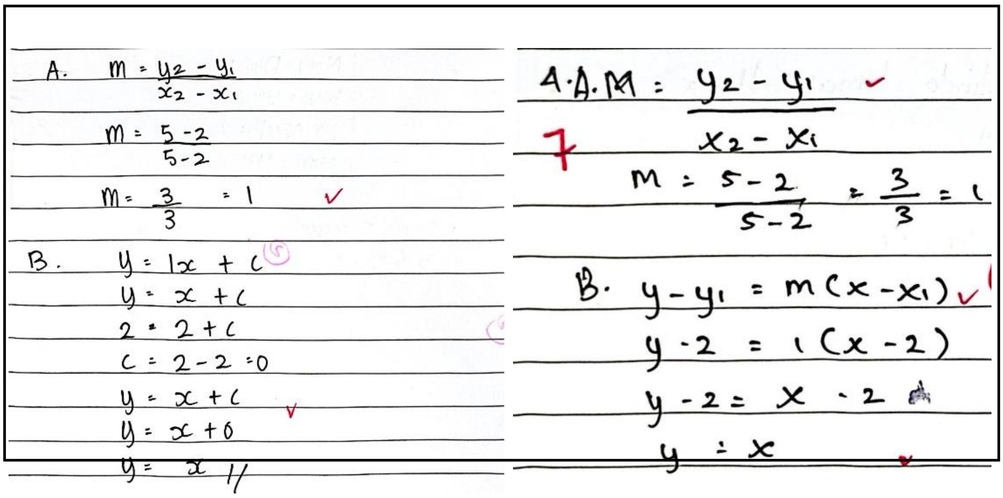


Figure 4. Examples of Students' Written Work on Task 3

3.2.4. Generalization

The generalization aspect was viewed through how students see and understand the general form of a linear equation. In task 5, students must be able to see the elements of the general form and determine the line gradient of the given linear equation. Figure 5 shows that students could determine the line gradient by changing the equation to the general form and by using a formula with coefficients of variable x and y.

The Google Sites media allowed students to repeatedly engage with algebraic tasks, gradually refining their understanding and moving from specific examples to broader generalizations. The environment in the experimental class supports the abstraction process by enabling learners to visualize and manipulate algebraic relationships, fostering a deeper grasp of underlying structures. Empirical evidence shows that technology helps students overcome obstacles in understanding variables and algebraic notation, making it easier to identify and articulate general rules from specific cases (Liadiani et al., 2020). Furthermore, technology-assisted learning enhances students' ability to generalize in algebraic thinking by providing interactive environments where they can experiment with patterns, variables, and multiple representations (Duarte & Brocardo, 2011; Filho et al., 2021). Additionally, technology can personalize learning experiences, adapting to individual student actions and supporting the development of generalization skills at different paces (Baccaglini-Frank et al., 2024). Overall, integrating technology into algebra instruction not only improves students' ability to generalize but also strengthens their overall algebraic reasoning and problem-solving abilities.

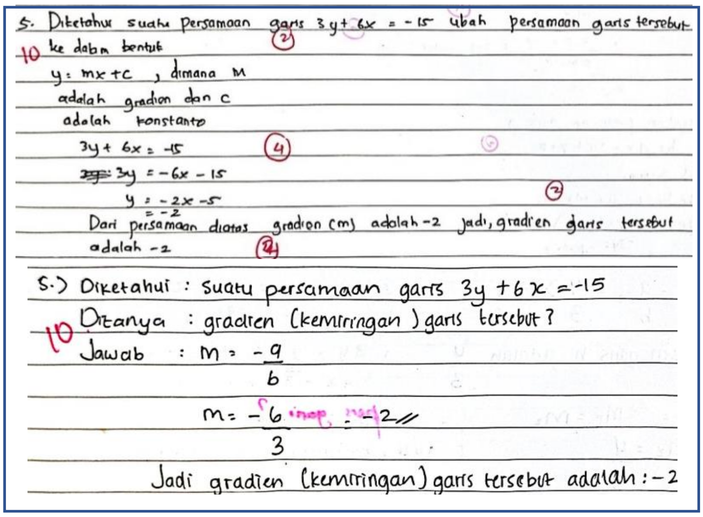


Figure 5. Examples of Students' Written Work on Task 4

Research shows that integrating technology, such as Google Sites, into mathematics learning can support the development of algebraic thinking by providing interactive, digital teaching materials and facilitating problem-based learning approaches (Nurdin et al., 2023; Safaatullah et al., 2025). Additionally, research also shows that Google Sites-assisted learning environments are effective, efficient, and practical, allowing students to engage with algebraic concepts through dynamic content, collaborative activities, and real-world problem scenarios (Nurdin et al., 2023). These digital platforms enable teachers to design lessons that encourage students to analyze, interpret, and generalize mathematical relationships, which are key aspects of algebraic thinking. Furthermore, the use of Google Sites can increase student motivation and participation, which are important factors in developing higher-order thinking skills, including algebraic reasoning (Safaatullah et al., 2025). Google Sites also offers a flexible and accessible tool for mathematics educators aiming to enhance students' algebraic thinking through engaging, technology-assisted learning experiences.

4. CONCLUSION

In conclusion, the implementation of the Prepropspec learning model supported by Google Sites in the experimental class showed significant improvement in students' mathematical critical thinking abilities, as indicated by the achievement of classical completeness. The average score of mathematical critical thinking skills in the experimental class was notably higher than that of the control class, which employed the Problem-Based Learning (PBL) model. Moreover, a greater percentage of students in the experimental class attained mastery level in the critical thinking test compared to their counterparts in the control class. These results indicate that integrating the Prepropspec model with digital platforms like Google Sites can serve as a promising and effective strategy in mathematics education to enhance students' critical thinking competencies more effectively than conventional PBL approaches. Furthermore, based on the analysis, students who experienced the Prepospec learning model showed better performance in algebraic thinking ability. This is shown by their performance in each indicator of algebraic thinking ability. One of the factors that affected their performance was the learning environment that supported them in exploring multiple representations of the material and easily accessing them independently, so they could deepen their skills, including algebraic thinking ability.

5. RECOMMENDATION

We acknowledge that this study has several limitations. As we only have students' written work data for students' algebraic thinking analysis, so triangulation of the data for this section is limited. In addition, we have not analyzed the effect of the Prepospec learning model, including the specific technology, on students' algebraic thinking ability in detail, either statistically or qualitatively. As a consequence, advanced comprehensive research with multiple environments might provide better information about students' algebraic thinking in technology-assisted or technology-based learning in mathematics.

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