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The effect of Google Earth Pro-assisted guided discovery learning on students' cognitive outcomes

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ABSTRACT

Students' cognitive learning outcomes in Geography remain relatively low, as evidenced by the average class score, which has not yet met the Minimum Completion Criteria (KKM). This low learning outcome is influenced by the delivery of material that tends to be abstract without interactive media, making it difficult for students to understand spatial concepts. The Guided Discovery Learning model, supported by Google Earth Pro, is a solution because it allows students to explore geographic objects interactively and contextually, thereby stimulating active learning and fostering meaningful understanding. This study aims to analyze the effect of Guided Discovery Learning assisted by Google Earth Pro on students' cognitive learning outcomes. The method used is a quasi-experimental Post-test Only Control Group design across two classes: the experimental class and the control class, selected based on teacher recommendations. Data were collected through essay tests on cognitive learning outcomes in accordance with the learning objectives. The results of the study indicate a significant effect of the model, as evidenced by the post-test scores of the experimental class being higher than those of the control class. The Stimulation stage in Guided Discovery Learning is a research finding that influences learning outcomes by creating an interactive, contextual, and meaningful learning experience.

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ABSTRAK

Hasil belajar kognitif murid pada mata pelajaran Geografi masih tergolong rendah, terlihat dari rata-rata nilai kelas yang belum memenuhi Kriteria Ketuntasan Minimal (KKM). Rendahnya hasil belajar ini dipengaruhi oleh penyampaian materi yang cenderung abstrak tanpa media interaktif, sehingga murid kesulitan memahami konsep spasial. Model Guided Discovery Learning berbantuan Google Earth Pro hadir sebagai solusi, karena memungkinkan murid mengeksplorasi objek geografi secara interaktif dan kontekstual, sehingga merangsang keaktifan belajar dan meningkatkan pemahaman bermakna. Penelitian ini bertujuan menganalisis pengaruh Guided Discovery Learning berbantuan Google Earth Pro terhadap hasil belajar kognitif murid. Metode yang digunakan adalah eksperimen semu (Quasi Experimental) dengan desain Post-test Only Control Group pada dua kelas, yaitu kelas eksperimen dan kelas kontrol yang dipilih berdasarkan rekomendasi guru. Data dikumpulkan melalui tes esai hasil belajar kognitif sesuai dengan tujuan pembelajaran. Hasil penelitian menunjukkan adanya pengaruh signifikan penggunaan model tersebut, dibuktikan dengan nilai post-test kelas eksperimen yang lebih unggul dibandingkan kelas kontrol. Tahap Stimulation dalam Guided Discovery Learning menjadi temuan penelitian yang mempengaruhi hasil belajar karena menciptakan pengalaman belajar interaktif, kontekstual, dan bermakna.

Kata Kunci: *Google Earth Pro; guided discovery learning; hasil belajar kognitif*

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INTRODUCTION

Along with the advancement of information and communication technology, the field of education continues to undergo transformation, including in the learning models used. As time passes, learning becomes less teacher-centered, often leading to student boredom due to a lack of involvement in the learning process. Such conditions can cause students to lose concentration during learning activities, leading to suboptimal performance. In contrast, contemporary learning requires a student-centered approach, as it can optimize students' active participation in the learning process. Student-centered learning can enhance students' adaptability, which, in turn, helps develop a meaningful understanding. Improving students' adaptability through student-centered learning can pave the way for achieving educational goals. (Ramadhan et al., 2024).

One of the main objectives of education is to achieve learning goals, which are indicated by students' learning outcomes, particularly in the cognitive domain. This domain includes thinking skills such as analyzing, evaluating, remembering, understanding, applying, and creating (Kasanah & Pratama, 2024). Good cognitive learning outcomes depend on teachers' roles as innovators, responsible for implementing instructional innovations. High-quality education and the use of appropriate learning models play an important role in achieving optimal cognitive learning outcomes (Fauhah & Rosy, 2020). Cognitive learning outcomes are essential because they encompass knowledge and thinking skills. Every student needs to achieve high cognitive learning outcomes, as this is one of the standards of success in the learning process (Attamimi et al., 2023).

This learning model is considered significant in increasing student activeness and developing critical thinking skills (Rivaldi et al., 2024). Guided Discovery Learning is a learning model in which students independently discover concepts, principles, or theories, with the teacher acting as a facilitator. It engages students actively by encouraging them to explore and discover knowledge independently, guided by the teacher (Christy et al., 2019). Guided Discovery Learning has an instructional syntax that facilitates learning, thereby enhancing students' thinking abilities, such as critical thinking skills (Nofiana, 2020). Based on observations at SMA Negeri 1 Pandaan, conventional teaching methods, such as lectures and textbook-oriented approaches in geography, often make it difficult for students to understand spatial concepts, particularly in the topic of Remote Sensing.

Remote sensing is an important topic in geography because it is essential for analyzing spatial phenomena. This can be conducted remotely, without the need to visit the object being studied. Students need to be trained in remote sensing practices to apply theoretical knowledge in geography (Ghafur, 2023). Therefore, not only can conventional methods such as lectures and question-and-answer sessions be used to learn remote sensing, but also supporting technologies, such as Google Earth Pro, can help teachers develop students' visual abilities and understanding of distances around the world.

There are several previous studies on Guided Discovery Learning. The first study found that the implementation of Guided Discovery Learning supported by Articulate Storyline media

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affects students' critical thinking skills (Rivaldi et al., 2024). The second study states that applying the Discovery Learning model can improve students' mathematics learning outcomes, particularly in logarithmic material (Haris & Amiruddin, 2023). Furthermore, the third study shows that students who use the Discovery Learning model achieve better learning outcomes than those who receive conventional instruction (Nadia & Mushafanah, 2023). Meanwhile, the fourth study indicates that Discovery Learning produces good learning outcomes and can encourage active student engagement, as well as improve understanding and retention of the material presented by the teacher (Prihatin, 2024).

The difference between this study and previous research lies in the type of variables, research subjects, and materials used. In this study, Guided Discovery Learning assisted by Google Earth Pro is the independent variable, while students' cognitive learning outcomes are the dependent variable. In addition, the indicators and model applied in this study distinguish it from previous research. The indicators of students' cognitive learning outcomes used include remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). The stages of Guided Discovery Learning include providing a stimulus through the presentation of Google Earth Pro, formulating questions and benefits, recording observations and information, interpreting imagery, providing clarification and reinforcement, and concluding with the learning outcomes. The material in this study is Grade X Remote Sensing, specifically related to image interpretation. This study aims to determine the effect of Guided Discovery Learning assisted by Google Earth Pro on students' cognitive learning outcomes in geography learning.

LITERATURE REVIEW

Guided Discovery Learning

The Guided Discovery Learning model employs student-centered learning, in which students are encouraged to identify problems, collect data, analyze information, and draw conclusions (Nofiana, 2020). In the context of geography, this model is highly effective because it allows students to explore spatial relationships, environmental phenomena, and socio-economic issues dynamically and interactively (Medani et al., 2022). For example, students may engage in fieldwork, map analysis, or case studies to understand geographical concepts (Zhiddiq et al., 2024; Cahya et al., 2023). This approach differs from conventional methods, which focus on traditional teaching and provide limited opportunities for independence and critical thinking. Students in a Discovery Learning environment actively construct their own understanding of geographical concepts. The Discovery Learning model has been shown to improve cognitive learning outcomes across various educational fields significantly.

Guided Discovery Learning has several advantages, the first of which is engaging students to stimulate their thinking and keep them actively involved (Cholifah & Fada, 2022). This aligns with constructivist theory, which underpins students' knowledge construction, thereby enhancing their abilities, understanding, and active participation in learning (Suparlan, 2019). For instance, teachers can design guided exploration activities that allow students to independently discover geographical concepts, earth-surface patterns, or interregional relationships through the observation and analysis of Google Earth features. This approach can also be combined with peer tutoring methods to achieve more optimal outcomes, in

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which students assist each other throughout the discovery process (Hadzami & Maknun, 2022).

Second, it can foster an inquiry attitude, in which students independently seek information or understanding. Guided Discovery Learning assists and engages students in the learning process by allowing them to search for and discover knowledge independently under teacher guidance (Sunarto & Amalia, 2022). Through this discovery process, students can better understand the material, which enhances long-term retention. When students uncover concepts or principles through direct experience, such as exploring features in Google Earth Pro to identify patterns, relationships, or geographical phenomena, learning becomes more meaningful. For example, by observing satellite imagery over time, students can identify land-use types, such as residential, agricultural, and industrial areas. The teacher acts as a facilitator who designs structured activities, but the students themselves make the primary discoveries.

Third, it supports problem-solving skills. Students can develop problem-solving abilities by building on their existing understanding and proficiency, gaining new experiences that enhance critical thinking when addressing problems (Palobo, 2021). In the context of using Google Earth, students may encounter issues related to geographical, environmental, or social phenomena. By exploring and analyzing these phenomena through Guided Discovery Learning, students not only grasp the concepts but also develop problem-solving strategies that can be transferred to other contexts. This approach helps students prepare to face increasingly complex real-world challenges that require strong problem-solving skills.

Fourth, it fosters positive relationships between students and teachers. Relationships are a key requirement for effective learning activities, ensuring that learning objectives can be optimally achieved (Arifin, 2020). The learning environment becomes more enjoyable when positive relationships exist among students and between students and teachers (Haris & Amiruddin, 2023). In line with this, students can participate in the learning process in groups, which encourages social interaction through group discussions and allows them to exchange ideas and build shared understanding through peer tutoring. Moreover, it can enhance teacher-student relationships through activities that guide students to ask questions, receive teacher guidance, and then independently find solutions.

Despite its advantages, Guided Discovery Learning also has limitations in its implementation. First, students may not always be enthusiastic about searching for and discovering information. Second, not all students can easily adapt to this type of learning activity. This learning process always involves teacher guidance and can be conducted in groups to facilitate peer understanding or through peer tutoring. Third, only certain topics are suitable for this approach (Rivaldi et al., 2024). Topics generally appropriate for this method include geography, geology, meteorology, environmental studies, urban planning, history (in the context of event locations), and some aspects of the social sciences with a spatial dimension. Therefore, not all topics are suitable for Guided Discovery Learning assisted by Google Earth Pro.

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Google Earth Pro

A media tool that can support student activities in geography learning is Google Earth Pro. The use of Google Earth Pro strongly aligns with 21st-century learning and the TPACK (Technological Pedagogical Content Knowledge) framework, requiring teachers to possess advanced skills in integrating technology into teaching. Google Earth Pro can help students navigate various curriculum challenges using standard media that facilitate understanding of information in spatial and geographical contexts (Tue & Lukum, 2025). Moreover, the use of Google Earth Pro not only enriches spatial thinking but also enhances critical analysis skills and equips students to leverage advanced technology in geographic information systems (Ali et al., 2024).

Google Earth Pro enables observation of a region both horizontally and vertically without direct contact with the study area, allowing for exploration and learning about the world through a virtual globe. Students can view satellite imagery, maps, and 3D buildings. Therefore, using Google Earth Pro in remote sensing instruction can optimize teaching and learning, prevent student fatigue, and support learning outcomes. This study employs Google Earth Pro to address previous limitations. To date, no research has been conducted on Guided Discovery Learning assisted by Google Earth Pro, so this study examines whether the model can influence learning outcomes.

METHODS

This study employed a quasi-experimental design with a Post-test Only Control Group, with two classes designated as the experimental and control groups. The study was conducted over four face-to-face meetings, with each session lasting 40 minutes. It took place in Grade X at SMA Negeri 1 Pandaan, where Class X-B had 36 students and Class X-C had 36 students. Class X-B was assigned as the experimental group, while Class X-C served as the control group. The experimental class received treatment using the Guided Discovery Learning model, assisted by Google Earth Pro, in geography, whereas the control class did not. Consequently, geography lessons in the control class were conducted using conventional learning methods, supplemented with the Deep Learning model and question-and-answer activities.

Table 1. Research Design with Post-test Only Control Group

Class	*Treatment*	*Postest*
E	XI	TI
K	X2	T2

Source: Payadnya & Jayantika (2018) in Experimental Research Guide with Statistical Analysis Using SPSS

Legend:
E: Experimental Class
K: Control Class
X1: Implementation of Guided Discovery Learning assisted by Google Earth Pro as the geography learning model

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X2: Implementation of conventional learning with the Deep Learning model, accompanied by question-and-answer activities
T1: Post-test (after treatment) for the experimental group
T2: Post-test (after treatment) for the control group

Data collection in this study was conducted through a cognitive learning outcomes test in the form of essay questions, developed based on the learning objectives for the remote sensing material. The test instrument was first validated using item analysis to ensure that each question could measure the predetermined indicators. Content validity was established by evaluating each item's alignment with the cognitive domain indicators C1–C6 of Bloom’s taxonomy. Furthermore, the instrument’s reliability was assessed using an internal consistency formula, yielding a high reliability coefficient. Instruments that met the criteria for validity and reliability were then used to collect learning outcome data from the experimental class using the Guided Discovery Learning model assisted by Google Earth Pro and from the control class using conventional learning.

At the initial stage of data analysis, assumption tests were conducted, including tests for normality and homogeneity, to ensure that the data were normally distributed and that variances were homogeneous before performing the hypothesis test. Normality was tested using the Kolmogorov-Smirnov test, with the criterion that if sig ≥ 0.05, the data are considered normally distributed. Homogeneity was tested using Levene’s test for equality of variances, with the criterion that if sig ≥ 0.05, the data are considered homogeneous. The hypothesis test in this study employed a non-parametric Mann-Whitney U-Test using SPSS 21 because the test data were not normally distributed. The difference in mean scores between the experimental and control classes was then analyzed using statistical hypothesis testing with the following criteria.

- If the Asymp. (significance) value > 0.05, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted.
- If the Asymp. (significance) value < 0.05, the null hypothesis (H_0) is accepted and the alternative hypothesis (H_a) is rejected.

RESULT AND DISCUSSION

The Guided Discovery Learning model can be implemented by comparing the experimental and control classes. In the experimental class, the teacher begins the lesson by presenting the Google Earth Pro application to stimulate students’ curiosity through open-ended questions or engaging phenomena. Students then engage in learning using Google Earth Pro, with the teacher serving as a facilitator throughout. Meanwhile, in the control class, learning is conducted using conventional methods, such as lectures. In contrast, the experimental class receives treatment with the Guided Discovery Learning model assisted by Google Earth Pro. Subsequently, learning outcomes are measured through a post-test administered after the lessons in both classes to determine whether there are significant differences in students’ learning outcomes between the experimental and control groups.

Table 2. Average Post-test Scores of Grade X Students’ Learning Outcomes

Descriptives		
	Class	Statistic

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Learning Outcomes	Class Eksperimen	*Mean*	90,00
		Minimum	75
		Maximum	95
	Class Control	*Mean*	79,11
		Minimum	77
		Maximum	80

Source: Data Processing Results, 2024

Based on the average post-test scores of Grade X students' learning outcomes, differences can be observed between the experimental and control classes. Students in the class who used the Google Earth Pro learning media demonstrated better achievement than those who did not. This indicates that using technology-based learning media, such as Google Earth Pro, can provide contextual, interactive learning experiences, thereby enhancing students' understanding of the material. These findings suggest that innovative, technology-integrated learning approaches can serve as effective strategies for improving students' learning outcomes, particularly in geography education. The average post-test scores of students in the experimental and control classes are presented in **Table 2**.

Table 3. Normality Test of Grade X Students' Post-test Learning Outcomes

Test of Normality						
		Kolmogorov-Smirnov			**Shapiro-Walk**	
KELAS		**Statistic**	**df**	**sig**	**Statistic**	**df**
Learning Outcomes	Class E	.375	36	.000	.352	36
	Class K	.193	36	.002	.897	36

Source: Data Processing Results, 2024

Meanwhile, the normality test results for students' learning outcomes in the experimental and control classes are presented in Table 3. Based on the post-test normality test for Grade X students, it was found that the data distribution in one class did not meet the normality assumption. This is indicated by the Kolmogorov-Smirnov significance value, which falls below the required threshold for a normal distribution. Therefore, the students' learning outcome data are not fully normally distributed in either group. Consequently, for further analysis, parametric statistical tests that require normally distributed data cannot be optimally applied to all groups. Instead, data analysis should use nonparametric statistical tests that do not rely on the data distribution to ensure the interpretation of the research results remains valid and accurate. The results of the homogeneity test for the experimental and control classes are presented in **Table 4**.

Table 4. Homogeneity Test of Grade X Students' Post-test Learning Outcomes

Test of Homogeneity of Variance			
Levene Statistic	df1	df2	Sig
8.791	1	70	.004

Source: Data Processing Results, 2024

Based on the results of the homogeneity test for Grade X students' post-test learning outcomes, the data did not meet the assumption of homogeneity of variances. This is

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indicated by the significance value falling below the required threshold, indicating that the variances between the groups are unequal. This condition suggests a difference in the distribution of learning outcome data between the experimental and control classes. Since the homogeneity assumption is not met, parametric tests that require variance homogeneity are less appropriate for comparing the two groups. The processed data are presented in Table 4 for the homogeneity test of Grade X students' post-test learning outcomes, and in Table 5 for the nonparametric Mann-Whitney U test of post-test learning outcomes.

Table 5. Mann-Whitney U-Test *Post-test* Hasil Belajar Murid Kelas X

Mann-Whitney Test				
Ranks				
	Class	N	Mean Rank	Sun of Ranks
Learning Outcomes	Control Class	36	50.26	1809.50
	Experiment Class	36	22.74	818.50
	Total	72		
Test Statistics				
			Learning Outcomes	
Mann-Whitney U			152.500	
Wilcoxon W			818.500	
Z			-5.767	
Asymp. Sig. (2-tailed			.000	

Source: Data Processing Results, 2024

Based on the results of the non-parametric statistical test using the Mann-Whitney U-Test on the post-test learning outcomes of Grade X students, as presented in Table 5, it was found that there is a significant difference between the experimental and control classes. This test was conducted because the data did not meet the assumptions of normality and homogeneity, making the non-parametric approach the appropriate choice for analyzing differences between two non-normally distributed groups. The test results indicate a substantial difference in the average ranks between the two classes, meaning that the learning treatment provided to the experimental class had a significant impact on students' learning outcomes.

Discussion

These findings reinforce the conclusion that the learning approach implemented in the experimental class is more effective at improving students' learning outcomes than the control class.

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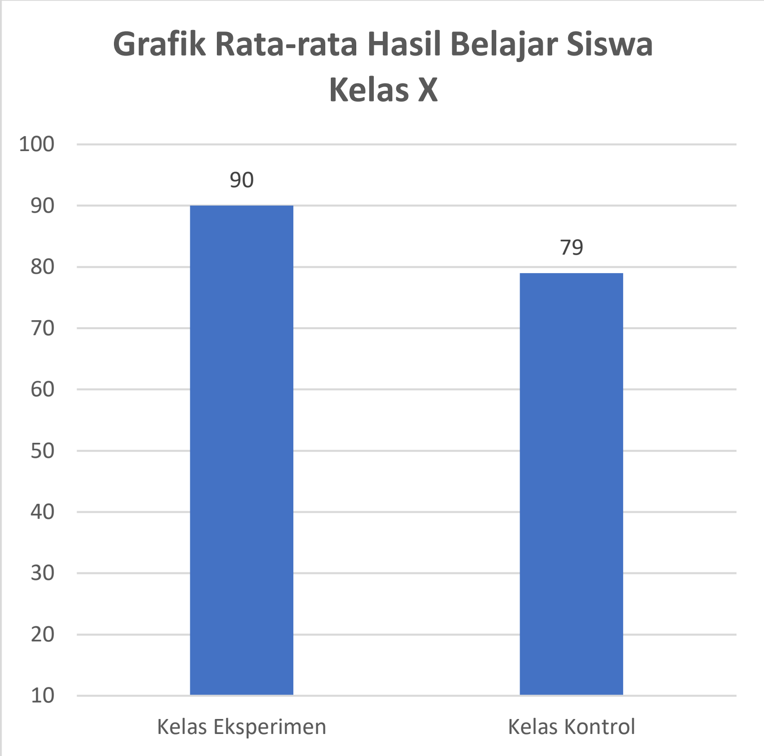

Figure 1. Average Learning Outcomes of Grade X Students
Source: Research Documentation, 2024

Based on the post-test results, the findings are presented in Figure 1. The post-test data show that the average scores of students in the experimental and control classes differ. In the control class, which employed conventional learning methods such as lectures and school-provided materials like textbooks and worksheets, students often struggled to understand material that was largely abstract and lacked clear visualizations of earth surface features. In contrast, the experimental class used Google Earth as a learning medium, a technology-enhanced tool that made students more engaged and enabled them to visualize remote sensing material during the learning process actively. The differing treatments between the experimental and control classes had a significant impact on students' learning outcomes in geography, as evidenced by higher post-test scores in the experimental class. The control class achieved a 79% score, while the experimental class achieved 90%.

The percentages from the two classes indicate a notable difference in learning outcomes when Google Earth is used as a learning medium. During lessons, using Google Earth in the experimental class increased students' motivation and interest in learning geography. This study is supported by previous research demonstrating a significant effect of Google Earth on students' geographical thinking skills and learning outcomes (Hakim, 2024). Other studies have shown that Google Earth significantly improves students' learning outcomes and visual abilities (Agus & Purnama, 2022). The combination of the Guided Discovery Learning model with Google Earth learning media positively influences students' learning motivation, as reflected in improved learning outcomes and active participation in geography lessons, particularly in remote sensing material.

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The latest findings from this study indicate that using Google Earth as a learning medium increases students' motivation to learn. This is evident in students' active participation, including asking questions and engaging with the information provided by the teacher. These observations demonstrate a significant effect of using Google Earth on the interaction between the learning media and students. Classroom observations during the learning process show that effective understanding can be influenced by the learning media utilized (Wardani et al., 2024). Furthermore, the use of Google Earth encourages students to work collaboratively in groups, fostering strong connections among group members and enhancing understanding, supported by the technology-assisted learning media (Hakim, 2024).

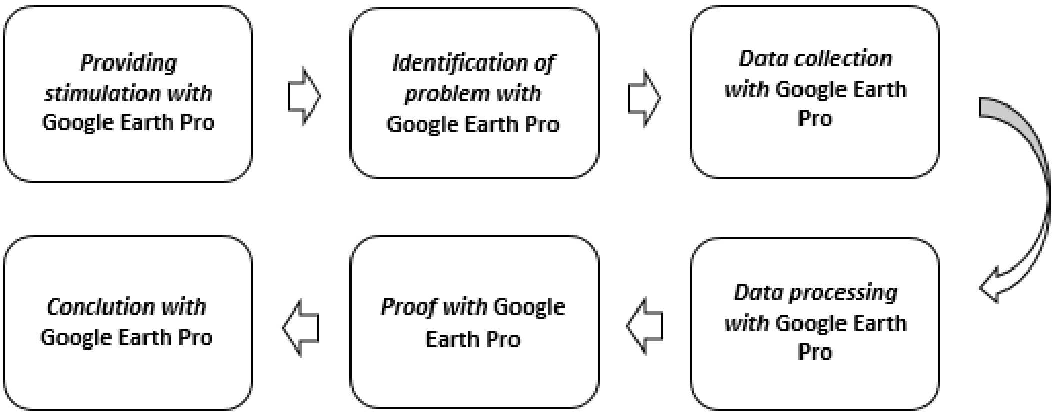

Figure 2. Syntax of Guided Discovery Learning Assisted by Google Earth Pro
Source: Research Documentation, 2024

The implementation of the Guided Discovery Learning model assisted by Google Earth Pro is illustrated in Figure 2. In the experimental class, the model was applied through structured treatment. During classroom learning, the Guided Discovery Learning process involves several stages. First, in the stimulation stage, students are presented with real-world phenomena on the earth's surface that involve issues, such as land-use changes to residential, agricultural, or industrial areas, observed over time using Google Earth Pro. Students measure distances and land areas in specific regions and compare changes across different time periods. They then discuss the causes and implications of these land-use changes in groups, and experiment with rotation, zoom, and navigation features to develop spatial thinking skills and understand spatial patterns and relationships (Alfatikh et al., 2020).

Through these activities, students receive initial stimuli that foster curiosity, enhance spatial thinking skills, and develop the ability to relate geographic data to real environmental problems (Yusuf et al., 2024). Second, during the problem statement stage, or problem identification, students are guided to formulate questions based on phenomena observed in Google Earth Pro. The teacher provides worksheets for image interpretation tasks, allowing students to identify the meaning of observed objects. Additionally, students describe the objects' physical and social conditions, compare changes over time, and discuss potential causes of the problems. This process encourages students to draft preliminary research questions, making learning more focused on real geosphere issues (Syaviar, 2020). The characteristics of objects in images are determined using nine interpretation elements: shape, size, texture, tone, color, shadow, pattern, site, and association (Hartono, 2024).

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Third, during data collection, students are given practice questions and the freedom to gather as much information as possible from various sources, including Google Earth Pro and relevant literature. Students are then guided to collect data that aligns with the previously formulated problems. Data collection can be conducted through both direct and indirect sources. Students utilize Google Earth Pro to obtain spatial data, such as land-use changes, river flow patterns, or settlement distributions. Additionally, they can complement this data with information from topographic maps, literature, or environmental reports. This activity aims to develop students' critical and spatial thinking skills, including observing, recording, and analyzing information obtained from multiple media (Syaviar, 2020).

Fourth, during data processing, students are guided to analyze the information obtained during the learning activities using the Guided Discovery Learning model, assisted by Google Earth Pro, through observation, questioning, and teacher-guided exercises. The collected data are then organized into tables, graphs, or simple maps to facilitate analysis. Google Earth Pro features help students measure distances and areas and compare land-use changes over time. Furthermore, students are encouraged to identify spatial patterns and relationships among phenomena and integrate visual data with conceptual information from literature, enabling a deeper interpretation of their observations (Riyadi & Arif, 2025; Rahayu et al., 2019).

Fifth, in the verification stage, previously formulated statements are reviewed to determine whether the evidence supports them. At this stage, students compare their data analysis results with relevant geographic theories or concepts and discuss them in groups or, under the teacher's guidance, in class. Students conduct tests using alternative data, such as additional satellite imagery, thematic maps, or other literature, to confirm the accuracy of their interpretations. Group discussions are then directed to examine the alignment between observations and the initial hypothesis, enabling students to draw preliminary conclusions logically and scientifically (Riyadi & Arif, 2025; Rahayu et al., 2019).

Finally, in the generalization stage, students formulate conclusions based on the implementation of the Guided Discovery Learning model assisted by Google Earth Pro. At this stage, students are required to present their findings and understanding, both orally and in writing, for example, through reports, class discussions, or maps of interpretation results. The teacher facilitates conceptual clarification to ensure that students' conclusions align with relevant geographic theories. This activity aims to train students to communicate scientific reasoning systematically, link data to concepts, and generalize findings for application in other geosphere problem contexts (Riyadi & Arif, 2025; Rahayu et al., 2019).

The stages implemented in the experimental class demonstrate that the Guided Discovery Learning model can enhance students' engagement in geography learning. This aligns with the concept of Student-Centered Learning, which positions students at the core of the learning process to achieve more optimal cognitive learning outcomes (Kasanah & Pratama, 2024). Through the stimulation and data collection stages, students have the opportunity to discover geographic concepts actively. This reflects the principles of Guided Discovery Learning, which encourage students to think critically through direct experiences in utilizing technology (Nofiana, 2020; Medani et al., 2022). Using Google Earth Pro to observe spatial phenomena further strengthens spatial thinking skills and problem-solving abilities, which

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are key objectives of Guided Discovery Learning (Yusuf et al., 2024; Attamimi et al., 2023). This approach helps students develop critical thinking skills (Rivaldi et al., 2024).

In contrast, in the control class, learning was conducted using a conventional model that relied primarily on a lecture-based approach. The learning process in the control class was conducted over two meetings, each with the same allocated time. The learning steps included: First, apperception, in which the teacher presented the learning objectives and connected the new material to prior knowledge. Second, material delivery, in which remote sensing material was explained using a lecture method supported by PowerPoint media. Third, question-and-answer activities in which the teacher posed triggering questions, such as "What is the role of remote sensing in land-use change?", and provided feedback to deepen understanding. Fourth, practice exercises in which students completed remote sensing-related tasks as a measure of their spatial thinking skills. Fifth, reflection, in which the teacher and students reflected on and summarized the material together.

Based on the implementation of learning in both the experimental and control classes, it can be observed that in the Guided Discovery Learning syntax assisted by Google Earth Pro applied in this study, the stage that most significantly influenced the research findings was the stimulation stage. This stage exposed students for the first time to real geographic phenomena through Google Earth Pro, which: first, sparked curiosity and learning motivation from the outset; second, transformed abstract remote sensing material into concrete and contextual visualizations; third, facilitated students in identifying relevant problems for the problem statement stage; and fourth, triggered active student engagement throughout the learning process, thereby having a significant impact on their cognitive achievements (Auliah et al., 2025). It can be concluded that the success of the stimulation stage determines the smoothness and effectiveness of all subsequent syntax stages, making it a key factor in improving cognitive learning outcomes in the experimental class (Aprilianti et al., 2021).

Several challenges and limitations were encountered in the implementation of the Guided Discovery Learning model assisted by Google Earth Pro. First, Google Earth Pro requires electronic devices, such as laptops, and a stable internet connection, which not all students have access to. Second, not all students can easily adapt to this learning activity. Given the new technology, errors often occur during the installation of Google Earth Pro or in its use for image interpretation. Third, the numerous steps and lack of prior training for students in using Google Earth Pro require a longer learning period. Fourth, teachers face difficulties providing guidance and instructions for discovery when the class size is large.

CONCLUSION

Based on the results of this study, it can be concluded that the Guided Discovery Learning model, supported by Google Earth Pro, has a significant impact on students' cognitive learning outcomes in geography. This is evidenced by the higher average post-test scores in the experimental class compared to the control class. An important finding of this research indicates that the stimulation stage in the Guided Discovery Learning syntax is the most dominant phase influencing the improvement of students' cognitive learning outcomes. This stage provides stimuli that foster curiosity, increase student engagement, and create an

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interactive, contextual, and meaningful learning experience, making it easier for students to understand spatial concepts that were previously considered abstract. Therefore, the use of this learning model can serve as an innovative option for enhancing the quality of geography education in schools. Recommendations for future researchers include paying attention to several challenges observed during this study. One major constraint was the limited instructional time, which prevented the model from being explored more broadly across various materials. In addition, limitations in school technological facilities, such as the availability of computers or internet access, posed obstacles to maximizing the use of Google Earth Pro. Therefore, future research is expected to overcome these challenges through better time planning, improved facility support, and expanded coverage of learning materials, so that the implementation of the Guided Discovery Learning model assisted by Google Earth Pro can achieve optimal and practical results in enhancing students' learning outcomes.

AUTHORS NOTE

The author declares that there is no conflict of interest regarding the publication of this article. The author affirms that the data and content of the article are free from plagiarism.

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