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Geography Learning Models in Improving Spatial Thinking Skills: A Literature Review

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Abstract
Spatial thinking skills are essential in everyday life. These skills can be improved through geography learning. Various studies on efforts to improve spatial thinking skills through geography education have been conducted in Indonesia; however, none have specifically examined the various models, teaching materials, and learning outcomes. Through a comprehensive review of previous findings, this study was conducted to fill this gap. The results of this study can be helpful for teachers and researchers in further developing geography education. This study employs a qualitative research design, specifically a document study or literature review. Publish or Perish software is used in the process of exploring or conducting literature searches. Through the initial search process, a total of 61 documents were obtained. These documents were then reviewed individually, resulting in a total of 16 documents that met the inclusion criteria. The results of the study showed that the most widely applied geography learning model was Project-Based Learning, followed by Discovery Learning and EarthComm. The teaching materials used are Disaster and Disaster Management, Basics of Mapping, Remote Sensing, and Geographic Information Systems (GIS), Atmosphere, Hydrosphere, Lithosphere Dynamics and Its Impact on Life, and Potential of Indonesian Marine Waters. Through the application of the learning model, various improvements were obtained in several indicators of spatial skills. The Project-Based Learning model is the most successful approach in improving various indicators of spatial thinking skills, including Analogy, Aura, Pattern, Association, Form, and Analysis.

Keywords: Learning Model, Geography, Spatial Thinking Skills

INTRODUCTION

Spatial thinking is a skill that is highly needed in life. Every day, individuals are required to be able to read graphs, diagrams, find the shortest path, and even use space to think about phenomena unrelated to the space itself (Ishikawa & Newcombe, 2021). Basantia & Gantait (2024) explain that spatial thinking is the ability to visualize spatial relationships, depict scale transformations, remember the image of a space, create new perspectives, and so on. Spatial thinking is closely related to mental and cognitive processes in representing, analyzing, depicting, creating, and manipulating spatial properties (Cole, Cohen, Wilhelm, & Lindell, 2018; Uttal, Miller, & Newcombe, 2013). This process can be observed when individuals attempt to understand maps, diagrams, graphs, and similar visual aids, which serve to solve problems and draw conclusions.

One way to improve spatial thinking skills is through geography learning (Jo & Hong, 2018). Maps, Remote Sensing (RS), and Geographic Information Systems (GIS) are subjects that can support the enhancement of these skills (Buzo-Sánchez, Mínguez, & De Lázaro-Torres, 2022; Jo & Hong, 2018; Jo, Hong, & Verma, 2016; Saputro, Liesnoor, & Hardati, 2020; Wang, Jiang, Zhang, & Zhao, 2020). However, research on the effect of geography learning on spatial thinking skills remains scarce (Verma & Estaville, 2018). Further research is needed to gather knowledge in the fields of curriculum, teaching instruction, assessment, and teacher competence development (Jo & Hong, 2018).

This research is conducted to meet one of these needs. The spatial thinking skills essential for the present require educators to find the most effective ways to develop these skills in students (Jo et al., 2016). Various studies on efforts to enhance spatial thinking skills through geography education have been conducted in Indonesia, but none have specifically examined the various models, teaching materials, and learning outcomes. Through a comprehensive review of previous findings, this research is conducted to fill this gap. The results of this study can be beneficial for both teachers and researchers in the further development of geography education.

RESEARCH METHODS

This research employs a qualitative approach, utilizing a research design that involves a document study or literature review. Document studies focus on the analysis and interpretation of written materials according to their context (Abdussamad, 2021). This research design is suitable for studies that emphasize theoretical and contextual analysis of the literature to be discussed (Manakane, Latue, & Rakuasa, 2023).

The literature search in this study is conducted through three stages: exploration, selection, and analysis (Figure 1). The software Publish or Perish is used in the literature search process by entering two keywords: "spatial thinking" and "geography learning". The database chosen for this search is Google Scholar, as it provides a broad and complex range of academic literature from all fields of study (Balqis et al., 2023).

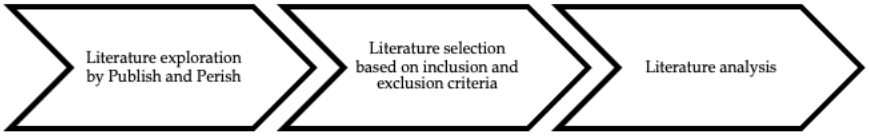

Figure 1. Literature Search Strategy (Source: Data Processing, 2025)

The inclusion and exclusion criteria used in the literature review process are presented in Table 1. Through the initial search process, a total of 61 documents were retrieved. These documents were then examined individually, resulting in a total of 16 documents that met the inclusion criteria.

Table 1. Inclusion and Exclusion Criteria

Indicator	Inclusion Criteria	Exclusion Criteria
Research Topics	Geography learning models to enhance spatial thinking skills	Efforts to enhance spatial thinking skills without implementing geography learning models
Research Methods	Direct research (e.g., experiments and classroom action research)	Literature review
Research Results	Shows the improvement of each indicator specifically	Demonstrates general improvement in spatial thinking skills
Research Locations	Indonesia	Outside Indonesia
Languages	Indonesia and English	Neither Indonesia nor English
Publication types	Journal and conferences proceeding	Peer-reviewed paper, thesis/dissertation, book, book chapter, abstract, and popular magazine

The selected documents were then analyzed in-depth through exploratory descriptive analysis. This analysis focused on exploring various geography teaching models applied, the teaching materials used, and the variations in learning outcomes achieved. The final goal of this analysis was to map the indicators of spatial thinking skills that improved as a result of implementing a specific teaching model.

RESULTS AND DISCUSSION

Implementation of Various Geography Learning Models in Improving Spatial Thinking Skills

Research on the influence of implementing geography learning models on improving spatial thinking skills in Indonesia has been widely conducted. However, there are only 16 journals that discuss in detail the influence of implementing the model on each indicator of critical thinking skills. Table 2 presents the various learning models implemented, with Project-Based Learning being the most widely used model.

Table 2. Various Geography Learning Models in Improving Spatial Thinking Skills

No	Learning Model	Researcher
1	Project Based Learning	Elisa, 2024; Hidayanti, Soekamto, & Masruroh, 2023; Pangastuti, Nurdin, & Kurnianto, 2022; Rahayu, Handoyo, & Rosyida, 2022
2	Discovery Learning	Medani, Suharto, Taryana, & Sumarmi, 2022; Syafitri, Munandar, & Handawati, 2023; Virgiawan, Murtini, & Raifatur, 2023
3	Earthcomm	Aliman, Halek, Lukman, Marni, & Alnursa, 2022; Choiri, Purwanto, Rosyida, & Wagistina, 2022
4	Problem Based Learning	Buana & Putra, 2023; Ningrum & Perkasa, 2024
5	Science, Environment, Technology, and Society (SETS) Model Integrated with Google Earth	Safira, Sahrina, Utomo, & Astina, 2024
6	Relating, Experiencing, Applying, Cooperating, Transfering (REACT)	Hidayanti, Sumarmi, & Utomo, 2019
7	Contextual Teaching and Learning (CTL)	Ardiyanto, Astutik, & Pangastuti, 2023
8	Resource Based Learning (RBL)	Fatmawati, Yushardi, Nurdin, Astutik, & Kurnianto, 2023
9	Flipped Classroom	Ayun, Cho, & Zondi, 2023

(Source: Data Processing, 2025)

Project-Based Learning

The Project-Based Learning learning model is the most widely implemented because it is considered effective in improving spatial thinking skills (Elisa, 2024; Hidayanti, Soekamto, & Masruroh, 2023; Pangastuti, Nurdin, & Kurnianto, 2022; Rahayu, Handoyo, & Rosyida, 2022). This model enables a learning process that is more engaging, challenging, and encourages students to be more actively involved during the learning experience. The Project-Based Learning model also incorporates the design thinking process, where each group develops solutions through ideation, prototyping, testing, and evaluation (Burns, 2020, as cited in Pangastuti, Nurdin, & Kurnianto, 2022).

Through the implementation of this model, students find it easier to understand the material, and their spatial thinking skills improve.

Project-based Based Learning emphasizes the provision of contextual projects, namely those related to real life, so that the learning process becomes more structured. Students are required to be actively involved throughout the learning process, from identifying problems and designing projects to improving results. Students are also motivated to compete and have the freedom to carry out the project. In the context of geography learning, the use of Google Earth through project-based Learning can help students better understand spatial data in their surrounding environment. Additionally, students can store spatial data for a long time, as Google Earth provides a visual representation of the Earth in a three-dimensional format (Rahayu, Handoyo, & Rosyida, 2022).

The Project-Based Learning model has advantages in terms of increasing student motivation related to learning experiences and the environment. The experiences gained by students during learning will affect their thinking skills, while the environment can encourage student motivation in supporting learning activities. However, the implementation of this model often encounters obstacles, particularly related to time constraints. The stages of project completion can take a considerable amount of time, so teachers must consider them carefully to ensure the project is completed correctly. Project-based Learning, carried out in groups, also often does not take place constructively, so teachers have a vital role in managing the learning process (Hidayanti et al., 2023).

Discovery Learning

The Discovery Learning model is considered effective in improving spatial thinking skills (Medani et al., 2022; Syafitri, Munandar, & Handawati, 2023; Virgiawan, Murtini, & Raifatur, 2023). This model places students at the center of learning, allowing them to delve deeper into the material and develop their creativity and imagination by connecting old knowledge with new. As a result, Discovery Learning enables students to take an active role in their learning and develop independence.

The implementation of the Guided Discovery Learning model, also commonly referred to as Guided Discovery Learning, can be achieved through the process of observation or experimentation. These learning activities can encourage collaboration between teachers and students in building knowledge and finding new information appropriately. Guided Discovery Learning emphasizes the importance of the problem-solving process undertaken by students through research steps, including problem identification, hypothesis formulation, data collection, verification of research results, and generalization to conclude (Margunayasa, 2019, as cited in Medani et al., 2022).

The success of implementing the Discovery Learning model is highly dependent on how teachers prepare their students, as mental readiness is essential in this learning approach (Virgiawan, Murtini, & Raifatur, 2023). Students who are ready to engage in learning activities through this model will reap various benefits, including enhanced cognitive skills, in-depth knowledge, and increased self-confidence. However, if students are not ready because they are not accustomed to learning independently, it will reduce the success of implementing the model. Additionally, implementing the Discovery Learning model requires a significant amount of time, so teachers must consider their availability.

Earthcomm

The EarthComm model emphasizes learning outside the classroom, providing students with a more realistic learning experience. The implementation of the Earthcomm model in field learning provides students with the opportunity to see problems directly and study them visually. The model also enables students to learn actively and participate directly in scientific investigations. This approach has proven effective in increasing awareness of the conditions and geographical location of an area (Nisa et al., 2021, as cited in Aliman et al., 2022). The implementation of the Earthcomm model, which focuses on solving problems related to geosphere phenomena, can encourage students to develop environmental awareness. However, developing knowledge through the implementation of this model becomes difficult if it is not supported by adequate data access (Choiri et al., 2022).

Problem-Based Learning

The Problem-Based Learning model is based on constructivist theory. This model accommodates student involvement in learning and contextual problem-solving. To obtain information and develop concepts, students are required to learn how to construct problem frameworks, observe, collect data, organize problems, compile facts, analyze data, and compile arguments related to problem-solving, both individually and in groups (Dewi, 2021; Ningrum & Perkasa, 2024).

Problem-Based Learning is a learning model that aligns with the demands of 21st-century learning, particularly in terms of student collaboration. This is because the Problem-Based Learning model emphasizes student-centered learning throughout the learning process. Spatial thinking skills are a vital asset in implementing this learning model because each study of the geosphere phenomenon encompasses more than one space that influences one another. However, the implementation of the Problem-Based Learning model will be hampered if students are not accustomed to searching for information independently, considering that they are currently accustomed to receiving information directly from teachers. Additionally, this model requires the support of the media to facilitate the learning process, so teachers must undergo thorough preparation before implementation.

Science, Environment, Technology, and Society (SETS) Model Integrated with Google Earth

Through the implementation of the SETS model assisted by Google Earth, teachers invite students to investigate, analyze, and form spatial thinking concepts in a comprehensive and structured manner. Google Earth media have been proven to help students develop a framework of thinking by displaying changes in objects and providing visual images of phenomena on the Earth's surface. However, the implementation of this model can encounter obstacles if teachers do not pay sufficient attention to student activities during learning, making it difficult to explain the impact of learning on each student.

Relating, Experiencing, Applying, Cooperating, Transfering (REACT)

The REACT model has been proven to encourage an increase in students' spatial thinking skills, as it utilizes direct observation of objects during field-based learning. This model has several advantages, including the ability to build understanding gradually. As basic understanding is expected to emerge, students can then connect material concepts and gain a deeper understanding (Durotulaila, Masykuri, & Mulyani, 2014, as cited in Hidayanti et al., 2019). This gradual learning can train and hone students' thinking skills, including spatial thinking. However, the drawback is that it requires special attention to several things in the learning process, such as classroom

management, time allocation, and differences in student skills.

Contextual Teaching and Learning (CTL)

The CTL offers tea with the opportunity to understand and explore study skills in connection with academic material and everyday life. Thus, teacher creativity is the primary key to successful learning, making the learning process more meaningful and productive (Ramdani, 2018, as cited in Ardiyanto et al., 2023). The CTL model enables students to gain a deeper understanding because they are trained to solve problems and learn how to do so (Siahaan, 2021, as cited in Ardiyanto et al., 2023). In addition, classroom learning becomes more meaningful and relevant because students can see the relationship between the material taught in school and real life. However, the implementation of the CTL model has several weaknesses, including requiring a significant amount of time, adequate resources, being difficult to adapt to the curriculum, and relying heavily on student experience.

Resource-Based Learning (RBL)

The RBL model directly involves students with various learning resources, both individually and in groups. This model also fosters a fun learning atmosphere and captures students' interest, particularly in geography. Student activity, along with the role of teachers as facilitators and motivators, is key to the success of the RBL model. The RBL model offers several advantages, including enhancing students' learning skills and motivation, reducing their dependence on teachers, and providing learning opportunities through various sources. This model also helps students overcome new challenges, practice problem-solving skills, and foster curiosity through their active involvement in the learning process. However, the RBL model also has several disadvantages, including requiring more time to access and process learning resources and making it difficult for students who are less skilled in finding or using learning resources. The RBL model also requires facilities and access to technology that may not be available in all schools (Suharwati et al., 2016, in Fatmawati et al., 2023).

Flipped Classroom

The last learning model that can improve spatial thinking skills is the Flipped Classroom. The Flipped Classroom model, combined with a STEAM approach, can capture students' interest in learning geography because they tend to be drawn to visual and digital content. This model not only utilizes learning videos but also emphasizes the importance of time in enhancing the quality of learning and developing students' critical thinking skills. Through the STEAM approach, geography learning becomes more engaging, where students are invited to visualize material through educational videos that develop their critical and spatial thinking skills.

The Flipped Classroom model, combined with a STEAM approach, has several advantages, including increased student engagement, the development of critical and spatial thinking skills, and encouragement of independent learning. However, the disadvantages include dependence on technology, increased preparation time, and difficulties for students accustomed to conventional methods.

A Variety of Geography Learning Materials to Improve Spatial Thinking Skills

Learning materials are an essential component in the learning process. Without materials, the learning process would be meaningless due to the absence of specific learning objectives. Learning models can also only be implemented when there is material to be taught. To improve spatial thinking skills, several learning materials can be utilized. Through 16 studies examining the influence of geography learning models on spatial thinking skills, five primary learning materials are used, namely Disasters and

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Disaster Management, Basics of Mapping, Remote Sensing, Geographic Information Systems (GIS), Atmospheric Dynamics, Hydrosphere Dynamics, and Lithosphere Dynamics (Table 3).

Table 3. A variety of Geography Teaching Materials to Improve Spatial Thinking Skills

No	Teaching Materials	Learning Model
1	Disasters and Disaster Management	Discovery Learning; Problem Based Learning; Project Based Learning; dan SETS Model Integrated with Google Earth
2	Basics of Mapping, Remote Sensing, and Geographic Information Systems (GIS)	Earthcomm; Project Based Learning; dan Guided Discovery Learning
3	Atmosphere	RBL; REACT; CTL; Problem Based Learning; dan Earthcomm Berbantuan Aplikasi Windy
4	Hydrosphere	Project Based Learning dan Flipped Classroom
5	Lithosphere Dynamics and Impact on Life	RBL
6	Potential of Indonesian Marine Waters	Discovery Learning

(Source: Data Processing, 2025)

Disasters and Disaster Management

The Disasters and Disaster Management material covers two topics to enhance spatial thinking skills, namely "Distribution of Natural Disaster-Prone Areas in Indonesia" and "Distribution of Natural Disasters and Their Mitigation." Through the first material, "Distribution of Natural Disaster-Prone Areas in Indonesia," students learn spatial concepts related to location, distance, direction, and spatial relationships between regions. In addition, students analyze and identify patterns of natural disaster distribution, including earthquakes, volcanic eruptions, tsunamis, landslides, and floods. This material is taught through the implementation of the Discovery Learning model, which helps students understand the concept of spatial thinking by conducting direct exploration and discovery activities.

In the second material, titled "Distribution of Natural Disasters and Their Mitigation," students learn about the distribution of disasters, potential damage, and mitigation efforts that can be implemented based on the geographical conditions of an area. Spatial skills are crucial for identifying and analyzing disaster-prone areas. This material is taught through the application of three learning models: Project-Based Learning, Problem-Based Learning, and the SETS Model, Integrated with Google Earth. This learning model allows students to be directly involved in projects and case studies, thereby honing their spatial thinking and in-depth analysis skills.

Basics of Mapping, Remote Sensing, and Geographic Information Systems (GIS)

Students who receive the material "Basics of Mapping, Remote Sensing, and Geographic Information Systems (GIS)" will learn the concepts and techniques used to collect, analyze, and manage geographic data. Spatial thinking skills are crucial for comprehending and interpreting maps, satellite imagery, and data collected through remote sensing and GIS technology. This material is taught through the implementation of three learning models, namely Earthcomm, Project-Based Learning, and Guided Discovery Learning. The implementation of these learning models enables students to learn actively by exploring geographic data, working on problem-based projects, and discovering concepts independently, thereby strengthening their understanding of spatial

concepts and their applications in real-life situations.

Atmosphere

Through the Atmosphere material, students learn about temperature, weather, and climate, as well as how geographic and social conditions influence the impact of climate change in various locations. Spatial thinking skills are needed in this case to analyze climate change, identify areas vulnerable to its impacts, and design mitigation solutions to reduce the risks posed. This material is taught through the implementation of various models, including RBL, REACT, CTL, Problem Based Learning, and Earthcomm Assisted by the Windy Application which allows students to relate the concept of the atmosphere to real-life contexts, think critically in solving problems related to climate change, and understand the interaction between geographic, social, and environmental factors in more depth.

Hydrosphere

The Hydrosphere material covers two topics: "Hydrosphere Dynamics" and "Hydrological Cycle." The first topic, "Hydrosphere Dynamics," includes a section on river flow patterns that examines abstract concepts related to the shape and characteristics of river flow patterns in various regions, as well as the reasons why these patterns can vary. Spatial thinking skills are essential for analyzing water distribution patterns, identifying relationships between regions, and assessing the impact of changes in hydrosphere conditions on the environment and human life. This topic is taught through the implementation of the Project-Based Learning model, which allows students to work on real-world, problem-based projects. This approach enables them to develop spatial thinking and problem-solving skills through direct exploration and field research.

Regarding the topic of the "Hydrological Cycle," it focuses on the movement of water on Earth, including rain, evaporation, and the flow of water in rivers and lakes. Spatial thinking skills enable us to understand how water moves and is distributed in various locations, as well as how geographic and climatic conditions influence water distribution. This topic is taught through the implementation of the Flipped Classroom model that allows students to learn independently. Furthermore, students can discuss and study the material in depth to strengthen their understanding of the concept of the hydrological cycle.

Lithosphere Dynamics and Impact on Life

Through the "Lithosphere Dynamics and Its Impact on Life" material, students learn about geological processes, including tectonic plate movements, earthquakes, volcanic eruptions, and mountain formation, that occur on the Earth's surface. Spatial thinking skills are essential for understanding how these processes are distributed across different locations, as well as their impact on physical conditions and human life. The material is taught through the implementation of the RBL model, which enables students to access various sources and information, allowing them to study the material independently and apply their knowledge in real-life contexts.

Potential of Indonesian Marine Waters

The material, "Potential of Indonesian Marine Waters," examines the distribution of natural resources and the associated problems related to marine potential in various regions, presenting the findings in the form of infographics. Spatial thinking skills are essential for analyzing and providing solutions related to understanding the distribution of marine potential, thereby facilitating informed decision-making for the effective utilization and management of marine resources. This material is taught through the implementation of the Discovery Learning model, which enables the exploration and understanding of spatial concepts through direct experience.

Various Indicators of Spatial Thinking Skills that Increase as a Result of Implementing Various Geography Learning Models

Researchers in Indonesia employ various indicators of spatial thinking skills in their assessments. The use of these indicators is adjusted to each reference source. Table 4 is a breakdown of the indicators used by the researchers.

Table 4. Variety of Spatial Thinking Skills Indicators

No	Spatial Thinking Indicators	Reference Source	Researcher
1	Comparison; Aura; Region; Hierarchy; Transition; Analogy; Pattern; & Association	Association of American Geographers (2006)	Ardiyanto et al., 2023; Ayun et al., 2023; Fatmawati et al., 2023; Ningrum & Perkasa, 2024; Pangastuti et al., 2022; Rahayu et al., 2022; Syafitri, Munandar, & Handawati, 2023
2	Location, Pattern, Connectivity, Association, and Analogy	Gersmehl (2008)	Virgiawan et al., 2023
3	Location; Shape; Identify; Table; & Analyze	Jo dan Bednarz (2009)	Hidayanti et al., 2023; Medani et al., 2022
4	Location; Identifying the region; Spatial association; Identifying the content of aerial imagery photos; Elaborate; Analysis; Plan	Jo dan Bednarz (2010)	Safira et al., 2024
5	Spatial primitive; Simple Spatial; Complex Spatial; Use Tools of Representation; Input; Processing; Output	Jo & Bednarz (2011)	Buana & Putra, 2023; Choiri et al., 2022
6	Analysis, Comprehension, Representation, Application, Scale, Spatial interaction	Huynh & Sharpe (2013)	Aliman et al., 2022; Elisa, 2024
7	Making spatial comparisons; Delineating a region/place; Spatial influences; Identifying places/locations in a spatial hierarchy; Describing spatial transitions; Identifying spatial analogues	-	Hidayanti et al., 2019

The differences in the various indicators used also result in variations in the implementation results of learning models. Indicators that come from the same reference source do not all experience maximum improvement. Several indicators increase drastically, while others experience only a slight increase.

Table 5. Various Indicators of Spatial Thinking Skills that Experience the Highest Increase as a Result of Implementing Various Learning Models

No	Learning model	Increasing Indicators
1	Discovery Learning	Aura, Pola, dan Region
2	Earthcomm	Use tools of representation
3	SETS Model Integrated with Google Earth	Spatial Association
4	Project Based Learning	Analogy, Aura, Pattern, Association, Form, and Analysis
5	REACT	Delineation of a region/place (Region)
6	Problem Based Learning	Output, Association, and Region
7	CTL	Hierarchy, Aura, and Region
8	RBL	Aura
9	Flipped Classroom	Comparison

Table 5 shows that the spatial thinking skill indicators that increased the most were Aura and Region. According to the Association of American Geographers, in 2006, aura refers to the influence exerted by a place or object on its surrounding environment. In contrast, a region is a specific location or area that has a defined spatial relationship (Sari, Suharini, & Banowati, 2021). Aura experienced the highest increase as a result of implementing the Discovery Learning, Project-Based Learning, CTL, and RBL models. The Region indicator was improved through the implementation of the Discovery Learning, Problem-Based Learning, and CTL models. These learning models have been proven to improve the Aura and Region indicators in students, as they involve an active and independent learning process through experiments, problem-solving, reviewing various sources of information, and direct observation in the field.

The second most significant indicator to experience the highest increase was the Association. Three learning models can increase the Association indicator: the SETS Model Integrated with Google Earth, Project-Based Learning, and Problem-Based Learning. Association is a relationship or connection between elements in space that influence each other. At the same time, a Region is a specific location or area that has a relationship in a space (Association of American Geographers, 2006, in Sari et al., 2021). These learning models have been proven to increase the Association indicator in students because they help students connect various concepts in real-world situations. Through the implementation of SETS, students learn how science, technology, and society are interconnected and affect the environment. Meanwhile, Project-Based Learning and Problem-Based Learning provide students with the opportunity to solve everyday life problems that involve the relationship between elements of space and the concepts surrounding them, thereby strengthening students' ability to build more complex associations.

The third most significant indicator that experienced the highest increase was Pattern. Discovery Learning and Project-Based Learning are learning models used to improve this indicator. A pattern is an arrangement or sequence of elements that are regular or repeated in space (Association of American Geographers, 2006, in Sari et al., 2021). These learning models have been proven to improve the Pattern indicator in students because Discovery Learning allows students to learn to identify patterns independently through exploration and observation in their surrounding environment, encouraging them to be active and recognize patterns around them. Meanwhile, through Project-Based Learning, students are trained to work on projects that involve pattern analysis in real-world situations, helping them connect knowledge to everyday life. Both models also enable students to recognize,

understand, and apply patterns in various contexts.

Finally, the indicators with the highest increase but only from one study each are Use tools of representation (Earthcomm model), Analogy (Project Based Learning), Form (Project Based Learning), Analysis (Project Based Learning), Output (Problem Based Learning), Hierarchy (CTL), and Comparison (Flipped Classroom). Through the various results of these improvements, Project-Based Learning is the learning model that most improves various indicators of spatial thinking skills. This is because the Project-Based Learning model has a complex syntax and requires a significant amount of time, thereby maximizing students' success in learning. Project-based Learning is also carried out contextually, based on real-life situations, making it easier for students to understand.

CONCLUSION

Spatial thinking skills are essential in everyday life. These skills can be improved through formal geography learning. The implementation of learning models in various geography teaching materials has been widely studied in Indonesia to improve spatial thinking skills. However, a specific review of the models used and their impact on each indicator of spatial thinking skills has not been carried out. Through a review of various Indonesian journals that discuss the influence of implementing geography learning models on improving spatial thinking skills, it was found that the most widely used model is the Project-Based Learning model. The following are the most widely used models: Discovery Learning and Earthcomm. The implementation of learning models is carried out in various geography teaching materials, including Disasters and Disaster Management, Basics of Mapping, Remote Sensing, and Geographic Information Systems (GIS), Atmosphere, Hydrosphere, Lithosphere Dynamics and Impact on Life, and Potential of Indonesian Marine Waters. The results of implementing various geography learning models show that several indicators of spatial thinking skills, including Aura, Pattern, Region, Use of tools of representation, Spatial association, Analogy, Pattern, Association, Form, Analysis, Delineation of a region/place, Output, Hierarchy, and Comparison, are improved. The Project-Based Learning model is the most successful approach in improving various indicators of spatial thinking skills, including Analogy, Aura, Pattern, Association, Form, and Analysis.

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