



## Systematic Literature Review: Effectiveness of Discovery Learning on the Learning Outcomes of Students in Elementary Schools in Science

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### ABSTRACT

A teacher-centred approach still dominates science learning in schools. This condition contradicts the nature of science as a discovery process and the demands of the Independent Curriculum, which emphasises student-centred learning. This study aims to analyse the effectiveness of the Discovery Learning model in improving elementary school students' science learning outcomes, based on a review of the relevant literature. The research method was a Systematic Literature Review (SLR) conducted in accordance with the PRISMA protocol. Data were obtained via Google Scholar using Publish or Perish and Covidence. Of the 404 identified articles, 18 articles indexed in SINTA 1–4 between 2021 and 2025 met the inclusion criteria. The results indicate that Discovery Learning is effective in improving science learning outcomes in cognitive, affective, and psychomotor aspects. Cognitive improvements are demonstrated through increases in average scores, learning completion, and N-Gain; affective improvements include increased motivation, scientific attitudes, and student activeness; and psychomotor improvements include the development of science process skills. The effectiveness of this model is further optimised with the support of contextual and visual media. Thus, Discovery Learning has been proven effective, relevant, and adaptive for science learning in elementary schools and aligns with the principles of the Independent Curriculum.

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## 1. INTRODUCTION

Education is a manifestation of human culture that functions in the development of life. Therefore, educational development must occur in line with cultural change. This change is understood as continuous educational renewal at every level to anticipate future needs. Good educational activities will connect people, by people, and for people, and will influence abilities and personalities within society. The world of education is not only about the transfer of knowledge but also about the transfer of values that protect social unity and help maintain civilisation.

Education that supports future development is education that fosters student achievement, potential, and abilities, preparing them to thrive in the coming era of globalisation. At every stage of the learning process, cognitive skills must be developed. Learning design plays a crucial role because each stage is closely related to life. Essentially, the outcomes of each learning process serve as a foundation for students to face challenges around them and prepare for their future lives (Yanti et al., 2022).

Learning is a process aimed at changing a person's behaviour to be more positive as expected. Learning is also the process of internalising knowledge within an individual. This process involves the activities of students as learners and teachers as educators. Learning is carried out in several stages, starting with planning, implementation, and evaluation by the teacher, and then implemented through face-to-face meetings supported by appropriate media, tools, and teaching materials. The teacher's role as an educator is to control or direct the skills and knowledge that students are to master. Meanwhile, students, as pupils, play an active role in carrying out the teacher's instructions to achieve learning objectives, as reflected in competency achievement indicators (Haizatul Faizah, 2024).

The Independent Curriculum is a new policy developed by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) as an effort to realise more flexible, competency-oriented learning and to emphasise the strengthening of the character and profile of Pancasila Students. One of the updates presented in the Independent Curriculum at the elementary school level is the introduction of Natural and Social Sciences (IPAS) subjects. According to the official IPAS Learning Outcomes document published by Direktorat Sekolah Dasar, Kemendikdasmen (2022), IPAS is an integration of Natural Sciences (IPA) and Social Sciences (IPS) subjects that aims to develop scientific thinking skills, process skills, and an integrated understanding of concepts between natural and social aspects.

Through science learning, students are guided to understand the relationships between natural phenomena and the social life around them in a holistic, contextual manner. This approach is expected to foster curiosity, critical thinking skills, and environmental awareness. However, in practice, subjects related to scientific concepts, such as science, are still often considered difficult by most elementary school students, necessitating learning strategies that can make science learning more meaningful and enjoyable (Hartina et al., 2025).

Science has been an integral part of human life since humans began to master themselves and their surroundings. Humans and nature are the inseparable source, object, and subject of science. However, in practice, science instruction by teachers tends to be conventional. Teachers have not yet fully implemented active and creative learning to engage students, and the method is still dominated by lectures and assignments (Pratiwi, 2025).

Science learning in schools tends to be teacher-centred, with the teacher as the sole source of information and students playing a passive role as recipients of knowledge. This condition

contradicts the nature of science as a process of discovery that requires active student involvement in exploration and investigation activities. Monotonous and less varied learning causes students to feel bored and less motivated to learn science. The one-way lecture method prevents students from developing critical thinking, creativity, and problem-solving abilities, which are 21st-century competencies (Tanjung et al., 2022). This is caused by several factors, including: (1) a learning approach that is still teacher-centred, (2) a lack of active student involvement in the learning process, (3) minimal use of innovative learning models, and (4) limited teaching materials that can stimulate student interest in learning (Mediawadi & Bayu, 2022).

Learning outcomes in Natural Sciences (IPA) subjects integrated into the Social Sciences (IPAS) are indicators of students' success in understanding and mastering the competencies established in the learning process. In the context of the IPA subject in elementary schools, learning outcomes encompass not only cognitive aspects of knowledge, but also affective, attitudes, and psychomotor (skills). IPA learning aims to foster scientific thinking skills, curiosity, and concern for nature and the environment in students' daily lives (Kusumawati & Riyanto, 2022).

However, in practice, science learning outcomes at the elementary school level often fall short of optimal results. This is due to several factors, including the use of teacher-centred learning models, low levels of active student involvement in the learning process, and limited opportunities for students to explore and discover independently. As a result, science learning tends to be rote and unable to foster deep conceptual understanding or critical and creative thinking skills (Agung et al., 2025). Low science learning outcomes reflect the need for innovation in learning strategies, including models that encourage students to discover concepts through direct, active learning experiences. Therefore, the Discovery Learning Model is essential because it allows students to be directly involved in understanding nature and to practice the material they have learned.

Although various studies indicate that Discovery Learning has the potential to improve science learning outcomes, the available empirical evidence remains scattered across contexts, research designs, and diverse learning media. This situation has resulted in a lack of systematic mapping of conclusions about the effectiveness of Discovery Learning, particularly regarding its impact on cognitive, affective, and psychomotor aspects as a whole. Therefore, this study aims to systematically review the literature to answer the following research questions: RQ1: How effective is Discovery Learning in improving cognitive, affective, and psychomotor learning outcomes in science learning at the elementary school level? RQ2: What factors optimise the effectiveness of Discovery Learning in the context of science learning in elementary schools? Therefore, a more structured study using a Systematic Literature Review (SLR) approach is needed to provide a comprehensive overview of the effectiveness of Discovery Learning and the supporting factors that maximise its application in science learning in elementary schools.

The application of an appropriate learning model can be a strategy to improve the quality of the learning process. One such model is discovery learning. This study aims to review the literature related to the application of the discovery learning model to improve student learning outcomes at the elementary school level. This study used the Systematic Literature Review (SLR) method. The data collection process was carried out in a structured manner by documenting all articles relevant to the research topic. Learning in elementary schools still

tends to be teacher-centred, with a dominant lecture method, resulting in students being less active in the knowledge-construction process (Yulizar et al., 2024).

The Discovery Learning model is a student-centred learning approach that emphasises the independent discovery of concepts. This model aligns with the characteristics of science and science learning, which require a scientific approach and conceptual exploration. Various empirical studies have shown that the application of Discovery Learning can improve student learning outcomes (Candra et al., 2021).

Discovery learning is a learning model that emphasises students discovering concepts through exploration and investigation. Bruner (1961), the originator of discovery learning theory, emphasised that learning is more meaningful when students actively discover knowledge through inquiry (Muhammad et al., 2023). This model aligns with the constructivist theory, which views students as active constructors of their own knowledge. Discovery learning is effective in improving the cognitive, affective, and psychomotor learning outcomes of elementary school students. This model facilitates students' development of science process skills such as observing, classifying, measuring, predicting, and concluding, which are important foundations for advanced science learning (Puspitasari & Budiyanto, 2025).

Given the importance of evaluating the effectiveness of the Discovery Learning model in elementary science education, a systematic review of research findings is necessary. A Systematic Literature Review (SLR) is an appropriate method for identifying, evaluating, and synthesising empirical evidence on the effectiveness of Discovery Learning on science and learning outcomes.

Several findings indicate that low student learning outcomes, particularly in science subjects, are caused by suboptimal, still-conventional learning processes (Hamid et al., 2023). Teachers tend to rely on lectures and assignments without actively and creatively involving students. This results in student learning outcomes failing to meet the Minimum Completion Criteria (KKM), compounded by minimal individual attention from teachers. This study aims to examine the effectiveness of student learning styles and teachers' use of the Discovery Learning model as factors influencing student learning outcomes, through a review of relevant literature.

## 2. METHODS

This study employed a Systematic Literature Review (SLR) method following the PRISMA protocol. This study used the Systematic Literature Review (SLR) method, an approach to research conducted systematically. To collect secondary data, evaluate it critically, and synthesise all relevant scientific evidence, the study addresses specific research questions. SLR is the process of identifying, assessing, and interpreting available research to produce comprehensive, objective, reliable, and replicable answers. The analytical review in the SLR is designed to establish clear inclusion and exclusion criteria, ensuring transparent and credible study results (Latifah, 2023). This study used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol, as it involved a systematic literature review. PRISMA is a systematic review reporting guideline that helps researchers explain the background, objectives, and review procedures in a structured, evidence-based manner.

The SLR stages in this study include planning, conducting, and reporting. The planning stage begins with establishing a research question (RQ) as the basis for the literature search and selection. All data used are secondary, obtained from literature studies and scientific

documents, without involving field research. The collected data is systematically analysed and synthesised to develop a current understanding of the research topic (Suprpti et al., 2022). The implementation stage includes searching for and selecting articles and scientific journals relevant to the research focus. Literature selection is conducted strictly, prioritising reputable national and international journals. Articles that meet the criteria are then sorted, analysed, and processed as study material in the literature review (Mulia, 2022). The reporting stage is the final stage, namely, the preparation of the SLR results into a scientific manuscript. At this stage, PRISMA is used as a guide to ensure the quality, transparency, and completeness of the systematic review report. The PRISMA protocol provides a checklist of key items that must be explained carefully, from the study's basis to the methods used (Habibah & Nuraini, 2025).

The article selection procedure follows the PRISMA Flow Diagram which includes four stages, namely: (1) identification of articles from various data sources, (2) screening through the elimination of duplication and selection of titles and abstracts, (3) assessment of eligibility through a comprehensive review of the article content, and (4) inclusion of final articles for the data extraction and synthesis process (Yinuo, 2025). Data collection was conducted using the Publish or Perish application and the Google Scholar database, with a combination of relevant keywords, such as Discovery Learning, learning outcomes, and elementary school science and education. The articles analysed were limited to publications from 2021–2025 to ensure the data's up-to-dateness (Rizkiyah, 2025). Articles that met the inclusion criteria were then analysed through data extraction to identify learning models, media innovations, research methods, and key findings. Data were analysed descriptively and qualitatively to produce a comprehensive thematic synthesis, so that the SLR not only summarises the literature but also maps knowledge and directions for the development of research in science and education in elementary schools (Dini et al., 2024).

### **3. RESULTS AND DISCUSSION**

Results section. This is organised based on the Systematic Literature Review (SLR) of 18 articles that discuss the effectiveness of discovery learning on the learning outcomes of elementary school students in science. The analysis was conducted descriptively by tracing Publications, Citations, and Researchers; Place of Publication; Sinta Indexed; Research Methods in the Reviewed Literature; and Research Issues and Themes in the Reviewed Literature used in the articles.

The article selection process involved several stages: identifying relevant articles, screening them based on titles and abstracts, and thoroughly reviewing their content. This resulted in 18 articles deemed suitable for further analysis.

Based on an analysis of 18 research articles using various research methods, the discovery learning model has the potential to improve students' science learning outcomes at the elementary school level. Qualitative research articles indicate that the discovery learning model is effective in improving student learning outcomes (Rikmasari & Rosesa, 2022; Yulianti & Andrijati, 2024).

On the other hand, quantitative research articles show that the use of the discovery learning model has a significant impact on student learning outcomes (Tapa et al., 2023; Kasmini, 2021; Sudirama et al., 2021; Sasingan & Wote, 2022; Gede et al., 2020; Naibaho & Hoesein, 2021; Mayuni et al., 2021; Kusumayuni et al., 2023; Sabrina et al., 2025; Parla et al., 2025).

In addition, research articles on Mixed Methods/PTK Dominant Qualitative affective in improving students' science learning outcomes (Olivia & Sanoto, 2023), (Khotimah, 2021), (Mila Deviana, Ervina Eka Subekti, 2021), (Aryantini et al., 2021; Husni & Suryawan, 2022). Development research also indicates that the use of discovery learning strategies positively impacts elementary school students' learning outcomes.

Discovery Learning is a learning model that places students at the centre of learning activities, actively involved in exploration, observation, and problem-solving to discover new concepts or principles without being given final answers by the teacher. In this model, students are allowed to investigate information through experiments, observations, or data processing to construct their own knowledge based on their learning experiences. The teacher's role shifts to that of a facilitator who guides the discovery process rather than simply transmitting material, making the learning process more interactive and meaningful for students (Ilmiati, 2024).

In discovery learning, students engage in mental activities such as discussions, exchanging opinions, reading information from various sources, and conducting their own observations and experiments. The discovery learning model guides students to discover concepts through various information or data obtained from observations or experiments. In addition, the application of the discovery learning model at the elementary level has the following advantages: 1) Enriching students' learning experiences, 2) Providing opportunities for students to interact with sources of knowledge other than books, 3) Encouraging student creativity, 4) Increasing students' self-confidence, and 5) Strengthening cooperation between students (Bakhtiar & Nasir, 2025).

In the discovery learning model, various media are used to achieve goals and outcomes. Learning media plays a role in conveying messages and making abstract material more concrete because, at the elementary school level, students are still in the concrete operational stage (Aini & Alim, 2025). In 18 articles that have been mentioned, there is a variety of media used in learning Discovery learning, such as: 1) PowerPoint media, 2) video and audiovisual media, 3) interactive media, and 4) mind mapping media. The use of various media has improved student learning outcomes. In this model, each student gains similar knowledge, making learning more effective and efficient.

Using the discovery learning model can expand students' learning experiences. In addition to relying on textbooks and teachers, students can also utilise a variety of other learning resources, such as videos, interactions with classmates, group work, and everyday experiences. With this variety of learning resources, students have a greater opportunity to master the learning material. The advantages students gain from this learning model include stimulating curiosity and developing independent problem-solving skills. However, the discovery learning model also has disadvantages, including the lengthy learning time required, inefficiency when teaching a large number of students, the need for mental preparation, and insufficient attention to developing attitudes and skills (Khasinah, 2021)

This research shows that applying the discovery learning model can improve student learning outcomes for the following reasons. First, the discovery learning model aligns with the constructivist approach, which views students as actively constructing their own knowledge. Second, the discovery learning model provides opportunities for students to participate in class activities and actively use various learning resources. Third, the stages in the discovery learning model encourage students to systematically, critically, and logically

search for and investigate problems, enabling them to independently acquire knowledge, attitudes, and skills through their learning (Adi, 2022).

### **Effectiveness of Discovery Learning towards Learning Outcomes Cognitive**

The study results literature shows that applying the Discovery Learning model in ways that yield consistent and significant gains supports the cognitive education of school participants in the fundamentals of science learning. This improvement is reflected in the ability to understand concepts, analyse problems, and apply knowledge in everyday contexts. Various studies in the synthesis table report increases in average grades, learning completeness, N-Gain, and high effect sizes, both through experimental designs, CAR, and meta-analyses. Furthermore, the use of supporting media such as mind mapping, concrete media, and visual presentations has been shown to strengthen the knowledge-construction process and help students organise concepts more systematically and meaningfully (Setiawati & Mursidik, 2024).

Findings are in line with Bruner's study (1961), which emphasises the importance of the discovery process in building deep conceptual understanding. When students are engaged in active exploration, observation, and problem-solving, learning shifts from memorisation to a more conceptual understanding. This is also in line with the constructivist theories of Piaget (1970) and Vygotsky (1978), which state that knowledge is actively constructed through interactions with the environment and social processes. Thus, Discovery Learning can be seen as an effective learning model for improving elementary school students' cognitive learning outcomes in science. However, the generalisation of findings still needs to be done carefully, considering variations in research designs and contexts (Dewi & Elisa, 2025).

### **Effectiveness of Discovery Learning towards Learning Outcomes Affective**

Synthesis results show that the Discovery Learning model not only effectively increases cognitive results, but also provides a significant and positive impact on affective participant education, such as interest, motivation for learning, curiosity know, scientific attitude, and caring towards the science learning process. Through active involvement in observing, asking, discussing, and finding out, participants draft independently; they become more enthusiastic, more responsible in their responses, and more positive in their attitude toward learning.

Findings. This is in line with the view of Hosnan (2014), who emphasised that Discovery Learning can foster a positive attitude among scientific participants, and is reinforced by the results of the study in the table synthesis, which show improvements in motivation, activity, and independence. The study of students in schools is based on a learning centred on the discovery process. Thus, Discovery Learning is relevant to educational goals that are not only oriented towards mastering knowledge but also towards the holistic formation of students' values, attitudes, and character (Husniah, 2025).

### **Effectiveness of Discovery Learning towards Learning Outcomes: Psychomotor**

Synthesis results in the literature show that the Discovery Learning model not only effectively improves cognitive outcomes but also makes a meaningful contribution to the development of psychomotor outcomes for students, especially in basic science learning at school. Aspects that develop psychomotor skills, covering science process skills such as observing, classifying, measuring, conducting experiments, predicting, and drawing interesting conclusions based on the data obtained in a direct way (Ningsih & Winarni, 2025). Meaningful science learning must involve participants being actively educated in the scientific

process. Discovery Learning positions students as the main Learning. Through stages of stimulation, data collection, data processing, verification, and conclusion drawing, students are directly trained to engage in integrated physical and mental activities. These activities encourage students' motor skills in experiments, observations, discussions, and the use of learning tools and media.

The empirical findings in the synthesis table support this argument. Research (Kusumayuni et al., 2023) shows that implementing STEAM-based Discovery Learning significantly improves students' science process skills, particularly in observing, experimenting, and drawing conclusions from experimental results. Similar results were also found by Rikmasari & Rosesa (2022), who concluded that Discovery Learning consistently has a positive impact on psychomotor aspects when supported by thorough learning planning and the use of media appropriate to the characteristics of elementary school students.

Furthermore, research integrating concrete and visual media, such as mind mapping (Sattvika et al., 2024) and real objects (Husni et al., 2022), shows that students' physical activity in manipulating learning objects can strengthen motor skills and motor coordination. This confirms that discovery-based learning oriented towards direct experience is highly relevant to the concrete operational stage of development in elementary school students. Therefore, based on the results of the literature review and the research synthesis table, Discovery Learning is effective in improving students' psychomotor learning outcomes through active, contextual, and direct, experience-based learning. This model provides space for students to learn through action (learning by doing), so that science process skills and motor abilities develop optimally and meaningfully.

The application of Discovery Learning in science learning has been proven to be effective in improving the learning outcomes of elementary school students, because students do not only receive knowledge passively, but actively build concepts through exploration, observation, and their own investigations; for example, experimental research shows that fifth-grade students taught with this model have a significant increase in posttest and N-Gain scores compared to conventional learning, which indicates an increase in understanding of science concepts. Discovery Learning is effective in improving science learning outcomes in elementary school (Sari et al., 2022) In addition, another study found that implementation Discovery Learning in a way significant repair results Study students in various science and natural sciences materials, including influence style to objects and materials other materials, namely score posttest student increase in a way real after learning based findings of the discovery learning model have an influence positive to results learning science (Permatasari et al., 2024).

## **Discussion**

How effective is the Discovery Learning model in improving the science learning outcomes of elementary school students according to the results of relevant literature reviews?

### **Effectiveness of Discovery Learning on the Outcomes of Science Learning**

Based on the synthesised literature, Discovery Learning can be understood as an effective learning model for improving the quality of science learning in elementary schools, primarily because it encourages active student involvement in the learning process. Learning is no longer centred on the teacher as the primary source of information, but rather positions students as subjects who construct knowledge through direct experience. In the context of

science learning, this approach is highly relevant because science fundamentally emphasises the process of discovery, investigation, and proof of concepts through real-world experiences in the learning environment.

Theoretically, the effectiveness of Discovery Learning can be explained through a constructivist approach, which emphasises that knowledge is not acquired through memorisation but is actively constructed through interactions between students and the learning environment. Through the stages of stimulation, problem identification, data collection, data processing, proof, and conclusion, students are encouraged to think systematically, critically, and logically. This process makes learning more meaningful because students do not simply receive concepts as ready-made information but instead experience the process of discovering them. This strengthens students' conceptual understanding and scientific skills, as explained by Discovery Learning, which provides significant opportunities for students to construct knowledge, attitudes, and skills independently through active investigation. (Tarigan et al., 2025). Furthermore, this approach is crucial because students are at a developmental stage that requires concrete experiences to understand abstract concepts. Therefore, Discovery Learning not only improves academic learning outcomes but also fosters a scientific mindset through the practice of observing, testing, and drawing conclusions.

### **Relevance Discovery Learning with Merdeka Curriculum and IPAS**

Discovery Learning is also relevant to the implementation of the Independent Curriculum, particularly because it emphasises student-centred, experiential learning and encourages exploration and competency development. In the context of science and science, which integrates science and social studies concepts, Discovery Learning provides students with the opportunity to connect natural and social phenomena through observational activities, simple experiments, and contextual analysis. Thus, learning not only emphasizes cognitive outcomes but also develops the affective aspects and skills needed for 21st-century learning. This strengthens the argument that Discovery Learning aligns with the goals of the Independent Curriculum to foster meaningful, in-depth learning. (Ramadhanty et al., 2024).

Pedagogically, Discovery Learning supports the demands of science and science learning, which emphasise the scientific process, inquiry, and the development of thinking skills. This model provides students with the opportunity to experience the stages of scientific thinking, from formulating problems to concluding. This not only increases students' cognitive engagement but also fosters enthusiasm and curiosity, which are the foundation of science learning. Therefore, Discovery Learning can be viewed as a learning strategy that is not only empirically effective but also philosophically aligned with the direction of science learning in the Independent Curriculum. (Hidayatulloh & Anshori, 2024).

The effectiveness of Discovery Learning will be optimal when supported by learning media suited to the characteristics of elementary school students who are still in the concrete operational stage. Visual and contextual media, such as mind maps, concrete objects, and digital media, help students organise concepts more systematically. Media support also strengthens the concept discovery process, enabling students to understand the material more deeply and retain it. Integrating this model with a contextual or STEAM approach also enriches the learning experience by connecting science concepts to real-life issues relevant to students' lives. (Hidayati et al., 2025). Furthermore, integrating Discovery Learning with

contextual and STEAM approaches enriches the learning process by linking scientific concepts to real-life problems and cross-disciplinary activities.

Overall, the SLR results indicate that the Discovery Learning model is effective in improving elementary school students' science learning outcomes across cognitive, affective, and psychomotor domains. This finding strengthens Bruner's theory and constructivism and supports various previous research results that emphasise the importance of active and meaningful learning. Thus, this finding indicates that Discovery Learning is effective in addressing problems in science learning, which have been dominated by lecture methods, minimal active student involvement, and low conceptual understanding, the main background of this research. The results of the literature review indicate that the cognitive aspect is the dominant component of learning outcomes and improves through the application of the discovery learning model. Students who learn using this model demonstrate stronger abilities in understanding scientific concepts, linking natural and social phenomena, and applying concepts in everyday contexts.

The practical implications of these findings for elementary school teachers are that Discovery Learning needs to be systematically designed by providing contextual stimuli, exploratory worksheets (LKPD), visual and concrete media, and discussion facilitation strategies that encourage students to actively observe, ask questions, and independently draw conclusions about concepts. Teachers act as facilitators who guide students' thinking processes so that learning does not merely follow syntax, but truly builds conceptual understanding and scientific skills. The application of this model can also strengthen 21st-century skills such as critical thinking, collaboration, communication, and independent learning, making it relevant to science learning in the Independent Curriculum. However, the results of the reviewed studies still have general limitations, mainly because most of the studies are dominated by Classroom Action Research (CAR) designs that do not involve control groups, resulting in weak causal inferences, unequal representation of research locations, requiring caution in national generalisations, and the lack of research evaluating long-term retention of learning outcomes. Therefore, further research is recommended to employ a more robust experimental design, expand the study's scope, and conduct longitudinal evaluations to better understand the effectiveness of Discovery Learning.

#### **4. CONCLUSION**

Based on a Systematic Literature Review of 18 research articles published between 2021 and 2025, the Discovery Learning model has proven effective in improving elementary school students' science learning outcomes. This effectiveness is consistently demonstrated across various research designs, including quantitative, qualitative, mixed methods, and Classroom Action Research. Improved learning outcomes occur not only in the cognitive domain but also in the affective and psychomotor domains. In the cognitive domain, Discovery Learning can improve conceptual understanding, critical and analytical thinking skills, and the application of science concepts in everyday life. In the affective domain, this model encourages the development of motivation to learn, curiosity, scientific attitudes, independence, and active participation among students. Meanwhile, in the psychomotor domain, Discovery Learning contributes to the development of science process skills, such as observing, classifying, measuring, conducting experiments, predicting, and drawing conclusions based on empirical data. The effectiveness of this model is further optimised when supported by contextual and visual learning media appropriate to the concrete operational thinking characteristics of elementary school students.

Scientifically, the results of this study provide an important contribution to the development of science learning theory and practice in elementary schools. The research findings strengthen the empirical basis for the claim that Discovery Learning aligns with the constructivist theories of Bruner, Piaget, and Vygotsky and is relevant to the Independent Curriculum's direction, which emphasises active, exploratory, and learner-centred learning. This study also emphasises the role of Discovery Learning in the holistic development of 21st-century skills. As a recommendation, further research is suggested to examine the implementation of Discovery Learning through large-scale, cross-regional experimental designs and to integrate it with digital technology, the STEAM approach, and authentic assessment. Furthermore, longitudinal research is needed to examine the long-term impact of Discovery Learning on students' scientific literacy, character, and higher-order thinking skills.

## 5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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