

# Science Learning Trends in Elementary Schools 2015–2025: A Review

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**Abstract:** This study aims to identify trends in instructional models, research variables, learning materials, subject characteristics, and research outcomes in elementary science (IPA) education through a meta-analysis of 30 peer-reviewed articles published between 2015 and 2025. Articles were selected based on specific inclusion criteria and analyzed using descriptive qualitative content analysis. The findings reveal that Problem Based Learning (PBL) is the most frequently used instructional model (18 articles), consistently demonstrating effectiveness in improving student learning outcomes, critical thinking, motivation, creativity, and problem-solving skills. Other models used include Project Based Learning (6 articles), Discovery Learning (3 articles), and several others such as Inquiry-Based Learning and Teams Games Tournament. Most studies focus on cognitive variables, particularly learning outcomes and critical thinking, while affective aspects like motivation and scientific attitudes remain underexplored. Furthermore, several studies either vaguely reported or did not specify the learning materials used, indicating a gap in methodological reporting. In terms of subject characteristics, 73.30% of the studies did not mention gender composition, suggesting limited attention to student demographics. Despite these gaps, the overall analysis shows that the implementation of innovative learning models has a positive impact on elementary science education, especially in enhancing students' academic performance. These findings highlight the importance of adopting student-centered learning approaches and improving research transparency in reporting instructional contexts and subject characteristics.

**Keywords:** Elementary School; Learning Models; Science Learning

## Introduction

Natural Sciences (IPA) is one of the subjects in elementary schools (SD) that aims to develop cognitive abilities, science process skills, and scientific attitudes so that students are able to understand nature scientifically. The Merdeka Curriculum emphasizes student-centered science learning through contextual inquiry, observation, experimentation, and problem-solving activities to improve 21<sup>st</sup> century competencies, especially critical thinking, creativity, communication, and collaboration skills (Thornhill-Miller et al., 2023; Van Laar et al., 2020). Based on previous research findings, the science learning outcomes of elementary school students are still relatively low because learning

tends to be teacher-centered and does not involve student activity (Saragih, 2022). Therefore, an innovative, meaningful, and able learning model is needed to optimize the potential of students (Csizér & Albert, 2024; Weinhandl et al., 2025).

One of the recommended learning models is Problem Based Learning (PBL), which is able to improve critical thinking skills, learning outcomes, and problem-solving skills through real problem (Daud, 2024; Wardani & Fiorintina, 2023). The Project Based Learning (PjBL) model has also been shown to be effective in increasing students' creativity, learning motivation, and scientific attitudes through involvement in contextual and collaborative projects (Megahati S & Yuliana, 2025; Muliastri & Gotama, 2025). In addition, Discovery

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Learning provides opportunities for students to discover science concepts on their own through the exploration stage so that they can improve concept understanding, curiosity, and learning outcomes (Kamaluddin & Widjajanti, 2019; Maharani et al., 2025).

Some of the variables that are often used as indicators of the success of science learning in elementary school include critical thinking skills, problem-solving skills, creativity, learning outcomes, concept understanding, scientific attitudes, curiosity, learning motivation, and student learning activity (Ilhami et al., 2025; Nuraini & Sujarwo, 2025). The improvement of these variables is one of the main targets in the implementation of the Independent Curriculum through the application of innovative learning models such as PBL, PjBL, and Discovery Learning.

Thus, the application of the right learning model is very necessary in elementary science learning to realize the goal of science education, which is to produce students who are able to think critically, be creative, have a scientific attitude, and excel in learning science. Therefore, this study aims to analyze science research trends related to materials, learning models, variables, research objects and research results.

**Method**

This study uses the Meta-Analysis method which involves research results from several researchers. Meta Analysis is information that describes, explains, and finds information that is easy to find again. This study emphasizes the classification of the learning model used, the research method used, the science teaching materials taught, the variables studied, the subject, and the results of each research.

*Research Source*

The data analyzed in this study was obtained from 30 national scientific articles published in accredited journals and scientific proceedings. These articles were obtained through a Google Scholar search.

*Inclusion Criteria*

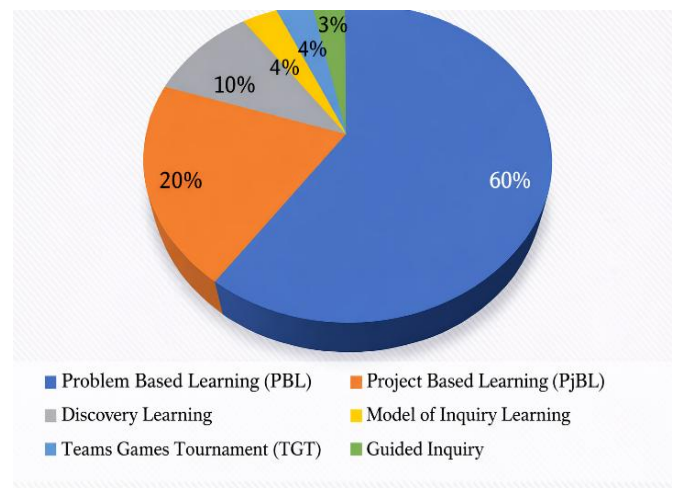
Articles included in the analysis must meet the following criteria: It is an article based on empirical research; Focus on science learning in elementary schools; Using learning models such as Problem Based Learning, Project Based Learning, Discovery Learning, Teams Games Tournament, or other innovative learning models; Examining variables such as learning outcomes, critical thinking, creativity, problem-solving, learning motivation, or scientific attitude; Published between 2015 - 2025; and The article is available in full text and clearly presents the data of the research results.

*Data Collection Techniques*

To collect data, documentation is used to collect and examine articles that meet inclusion requirements. Based on the following variables, each article is encoded into a tabulation format: Author's name and publication date, Title of the article, learning model, Research methods and instruments, Data analysis techniques, Subject research (number, tier, and location if available), Material or topics covered in the language of science (if specified), Bound and independent variables and Research results

**Result and Discussion**

Based on the analysis of 30 scientific articles on science learning in elementary schools, five main conclusions were obtained, including: the learning model used, the variables studied, the subject matter that became the context of the research, the characteristics of the research subject, as a whole shown in Figure 1.



**Figure 1.** Learning model

The most widely used learning model is Problem Based Learning (PBL) as many as 18 articles, this model is effective in improving learning outcomes, critical thinking, learning motivation, creativity and problem solving (Fitriyah et al., 2024; Prasetiawan et al., 2025). The Project Based Learning (PjBL) model was used in 6 studies and also showed a positive influence in improving students' creativity and learning outcomes. The Discovery Learning model was used in 3 studies. Other learning models used are Inquiry, Teams Games Tournament and Guided Inquiry each with 1 article. Based on figure 1, Problem Based Learning (PBL) is the most dominant learning model, used in 18 articles. These results show that PBL is seen as effective in improving the science learning outcomes of elementary school students (Fa'iqoh et al., 2025; Halimatus Sa'diyah et al.,

2024). Most of the research variables focused on student learning outcomes with a total of 13 appearances, critical thinking skills 3 times. In addition, there are several combinations of other variables such as critical thinking skills and learning outcomes (2 times), problem-solving skills (2 times), activeness and learning outcomes (2 times), and motivation to learn science (2 times). Other variables such as critical thinking skills, problem-solving skills, creativity, concept understanding, scientific attitudes, and achievements also appear but at a lower frequency, as shown in Figure 2.

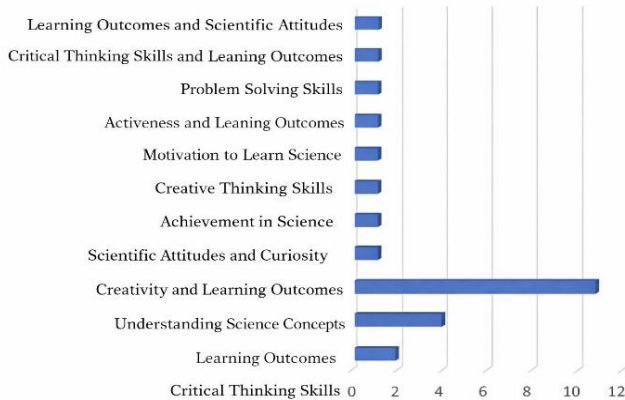


Figure 2. Research variables

The findings in figure 2 show that most studies tend to focus on the cognitive aspects of students, especially learning outcomes and thinking skills, while attention to affective variables such as motivation and scientific attitudes is still limited (İnce, 2023; Oknaryana et al., 2025). This is in accordance with the findings of Arifin et al. (2025); Nur'azizah et al. (2021) that improving learning outcomes is still the main goal of applying innovative models to elementary science learning, while the development of students' character and scientific attitudes tends to not be the main focus. Of the 30 articles, as many as 6 studies did not mention what learning materials were used in the research, then 5 studies used science materials but were not specifically mentioned, but other studies used various topics such as energy and its changes, changes in the form of objects, force and motion, human respiratory system, food and nutrition, single-mixed substances, ecosystems, water cycles, diversity of living things, ecosystems and natural events, as shown in Figure 3.

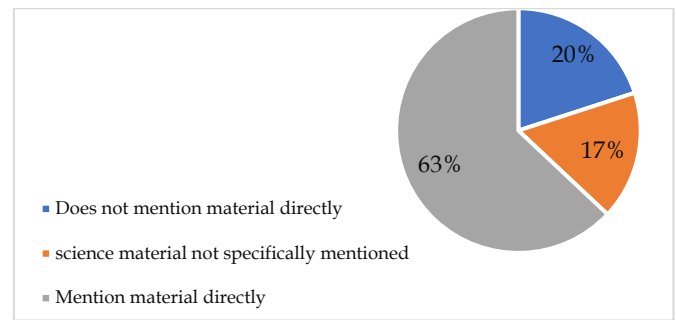


Figure 3. Learning materials

The results in Figure 3 show that innovative learning models can be flexibly applied to science learning (Darmaji et al., 2022; Mundelsee & Reschke, 2025). Reporting of teaching materials that is not detailed is one of the weaknesses in research reporting. The research subjects were all elementary school students, as many as 22 studies did not mention gender composition, while 8 studies mentioned subjects based on men or women. This shows that gender aspects have not been the main concern in elementary science learning research, even though this information is important to see differences in responses or achievements based on student characteristics. Differences in research that included gender and were not shown in Figure 4.

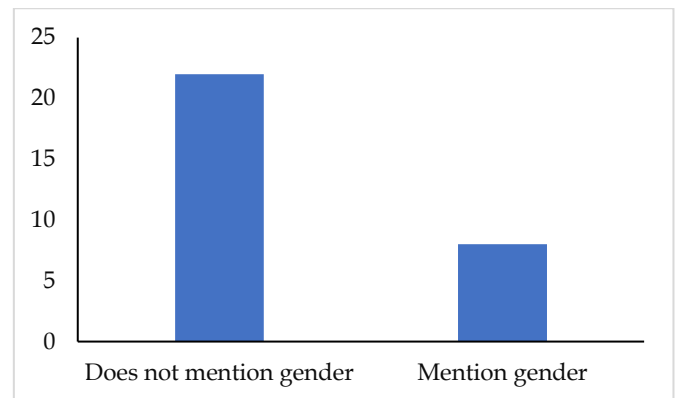


Figure 4. Research subject

The findings in Figure 4 show that the majority of elementary school science research still does not prioritize gender composition reporting in the study subjects. In fact, this data helps in an in-depth analysis of differences or equality in learning outcomes between genders (Nengyanti et al., 2025; Öz, 2022). Low reporting of gender subjects can have an impact on the limitations of analysis related to differences in learning outcomes between genders, resulting in the interpretation of research results being less comprehensive. Based on Table 1 of the Research Results, there are variations in research focuses on science learning in elementary schools, including critical thinking skills, learning

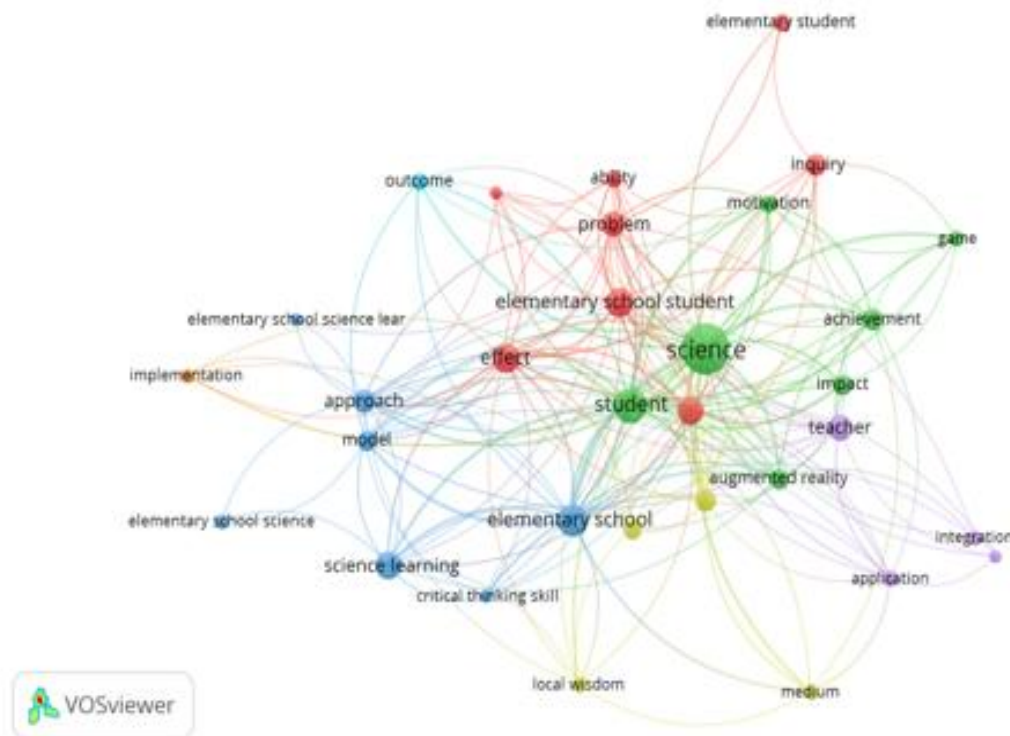
outcomes, concept understanding, creativity, problem solving, and student motivation and active learning.

Below are the visualization is accomplished by generating a landscape map, which offers a visual representation of subjects related to scientific studies. The outcomes of bibliometric mapping for the co-word network in articles related to the topic science learning in elementary schools are illustrated in Figure 5. Figure

5 shows the results of bibliometric keyword mapping on research trends on the science learning in elementary schools. In Figure 5 there are 32 keyword items that are often used in research on the science learning in elementary schools from 2015 to 2025. Figure 5 also contains 7 clusters, keywords in each cluster can be seen in Figure 5.

**Table 1.** Research result

Author & year of publication	Result of the study
(Fitriyanti et al., 2025)	Students' critical thinking skills are still low
(Muhamad, 2023); (Setyawan & Kristanti, 2021)	Improve critical thinking skills
(Hasyim et al., 2024); (Jenysa Al Muslimah et al., 2024)	Students' science learning outcomes improved
(Rismayani et al., 2019)	Understanding of science concepts increases
(Fatmawati et al., 2022)	Students' creative thinking abilities increase
(Cheng et al., 2017); (Salim et al., 2024); (Susilawati et al., 2024)	Science problem solving increases
(Samudin et al., 2026); (Susanti et al., 2022)	Student motivation and learning activity increases



**Figure 5.** Network visualization on trend science learning in elementary schools

Figure 5 above also shows that network visualization shows the network between the terms being visualized. Keywords classified into seven clusters are arranged in a color chart showing the divisions that are connected to each other. The results of this analysis can be used to determine keyword research trends in the last year. This analysis shows several keywords that are often used in research on the topic science learning in elementary schools. The more keywords that appear, the wider the visualization displayed. Below are also presented keywords regarding topic science learning in elementary schools based on overlay visualization.

Figure 6 shows the trend of keywords related to research on topic science learning in elementary schools in Google Scholar indexed journals from 2015 to 2025. Trends in the themes of writing articles related to the topic science learning in elementary schools from the oldest to the newest year are marked with purple, blue themes, turquoise, dark green, light green and yellow.

Research on science learning in elementary schools is one area of research that has developed rapidly in recent years. The following also presents keywords for science learning in elementary schools researchs based on density visualization. Figure 7 shows density

visualization. The density of research themes is shown in bright yellow. The brighter the colors of a theme, the more research is done. The fainter the color means the theme is rarely researched (Kaur et al., 2022; Liao et al., 2018). Faintly colored themes shows that these keywords

can be used as a reference for further research. Doyan et al. (2023) and Bahtiar et al. (2023) stated that yellow indicates keywords that are currently and frequently used in research.

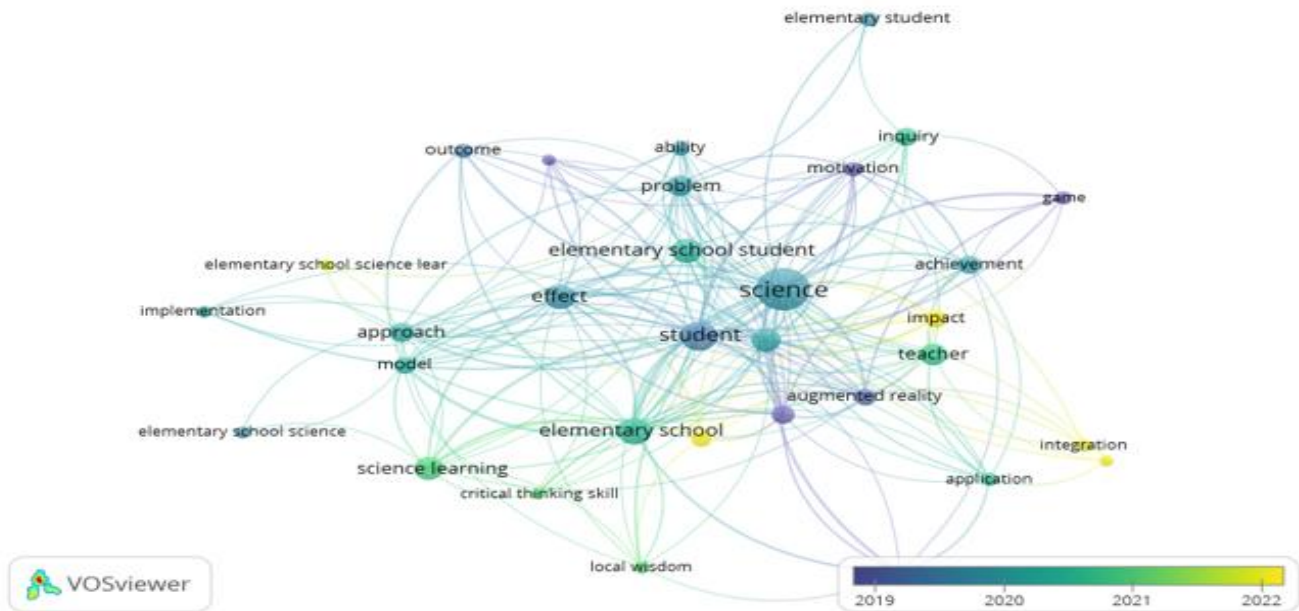


Figure 6. Overlay visualization on trend science learning in elementary schools research

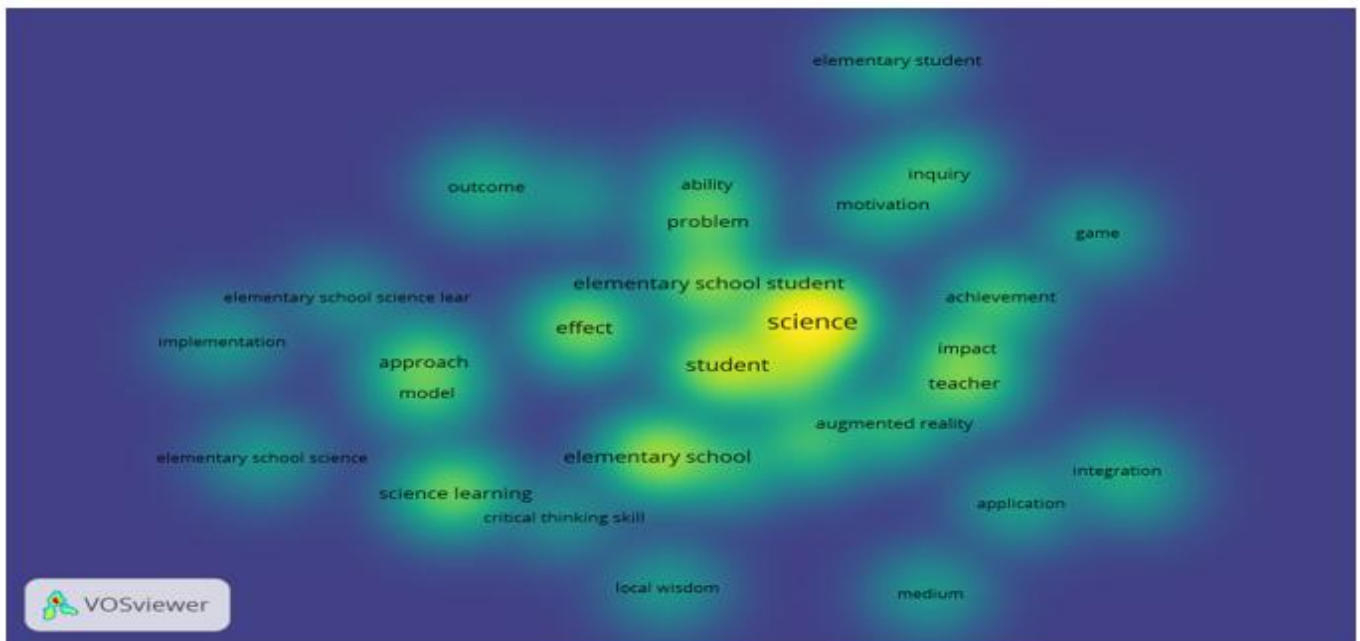


Figure 7. Density visualization on trend science learning in elementary schools researches

Overall, almost all articles show that the application of innovative learning models has a positive impact on elementary science learning, especially in improving student learning outcomes as the highest finding. In accordance with Table 1, the Problem Based

Learning (PBL) model consistently improves student learning outcomes (Dewi et al., 2021; Kans & Claesson, 2022), maintaining learning activity and motivation (Santosa, 2022; Suari, 2018) and developing critical thinking (Astika, 2024). This shows the importance of

implementing a student-centered learning model to support the success of science learning. Problem Based Learning is also in line with the scientific approach emphasized in the 2013 Curriculum in Indonesia, so many researchers are interested in testing it. Research as conducted Astiti et al. (2021); Widani et al. (2019) show that PBL not only improves learning outcomes, but also high-level thinking skills, which are the demands of the 21<sup>st</sup> century.

## Conclusion

Based on the analysis of 30 research articles on the application of the learning model in science learning in elementary schools, it can be concluded as follows: The *Problem Based Learning* (PBL) model is the most frequently used learning model. Consistently, PBL improves the science learning outcomes of elementary school students, both in terms of completeness and average scores; Affective variables such as the desire to learn and scientific attitudes are still not paid attention. On the other hand, the most research variables focused on cognitive aspects, especially thinking skills and learning outcomes; As many as 63% of the studies listed science learning materials with various topics, but 17% of the studies only mentioned the material in general and 20% of the studies did not even mention it at all. This shows that material reporting is still not a top priority; There were eight articles from the study subjects that did not mention the gender composition of the students, this shows that student characteristics have not been the main focus of the study; and In general, all studies reported the positive impact of the application of innovative learning models on elementary science learning, with the highest results in the form of an improvement in science learning outcomes through the application of Problem Based Learning (PBL).

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## Author Contributions

Conceptualization; methodology.; validation; formal analysis; investigation; resources; data curation; writing – original draft preparation; writing – review and editing.; visualization: S. P., A. I. A. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of Interest

The author declares no conflict of interest.

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