

The Effectiveness of Integrating Various Learning Models in Science Education to Enhance Scientific Literacy (2015–2026): A Systematic Literature Review

Teti Nurmasari¹, Laifa Rahmawati²

¹ Universitas Negeri Yogyakarta, Indonesia: tetinurmasari.2025@student.uny.ac.id

² Universitas Negeri Yogyakarta, Indonesia: laifa.rahmawati@uny.ac.id

Article history

Submitted: 2026/07/22; Revised: 2026/08/14; Accepted: 2026/09/30

Abstract

Science literacy is one of the abilities that students must have to compete in the international world. Various efforts are made to improve science literacy. The purpose of this research is to review, summarize, and analyze the results of primary research on various learning models to improve science literacy through a comprehensive Systematic Literature Review. This research was conducted at the elementary, junior high, and high school levels using the PRISMA (Preferred Reporting Items for Systematic Review and Meta Analysis) method. Data was collected from the Google Scholar database published from 2015 to May 2026 with the keywords "Effectiveness", "Learning model", "Science", "improving science literacy". The first search results using Publish on Perish obtained as many as 200 articles. Several inclusion and exclusion criteria were applied so that 18 articles were analyzed and synthesized according to the research focus. This study found that the guided inquiry model was proven to be effective in improving science literacy with an average N-Gain value of 0.89 with a high category, the most frequently used learning model in this study was Problem Based Learning (44%), the combination of STEM approaches and PhET platforms with a learning model was widely carried out with a frequency of 2 studies (29%), and research was widely applied at the junior high school level (61%).

Keywords

Effectiveness, Learning Model, Science Learning, Science Literacy, SLR



© 2026 by the authors. This is an open-access publication under the terms and conditions of the Creative Commons Attribution 4.0 International (CC BY SA) license, <https://creativecommons.org/licenses/by-sa/4.0/>.

INTRODUCTION

21st century learning, also known as digital era learning, is a significant advancement of science and technology. This era not only encourages students to be able to memorize science materials and formulas, but the most fundamental characteristic of students in this era is that students have science literacy (Harahap et al, 2022). The OECD (2025) defines science literacy as the ability of students to understand science knowledge, explain phenomena scientifically, interpret scientific data and evidence, and make decisions and actions based on facts. The PISA 2025 framework is different from PISA 2022, this framework focuses on expanding science literacy into broader science education outcomes, adding scientific information evaluation for

decision-making, integrating data interpretation with scientific investigation, and emphasizing environmental sustainability (OECD, 2025).

However, based on PISA score data in 2022, Indonesia is ranked 69th out of 80 participating countries with a score of 383 for science literacy, which is lower when compared to the average score of 485 OECD countries (OECD, 2023). The results of other research at SMP N 54 Surabaya in grade VII with 31 students also showed that the science literacy ability of students in grade VII was still relatively low. This is evidenced by the students' achievement in the indicators of explaining scientific phenomena by 34.4%, evaluating and designing scientific investigations by 36.6%, and interpreting scientific data and evidence by 33.3% (Tillah, N. F., & Subekti, H., 2025). The phenomenon of low science literacy is caused by learning that is not contextual, monotonous, and not close to students' lives (Suparya, I. K., I Wayan Suastra, & Putu Arnyana, I. B., 2022). All ways and efforts to improve science literacy. One of them is by integrating learning models into science learning.

Science is a science obtained through observation and experimentation. Science learning is introduced by the existence of science. Carin & Sund (1970) defines the essence of science consisting of four elements, namely first, science as a product, namely science consisting of facts, concepts, laws, or theories that are seen as the result of self-development to know the environment, second, science as a process, namely skills used to research events in nature in a structured manner to develop science to the next stage. Third, science as a scientific attitude is an attitude that a scientist must have, such as objective, honest, thorough, determined, responsible, and open to new things, and science as a scientific application, namely the application of science in technology that is integrated with values in people's lives.

Science material is one of the materials that is classified as abstract. Science material in learning it requires the right learning model. The learning model is the design of learning activities with the aim that teaching and learning activities are carried out and accepted easily by students (Ahyyar, D.B., 2021). The characteristic of the learning model is that it has a syntax or steps of a teacher in carrying out learning in the classroom.

Research on the use of learning models for science learning is dominated by development research (R&D). The research focus on Systematic Literature Review is still relatively limited, so it is interesting to continue to develop. Several previous studies have shown that learning models have an important role in improving science literacy. Research conducted by Fajri et al (2026) entitled Systematic Literature Review: Discovery learning and science literacy of elementary school students found that the discovery learning model contributes to being stronger when combined with digital media, such as Google Sites, Assemblr Edu, interactive videos, and animated videos. Meanwhile, research conducted by Zakiyah and Wahyuni (2025) entitled "The Effectiveness of the Project-Based Learning Model in Improving Science Literacy of Junior High School Science Students" shows that the Project Based Learning (PBL) model has a significant impact on improving the literacy of junior high school students. The Systematic Literature Review study shows that the model studied is still separate and has not been widely studied in one broader study. Based on this, the researcher

wants to comprehensively research various science learning models in improving students' science literacy. Therefore, this Systematic literature review research aims to review and summarize the results of primary research on various learning models to improve science literacy. The research questions asked in this study are (1). How effective is the integration of various learning models in science learning for the period 2015-2016 (2). What are the learning models that are most often integrated in science learning? (3) What is the form of integration of learning models in science learning? (4) At the education level, what is the most widely applied integration of science learning models?

METHODS

The method used in this study is Systematic Literature Review. This method aims to identify, analyze, evaluate, and interpret all relevant research so as to answer the questions that have been set (Barricelli et al., 2019). This study follows the PRISMA (Preferred Reporting Items for Systematic Review and Meta Analysis) guide. This method was chosen because it is able to provide systematic guidance in the process of searching, filtering, and selecting relevant articles. The research method uses the PRISMA approach. This method is divided into several steps, namely identification, screening, eligibility, included.

To support this research, the researcher collected journal articles from Google Scholar from 2015-2026. The researcher used keywords in the search, namely "Effectiveness", "Learning model", "science", "improving science literacy". The search process is based on predetermined inclusion and exclusion criteria. The following is a table of inclusion and exclusion criteria.

Criteria	Inclusions	Exclusion
Year of Publication	Articles published from 2015-2026	Articles published before 2015
Publication Type	The articles used are in the form of journal articles	Articles in the form of conference papers, proceedings, theses or theses
Keywords	Keywords relevant to the research topic	Keywords are not relevant to the research topic
Journal indexing	Journal articles indexed by Google Scholar	Journal articles that are not indexed Google Scholar
Research subjects	Elementary, junior high, and high school students	In addition to elementary, junior high, and high school
Language	Articles in English or Indonesian	Articles in languages other than English and Indonesian
Accessibility	Full-text articles	Not available in full text

RESULTS AND DISCUSSION

The steps for selecting articles followed the four stages of the PRISMA diagram which included identification, screening, eligibility, and included. In the identification stage, the initial search using Publish on Perish obtained 200 articles.

At the identification stage, 200 articles obtained were excluded based on articles in the form of conference papers, proceedings, theses or theses totaling 60 articles, articles that were not available in fulltext or not open access were obtained 27 articles, then at the screening stage as many as 81 articles were excluded based on the study of titles and abstracts. Furthermore, it entered the eligibility stage to assess the feasibility of complete articles. As many articles were eliminated because they did not explicitly measure science literacy 14 and did not have adequate result data to be synthesized. Thus, 18 final articles were obtained that were analyzed in depth in this study.

Effectiveness of integrating various learning models in science learning for the period 2015-2026

The Problem Based Learning model assisted by mind mapping has been proven to be effective in improving science literacy. Research conducted by Dewanti, et al (2022) shows that Problem Based Learning assisted by mind mapping has increased science literacy skills with an N-Gain of 0.55 in experimental classes. Research by Sidik, et al (2025) shows that the development of LKPD based on Problem Based Learning has proven to be effective in improving science literacy. In the content knowledge indicator, N-Gain is obtained at 0.83, epistemic knowledge is 0.74, and procedural knowledge is N-Gain at 0.57. The indicator explains the phenomenon scientifically obtained an N-Gain of 0.48, interprets data and facts scientifically with an N-Gain of 0.58.

Critical thinking skills are one of the skills of the 21st century. This is in line with the research of Kusumaningsih, et al (2025) who developed an SSI-based PBL e-module resulting in a pretest score of 64.9 and a posttest of 89.6 with an N-Gain of 0.70. Dari & Nasih (2020) defines an e-module as an ICT-based module that has advantages compared to print modules because it is interactive which contains images, audio, video, and animations and is equipped with formative tests or quizzes as easy-to-use feedback. Thus, based on the acquisition of SSI-based PBL e-modules, it is effective in increasing science literacy.

Research conducted by Susanti, et al (2019) shows that the development of LKPD is not only to improve science literacy but also to improve students' character. In line with the research of Mardhiya, et al (2025) which integrates PBL with GI, the PBL and GI models both offer a more active and student-centered learning process. Through discussion, investigation, and problem-solving activities, students are encouraged to understand concepts more deeply, develop critical thinking skills, and get used to connecting learning materials with real-life problems. Therefore, these two models are considered to be able to support the development of students' science literacy more effectively (Sari & Kristin, 2020). Research by Pratama (2022), the PBL model combined with blended learning is a digital learning innovation. The characteristic of blended learning is that students learn more by using social networks who have a lot of time and overcome boredom (Manggabarani, Sugiarti, & Masri, 2016). The results of this study have a significant influence of the blended learning-based PBL model on students' science literacy, but the achievement of an N-Gain of 0.30 shows that it is less effective. This

research resulted in a higher N-gain value in the experimental class (0.6487) than in the control (0.5064).

Other research that contributes to improving science literacy is by Andayani, et al (2025) which produces a score on the indicator explaining the phenomenon scientifically at 74.6% (good category), evaluating and designing scientific investigations: 75.4% (good category), interpreting data and evidence scientifically: 94.4% (very good category). The inquiry model also contributes to improving science literacy. Students are actively involved in the learning process through teacher guidance. With teacher guidance, students are also trained to think critically, logically, and be able to solve problems (Fajri, 2021). Research by Dewi, et al (2022) shows that the development of guided inquiry-based LKPD integrating local potential in the form of seagrass ecology is able to significantly increase students' science literacy with an N-Gain value of 0.89 in the high category. These results reinforce that the use of local environment-based learning resources can make learning more contextual and closely related to students' lives. Research by Rohmi (2021) shows that the development of LKPD based on the Inquiry model is effective in improving science literacy. According to Trianto (2007), Student Worksheets (LKPD) are a set of activity sheets designed to guide students in the form of systematic instructions and steps aimed at completing certain learning objectives. Based on the acquisition of an average pretest score of 35.78, it increased to 59.22 in the posttest. This can be seen to have increased by 23.29% with an N-gain of 0.36, which is included in the medium category. Another research by Arbadilah, et al (2025) powtoon acts as a visual support medium that helps students understand abstract concepts more easily and interestingly. The guided inquiry model assisted by powtoon media was effective in increasing science literacy, namely knowledge in the experimental class of 0.52 and the control class of -1.94, the aspect of science competence in the experimental class of 0.65 in the medium category and the control class: 0.38 in the medium category, the Context aspect in the experimental class: 0.73 in the control class of 0.46 (medium), the aspect of identity in the experimental class was 0.87 with the high category and the control class was 0.71 with the high category. Research by Zakiya, et al (2020), the guided inquiry model was effective in increasing science literacy with an N-Gain of 0.53 in the experimental class.

Digital developments are growing significantly and rapidly. This development provides the option to choose the right platform, one of which is Physics Education and Technology (PhET). PhET acts as an interactive platform that can help students understand abstract concepts in physics through more concrete visualizations and simulations (Rizaldi et al, 2020). In line with Solehayati's research, et al (2025) showed that PhET-assisted inquiry learning is significantly effective, but its effectiveness still needs to be improved. The contribution of the research by Rahma (2022) showed that there was an increase in experimental classes that received learning treatment with the Group Investigation (GI) model assisted by Virtual PhET simulation with an N-Gain of 57.36 was included in the category of moderately effective while the control class of 41.39 was included in the less effective category.

The incorporation of cultural elements known as indigenous knowledge is incorporated into science learning known as ethnoscience. Ethnoscience as a way of visualization between the world of student life and school science as a mixture of cultural elements (Aikenhead & Jegede, 1999). The Science, Technology, Engineering, Mathematics (STEM) approach combines meaningful learning that includes science, technology, machinery, and mathematics (Rahmadhani et al, 2023). Research by wulandari (2023) shows that the Ethno-STEM integrated inquiry learning model is effective in improving students' literacy, obtaining a pretest score of 29.17 before treatment and a posttest score of 81.67 after receiving treatment and an average N-Gain of 0.76 in the medium category. Investigation Based Science Collaborative (IBSC) is a collaborative learning model that trains communication and collaboration skills between students in sharing tasks and conducting investigations (Suharti et al., 2020). The contribution of Nafi'ah, et al (2026) shows that the Investigation Based Scientific Collaborative (IBSC) learning model model is effective in improving science literacy, 68% of students are in the high category and 32% of students are in the medium category.

The most commonly integrated learning models in science learning

The selection of the right learning model will affect the improvement of students' science literacy. The following are the results of the analysis of 18 articles based on the learning model used

Table 3 Selection of Learning Models Used in Research

No.	Learning Model	Quantity
1.	Problem Based Learning	8
2.	Inquiry	6
3.	Group Investigation (GI)	2
4.	Project Based Learning	1
5.	Investigation Based Science Collaborative (IBSC)	1

Here's how it is presented in the form of a pie chart

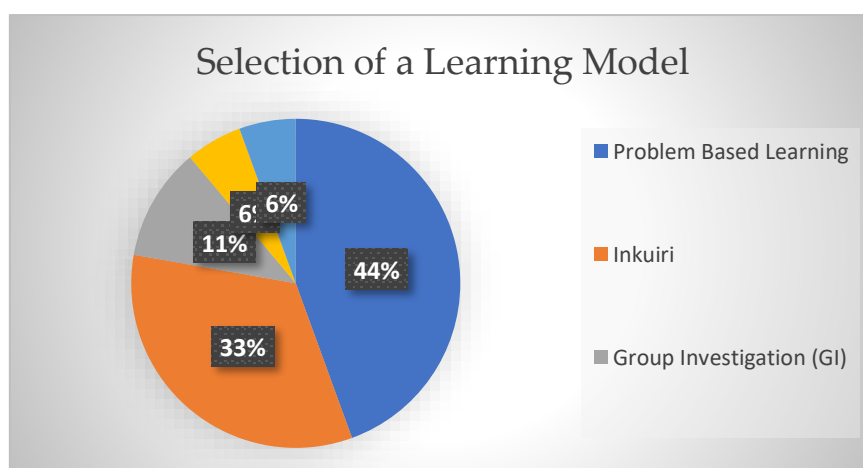


Figure 1. Diagram Selection of Learning Models in Research

Based on the data obtained, the most frequently used learning model is Problem Based Learning with a total of 8 studies. This shows that the model is quite widely chosen because it is considered to be able to help students develop critical thinking skills through problem solving. Furthermore, the Inquiry model was used in 6 studies, which shows that the discovery-based approach is also quite in demand in the learning process. Meanwhile, the Group Investigation (GI) model was only found in 2 studies. The Project Based Learning and Investigation Based Science Collaborative (IBSC) were each used in 1 study. This smaller number indicates that the two models are still not widely applied compared to other learning models. In general, the data show that Problem Based Learning and Inquiry are the more dominant learning models used.

Forms of integration of learning models in science learning

Each learning model has its own advantages and disadvantages. Therefore, its use will be more effective when combined with other learning models, media, or approaches that complement each other. This integration can help create a learning process that is more varied, interactive, and in accordance with the needs of students. In addition, the selection of the right learning model also needs to consider the characteristics of the material, learning objectives, and the conditions of students so that the learning results obtained can be more optimal. The following is a table of the forms of integrating the model used with teaching media.

Table 4. Forms of Learning Model Integration

No.	Media, Models, Approaches	Quantity
1.	GI	1
2.	SETS	1
3.	Powtoon	1
4.	STEM	2
5.	PhET	2

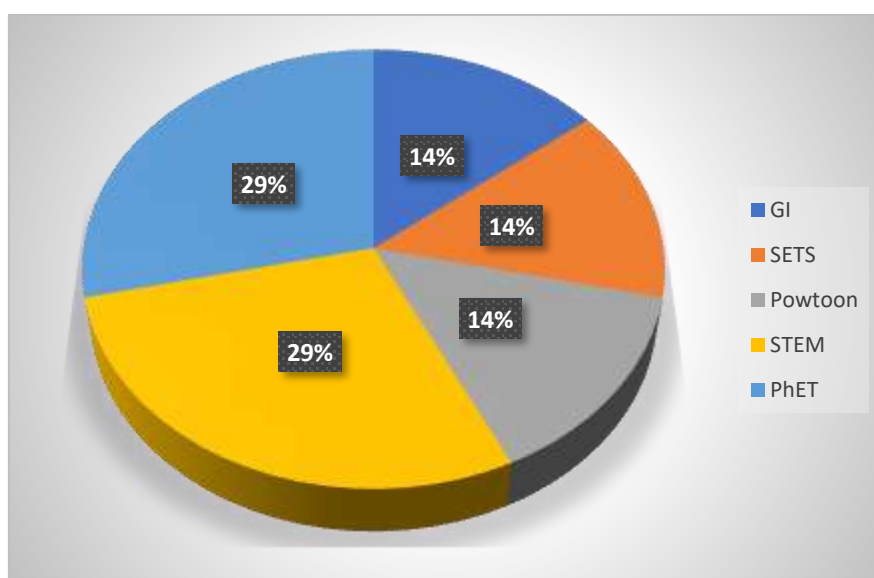


Figure 2. Diagram Forms of Integration into Learning Models

Based on the table and diagram above, the integration of GI (Group Investigation) appears 1 time, which means that the group investigation-based learning model is used or one study is found (Mardhiya et al, 2025), SETS (Science, Environment, Technology, and Society) appears 1 time showing the integration of learning that connects science, environment, technology, and society in one research/study (Yeni Suryaningsih, 2025), Powtoon appears 1 time, indicating that animation-based learning media/video presentations are used once (Arbadilah et al (2025), STEM (Science, Technology, Engineering, and Mathematics) appears 2 times, so it can be interpreted that the STEM approach is more often used than several other models/media in the data (Almiasih et al, 2022) and (Wulandari et al, 2023). PhET (Physics Education Technology) appeared 2 times, showing that interactive simulations of PhET are also quite often integrated in learning (Solehayati et al, 2025) and Rahma (2022).

Learning model integration

Efforts to improve science literacy by integrating learning models at certain levels in some of the studies studied are presented in the table below.

Table 5. Distribution of Education Levels in Research

No.	Education Level	Quantity
1.	SD	2
2.	SMP	11
3.	SMA	5

Based on the results of the analysis of 18 relevant articles, based on the table of education levels, it can be seen that research on integrating learning models and media is more carried out at the junior high school level with a total of 11 studies, compared to high school with 5 studies and elementary school with only 2 studies. This shows that there is an imbalance in research focus, where the elementary school level still receives less attention. In fact, the application of learning models and media from an early age at the elementary level is very important to build a foundation for students' understanding of concepts. Thus, there is a research gap in the form of a lack of research at the elementary level that needs to be further explored in future research.

The following is presented in the form of a pie chart

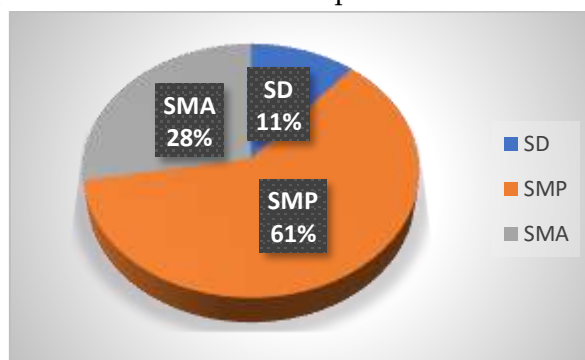


Figure 3. Diagram Distribution of Education Levels in Research

CONCLUSION

One of the various efforts to improve science literacy is the use of various learning models such as inquiry, problem-based learning, and project-based learning that are integrated into science learning. Research by Dewi, et al (2022) shows that the development of guided inquiry-based LKPD integrating local potential in the form of seagrass ecology can significantly increase students' science literacy with an N-Gain value of 0.89 in the high category. These results reinforce that the use of learning resources based on the local environment can make learning more contextual and close to students' lives. Based on the data obtained, the most widely used learning model in various studies to improve science literacy at both the elementary, junior high, and high school levels is Problem Based Learning with a total of 8 studies, thus showing that this approach is still the main choice in efforts to improve science literacy, but on the other hand, the results of the analysis of this article also identify a fairly significant research gap, namely the lack of use of the discovery learning model in existing studies, and the limited studies conducted at the elementary school (SD) level, even though this level is an important phase in the formation of the basic science literacy skills of students who should receive more attention in the development of learning models that are in accordance with the characteristics of the cognitive development of elementary school students.

REFERENCES

- Aikenhead, G.S. and Jegede, O.J. (1999), Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *J. Res. Sci. Teach.*, 36: 269-287. [https://doi.org/10.1002/\(SICI\)1098-2736\(199903\)36:3<269::AID-TEA3>3.0.CO;2-T](https://doi.org/10.1002/(SICI)1098-2736(199903)36:3<269::AID-TEA3>3.0.CO;2-T)
- Almiasih, S., Winarto, W., & Kristyaningrum, D. H. (2022). Efektivitas Model Pembelajaran Pjbl Berbasis Stem-Nos Terhadap Literasi Sains Siswa Kelas V Sd Negeri Kalierang 01: Array. *Dialektika Jurnal Pemikiran dan Penelitian Pendidikan Dasar*, 12(2), 1021-1021. <https://doi.org/10.58436/jdpgsd.v12i2.1229>
- Andayani, A. A., & Agustina, L. (2025). Efektivitas Model Pembelajaran Problem Based Learning Terhadap Literasi Sains Siswa Pada Materi Klasifikasi Makhluk Hidup Kelas VII SMP. *Bioscientist: Jurnal Ilmiah Biologi*, 13(1), 117-125. <https://doi.org/10.33394/bioscientist.v13i1.14909>
- Arbadilah, A., Juliyanto, E., & Dewantari, N. (2025). Efektivitas model pembelajaran inkuiri terbimbing berbantuan powtoon untuk meningkatkan kemampuan literasi sains pada materi zat dan perubahannya. *Jurnal Pendidikan Matematika dan Sains*, 13(2), 431-443. <https://doi.org/10.21831/jpms.v13i2.90153>.
- B. R. Barricelli, F. Cassano, D. Fogli, and A. Piccinno, "End-user development, end-user programming and end-user software engineering: A systematic mapping study," *J. Syst. Softw.*, vol. 149, pp. 101-137, Mar. 2019.
- Carin&Sund. 1970. *Teaching Science Through Discovery second edition*. Charles E.: Merrill Publishing Company
- Dari, R. W., & Nasih, N. R. (2020). Analisis Keterampilan Proses Sains Mahasiswa Pada Praktikum Menggunakan E-Modul. *Edu Sains Jurnal Pendidikan Sains & Matematika*, 8(2),

- 12–21. <https://doi.org/10.23971/eds.v8i2.1626>
- Dewanti, Binar Ayu, Nurlaily Santi Aprilia, and Indri Susanti. "Analisis literasi sains siswa SMP pada pembelajaran IPA dengan model problem based learning disertai mind mapping." *PSEJ (Pancasakti Science Education Journal)* 7.2 (2022): 89-96. <https://doi.org/10.24905/psej.v7i2.149>
- Dewi K. R., Syukur, A., & Santoso, D. (2022). Efektifitas LKPD Terintegrasi Nilai Ekologi Lamun Berbasis Inkuiri Terbimbing untuk Meningkatkan Literasi Sains Siswa SMP Pesisir Selatan Lombok Timur. *Jurnal Ilmiah Profesi Pendidikan*, 7(2c), 921-927. <https://doi.org/10.29303/jipp.v7i2c.687>
- Fajri, H. N., Purwanto, A., & Utomo, E. (2021). Study on Implementation of Inkuiri Learning Model Guided to Students' Critical Thinking Ability. *International Journal of Multicultural and Multireligious Understanding*, 8(2), 403-410.
- Fajri, M., Purwati, P. D., Wijayati, N., & Avrilianda, D. (2026). Systematic Literature Review: Discovery Learning dan Literasi Sains Siswa Sekolah Dasar. *JagoMIPA: Jurnal Pendidikan Matematika dan IPA*, 6(2), 911-929.
- Harahap, D. G. S., Nasution, F., Nst, E. S., & Sormin, S. A. (2022). Analisis kemampuan literasi siswa sekolah dasar. *Jurnal Basicedu*, 6(2), 2089-2098. <https://doi.org/10.31004/basicedu.v6i2.2400>
- Kusumaningsih, N. K. H., Pujani, N. M., & Tika, I. N. (2025). The Effectiveness of Science E-modules Containing SSI with the PBL Model to Improve Critical Thinking Skills and Science Literacy of Junior High School Students. *Jurnal Penelitian Pendidikan IPA*, 11(8), 977-988. DOI: 10.29303/jppipa.v11i8.12300
- Manggabarani, A. F., Sugiarti, & Masri, M. (2016). Pengaruh Model Pembelajaran Blended Learning Terhadap Motivasi dan Hasil Belajar Siswa Kelas X SMA Negeri 1 Pitumpanua Kab.Wajo (Studi Pada Materi Pokok Sistem Periodik Unsur). *Jurnal Chemica*, 17(2), 83–93.
- Mardhiya, J., & Nugroho, D. E. (2025). Efektivitas model PBL-GI dalam meningkatkan literasi sains pada materi kesetimbangan kimia di SMA. *Arfak Chem: Chemistry Education Journal*, 8(1), 688-699.
- Nafiah, Q. A., & Puspitarini, S. (2026). Implementasi Pembelajaran IBSC (Investigation Based Science Collaborative) untuk Meningkatkan Literasi Sains Siswa. *Paedagogie*, 21(1), 1141-1150. <https://doi.org/10.31603/paedagogie.v21i1.16346>
- Organisation for Economic Co-operation and Development (OECD). (2023). *PISA 2022 Results (Volume I and II): Country Notes – Indonesia*. OECD Publishing. [OECD PISA 2022 Indonesia Country Note](https://doi.org/10.31603/pisa2022.id)
- PISA, 2025. Science Framework (Second Draft)
- Pratama, M. A., & Zilhakim, R. (2022). Pengaruh Model Pembelajaran Problem Based Learning Berbasis Blended Learning Terhadap Literasi Sains Siswa di MTsN 1 Bengkulu Selatan. *Jurnal Jendela Pendidikan*, 2(01), 54-60. <https://doi.org/10.57008/jjp.v2i01.128>
- Rahma, A. A. (2022). Penerapan model group investigation (GI) berbantuan simulasi virtual phet terhadap kemampuan literasi sains siswa. *Jurnal Pendidikan Dan Konseling*, 4(3), 2547-2555.
- Rahmadhani, C., Pujiastuti, H., & Fathurrohman, M. (2023). Pendekatan STEM dalam Pembelajaran Matematika: Study Literature Review. *JlIP-Jurnal Ilmiah Ilmu Pendidikan*, 6(1), 549-557. <https://doi.org/10.54371/jljp.v6i1.1280>
- Rohmi, P. (2021). Efektivitas LKPD Berbasis Inquiry Lesson Untuk Meningkatkan Literasi

- Sains Peserta Didik. *Papua Journal Of Physics Education*, 2(1).
- Rukmananda, Y. P., & Suhartini. (2024). Effectiveness of Implementing Problem-based Learning Model in Improving Science Literacy on Environmental Pollution Material in High School. *Jurnal Penelitian Pendidikan IPA*, 10(12), 11084–11091. <https://doi.org/10.29303/jppipa.v10i12.8569>
- Sari, B. T. W., & Kristin, F. (2020). Efektivitas Penggunaan Model Problem Based Learning dan Model Group Investigation Terhadap Kemampuan Kerjasama Siswa Sekolah Dasar. *Jurnal Basicedu*, 4(2), 257–267.
- Sidik, M. A., Latip, A., & Rahmانيar, A. (2025). Efektifitas LKPD berbasis problem based learning untuk meningkatkan literasi sains siswa pada materi pemanasan global. *Jurnal Kajian Pendidikan IPA*, 5(1), 32–42. <https://doi.org/10.52434/jkpi.v5i1.42340>
- Solehayati, R., Kariadinata, R., & Chusni, M. M. (2025). Penerapan Model Pembelajaran Inquiry Berbantuan Simulasi PhET untuk Meningkatkan Literasi Sains Peserta Didik Kelas XII. *SEMESTA: Jurnal Ilmu Pendidikan dan Pengajaran*, 3(3), 123–133. <https://doi.org/10.70115/semesta.v3i3.330>
- Suharti, P., Ibrahim, M., & Rahayu, Y. S. (2020). Validity of Investigation Based Scientific Collaborative (IBSC) Learning Model To Facilitate Students' Communication and Collaboration Skills. <https://doi.org/10.2991/icracos-19.2020.37>
- Suparya, I. K., I Wayan Suastra, & Putu Arnyana, I. B. (2022). RENDAHNYA LITERASI SAINS: FAKTOR PENYEBAB DAN ALTERNATIF SOLUSINYA. *Jurnal Ilmiah Pendidikan Citra Bakti*, 9(1), 153–166. <https://doi.org/10.38048/jipcb.v9i1.580>
- Suryaningsih, Y. (2025). Efektivitas Model Pembelajaran Group Investigation Bervisi SETS Terhadap Literasi Sains Siswa. *Papanda Journal of Mathematics and Science Research*, 4(1), 76–82. <https://doi.org/10.56916/pjmsr.v4i1.1164>
- Susanti, S., Asyhari, A., & Firdaos, R. (2019). Efektivitas LKPD terintegrasi nilai islami pada pembelajaran berbasis masalah untuk meningkatkan kemampuan literasi sains. *Indonesian Journal of Science and Mathematics Education*, 2(1), 64–78. DOI : 10.24042/IJSME.V2I1.3987
- Tillah, N. F., & Subekti, H. (2025). Analisis kemampuan literasi sains siswa SMP berdasarkan indikator dan level literasi sains. *Edusaintek: Jurnal Pendidikan, Sains Dan Teknologi*, 12(1), 137–154. <https://doi.org/10.47668/edusaintek.v12i1.1271>
- Trianto. (2007). Model-Model Pembelajaran Inovatif Berorientasi Konstruktivistik. Pustaka Pelajar.
- Wulandari, F., & Hanim, M. (2023). Model Pembelajaran Inkuiri Terintegrasi Etno-STEM terhadap Kemampuan Literasi Sains Siswa. *JlIP-Jurnal Ilmiah Ilmu Pendidikan*, 6(12), 10779–10786. <https://doi.org/10.54371/jiip.v6i12.3121>
- Zakiyah, N. F., & Wahyuni, S. (2025). Studi Literatur: Efektivitas Model Project-Based Learning dalam Meningkatkan Literasi Sains Siswa IPA SMP. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, 13(2).
- Zendrato, E. K., Gea, H. A., Telaumbanua, G. C., Gea, F. K., Halawa, E. K., Hulu, E. N., Telaumbaua, H., Gulo, F. N., & Harefa, E. (2024). Efektivitas Model Project-Based Learning Terintegrasi STEM Dalam Peningkatan Kemampuan Literasi Sains. *Indo-MathEdu Intellectuals Journal*, 5 (4), 4842–4850. <http://doi.org/10.54373/imeij.v5i4.1615>