

# Issues of Developing Scientific Literacy in Science Learning: Systematic Literature Review

I Gusti Ayu Ngurah Kade Sukiastini <sup>1</sup>, Ni Putu Juni Artini <sup>2</sup>, Irwan Febryan <sup>2</sup>

<sup>1</sup> *Baliem Papua University*

Jl. SD Percobaan No 50 Wamena Regency, Papua, 99501, Indonesia

<sup>2</sup> *Triatma Mulya University*

Jl. Danau Batur, Lelateng, Negara District, Jembrana Regency, Bali, 82218, Indonesia

DOI: [10.22178/pos.125-4](https://doi.org/10.22178/pos.125-4)

LCC Subject Category: L7-991

Received 21.11.2025

Accepted 27.12.2025

Published online 31.12.2025

Corresponding Author:

[I Gusti Ayu Ngurah Kade Sukiastini](#)

© 2025 The Authors. This article is licensed under a [Creative Commons Attribution 4.0](#)

License 

**Abstract.** Scientific literacy is a person's ability to apply scientific ideas in everyday life, explain scientific phenomena, and justify these ideas using scientific evidence. In learning the Natural Sciences (IPA), scientific literacy encompasses not only scientific knowledge but also scientific processes and attitudes. Therefore, this article aims to examine the key issues in developing scientific literacy in science education and to provide strategic recommendations for improving students' scientific literacy. This research uses a qualitative systematic literature review approach, following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Inclusion data in this research were mapped using several criteria, such as: 1) Research articles using quantitative methods (experiment, descriptive, correlation) and qualitative methods (case studies); 2) The articles used were primary sources; 3) Articles have full text (contains abstract, introduction, methods, results, and discussion/discussion); 4) Articles with a year range between 2019 and 2024.

The results of this research are that a local wisdom-based approach, an inquiry-based learning model, socioscientific issues (SSI), the Science Literacy Circles (SLC) method, textbook development, student worksheets (LKS), comprehensive evaluation, curriculum development, use of technology, increasing teacher abilities in scientific literacy, and active student involvement are issues of developing scientific literacy that can significantly improve students' scientific literacy.

**Keywords:** Scientific literacy; Science learning; Systematic literature review.

## INTRODUCTION

Scientific literacy is a person's ability to use scientific concepts to apply them in everyday life, explain scientific phenomena, and describe these phenomena based on scientific evidence [1]. Scientific literacy plays a crucial role in learning the natural sciences (IPA) because it prepares students to be qualified, reliable, and able to compete at the international level [2].

Scientific literacy encompasses not only scientific knowledge but also scientific processes and attitudes [3]. Scientific literacy enables individuals to apply their knowledge to make decisions about nations, cultures, and economic growth [4]. The

concept of scientific literacy also includes applying scientific content to assess children's scientific abilities [5]. In addition, scientific literacy encompasses understanding and knowledge of scientific ideas and processes used to solve problems and to make decisions about nature and the changes caused by human actions [6]. Scientific literacy also enables someone not only to read, write, and discuss scientific concepts but also to analyse, interpret, and make decisions in scientific matters [7]. Increasing scientific literacy in science education is a fundamental aspect of growing students' understanding and critical thinking skills of scientific concepts. In the educational context, scientific literacy has a vital role in

preparing students to face increasingly complex and dynamic global challenges.

However, developing scientific literacy in science education is crucial given the low levels in several countries, including Indonesia. The results of the 2018 Program for International Student Assessment (PISA) show that students' scientific literacy in Indonesia is far below the global average; Indonesia ranks 9th from the bottom among 79 countries, with an average score of 396 out of 600 [8]. In addition, PISA results from 2000 to 2009 show that Indonesian students' scientific literacy is consistently ranked among the top 10 [9]. PISA data also indicate that Indonesian students' scientific literacy is below the global average and lower than that of other countries [10]. The results of the Program for International Student Assessment (PISA) show that the quality of science education in Indonesian junior high schools is also low compared to that of OECD member countries [11]. This indicates an urgent need to improve the quality of science learning in schools. There are many reasons for the low level of scientific literacy. One cause of low scientific literacy is the underutilisation of scientific literacy in teaching and instructional materials, which can hinder optimal learning outcomes [12]. In addition, intrinsic factors such as student motivation, participation, and the organisation of the learning process play an essential role in the success of scientific literacy in education [13].

The development of scientific literacy encompasses various aspects, including a relevant, contextually grounded curriculum, effective teaching methods, and the use of supportive media and learning resources. Teachers, as learning facilitators, also need adequate knowledge and skills to teach science effectively. Moreover, students' active participation in the learning process is essential to developing scientific literacy.

Along with advances in technology and information, the need to increase scientific literacy is becoming increasingly urgent, as it is crucial to prepare individuals to compete globally and master technological developments that are essential to a country's progress [14].

Scientific literacy is crucial not only for catching up in education but also for enhancing the nation's competitiveness in the era of globalisation. Therefore, the development of scientific literacy in science education requires serious attention from various stakeholders, including the gov-

ernment, educational institutions, teachers, and the community.

This article aims to explore the key issues in developing scientific literacy in science education and to offer strategic recommendations for improving students' scientific literacy. In this way, a generation can be created that not only understands scientific concepts but also applies them in everyday life to solve various problems.

## METHODS

This research uses a qualitative systematic literature review approach, following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. PRISMA provides clear and structured guidelines for reporting protocols, search processes, study selection, study quality assessment, and the synthesis of findings from SLR [15]. The article selection stage is shown in Figure 1.

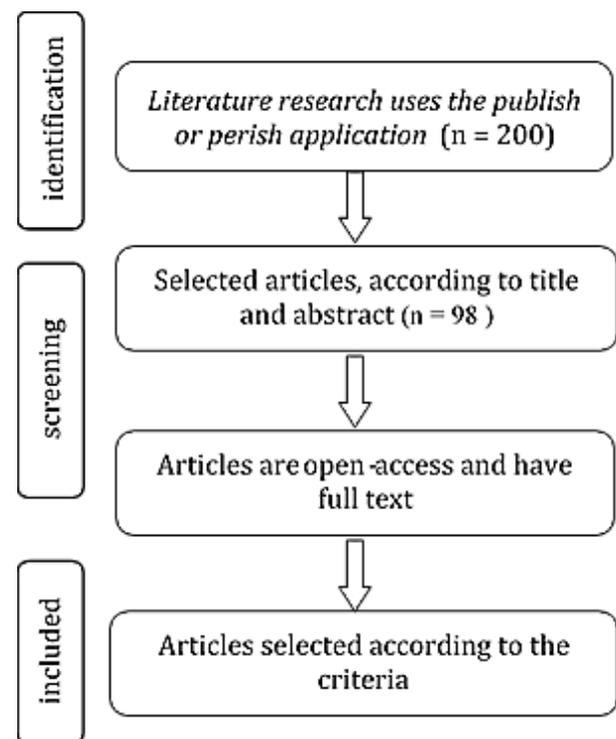


Figure 1 – Article Selection Process Chart

The search for articles and references focuses on research articles (empirical research), both qualitative and quantitative, which have an introduction, methods, abstract, results, and discussion. The search engine uses Publish or Perish, Google Scholar, and Crossref. A general search of article databases using keywords appropriate to the

topic of this research was conducted, namely "development of scientific literacy" and "issues of developing scientific literacy". Inclusion data in this research were mapped using several criteria, such as:

- 1) Research articles using quantitative methods (experiment, descriptive, correlation) and qualitative methods (case studies);
- 2) The articles used were primary sources;
- 3) Articles have full text (contains abstract, introduction, methods, results, and discussion/discussion);

4) Articles with a year range between 2019 and 2024. Based on the PRISMA analysis, 15 of 200 research journals met the eligibility criteria.

## RESULTS AND DISCUSSION

Based on the literature review, the researchers analysed 15 articles for their relevance to the development of scientific literacy. The following articles are the focus of research, as shown in Table 1.

Table 1 – Results of selected articles

Author	Results
[16]	The development of scientific literacy must focus on preparing future generations of scientists through a curriculum that considers culture and everyday life, thereby making it more contextual.
[17]	This study demonstrates how adequate local knowledge can promote student engagement and scientific literacy in science classes.
[18]	Developing scientific literacy and character can be achieved through science education that maximises students' scientific inquiry and engagement.
[19]	After using an inquiry-based learning model, students' cultural and scientific literacy skills fall within an acceptable range.
[20]	The study's findings demonstrated that when students engaged in socioscientific issue-based learning using the problem-based learning model, their scientific literacy increased.
[21]	The Socioscientific Issues (SSI) approach to learning reaction rates helps students develop scientific literacy.
[22]	Studies show that classes implementing the Science Literacy Circles (SLC) approach outperform those that do not in terms of scientific literacy skills.
[23]	Educators enhance students' scientific literacy by using textbooks, learning models, worksheets, and assessment tools grounded in scientific literacy.
[24]	Increasing the scientific literacy of aspiring teachers is one way to improve Indonesian children's scientific literacy.
[25]	Teachers who possess attributes such as readiness and the capacity to support students' scientific literacy development are essential for training and enhancing students' scientific literacy.
[26]	With the aid of the RE-STEM application, students can learn about ethnoscience, science, technology, engineering, and mathematics (STEM), or ethno-STEM, thereby advancing their scientific literacy.
[27]	After using the Wikipedia digital library, students' scientific literacy improves significantly.
[28]	Science students' literacy development is strongly and paradoxically impacted by the use of media (YouTube, blogs, Wikipedia, popular science books and journals, Facebook and other social networks, popular science programs on TV, online courses, news, the web, radio) for scientific information searches.
[29]	The curriculum focuses on mindsets designed to foster or highlight scientific literacy in students, enabling them to apply scientific knowledge across a range of contexts and circumstances related to scientific inquiry.
[30]	There is an impact on students' scientific literacy. By how engaged students are, who, after learning from teachers in the classroom, can deepen their basic knowledge through experience and expertise.

Based on the research reported in several journals in Table 1, it can be concluded that developing students' scientific literacy can be achieved through a culturally or locally wisdom-based approach [16, 17]. This approach allows students to learn through cultural contexts and local wisdom relevant to their daily lives, making it easier for them to understand scientific concepts. This was also reported by [31], who found that scientific literacy increased when a science learning model grounded in local wisdom was used. Developing scientific literacy through a culture-based or local wisdom learning model integrates local cultural elements into the science learning process. The main goal is to make learning more relevant, contextual, and meaningful for students. With this approach, scientific literacy is not only about understanding scientific concepts but also about applying them in the context of local culture and environment; this will produce a generation that is not only knowledgeable in science but also wise in preserving and advancing its cultural heritage.

Researchers have shown that inquiry-based learning models can also develop scientific literacy [18, 19]. In this context, the inquiry-based learning model explicitly aims to improve students' understanding of scientific concepts and their ability to apply scientific skills. The results of the research (Friday, 2022) show that the application of the inquiry learning model can positively impact students' scientific literacy. Through an inquiry approach, students are allowed to explore, discover, and solve problems independently, thereby fostering holistic scientific literacy. The development of scientific literacy can also be achieved through a socioscientific issues (SSI)-based learning model [20, 21]. This learning model aims to increase students' understanding of scientific concepts in the context of relevant social and scientific issues. Research by [32] also highlights the importance of STS/SETS and SSI approaches in fostering students' scientific and technological literacy and encouraging their values and ethics. With the SSI approach, students not only learn scientific concepts but also how to apply science in authentic contexts, such as environmental, health, and social issues; this helps students develop critical, analytical, and decision-making skills grounded in scientific evidence, which are essential to scientific literacy. In addition to the socioscientific issues (SSI)-based learning model, the use of the Science Literacy Circles (SLC) method can also improve stu-

dents' literacy skills [22]. Research by [33] highlights the importance of developing students' scientific literacy skills through the Science Literacy Circles (SLC) method, which assesses students' ability to understand scientific investigation methods that generate scientific knowledge and to organise, analyse, and interpret quantitative data and scientific information. Thus, the use of the Science Literacy Circles (SLC) method can be a practical approach to developing students' scientific literacy by providing higher-achieving scientific literacy skills.

Students' scientific literacy has increased as a result of the development of numerous components for scientific literacy-based learning. Educators can significantly enhance students' scientific literacy by developing scientifically grounded textbooks, learning models, worksheets, and assessment tools [23]. A key factor in raising students' scientific literacy is the creation and application of science textbooks, worksheets, and assessment instruments. According to [34], scientific literacy encompasses students' capacity to use scientific reasoning, conduct scientific research, and engage in scientific habits of mind. By integrating scientific literacy themes into instructional resources such as textbooks and worksheets, learners can deepen their understanding of the essence of science and its relevance across diverse scientific fields. Teachers' scientific literacy skills affect students' scientific literacy development, as well as the development of scientifically literate textbooks, learning models, worksheets, and assessment tools [24, 25]. Additionally, research by [35] demonstrates that the scientific literacy profile of aspiring teachers can affect the selection of suitable models or learning approaches, the formulation of questions, and the choice of assessment tools that enhance students' scientific literacy. Therefore, improving students' scientific literacy comprehension and proficiency depends heavily on teachers' ability to foster these outcomes through a variety of learning models, technologies, and strategies.

Utilising various technologies, such as digital libraries (e.g., Wikipedia), YouTube, blogs, popular science books and journals, social media platforms (e.g., Facebook), popular science TV programs, online courses, news outlets, websites, and radio, can also significantly increase scientific literacy [26, 28]. These resources provide a range of information on scientific topics, making science more accessible and engaging to the general public [36]. Overall, integrating technological

tools and educational resources is vital to increasing science literacy among diverse groups in society, underscoring the need to leverage these platforms to deepen understanding and engagement with science. Developing a science curriculum that is relevant to students' and society's needs and encouraging students' active involvement in science learning are essential for increasing students' scientific literacy [29, 30]. In the context of science curriculum development, it is necessary to pay attention to student involvement in learning, both through observation, experimentation, and the use of media that is appropriate to the student's environment [37].

Based on the findings, a comprehensive, integrated approach influenced by various factors can enhance students' scientific literacy. Numerous studies demonstrate that educators can develop students' scientific literacy holistically and effectively by combining local wisdom-based approaches, inquiry learning models, SSI-based learning models, SLC methods, textbook and worksheet development, thorough evaluation, appropriate curriculum development, the use of technology, improved teacher competence in scientific literacy, and active student involvement. Through a comprehensive, integrated approach to the outlined factors, it is hoped that students' scientific literacy will continue to improve, preparing them to address future challenges.

## CONCLUSIONS

Scientific literacy development issues that can significantly increase students' scientific literacy include the use of technology, curriculum development, textbook development, student worksheets (LKS), socioscientific issues (SSI), an inquiry-based learning model, the science literacy circles (SLC) method, and active student involvement.

A local wisdom-based approach connects scientific concepts with the cultural context and environment around students, making learning more relevant and meaningful. The inquiry-based learning model encourages students to explore and discover new knowledge through investiga-

tion and experimentation, thereby improving critical thinking and problem-solving skills.

Socioscientific Issues (SSI) integrates scientific issues with societal contexts, encouraging students to understand and consider the social impacts of scientific and technological developments. The Science Literacy Circles (SLC) method allows students to discuss and share knowledge in small groups, strengthening their conceptual understanding and communication skills.

The development of textbooks and student worksheets (LKS) designed explicitly for scientific literacy provides students with structured, systematic resources for studying scientific concepts in depth. Comprehensive evaluations, including formative and summative tests, portfolios, and authentic assessments, help measure the extent to which students understand and can apply their science knowledge.

The development of a curriculum integrated with scientific literacy ensures that all aspects of learning support this goal. In contrast, the use of modern technology in science learning allows access to digital resources, simulations, and interactive tools that enrich the student learning experience.

Teachers' scientific literacy is essential for guiding and facilitating effective learning. Scientifically literate teachers can relate science concepts to students' daily lives, use innovative teaching methods, and conduct in-depth evaluations.

Finally, the active involvement of students in the learning process, whether through discussions, projects, or experiments, ensures that they not only receive information but also actively participate in constructing their own knowledge. By combining these elements, students' scientific literacy can be developed holistically, preparing them to become knowledgeable, critical individuals who can face future scientific challenges.

## Acknowledgement

We want to thank our colleagues at Baliem University, Papua, and Triatma Mulya University for their help in writing this article, which enabled its publication.

## REFERENCES

1. Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). *Analisis faktor penyebab rendahnya kemampuan literasi sains peserta didik* [Analysis of factors causing low science literacy among

- students]. *Jurnal Ilmiah Profesi Pendidikan*, 5(2), 108–116. doi: [10.29303/jipp.v5i2.122](https://doi.org/10.29303/jipp.v5i2.122) (in Indonesian).
2. Irsan, I. (2021). *Implementasi Literasi Sains dalam Pembelajaran IPA di Sekolah Dasar* [Implementation of Science Literacy in Science Education in Primary Schools]. *Journal Basicedu*, 5(6), 5631–5639. doi: [10.31004/basicedu.v5i6.1682](https://doi.org/10.31004/basicedu.v5i6.1682) (in Indonesian).
  3. Handayani, T., Winarni, E. W., & Koto, I. (2021). *Pengembangan media komik digital berbasis STEM dalam meningkatkan kemampuan literasi sains siswa* [Development of STEM-based digital comic media to improve students' science literacy skills]. *Jurnal Pembelajaran Dan Pengajaran Pendidikan Dasar*, 4(1), 22–29. doi: [10.33369/dikdas.v4i1.14630](https://doi.org/10.33369/dikdas.v4i1.14630) (in Indonesian).
  4. Kristyowati, R., & Purwanto, A. (2019). *Pembelajaran literasi sains melalui pemanfaatan lingkungan* [Science literacy learning through environmental utilisation]. *Scholaria Jurnal Pendidikan Dan Kebudayaan*, 9(2), 183–191. doi: [10.24246/j.js.2019.v9.i2.p183-191](https://doi.org/10.24246/j.js.2019.v9.i2.p183-191) (in Indonesian).
  5. Widayati, J. R., Safrina, R., & Supriyati, Y. (2020). *Analisis Pengembangan Literasi Sains Anak Usia Dini melalui Alat Permainan Edukatif* [Analysis of Early Childhood Science Literacy Development through Educational Toys]. *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini*, 5(1), 654. doi: [10.31004/obsesi.v5i1.692](https://doi.org/10.31004/obsesi.v5i1.692) (in Indonesian).
  6. Banila, L., Lestari, H., & Siskandar, R. (2021). *Penerapan Blended Learning Dengan Pendekatan STEM Untuk Meningkatkan Kemampuan Literasi Sains Siswa Pada Pembelajaran Biologi Di Masa Pandemi Covid-19* [The Application of Blended Learning with a STEM Approach to Improve Students' Science Literacy Skills in Biology Learning During the Covid-19 Pandemic]. *Journal of Biology Learning*, 3(1), 25. doi: [10.32585/jbl.v3i1.1348](https://doi.org/10.32585/jbl.v3i1.1348) (in Indonesian).
  7. Sativa, B. R., & Eliza, D. (2023). *Pengembangan E-Modul Literasi Sains Anak Usia Dini* [Development of E-Modules for Early Childhood Science Literacy]. *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini*, 7(2), 1564–1574. doi: [10.31004/obsesi.v7i2.4037](https://doi.org/10.31004/obsesi.v7i2.4037) (in Indonesian).
  8. Wulandari, N. A. S., Suma, N. K., & Mardana, N. I. B. P. (2023). *Pengaruh Model Pembelajaran Inkuiri Bebas terhadap Peningkatan Literasi Sains Sekolah Menengah Pertama* [The Effect of the Free Inquiry Learning Model on Improving Science Literacy in Junior High Schools]. *Jurnal Pendidikan Mipa*, 13(1), 78–88. doi: [10.37630/jpm.v13i1.822](https://doi.org/10.37630/jpm.v13i1.822) (in Indonesian).
  9. Derlina, D., & Sitepu, E. (2018). *Efek Model Pobleem Based Learning Terhadap Peningkatan Literasi Sains Siswa Pada Materi Pokok Momentum, Impuls, Dan Tumbukan Di Sma Negeri 2 Lubuk Pakam T.A. 2017/2018* [The Effect of Problem-Based Learning Model on Improving Students' Science Literacy in the Subject Matter of Momentum, Impulse, and Collision at Lubuk Pakam 2 State Senior High School in the 2017/2018 Academic Year]. *Inpafi (Inovasi Pembelajaran Fisika)*, 6(3). doi: [10.24114/inpafi.v6i3.11117](https://doi.org/10.24114/inpafi.v6i3.11117) (in Indonesian).
  10. Nurwidhiyanti, A., & Sari, P. M. (2022). *Pengembangan Media Pembelajaran Flipbook Berbasis Literasi Sains pada Pembelajaran IPA Sekolah Dasar* [Development of Science Literacy-Based Flipbook Learning Media in Primary School Science Education]. *Journal Basicedu*, 6(4), 6949–6959. doi: [10.31004/basicedu.v6i4.3421](https://doi.org/10.31004/basicedu.v6i4.3421) (in Indonesian).
  11. Setiadi, D. (2014). *Model Pembelajaran Berbasis Peningkatan Literasi Sains Dan Implementasinya Dalam Kurikulum Sains SMP 2013* [Science Literacy Improvement-Based Learning Model and Its Implementation in the 2013 Junior High School Science Curriculum]. *Jurnal Pijar Mipa*, 9(1). doi: [10.29303/jpm.v9i1.36](https://doi.org/10.29303/jpm.v9i1.36) (in Indonesian).
  12. Kristina, H., Vitasari, M., & Taufik, A. N. (2022). *Pengembangan E-modul Berbasis Literasi Sains Tema Ayo Siaga Bencana untuk Melatih Kemandirian Belajar Siswa SMP* [Development of Science Literacy-Based E-modules on the Theme of Disaster Preparedness to Train Junior High School Students' Independent Learning]. *PENDIPA Journal of Science Education*, 6(3), 754–763. doi: [10.33369/pendipa.6.3.754-763](https://doi.org/10.33369/pendipa.6.3.754-763) (in Indonesian).

13. Jufrida, J., Basuki, F. R., Kurniawan, W., Pangestu, M. D., & Fitaloka, O. (2019). Scientific literacy and science learning achievement at junior high school. *International Journal of Evaluation and Research in Education (IJERE)*, 8(4), 630. doi: [10.11591/ijere.v8i4.20312](https://doi.org/10.11591/ijere.v8i4.20312)
14. Subekt, H., Taufiq, M., Susilo, H., Ibrohim, I., & Suwono, H. (2017). *Mengembangkan Literasi Informasi Melalui Belajar Berbasis Kehidupan Terintegrasi STEM Untuk Menyiapkan Calon Guru Sains Dalam Menghadapi Era Revolusi Industri 4.0: Review Literatur* [Developing Information Literacy Through Integrated STEM Life-Based Learning to Prepare Prospective Science Teachers for the Industrial Revolution 4.0 Era: Literature Review]. *Education and Human Development Journal*, 3(1). doi: [10.33086/ehdj.v3i1.90](https://doi.org/10.33086/ehdj.v3i1.90) (in Indonesian).
15. Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, 4(1), 1. doi: [10.1186/2046-4053-4-1](https://doi.org/10.1186/2046-4053-4-1)
16. Dewi, C. A., Khery, Y., & Erna, M. (2019). An ethnoscience study in chemistry learning to develop scientific literacy. *Jurnal Pendidikan IPA Indonesia*, 8(2). doi: [10.15294/jpii.v8i2.19261](https://doi.org/10.15294/jpii.v8i2.19261)
17. Verawati, N. N. S. P., & Wahyudi, W. (2024). Raising the issue of local wisdom in science learning and its impact on increasing students' scientific literacy. *International Journal of Ethnoscience and Technology in Education*, 1(1), 42. doi: [10.33394/ijete.v1i1.10881](https://doi.org/10.33394/ijete.v1i1.10881)
18. Nomxolisi, M., M C. S., & Mabel-Wendy, M. (2021). Examining the Support Given to Teachers to Promote Science Learning and Science Literacy in Selected South African Schools. *Ponte Academic Journal*, 77(4). doi: [10.21506/j.ponte.2021.4.4](https://doi.org/10.21506/j.ponte.2021.4.4)
19. Haryanto, N., Bakar, A., & Sanova, A. (2020). Guided Inquiry: How to Improve Scientific Literacy of Senior High School. *Humanities & Social Sciences Reviews*, 8(4), 720–727. doi: [10.18510/hssr.2020.8471](https://doi.org/10.18510/hssr.2020.8471)
20. Husniyyah, A. A., Erman, E., Purnomo, T., & Budiyanto, M. (2023). Scientific Literacy Improvement Using Socioscientific Issues Learning. *IJORER International Journal of Recent Educational Research*, 4(4), 447–456. doi: [10.46245/ijorer.v4i4.303](https://doi.org/10.46245/ijorer.v4i4.303)
21. Yani, J., & Afrianis, N. (2022). Analysis of student scientific literacy using the socioscientific issues (SSI) approach on reaction rate. *Jurnal Pendidikan Kimia*, 14(1), 19–27. doi: [10.24114/jpkim.v14i1.32665](https://doi.org/10.24114/jpkim.v14i1.32665)
22. Anggraini, N., & Nazip, K. (2022). Application of the Science Literacy Circles Method Based on Local Reality to Improve Students' Scientific Literacy. *Science Education Journal*, 6(1), 23–33. doi: [10.21070/sej.v6i1.1619](https://doi.org/10.21070/sej.v6i1.1619)
23. Rusilowati, A., Astuti, B., & Rahman, N. A. (2019). How to improve students' scientific literacy. *Journal of Physics Conference Series*, 1170, 012028. doi: [10.1088/1742-6596/1170/1/012028](https://doi.org/10.1088/1742-6596/1170/1/012028)
24. Harahap, F., & Siregar, D. F. (2022). Development of a Tissue Culture Textbook Based on Scientific Literacy as a Student Learning Source. *Jurnal Pelita Pendidikan*, 9(4). doi: [10.24114/jpp.v9i4.25738](https://doi.org/10.24114/jpp.v9i4.25738)
25. Muspiroh, N., Sumantri, M. S., & Kusmawan, U. (2024). The role of the professional learning community in the professional development of Madrasah Ibtidaiyah teachers in scientific literacy skills. *International Journal of Innovative Research and Scientific Studies*, 7(2), 429–439. doi: [10.53894/ijirss.v7i2.2647](https://doi.org/10.53894/ijirss.v7i2.2647)
26. Subali, B., Ellianawati, E., Faizah, Z., & Sidiq, M. (2023). Indonesian national assessment support: Can the RE-STEM Android app improve students' scientific literacy skills? *International Journal of Evaluation and Research in Education (IJERE)*, 12(3), 1399. doi: [10.11591/ijere.v12i3.24794](https://doi.org/10.11591/ijere.v12i3.24794)
27. Toharudin, U., Damaianti, L. F., Hizqiyah, I. Y. N., & Kurniawan, I. S. (2023). Developing Students' Scientific Literacy through the Wikipedia Digital Library. *International Journal of Emerging Technologies in Learning (ijET)*, 18(24), 211–219. doi: [10.3991/ijet.v18i24.45605](https://doi.org/10.3991/ijet.v18i24.45605)

28. Fiiialka, S., Trishchuk, O., & Pobidash, I. (2021). Assessment of the Level of Students' Scientific Literacy in Ukraine in the Media Literacy Context. *Media Education Mediaobrazovanie*, 17(2). doi: [10.13187/me.2021.2.246](https://doi.org/10.13187/me.2021.2.246)
29. Lavonen, J. (2021). How the Finnish compulsory school science curriculum emphasises scientific literacy. *Eesti Haridusteaduste Ajakiri = Estonian Journal of Education*, 9(2), 26–46. doi: [10.12697/eha.2021.9.2.02b](https://doi.org/10.12697/eha.2021.9.2.02b)
30. Lestari, E., Adisyahputra, A., & Komala, R. (2019). Science Literacy Skills of Junior High School Students Based on Science Literacy Skills of Teachers and Geographical Location. *Edusains*, 11(1), 78–85. doi: [10.15408/es.v11i1.8602](https://doi.org/10.15408/es.v11i1.8602)
31. Widiya, M., Lokaria, E., & Sepriyaningsih, S. (2021). *Pengembangan Modul Pembelajaran IPA Berbasis Kearifan Lokal Kelas Tinggi di Sekolah Dasar* [Development of Local Wisdom-Based Science Learning Modules for Upper Grades in Primary Schools]. *Journal Basicedu*, 5(5), 3314–3320. doi: [10.31004/basicedu.v5i5.1281](https://doi.org/10.31004/basicedu.v5i5.1281) (in Indonesian)
32. Nisa, K., Wiyanto, W., & Sumarni, W. (2021). Sistematis Literatur Review: Literasi Sains Dan Sets (Science, Environment, Technology, And Society). *Edusains*, 13(1), 73–82. doi: [10.15408/es.v13i1.18717](https://doi.org/10.15408/es.v13i1.18717)
33. Göktepe, D., Doğan, E. E., & Doğan, D. (2022). *Fen öğretmenlerinin bilimsel okuryazarlık beceri düzeylerinin farklı değişkenler açısından değerlendirilmesi* [Evaluation of science teachers' scientific literacy skill levels in terms of different variables]. *E-International Journal of Educational Research*. doi: [10.19160/e-ijer.1058046](https://doi.org/10.19160/e-ijer.1058046) (in Turkish).
34. Mcconney, A., Oliver, M. C., Woods-Mcconney, A., Schibeci, R., & Maor, D. (2014). Inquiry, Engagement, and Literacy in Science: A Retrospective, Cross-National Analysis using PISA 2006. *Science Education*, 98(6), 963–980. doi: [10.1002/sce.21135](https://doi.org/10.1002/sce.21135)
35. Sumanik, N. B., Nurvitasari, E., & Siregar, L. F. (2021). *Analisis Profil Kemampuan Literasi Sains Mahasiswa Calon Guru Pendidikan Kimia* [Analysis of the Scientific Literacy Profile of Prospective Chemistry Education Students]. *Quantum Jurnal Inovasi Pendidikan Sains*, 12(1), 22. doi: [10.20527/quantum.v12i1.10215](https://doi.org/10.20527/quantum.v12i1.10215) (in Indonesian).
36. Astuti, R. K., & Hayati, M. N. (2019). Development of an Integrated Science Digital Module Based on Scientific Literacy. *Journal Pena Sains*, 6(1), 32. doi: [10.21107/jps.v6i1.5233](https://doi.org/10.21107/jps.v6i1.5233)
37. Laila, E., Sudarmin, S., Prasetya, A. T., & Sumarni, W. (2022). *Studi Literatur: Penggunaan Jenis Media Pembelajaran untuk Meningkatkan Kemampuan Literasi Kimia Siswa* [Literature Study: The Use of Learning Media Types to Improve Students' Chemistry Literacy Skills]. *Edukatif Jurnal Ilmu Pendidikan*, 4(3), 4982–4993. doi: [10.31004/edukatif.v4i3.2907](https://doi.org/10.31004/edukatif.v4i3.2907) (in Indonesian).