

Contextual Learning of Science Based on Environmental Problems Around Schools

Said Ashlan¹, Firayani²

¹Universitas Ubudiyah Indonesia

²Universitas Islam Negeri Sultan Thaha Saifuddin Jambi

Email: ash.said999@gmail.com, firayani60@gmail.com

Entered : August 9, 2025
Accepted : August 15, 2025

Revised : September 10, 2025
Published: September 22, 2025

ABSTRAK

Pembelajaran sains di sekolah sering kali tidak menghubungkan konsep sains dengan realitas lingkungan yang dihadapi siswa sehari-hari, hal ini menyebabkan rendahnya relevansi pembelajaran dan kurangnya kesadaran ekologis siswa, penelitian ini bertujuan untuk menguji efektivitas pembelajaran sains kontekstual berbasis masalah lingkungan di sekitar sekolah dalam meningkatkan pemahaman konsep dan kepedulian siswa terhadap isu-isu lingkungan, penelitian ini menggunakan pendekatan Systematic Literature Review (SLR) dengan menganalisis 27 artikel ilmiah yang diterbitkan antara tahun 2020-2025, artikel diperoleh dari berbagai database bereputasi dengan kriteria inklusi antara lain fokus pada pembelajaran sains berbasis lingkungan, Hasil analisis menunjukkan bahwa pembelajaran sains kontekstual berbasis isu lingkungan secara signifikan meningkatkan pemahaman konsep sains siswa, keterampilan berpikir kritis, serta membentuk karakter peduli lingkungan, selain itu pendekatan ini efektif dalam mengintegrasikan pengalaman nyata siswa dengan materi ajar, pendekatan kontekstual berbasis lingkungan merupakan strategi inovatif yang relevan untuk mendukung pendidikan sains yang bermakna dan berkelanjutan di sekolah.

Kata Kunci: pembelajaran kontekstual, sains, lingkungan sekolah, literasi sains, pembelajaran berbasis masalah.

ABSTRACT

Science learning in schools often does not connect science concepts with the environmental realities faced by students on a daily basis, this leads to low learning relevance and lack of ecological awareness of students, this study aims to examine the effectiveness of contextual science learning based on environmental problems around schools in improving students' understanding of concepts and concern for environmental issues, this study uses a Systematic approach Literature Review (SLR) by analyzing 27 scientific articles published between 2020–2025, articles were obtained from various reputable databases with inclusion criteria including a focus on environment-based science learning, available in full text, and from primary to secondary education levels, the results of the analysis showed that contextual science learning based on environmental issues significantly improved students' understanding of science concepts, Critical thinking skills, as well as forming a character of caring for the environment, in addition, this approach is effective in integrating students' real experiences with teaching materials, the environment-based contextual approach is a relevant innovative strategy to support meaningful and sustainable science education in schools.

Keywords: contextual learning, science, school environment, science literacy, problem-based learning

INTRODUCTION

Natural science (IPA) learning at the elementary to secondary school level often has not succeeded in integrating conceptual understanding with students' real



experiences, as can be seen from the learning approach that emphasizes memorization of concepts without providing opportunities for students to relate the material to the reality of the surrounding environment, this limitation makes students' understanding of science abstract and independent of the context of daily life. thus lowering their relevance and interest in science as part of life (Ayotte-Beaudet et al., 2021).

One of the factors causing the lack of connection between concepts and context is a learning approach that does not make the surrounding environment a potential source of learning, while environmental phenomena such as pollution, waste management, and climate change are actual issues that are close to students' lives and have high potential to be used as the basis of contextual learning, by utilizing environmental issues, students can not only develop a deeper scientific understanding, but also build a strong ecological awareness as part of continuing education (Ariza et al., 2021).

Natural Science Education (IPA) designed with a contextual approach provides students with the opportunity to build a more meaningful understanding through the relationship between the science material taught in class with the real problems they face in their daily lives, this approach not only strengthens the relevance of the content of the lessons, but also deepens students' conceptual understanding of the natural phenomena around them. when learning is geared towards answering the question "What are the benefits of this knowledge in my life?", students are more motivated to learn and show active participation in learning activities (Ibda et al., 2023).

The contextualization of science learning becomes increasingly effective when combined with an environmental problem-based learning model that is raised from local conditions, through environmental problem solving, students are not only trained to develop critical and analytical thinking skills, but also directed to have ecological awareness as well as a responsible attitude towards environmental conservation, this approach strengthens the relationship between science and values sustainability that is urgently needed in the face of current and future ecological challenges (Baptista et al., 2025).

The use of the environment around the school as a learning medium presents a great opportunity to make open space an authentic natural laboratory, students can be directly involved in scientific activities such as observation, simple experiments, and systematically directed exploration. These activities allow learners to build understanding based on real experiences, strengthen science process skills, and foster curiosity and a spirit of inquiry in them from an early age (Gallay et al., 2021).

Empirical facts show low environmental literacy and low concern of students for ecological problems they face daily (Listyowati et al., 2024). This is an indication that the current science learning approach has not optimally empowered the surrounding environment as a learning resource, so an innovative approach is needed that not only transmits knowledge, but also builds concern and responsibility for the environment (Nusantari et al., 2020).

The main problem in science education is the lack of integration between science materials and relevant local environmental contexts, several previous studies have shown that inquiry and problem-based learning approaches to environmental issues can improve students' understanding and higher-level thinking skills (Ayyubi & Wisudawati, 2025; Lo et al., 2021).

This research aims to explore how contextual-based science learning that raises environmental issues around schools can improve students' understanding of concepts and attitudes of caring for the environment, this research also seeks to design learning

strategies that are able to bridge the gap between science in the classroom and reality in the field.

The findings from previous research are the basis for the development of a more contextual and applicative learning design, but there is still little research that develops learning tools that are sourced from the identification of actual environmental problems around the school as a medium for students' scientific exploration, the main focus in this study is on the relationship between learning and the surrounding environment that students face directly, as well as how the learning shapes understanding scientific and ecological concern that is sustainable.

METHODS

This study uses a descriptive qualitative approach with the Systematic Literature Review (SLR) method which is used to identify, evaluate, and synthesize findings from various relevant studies in the period of 2020-2025, the design of this study aims to evaluate the implementation of contextual learning based on environmental problems in science learning.

The stages of SLR carried out include: (1) formulation of research questions, (2) determination of inclusion and exclusion criteria, (3) literature search strategies, (4) article selection and screening, (5) data extraction, and (6) analysis and synthesis of findings. The research questions formulated are: "How effective is contextual learning of science based on environmental problems in improving students' understanding of concepts and attitudes of caring for the environment?"

The population in this study is all scientific articles that discuss contextual science learning, problem-based learning, and environmental issues at the primary and secondary education levels, the research sample was selected based on inclusion criteria, namely: (1) published in 2020-2025, (2) focusing on an environment-based science learning approach, (3) available in an open database, (4) using English or Indonesian, and (5) having a clear research methodology. Exclusion criteria include non-peer-reviewed articles, books, and incomplete conference reports.

The data collection technique was carried out by searching the databases of reputable journals such as Scopus, DOAJ, Springer, and Google Scholar using the keywords: "contextual science education", "problem-based environmental learning", "local environmental issues in science learning", "environmental science education", and "STEM environmental learning". The search was carried out with Boolean operators (AND, OR) to optimize the search results, the number of articles that met the criteria and analyzed in this study as many as 27 scientific articles..

RESULTS AND DISCUSSION

Based on the analysis of 27 scientific articles that met the inclusion criteria, it was found that diverse research characteristics in exploring contextual learning of science based on environmental problems, the distribution of publications shows a trend of increasing research from 2020 to 2025, with a peak in 2024 as many as 8 articles, showing an increasing interest in the environment-based learning approach.

Table 1. Article Distribution

Year	Number of Articles
2020	4
2021	6
2022	4
2023	3
2024	8

2025	2
Total	27

Sumber: Hasil Pengolahan Data 2025

The table above found that most of the research (18 articles) was conducted at the elementary school level, while the rest were at the secondary level (9 articles), the dominance of research at the elementary school level shows the importance of building environmental awareness from an early age through contextual science learning.

The Effectiveness of Contextual Learning Based on Environmental Problems

Analysis of the research results indicates that science learning with a contextual approach based on environmental problems has a significant contribution in improving the quality of student learning processes and outcomes, the trans-contextual approach proposed by Chowdhury et al. (2020) is considered to be able to broaden students' horizons in understanding science issues directly related to real life, this approach not only improves students' conceptual understanding, but also shaping the character of a citizenry that is aware of global challenges, especially related to sustainable development, this confirms the importance of integrating local and global contexts in science teaching to build deeper ecological concerns.

Research conducted by Deveci & Karteri (2020) reinforces the argument that learning built from real context has a positive impact on the professional readiness of prospective science teachers, by using environment-based measurement tools, they found that the involvement of participants in authentic learning activities not only enriches the understanding of scientific concepts, but also cultivates practical skills that are relevant to the real world, This approach makes students more reflective and critical in responding to environmental issues around them, as well as strengthening the position of science learning as a means of forming ecological awareness and action.

Another aspect that helps strengthen the effectiveness of contextual learning is the use of digital technology, which provides a new dimension in integrating environmental issues into science education, Herlanti et al. (2024) prove that the implementation of online lesson studies is able to bridge students with the reality of their local environment, even though they are in distance learning, technology allows learning to remain contextual even though they are not physically in one room, As well as providing wider access to information, environmental data, and collaboration between students, this learning design not only improves students' environmental literacy, but also develops critical and collaborative thinking skills in understanding natural phenomena.

Grella (2024) highlights that an exploration-based approach to local environmental issues can optimize the potential of STEM learning through student involvement in solving real problems, when students are faced with environmental challenges that exist around them, motivation to learn increases due to the direct relationship between the subject matter and everyday experiences, this reinforces the principle that meaningful learning cannot be separated from the social and ecological context No matter where students are, the study confirms that active engagement in local environmental issues not only drives more authentic scientific discoveries, but also shapes learners who have a high ecological sensitivity and sense of social responsibility

Increased Understanding of Science Concepts

Environmental problem-based learning has been proven to be effective in improving students' understanding of science concepts, Brumann et al. (2022) in their

research on inquiry-based learning about climate change shows that a design-based approach can improve students' understanding of complex concepts in environmental science, students not only memorize concepts, but are able to apply them in a real context.

Istiana et al. (2023) prove that STEM learning with environmental education topics can improve students' problem-solving skills, integrating science, technology, engineering, and mathematics in an environmental context to provide a holistic and meaningful learning experience for students.

Nabilah et al. (2022) used an ethnoscience approach in the topic of environmental pollution successfully improved students' science literacy skills, this approach allows students to connect local knowledge with modern science concepts, so that learning becomes more relevant and easy to understand.

Parno et al. (2024) show that the STEM approach in problem-based learning on the topic of environmental pollution is effective in improving students' problem-solving skills. This research emphasizes the importance of integrating various disciplines in understanding complex environmental problems.

Development of Environmental Care Attitudes

One of the most significant impacts of contextual learning based on environmental problems is the development of students' environmental care attitudes, Häyrynen et al. (2021) show that the promotion of environmental citizenship through local socio-cultural traditions in science education can form a strong environmental caring character in students.

Lestari et al. (2021) through the RADEC learning model, succeeded in infusing the environmental dimension of ESD (Education for Sustainable Development) into science learning in elementary schools. This research shows that the integration of the concept of sustainable development in science learning can shape environmental awareness from an early age.

Nuriyah et al. (2020) developed a STEM-Cp-based environmental change textbook that has been proven to be effective in improving problem-solving skills in high school biology learning, this approach not only improves understanding of concepts, but also develops a responsible attitude towards the environment.

Ratnasari et al. (2024) emphasized that strengthening the character of caring for the environment through a contextual approach in science learning has a long-term impact on students' pro-environmental behavior, this study shows a positive correlation between contextual learning and the development of environmental caring character.

Implementation of Learning Technology and Innovation

The use of technology in environment-based contextual learning continues to show significant dynamics in increasing the effectiveness of the teaching and learning process, Puspitasari et al. (2024) underline that the use of animated videos in the Contextual Teaching and Learning (CTL) approach can strengthen students' active involvement in science learning, multimedia technology such as animation not only presents information in attractive visual form, but is also able to Simplifying the delivery of complex environmental concepts so that they are easier for learners to understand, this approach indirectly establishes a connection between learning content and the reality of students' daily lives, which is at the heart of contextual learning.

Rihatno et al. (2021) developed a web-based learning model specifically designed to accommodate environmental science materials, the digital platform allows for expanded access to flexible learning resources, anytime and anywhere, while opening

up collaborative opportunities between students through online interactive features, the existence of web-based media also encourages the creation of a learning environment that is adaptive to technological developments and individual needs. Students, in this context, digital technology not only plays a role as a learning aid, but also as a bridge that brings together the academic world with the ecological reality faced by students in the surrounding environment.

Interdisciplinary and STEAM Approaches

The integration of various disciplines in environmental learning has been proven to provide more effective and meaningful results for students, Hussim et al. (2024) through a systematic review of various literature, emphasizing that the incorporation of environmental aspects in STEM education is an important strategy to support students' holistic understanding of ecological issues, this interdisciplinary approach not only strengthens the linkage between science concepts, technology, engineering, and mathematics, but also broadening students' knowledge of the complexity of environmental problems, through the incorporation of various perspectives, students are invited to comprehensively examine ecosystem issues, which in turn forms a critical awareness of environmental sustainability challenges.

The implementation in the classroom of the research from Rahmawati et al. (2022) developed an ethical dilemma-based learning model within the framework of STEAM that places the issue of sustainability as the main focus, this model emphasizes on the emotional and intellectual involvement of students through dilemmatic ethical scenarios, which are closely related to actual environmental problems, the results of their research show that students' involvement in education for sustainability increases significantly when they faced with complex ethical choices, encouraging reflective, empathetic thinking, and encouraging moral responsibility towards the surrounding environment.

An approach oriented to the social context also makes a great contribution to increasing students' critical thinking capacity, Purwanto et al. (2022) utilize a socio-critical approach combined with a problem-based learning model to frame environmental issues in chemistry learning, by focusing on the social impact of ecological problems, students are not only asked to understand science concepts conceptually, but also trained to evaluate the impact of the application of science on society and the environment, this strategy hones students' ability to assess, solve, and reflect on real issues critically and responsibly.

CONCLUSION

Based on a systematic analysis of 27 scientific articles, it can be concluded that contextual science learning based on environmental problems around schools has proven to be effective in improving understanding of science concepts and developing students' environmental care attitudes, this approach has succeeded in bridging the gap between science theory in the classroom and the reality of environmental problems in the field, thereby creating meaningful and relevant learning for students.

The findings of the study show that the integration of local environmental issues in science learning not only improves students' conceptual understanding, but also develops critical thinking skills, problem-solving abilities, and sustainable ecological awareness, utilizing the environment around the school as an authentic natural laboratory allows students to be directly involved in the scientific process through systematic observation, experimentation, and exploration.

The implementation of technology and interdisciplinary approaches such as STEM and STEAM has been proven to strengthen the effectiveness of environment-based

contextual learning, the combination of problem-based learning, the use of multimedia technology, and the integration of various disciplines creates a holistic and comprehensive learning experience for students.

The impact of this research makes an important contribution to the development of a science curriculum that is more contextual and responsive to contemporary environmental issues, as well as a reference for educators in designing learning strategies that can form a generation that has high environmental awareness and qualified scientific capabilities to face future ecological challenges..

REFERENCE

Ariza, M., Christodoulou, A., Van Harskamp, M., Knippels, M., Kyza, E., Levinson, R., & Agesilaou, A. (2021). Socio-Scientific Inquiry-Based Learning as a Means toward Environmental Citizenship. *Sustainability*. <https://doi.org/10.3390/su132011509>

Ayotte-Beaudet, J., Chastenay, P., Beaudry, M., L'Heureux, K., Giamellaro, M., Smith, J., Desjarlais, E., & Paquette, A. (2021). Exploring the impacts of contextualised outdoor science education on learning: the case of primary school students learning about ecosystem relationships. *Journal of Biological Education*, 57, 277 - 294. <https://doi.org/10.1080/00219266.2021.1909634>

Ayyubi, S., & Graduates, P. (2025). Building Environmental Awareness: Problem-Based Learning Based on Constructivism. *FIKROTUNA: Journal of Islamic Education and Management*. <https://doi.org/10.32806/jf.v15i1.652>

Baptista, M., Pinho, A., & Alves, A. (2025). Students' Learning for Action Through Inquiry-Based Science Education on a Local Environmental Problem. *Sustainability*. <https://doi.org/10.3390/su17093907>

Brumann, S., Ohl, U., & Schulz, J. (2022). Inquiry-Based Learning on Climate Change in Upper Secondary Education: A Design-Based Approach. *Sustainability*. <https://doi.org/10.3390/su14063544>

Chowdhury, T., Holbrook, J., & Rannikmäe, M. (2020). Addressing Sustainable Development: Promoting Active Informed Citizenry through Trans-Contextual Science Education. *Sustainability*, 12, 3259. <https://doi.org/10.3390/su12083259>

Deveci, I., & Karteri, İ. (2020). Context-Based Learning Supported by Environmental Measurement Devices in Science Teacher Education: A Mixed Method Research. *Journal of Biological Education*, 56, 487 - 512. <https://doi.org/10.1080/00219266.2020.1821083>

Gallay, E., Flanagan, C., & Parker, B. (2021). Place-Based Environmental Civic Science: Urban Students Using STEM for Public Good. **, 6. <https://doi.org/10.3389/feduc.2021.693455>

Grella, R. (2024). Exploring Local Environmental Issues to Engage Students in Real-World STEM Problem Solving and Discovery. *Science Scope*. <https://doi.org/10.1080/08872376.2024.2407311>

Häyrynen, S., Keinonen, T., & Kärkkäinen, S. (2021). Promoting Environmental Citizenship Through Local Socio-Cultural Traditions in Science Education. *Discourse and Communication for Sustainable Education*, 12, 5 - 30. <https://doi.org/10.2478/dcse-2021-0013>

Herlanti, Y., Nobira, S., Kuboki, Y., & Qumilaila, Q. (2024). Online lesson study design: integrating environmental issues with science learning to enhance students' environmental literacy. *International Journal for Lesson & Learning Studies*. <https://doi.org/10.1108/ijlls-08-2024-0169>

Hussim, H., Rosli, R., & Erdogan, N. (2024). Incorporating Environmental Elements in Learning STEM: A Systematic Literature Review. *International Journal of Social Science Research*. <https://doi.org/10.5296/ijssr.v13i1.22353>

Ibda, H., Widyastuti, R., & Wijanarko, A. (2023). Conservation in Science Learning: Study Implementation of Contextual Teaching and Learning in Madrasah Ibtidaiyah. *Jurnal Ilmiah Widya Borneo*. <https://doi.org/10.56266/widyaborneo.v6i2.231>

Istiana, R., Herawati, D., Herniningtyas, F., Ichsan, I., & Ali, A. (2023). STEM Learning to Improve Problem Solving Ability on the Topic of Environmental Education. *Journal of Science Education Research*. <https://doi.org/10.29303/jppipa.v9i3.2979>

Lestari, H., Ali, M., Sopandi, W., & Wulan, A. (2021). Infusion of Environment Dimension of ESD into Science Learning Through the RADEC Learning Model in Elementary Schools. *Journal of Science Education Research*. <https://doi.org/10.29303/jppipa.v7ispecialissue.817>

Listyowati, E., Prahani*, B., Gunansyah, G., Hendratno, H., & Istiq'faroh, N. (2024). Implementation of Science Learning in Forming Awareness of Environmental Care among Elementary School Students. *Scaffolding: Journal of Islamic Education and Multiculturalism*. <https://doi.org/10.37680/scaffolding.v6i3.6365>

Lo, J., Lai, Y., & Hsu, T. (2021). The Study of AR-Based Learning for Natural Science Inquiry Activities in Taiwan's Elementary School from the Perspective of Sustainable Development. *Sustainability*. <https://doi.org/10.3390/SU13116283>

Nabilah, W., Sudibyo, E., & Aulia, V. (2022). Foster student's science literacy skills on environmental pollution topics through the etnoscience approach. *Jurnal Pijar Mipa*. <https://doi.org/10.29303/jpm.v17i3.3506>

Nuriyah, D., , S., & Prihatin, J. (2020). The development of environmental change textbook based on STEM-Cp to improve problem-solving skills in high school biology learning. *Journal of Physics: Conference Series*, 1563. <https://doi.org/10.1088/1742-6596/1563/1/012054>

Nusantari, E., Utina, R., Katili, A., Tamu, Y., & Damopolii, I. (2020). Effectiveness of Environmentally-Based Science Learning towards Environmentally-Friendly Character of Students in Coastal Area. *International Journal of Instruction*, 13, 233-246. <https://doi.org/10.29333/iji.2020.13316>

Parno, ., Pratiwi, N., Putri, F., & Ali, M. (2024). The Effect of STEM Approach in Problem-based Learning for Increasing Students' Problem-solving Ability in the Topic of Environmental Pollution. *KnE Social Sciences*. <https://doi.org/10.18502/kss.v9i13.16032>

Pérez-Martín, J., & Esquivel-Martín, T. (2024). New Insights for Teaching the One Health Approach: Transformative Environmental Education for Sustainability. *Sustainability*. <https://doi.org/10.3390/su16187967>

Purwanto, A., Rahmawati, Y., Rahmayanti, N., Mardiah, A., & Amalia, R. (2022). Socio-critical and problem-oriented approach in environmental issues for students' critical thinking skills development in Chemistry learning. *Journal of Technology and Science Education*. <https://doi.org/10.3926/jotse.1341>

Puspitasari, E., Krismanto, W., Tuken, R., & Pasinggi, Y. (2024). USING VIDEO ANIMATION IN CONTEXTUAL TEACHING AND LEARNING TO ENHANCE STUDENT ENGAGEMENT IN SCIENCE LEARNING. *Quantum: Jurnal Inovasi Pendidikan Sains*. <https://doi.org/10.20527/quantum.v15i1.17134>

Rahmawati, Y., Taylor, E., Taylor, P., Ridwan, A., & Mardiah, A. (2022). Students' Engagement in Education as Sustainability: Implementing an Ethical Dilemma-STEAM Teaching Model in Chemistry Learning. *Sustainability*. <https://doi.org/10.3390/su14063554>

Ratnasari, J., Hakam, K., Hidayat, M., & Kosasih, A. (2024). Strengthening Environmental Care Character through Contextual Approach in Science Learning. *Journal of Science Education Research*. <https://doi.org/10.29303/jppipa.v10i11.9024>

Rihatno, T., Safitri, D., Marini, A., Yunaz, H., Putra, Z., Nuraini, S., & Ibrahim, N. (2021). Web-based learning model for environmental science. *IOP Conference Series: Materials Science and Engineering*, 1098. <https://doi.org/10.1088/1757-899X/1098/5/052060>