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# Exploration of Teachers' Perspectives on The Integration of Environmental Education in Science Learning

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**Abstract:** This study aims to reveal the forms of environmental education integration in science learning and the challenges faced by teachers in its implementation. This reseach approach used is a qualitative with a phenomenological design, stages include four main steps, namely bracketing, intuition, analysis, and description. Based on the analysis of teachers' responses, three main forms of integration were obtained, namely. (1) a contextual learning approach, (2) utilizing the surrounding environment, both the school environment and conservation areas, (3) strengthening environmental literacy and awareness through student involvement in environmental management activities. This study also found various challenges in implementing, including limited facilities and infrastructure, low student learning motivation, and difficulties in managing learning activities outside the classroom. External factors, such as limited school support, logistics, weather conditions, and a lack of learning media, exacerbate these obstacles. These findings indicate that teachers have a high awareness of their strategic role in fostering students' ecological awareness. However, in addition, teachers' limited understanding of the concept of environmental education integration in science learning is still found. Therefore, increasing teacher capacity through training, curriculum development, and structural support is important for the successful integration of environmental education in science learning.

**Keywords:** Environmental Education; Exploration; Integration; Science Learning; Teacher Perspectives.

## Introduction

The importance of environmental awareness in modern society demands education that focuses on a deep understanding of ecosystems and environmental responsibility (Cartono, 2022). Education plays an important role in addressing climate change (Makrooni et al., 2025). Education is needed to solve environmental problems, so raising ecological awareness through education is very important (Hajj-Hassan et al., 2024; Ibáñez et al., 2020). Environmental education plays a vital role in addressing global challenges such as climate change, pollution, and ecosystem degradation (Husin et al., 2025; Velempini, 2025). The integration of environmental education into science learning is highly relevant, as science subjects inherently explore the interactions between humans, living organisms, and the environment (Littledyke, 2008; Punzalan, 2024; Sukma et al., 2020; Wals et al., 2014).

Science education needs to equip students not only with knowledge, but also with awareness, values, and actions for a sustainable world (Tytler et al., 2025). Science teachers view the importance of environmental education and the need for a student-centered approach to build awareness and proactive action on climate change (Karim et al., 2022). Science teachers who build

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scientific confidence and instill environmental values can spark student engagement in real-world environmental issues (Kang & Tolppanen, 2024). The implementation of environment-based science learning in schools can improve the quality of learning and student learning outcomes, make learning more meaningful, and increase student concern, curiosity, and motivation (Desrina, 2019; Nurmiati & Hasan, 2020).

However, the success of integrating Environmental Education into science learning depends heavily on teachers' perspectives, attitudes, and pedagogical practices (Amarulloh, 2023). Because teachers may have diverse perspectives on the goals, methods, and level of education environmental integration, this can lead to varied classroom practices. Understanding these perspectives is crucial for identifying strengths and gaps in current approaches and for designing targeted professional development programs. Numerous studies have examined teachers' perspectives and perceptions of environmental education, exploring its importance and how to teach it (Ekayanti et al., 2011; Gandolfi et al., 2024; Imran & Almusharraf, 2024; Widayastuti et al., 2019), but few have analyzed the implementation of environmental education in science learning carried out by teachers, including the challenges they face. This study seeks to explore how teachers integrate environmental education into science learning and the challenges they face.

Based on the description above, this study aims to describe the forms and challenges experienced by teachers in integrating environmental education into science learning. To achieve this research objective, several research questions were derived, including:
RQ1 How is the form of environmental education integration described in science learning?
RQ2 How are the challenges faced by teachers in integrating environmental education into science learning?

## Method

*Reseach design*

In this study, the approach used is a qualitative approach with a phenomenological design. Creswell & Clark (2011) explains that phenomenology aims to understand the common meaning of several individuals towards shared life experiences. This approach assumes that people's experiences can be analyzed, and that these are conscious experiences (Manen, 2016). The characteristic of phenomenological design is exploring or interpreting the life experiences of a group of people regarding a phenomenon they experience (Isnawan et al., 2022; R. Dangal & Joshi, 2020; Stolz, 2020). The group of people in this study were teachers whose life experiences were related to science teaching practices, and the phenomena studied were the forms and challenges in integrating environmental education into science learning.

The stages of this research include four main steps, namely bracketing, intuition, analysis, and description (Aqilah et al., 2023; Greening, 2019). In the Bracketing stage, researchers suspend personal assumptions to prevent them from influencing the data being collected. In the Intuition stage, researchers focus deeply on the meaning of participants' experiences, then develop an open-ended instrument consisting of several questions representative of the phenomenon. Next, they group the data and identify core themes from the experiences. The final stage involves identifying key themes that reflect the form and challenges of environmental education integration and explaining these themes in a comprehensive and clear description.

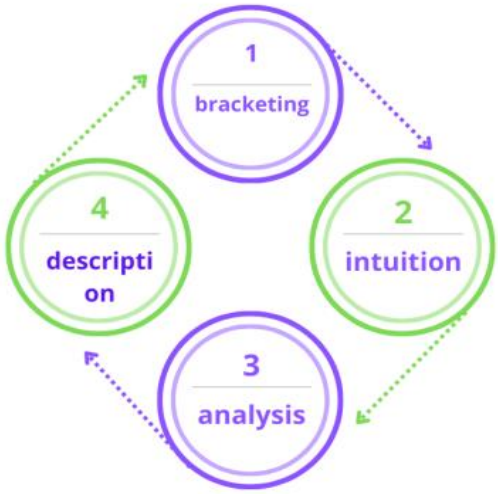


**Figure** 1. Research Flow

*Participants and Data Collection*

Participants in this study were 44 science teachers spread across several provinces in Indonesia. Of the 44 participants, the majority were women (80%), with 35 women and 9 men ranging in age from 25 to 55 years old and teaching experience ranging from 1 year to 36 years. Educational background: 30 were Biology teachers (67.5%), 7 were Physics teachers (15%), 4 were Chemistry teachers (10%), 1 was Mathematics teachers (2.5%), and 1 was Science teachers (general) (2.5%). 6 teachers taught in elementary schools (SD), 27 teachers taught in junior high schools (SMP/MTs), 9 teachers taught in vocational schools (SMK).

The primary instrument used was the researcher, who utilized additional tools for data collection. Data were collected through a Google Form containing several questions related to the integration of environmental education into science or biology learning, including the forms of integration

implemented and the difficulties encountered in integrating environmental education. These questions were reviewed by educational evaluation experts, who concluded that the Google Form met content validity requirements. In other words, the instrument effectively measured the problems teachers faced and their recommended solutions. The instrument can be accessed on the following page: The teacher perception exploration questionnaire.

*Analyzing of Data*

Data from the questionnaires completed by teachers was analyzed using a thematic analysis approach. This process involved several stages: understanding the data, developing initial codes, identifying themes, reviewing themes, defining and naming themes, and compiling a report (Byrne, 2022; Kiger & Varpio, 2020; Xu & Zammit, 2020)(Braun & Clarke, 2012). The analysis was conducted in-depth and iteratively, beginning with the coding process. The resulting codes served as the basis for developing themes relevant to the problem formulation, and the results were presented in a concise yet descriptive report (Braun & Clarke, 2012; Vaismoradi et al., 2013).

In the initial phase, researchers repeatedly read teachers' responses as part of the initial data understanding process. As patterns or similarities emerged, researchers began developing initial codes based on specific characteristics. These codes were then grouped into temporary themes based on shared characteristics. Afterward, researchers reviewed the themes formed by comparing them to the data and initial codes to ensure consistency. In the final phase, researchers formulated and named the main themes and provided descriptions that represented the meaning of each theme.

## Result and Discussion

*Result*

After reading the teachers' answers several times, it was found that 22 initial codes (IC) had been formed, consisting of 15 codes related to the form of environmental education integration, 3 codes related to challenges faced by teachers, and 4 codes that did not explicitly describe environmental education integration. A description of the IC can be seen in Table 2. The teachers' answers can be accessed in Table 3. Upon closer examination, several codes in Table 2 share similar characteristics. Therefore, several codes were grouped into one theme group. A complete description of the theme group can be seen in Table 4.

**Table 2.** Description of Initial Codes

| No. | Description |
|---|---|
| IC-1 | Inviting students to observe plants/animals in the |
| IC-2 | school environment |
| IC-3 | Hands-on practice in the field |
| IC-4 | Science learning linked to environmental issues |
| IC-5 | (ecosystems, pollution) |
| IC-6 | Managing and sorting waste |
| IC-7 | Providing insight before going into the field |
| IC-8 | Application of green chemistry |
| IC-9 | Integrating local wisdom in learning |
| IC-10 | Creating projects or miniature ecosystems |
| IC-11 | Teachers insert environmentally relevant questions |
| IC-12 | Difficulties in managing outdoor learning |
| IC-13 | Utilizing the surrounding environment as a learning |
| IC-14 | medium |
| IC-15 | Simple practicums with available tools/materials |
| IC-16 | Linking science concepts to real life |
| IC-17 | Difficulties in facilities/laboratories |
| IC-18 | Inserting environmental issues into additive material |
| IC-19 | Practicals with available tools |
| IC-20 | Waste reduction and greening campaigns |
| IC-21 | Students directly observe plant types and roots |
| IC-22 | Lack of student motivation |
| | Planting plants as part of learning |
| | Presenting videos as a substitute for hands-on practice |
| | Practical cuttings and grafting on plants |

**Table 3.** Description of Categories

| Theme Groups | Description |
|---|---|
| TG1-1 | Contextual Learning Strategies |
| TG1-2 | Integrating Science Material with Environmental Issues |
| TG1-3 | Practical Activities and Field Projects |
| TG1-4 | Utilizing the School Environment |
| TG1-5 | Strengthening Student Attitudes and |
| TG1-6 | Awareness |
| TG1-7 | Obstacles and Challenges in Integration |
| | Other/non-explicit forms of integration |

**Table 4.** Description of Themes

| Main Themes | Description |
|---|---|
| MT1-1 | Environment-Based Contextual Learning. |
| MT1-2 | Utilizing the Surrounding Environment as a Learning Resource. |
| MT1-3 | Developing Environmental Literacy and Awareness. |
| MT1-4 | Barriers to Integration Implementation. |
| MT1-5 | Supporting themes, not explicitly integrating. |

*Discussion*

*How is the description of the form of environmental education integration in science learning? (RQ-1)*

Based on the analysis of the teachers' answers, three main themes were obtained regarding the forms of integration carried out by science teachers, namely; **First**, a contextual learning approach that focuses on the

environment. Research by (Gustina & Djoehaeni, 2022) this study demonstrates that the Contextual Teaching and Learning (CTL) model can be implemented in learning that integrates environmental education. The contextual approach aims to provide students with hands-on learning experiences and help them understand the subject matter by relating it to real-life situations related to both the social and natural environment (Deveci & Karterib, 2022; Rahmawati & Koul, 2016; Welerubun et al., 2022). Similar findings were also conveyed by (Arik & Yilmaz, 2020; Ayyubi, 2025), as well as (Nurbaeti et al., 2020) which states that the application of CTL in environmental education makes a positive contribution in fostering students' concern for the environment. Besides that, (Baierl et al., 2022) noted an increase in knowledge and attitudes towards the environment as a result of this approach. Meanwhile, (Abdillah et al., 2021) added that problem-based learning and nature exploration provide more contextual and meaningful learning experiences for students.

**Second,** utilizing the surrounding environment as a learning resource. Surrounding environments, such as conservation areas and nature reserves, including school environments, have great potential as learning resources that support sustainable education (Cano-ortiz et al., 2025). Demonstrates that experiences in nature not only increase environmental awareness, but also create a closer connection between students and nature (Liefländer et al., 2013; Pirchio et al., 2021; Vasilaki et al., 2025). Students involved in nature education tend to show positive attitudes towards environmental conservation and are more active in conservation activities (Arsyad & Abdullah, 2024). Outdoor learning conducted in natural-humanistic environments (e.g., city parks, river areas) can strengthen students' scientific and ecological literacy (Ferreira & Pitarma, 2018). This finding is in line with several previous studies which state that learning about the environment has an impact on increasing students' knowledge, awareness and concern for environmental issues or increasing environmental literacy, including stimulating attitudes, involvement, self-confidence and understanding in studying environmental topics (Basche et al., 2016) because it is interesting and fun, so students are more active in learning (Nasrullah Rusly., 2025; Winarni et al., 2022; Wowor et al., 2023).

**Third,** strengthening environmental literacy and awareness. This learning involves involving students in environmental management activities such as waste reduction and reforestation campaigns. These findings indicate that teachers understand their strategic role in fostering environmental awareness in students. In other words, teachers have demonstrated a high level of awareness of the importance of integrating environmental education into the teaching and learning process (Aznar-d & Mar, 2019; Fodouop, 2025). Through student involvement in environmental management activities, ecological values are formed, which simultaneously strengthen character and enhance academic achievement, particularly in science (Lee, 2023). Furthermore, environmental education programs have been shown to have a significant impact on students' knowledge, attitudes, and behavior regarding sustainability (Robby & Karmilah, 2023). In fact, this program is able to shape students' character, such as honesty, responsibility, discipline, social and environmental awareness, courage, creativity, religiosity, and self-confidence (Nada et al., 2021).

*How is describe the challenges faced by teachers in integrating environmental education into science learning? (RQ-2)*

One important theme that emerged was the challenges faced by teachers, or the obstacles and limitations in implementing the integration of environmental education into science learning. There are three main obstacles faced by teachers: limited facilities and infrastructure, low student motivation, and difficulties in managing learning activities outside the classroom. Limited facilities hinder the implementation of environmental education, for example, a lack of learning media and minimal support from the school, both in the form of funding and infrastructure (Lestari et al., 2024; Rahman et al., 2018). The facilities referred to also include scheduling and logistical support, difficulty finding a study location, and incomplete instructional resources (Ding et al., 2025). Even TIMSS analysis shows that in many countries, schools experience a shortage of science equipment and experimental materials, which has a negative impact on the implementation of science learning and the learning environment (Isac & Sandoval-hernández, 2019).

Furthermore, implementing environment-based learning often faces challenges when conducted outside the classroom. Teachers face challenges such as time constraints, student behavior management, and weather factors (Frances et al., 2024; Ruether, 2018; Van Dijk-Wesselius et al., 2020) Many teachers feel that outdoor learning requires more time, which is often not available, making it difficult to complete the planned activities as planned (Patchen et al., 2024). Another concern stems from the inability to control student behavior in a larger, open environment. Furthermore, unpredictable weather also presents an additional obstacle to outdoor learning activities (Correia et al., 2024).

In the context of science learning, low student motivation is a challenge in itself. Several other studies have also shown that low learning motivation can hinder students' optimal achievement of competencies (Eminita et al., 2024; Isnawan et al., 2022; Rone et al.,

2023). This is important because motivation is closely related to students' learning goals and outcomes (Arifin, 2019; Handayani, 2019). However, student motivation is not only seen from the internal perspective of the student, but it is also very important to look at it from the external perspective, because low student motivation can also be influenced by external factors such as the learning environment, irrelevant material, or the way the teacher presents learning, even the two previous inhibiting factors are also related to student motivation. Alali & Wardat (2024) studies have revealed that limited resources and time are obstacles that affect students' motivation and commitment to science. Several studies have also revealed that students complain of low interest in learning, feel the material is irrelevant to their daily lives, and experience a boring learning environment. This directly reduces motivation to learn science in schools (Khan et al., 2019; Mkimbili & Ødegaard, 2019; Patall et al., 2018).

Vasilaki et al. (2025) In his research, he revealed the importance of fostering students' internal motivation for effective science learning, meaning that teachers actively build students' motivation from the outside. The quality of teaching, including teachers' beliefs and instructional practices, significantly influences students' motivation in science and mathematics, as well as their achievement and persistence (Ekmekci, 2022). Based on this, it is necessary for a teacher to design science learning that can trigger student motivation. Several studies show that the STEM education approach, contextual and exploratory learning in real environments, instilling environmental values during science learning, and outdoor learning can increase student engagement in science activities, motivation to learn, build scientific literacy, ecological critical thinking, and higher environmental awareness (Jong, 2020; Schönfelder & Bogner, 2020; Zulfana et al., 2025).

In addition to the themes of integration forms and challenges faced, another theme emerged that could be attributed to the challenges faced by teachers. After in-depth analysis, it was found that teachers lacked understanding regarding the integration of environmental education into science learning. According to Sikhosana (2022), Even though teachers have sufficient understanding of environmental concepts, this understanding has the potential to lead to errors in interpreting the meaning of integration, environmental education, and the integration of environmental education into learning. his can also be caused by limited teacher training, inadequate curriculum, minimal opportunities to improve teachers' professional capabilities, minimal practical experience, and low teacher self-efficacy (C, 2024; Kelani, 2015; Parry & Metzger, 2023).

On this basis, there is a need for training for teachers to improve their teaching skills related to the integration of environmental education. Waltner et al. (2020) His research shows that to effectively implement environmental education, teachers require professional training and structural support. Teachers who understand ESD (Education for Sustainable Development) tend to apply it more consistently and deeply in the classroom. Teachers with a good understanding and support can more effectively shape students' environmentally friendly attitudes and behaviors (Pamuk et al., 2022). The need for training, curriculum resources, and mentoring is critical to support the successful integration of sustainability into education (Albion et al., 2025).

## Conclusion

The result shows that there are three main forms of integration: (1) an environmentally based contextual learning approach; (2) utilizing the surrounding environment as a learning resource; and (3) strengthening environmental literacy and awareness. On the other hand, there are a number of challenges, including limited facilities and infrastructure, low student motivation, and technical difficulties in implementing learning outside the classroom. Furthermore, teachers' lack of understanding of the integration of environmental education into science learning is a significant obstacle.

The success of integrating environmental education into science learning is greatly influenced by teachers' perspectives, attitudes, and pedagogical skills, as well as adequate structural support and resources. Therefore, these findings implication the importance of increasing teacher capacity through training, curriculum development, and structural support, which are crucial for the successful integration of environmental education into science learning to ensure a long-term impact on developing students' ecological awareness.

**Author Contributions**

The authors listed in this article have contributed to the preparation of this article. "Conceptualization, R. D. K. and M. J. H.; methodology, R. D. K; validation, M. G. I, I. P. M. Z, F. A. R, and T.; formal analysis, R. D. K.; investigation, R. D. K, A. F. And S; data curation, M. J. H.; writing—original draft preparation, R. D. K.; writing—review and editing, R. D. K.; visualization, A. F.; supervision, A. F.; project administration, D. P. L and H. R..; funding acquisition, DPPM Kemdiktisaintek.

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**Conflicts of Interest**
All authors have no conflict of interest in the publication of this article.

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