Environmental education in primary school students: A systematic review

Educación ambiental en estudiantes de nivel primaria: una revisión sistemática

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Abstract

Environmental education has a positive impact on the environmental awareness of elementary school students, promoting sustainable and responsible attitudes. In this context, this systematic review identifies the main approaches researched in environmental education, such as playful processes, ecology, sustainability, and pro-environmental behavior change. To this end, the PRISMA method was applied and 20 articles were selected from databases such as Scopus, Scielo, Redalyc, and Web of Science. The research questions focused on the most frequently analyzed aspects of environmental education, its influence on elementary school students, and the associated benefits. The results highlight the importance of integrating environmental education into the school curriculum to strengthen pro-environmental behaviors from an early age. It is concluded that environmental education improves both the environmental awareness and ecological commitment of elementary school students, promoting behavioral changes and sustainable practices. It is recommended that its implementation in teaching be strengthened to ensure a solid environmental education for future generations.

Keywords: environmental awareness, environmental education, elementary school students.

Resumen

La educación ambiental tiene un impacto positivo en la conciencia ambiental de los estudiantes de primaria, promoviendo actitudes sostenibles y responsables. En este contexto, el presente estudio de revisión sistemática identifica los principales enfoques investigados en educación ambiental, tales como procesos lúdicos, ecología, sostenibilidad y cambios de comportamiento a favor del medio ambiente. Para ello, se aplicó el método PRISMA y se seleccionaron 20 artículos provenientes de bases de datos como Scopus, Scielo, Redalyc y Web of Science. Las preguntas de investigación se centraron en los aspectos más analizados de la educación ambiental, su influencia en estudiantes de primaria y los beneficios asociados. Los resultados resaltan la importancia de integrar la educación ambiental en el currículo escolar para fortalecer conductas proambientales desde edades tempranas. Se concluye que la educación ambiental mejora tanto la conciencia ambiental como el compromiso ecológico de los estudiantes de primaria, promoviendo cambios de comportamiento y prácticas sostenibles. Se recomienda reforzar su implementación en la enseñanza para asegurar una formación ambiental sólida en las futuras generaciones.

Palabras clave: conciencia ambiental, educación ambiental, estudiantes de primaria.

Introduction

Currently, environmental education plays a fundamental role in shaping the ecological awareness of primary school students, as it promotes responsible and sustainable attitudes from an early age. The incorporation of these contents into the school curriculum not only aims to broaden knowledge about the environment but also to encourage behavior changes in new generations (Coronel, 2023). However, its implementation remains partial and, in many cases, is confined to specific subjects, highlighting the need to expand its reach within primary education (Estrada et al., 2021).

Moreover, the significance of environmental education lies in its ability to harmonize economic, social, and ecological development, aligning with the principles of sustainable development (Dickel & Bonnin, 2019). In this process, environmental culture emerges as a key element, as it strengthens the responsible management of natural resources and fosters the protection of critical ecosystems, such as mangroves (Esteban et al., 2020). Nevertheless, significant challenges persist in teaching these topics in primary education, underscoring the urgency of designing more effective pedagogical strategies (Solís-Espallargas & Barreto-Tovar, 2020).

Various studies have addressed essential aspects of environmental education at the primary level. For instance, the relationship between environmental education and playful processes has been examined (Ticlla et al., 2021), as well as the crucial role of teacher training for effective implementation (Álvarez & Mantecón, 2019; Fuentes et al., 2019), and the positive impact of tools like school gardens on the development of ecological awareness (García & Hurtado, 2023).

Despite these advancements, significant gaps remain in the literature. There is a need to delve deeper into the identification and evaluation of genuinely effective teaching strategies, as well as to analyze the long-term impact of environmental education programs on primary students and specialized teacher training in this area (Mateos-Núñez & Martínez-Borreguero, 2022; Almanza, 2021). Furthermore, it is crucial to investigate how these strategies can contribute to comprehensive education and foster sustainable pro-environmental attitudes over time (Araoz et al., 2020). While studies like those by Gámez et al. (2021) have explored behaviors in school settings, further investigation into the long-term impact of environmental education in childhood is necessary. Similarly, teacher training in this field remains insufficient, underscoring the importance of designing more effective training programs (Núñez, 2019).

In this context, the present study aims to address the following research questions: What are the most researched aspects of environmental education? How does environmental education influence primary school students? What benefits does environmental education provide to these students?

Through a systematic literature review, this work examines the current state of environmental education in primary schools, identifies the teaching strategies employed, and evaluates their impact on the development of environmental awareness. The results obtained will guide future research and strengthen the integration of environmental education into the school curriculum, thereby ensuring a solid education for citizens committed to caring for the environment.

Methodology

In the context of this research, a qualitative approach was adopted, recognizing the value of systematic review as a fundamental tool for identifying trends and synthesizing knowledge in the educational field (Sánchez-Meca, 2022). For this reason, a systematic literature review was chosen as the primary method, following the guidelines proposed by Ferreras Fernández (2016) to ensure transparency, rigor, and replicability in the collection and analysis of information.

Additionally, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was employed, structuring the process into four essential phases: search, evaluation, analysis, and synthesis (Codina, 2024).

1. Search phase

Initially, an exhaustive search was conducted in recognized scientific databases, such as Scopus, Scielo, Dialnet, and Web of Science, to identify relevant studies on the influence and benefits of environmental education in primary school students. To optimize the accuracy of the results, keywords such as "environmental education," "primary students," and "environmental awareness" were used, combined through Boolean operators (AND, OR). Filters were also applied to select only studies published in the last five years (2019-2024), ensuring the information's currency. Only original and review articles published in Spanish and English and available as open access were included, ensuring academic quality and text availability.

2. Evaluation phase

Subsequently, the titles and abstracts of the articles obtained in the initial search were reviewed to determine their relevance concerning the research objective. In this stage, duplicate studies were eliminated, and those that did not specifically address the relationship between environmental education and environmental awareness in primary students were excluded. Articles not available in the selected languages or not directly related to the benefits of environmental education in the educational context were also discarded.

3. Analysis phase

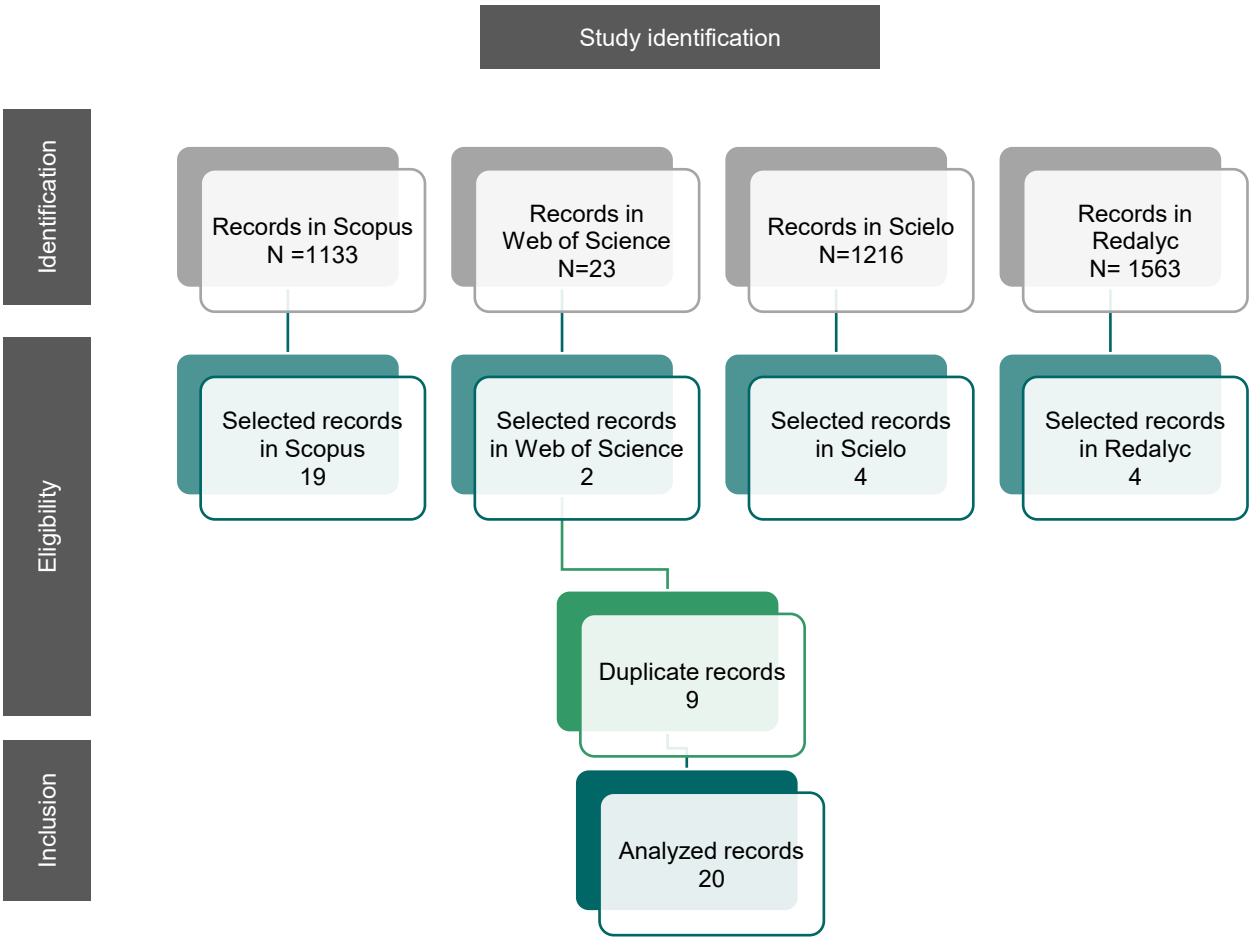
A detailed and critical reading of the selected articles was then conducted to extract relevant information regarding strategies, impacts, and benefits of environmental education in primary students. Aspects such as research design, studied population, employed methods, and key findings of each study were analyzed, allowing for comparisons between previous research. Special emphasis was placed on those works that evaluated the effectiveness of pedagogical strategies for developing environmental awareness in children.

4. Synthesis phase

Finally, the obtained results were synthesized, identifying patterns, similarities, and differences present in the analyzed literature. The most significant findings regarding environmental education and its influence on primary students were highlighted, as well as the main gaps detected in current research. Based on this synthesis, general conclusions were drawn about the importance of environmental education in promoting sustainable habits in childhood, and recommendations for future research in the area were proposed.

For the preparation of this study, a total of 20 scientific articles that met the established selection criteria and were pertinent to the research objectives were analyzed. Those works that did not originate from reliable sources or did not provide significant evidence on the topic were excluded, thus ensuring the validity and quality of the results presented.

Figure 1
Diagram of the PRISMA method



Results and discussion

The findings from this systematic review reveal that environmental education for primary school students has been approached from a variety of perspectives. For instance, Rodríguez-Miranda et al. (2022) highlight the incorporation of playful strategies as effective tools for promoting participatory and reflective learning environments. In line with this perspective, Moreno-Fernández (2020) suggests using theater as a didactic resource to address socio-environmental issues, facilitating meaningful learning through direct experience.

On the other hand, studies like those of Schneiderhan-Opel & Bogner (2021) underscore the influence of environmental values on the development of ecological knowledge. Complementarily, Khalifé et al. (2022) emphasize the potential offered by digital solutions to strengthen environmental education, especially in vulnerable contexts such as Lebanon. Globally, Ardoin et al. (2020), through a systematic review, demonstrate that environmental education programs yield concrete outcomes in attitudes, knowledge, and pro-environmental behaviors, although they warn that these programs should be better aligned with conservation goals.

From a curricular perspective, Monte & Reis (2021, 2024) emphasize the effectiveness of pedagogical models oriented towards environmental citizenship, provided there is a firm commitment from educators. Conversely, Jaimes Martínez (2022) points out the limitations imposed by the pandemic on the effective implementation of these contents in schools. Similarly, Díaz Grijalva et al. (2019) and Bonilla & Garzón (2022) analyze how the institutional context and teacher training condition environmental teaching practices, particularly regarding the development of pro-environmental and ecocitizen skills.

Regarding the direct influence of environmental education, research such as that by Sevillano (2023) demonstrates that environmental knowledge significantly impacts students' attitudes toward environmental

conservation. Kosta et al. (2022) and Yang et al. (2022) complement this view by showing that activities conducted in nature or those based on ecological narratives strengthen the sense of connection to the environment and foster solid ecological awareness. Delgado (2019) also highlights how educational initiatives centered on the environment can create a deep connection with the local ecosystem. Additionally, Ramos & Villaseñor (2024) introduce the concept of "sense of place," illustrating how the emotional bond students establish with their environment directly influences their predisposition to act in favor of the environment.

In terms of observed benefits, Martín et al. (2021) and Valenzuela-Morales et al. (2022) agree that school programs focused on specific topics, such as sustainable water use or waste management, lead to significant improvements in both knowledge and behavior among students. Complementarily, Ricoy (2022) notes that the incorporation of digital tools and gamification increases motivation and ecological awareness among students. Eichinger et al. (2022), when evaluating the Public Climate School program, confirm that structured school interventions can promote awareness and climate action from an early age. These findings reinforce the importance of initiating environmental education in the early years of schooling, as suggested by Torres et al. (2021), who report notable improvements following a pro-environmental intervention in students from Castilla-La Mancha.

In terms of temporal analysis, it is observed that all reviewed articles (100%) were published between 2021 and 2024, reflecting a recent and sustained interest in environmental education. Of these, 35% correspond to 2022, followed by 25% in 2021, and 20% each in 2023 and 2024, indicating a growing trend in scientific production on the topic. Geographically, most studies originate from Spain, followed by Mexico, Indonesia, and Brazil. Although countries like Peru, Colombia, and Germany are also represented, Latin American literature remains limited, highlighting the need to foster contextualized research that addresses local environmental realities.

Finally, significant gaps are identified regarding the impact of these programs on sustainable development. Freire & Merino (2020) offer a critical perspective on the superficiality with which the Sustainable Development Goals (SDGs) are addressed in some school contexts. Similarly, Delgado et al. (2019) warn about the influence of advertising and media literacy on the formation of children's environmental awareness, suggesting that these factors must be considered in the design of educational programs.

In summary, the results confirm that environmental education positively impacts the formation of primary school students, strengthening their knowledge, attitudes, and connections to nature. However, challenges persist in designing sustainable pedagogical strategies, teacher training, and consolidating more robust scientific production in Latin American contexts. Therefore, it is recommended to move toward a more integrated curriculum, implement innovative methodologies, and establish continuous evaluation of programs to ensure meaningful and lasting environmental learning.

Conclusions

Currently, environmental education faces various challenges for its appropriate incorporation into the school curriculum. Therefore, it is essential to promote pedagogical strategies from an early age that enable students to develop a solid and lasting environmental awareness. To achieve this goal, it is crucial to understand and apply the approaches and methodologies that have proven effective in teaching environmental education at the primary level. However, significant gaps still exist in the literature, particularly regarding effective pedagogical strategies for the early years of schooling.

The results of this research highlight the importance of designing educational recommendations that provide comprehensive support—cognitive, attitudinal, and emotional—in the realm of environmental education. Among the most studied topics are the relationship between environmental education and playful processes, which foster environments of trust and active participation; ecology and sustainability, which promote a deep understanding of environmental issues; and the encouragement of behavioral changes aimed at protecting the environment. Additionally, the role of teaching practices and factors linked to the development of pro-environmental behaviors in students has been analyzed, along with digital literacy as a key tool for strengthening environmental education.

To optimize the teaching of environmental education, it is essential to design educational strategies that consider three fundamental pillars. First, it is necessary to address the individual characteristics and needs of each student. Since each child possesses a unique foundation of environmental knowledge and experiences, diagnosing their level of understanding is crucial for designing strategies that facilitate the acquisition of pro-environmental skills. It is also important to address negative attitudes toward environmental education, promoting a positive environment that encourages active participation in conserving the surroundings. Second, teachers play

a central role in shaping students' environmental awareness. Therefore, it is imperative to offer continuous training programs that equip them with innovative methodologies and effective teaching resources. Evidence shows that strategies such as educational interventions and the use of digital literacy enhance environmental teaching, favoring meaningful learning and problem-solving in real contexts. Finally, the school curriculum should integrate environmental education transversally, incorporating real-life situations that allow students to apply their knowledge in concrete contexts. This entails linking environmental education with other disciplines, fostering critical thinking and problem-solving capabilities. Moreover, educational programs should focus on developing sustainable attitudes, beyond merely transmitting theoretical information.

In summary, this study underscores the relevance of environmental education in the holistic formation of primary school students, emphasizing its positive impact on environmental awareness and personal development. It has been demonstrated that environmental education contributes to the formation of responsible and sustainable attitudes, promoting essential habits and knowledge for environmental conservation. These findings support the need to continue strengthening environmental education within the school curriculum, establishing it as a key tool for fostering sustainability and environmental responsibility in future generations.

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