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Curricular innovations with an environmental focus in initial teacher education: A systematic review of literature

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ABSTRACT
The study analyzes the implementation of curricular innovations with an environmental approach in initial teacher training, considering the period 2021-2025. Through a systematic review based on the PRISMA method, 34 research studies were identified that highlight the need to integrate sustainability not only in curricular content, but also in pedagogical strategies. It is evident that the most effective proposals include active methodologies based on group research, fostering critical environmental thinking and the ethical commitment of future teachers. However, many initiatives remain isolated and disconnected from the educational context, which limits their impact on teaching practice. It is concluded that moving towards a comprehensive environmental education requires a solid articulation between training policies, innovative methodologies and collaborative projects that connect future teachers with their natural and social environment, promoting a transformative and sustainable pedagogical approach.

Keywords: Environment, Teachers, Innovation, Sustainable Methods

I. INTRODUCTION

We live in a time when the planet demands urgent and sustained responses. Schools, and especially those who teach in them, have the enormous task of educating citizens capable of caring for life in all its forms. In this context, environmental education becomes an ethical and pedagogical commitment that begins with the training of future teachers. It is not only a matter of including content on climate change or recycling, but also of transforming the way of teaching so that respect for the environment permeates all educational decisions. This is highlighted by UNESCO (2024), which calls for strengthening "green curricula" as an essential part of education committed to sustainability (UNESCO, 2024).

Some countries are already moving in this direction. For example, in Chile, the Ministry of Education decided that climate change should be a central part of the school curriculum from 2024. Not as an isolated topic, but as part of a comprehensive educational process that forms critical, informed and environmentally responsible citizens (MINEDU, 2024). This commitment not only transforms what is taught, but also how the teachers who will teach it are trained. This is where

curricular innovation makes sense: we need teachers who know how to integrate environmental issues from a creative and contextualized pedagogical perspective.

Other Latin American countries, such as Ecuador, are also rethinking initial teacher training with an environmental focus. Vernaza Arroyo (2025) states that it is necessary for the State, universities and companies to work together to design public policies, training programs and real projects that connect future teachers with their natural and social environment (Vernaza, 2025). This type of alliances show that caring for the environment is not the task of just one sector, but of all social actors committed to a transformative education.
From academia, concrete proposals to achieve this change are also emerging. A valuable example is that of Daryanes et al. (2025), who applied a learning model based on group research to foster critical thinking and environmental sensitivity in student teachers. Their findings show that when students work in teams to solve real problems related to the environment, they not only learn more, but also become emotionally and ethically engaged with their community (Daryanes et al., 2025).

However, not all contexts advance at the same pace. Research such as that of Ríos Quiñónez et al. (2024) warns that there are still important gaps in many teacher training programs. In their study, they show how environmental education is often reduced to specific activities or disconnected from the reality of the classroom, which prevents a real transformation. For this reason, they propose more comprehensive guidelines that help to include environmental issues in daily pedagogical practices, and not only as isolated content (Ríos Quiñónez et al., 2024).

In the case of Peru, the concern for integrating the environmental approach in initial teacher training has begun to be reflected in educational policy documents. The National Education Council (2022) prepared a report that analyzes the main weaknesses in the environmental preparation of future teachers and offers a series of recommendations to strengthen this dimension in the curricula. The document highlights that there are still structural gaps, such as the scarce specific training of teacher educators and the weak articulation between the national environmental policy and the curricula of pedagogical institutes (Consejo Nacional de Educación, 2022).

From a more practical perspective, the Peruvian Ministry of Education (2020) published a guide to facilitate the implementation of the environmental approach in schools. Although it is aimed at practicing teachers, it offers valuable pedagogical tools that are also useful for initial training, such as strategies for linking the local environment to learning or promoting sustainable school projects. This document highlights that the environmental approach should not be treated as an isolated topic, but as part of the integral development of the student and his or her link with the territory he or she inhabits (MINEDU, 2020).

Within this framework, this systematic review seeks to collect, analyze and compare the most recent research (between 2021 and 2025) on how curricular innovations with an environmental approach are being implemented in teacher training. The idea is to understand which strategies are yielding results, what challenges persist and how to build stronger paths for a truly transformative environmental education. The PRISMA method has been followed to ensure a rigorous and transparent process in the selection of the studies reviewed.

II. METHOD

This research follows the guidelines of the PRISMA 2020 method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which guarantees a rigorous and transparent process in the identification, selection, evaluation and synthesis of the included studies. A systematic literature review with a qualitative approach was chosen, aimed at describing and analyzing curricular

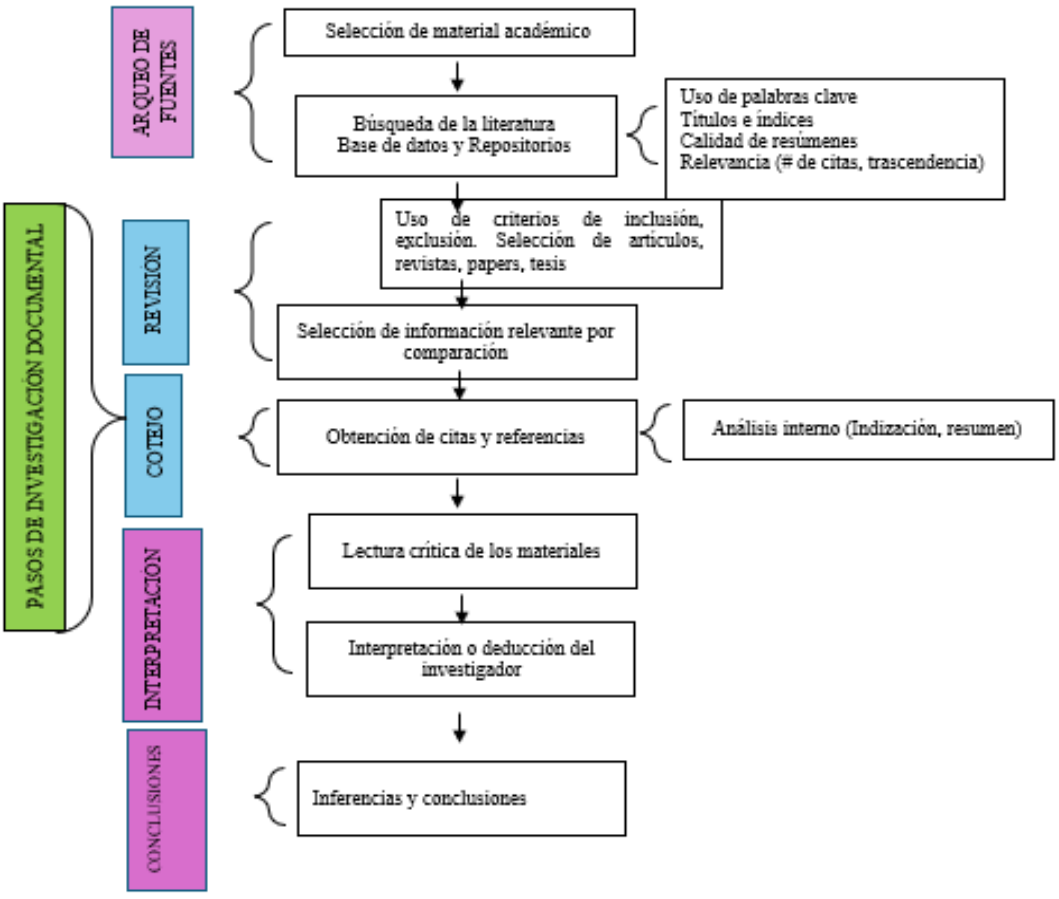
innovations with an environmental approach in initial teacher training at the international and Latin American levels, with special emphasis on recent contributions between 2021 and 2025.

Sources of information and search strategies; for the collection of information, an exhaustive search was carried out in recognized academic databases such as Scopus, Web of Science, Scielo, Dialnet, Redalyc and Google Scholar, using Boolean operators and descriptors such as: "environmental teacher training", "education for sustainable development", "green curriculum", "environmental curricular innovation" and "initial teacher training". Priority was given to original articles, technical reports and educational policy documents with empirical evidence.

Inclusion and exclusion criteria; research published between 2021 and 2025, written in Spanish or English, that explicitly addressed the incorporation of the environmental approach in initial teacher education was included. Duplicate articles, essays without empirical support, non-peer-reviewed publications and studies focused exclusively on secondary or higher education with no connection to initial teacher education were excluded.

Selection process: the selection was carried out in three stages: (1) reading of titles and abstracts; (2) reading of the full text; and (3) application of an evaluation form to verify relevance, methodological quality and thematic pertinence. The process was carried out independently by two researchers, and in case of discrepancies, discussions were held until a consensus was reached. In the end, 34 research studies were included that met all the defined criteria.

Figure 1: Flowchart of item selection with the Prisma method



Note: Steps of the systematic review proposed by the Prisma method, summary of the research activity procedures.

Table 1

Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Article publications from 2020 - 2025	Pre-2020 publications
Publications related to Curricular innovations with an environmental focus in initial teacher education.	Publications in other areas
Publications in Google Scholar, Scopus, WOS, Scielo and Dialnet that are grouped within the sciences, management, social sciences, only in credible journals.	Publications in other databases

Data analysis; for the analysis of the information, a categorical matrix was used in Excel where data such as author, year, title, objective, methodology, contributions, conclusions and access link were organized. Subsequently, an inductive thematic categorization was carried out to identify common patterns, tensions and contributions in environmental curricular strategies applied in teacher training. The narrative synthesis made it possible to compare results and draw significant lessons.

Table 2

Systematization of the articles reviewed

N°	Año	Autor	Título	Conclusión	Aporte	Enlace
1	2025	Daryanes, F., Zubaidah, S., Mahanal, S., & Sulisetijono. (2025).	Building Students' Research Skills in Environmental Science Courses with Research Team-Based Learning	El aprendizaje en equipo mejora las habilidades investigativas de los estudiantes en ciencias ambientales.	Propuesta de estrategia de aprendizaje basada en equipos para enseñanza ambiental.	https://www.ejmste.com/article/building-students-research-skills-in-environmental-science-courses-with-research-team-based-learning-15893
2	2025	Vernaza Arroyo, G. D. (2025).	Formación ambiental para la sustentabilidad en Instituciones de Educación Superior: Entre el Estado y la Empresa	Aún existen desafíos en articular políticas públicas y estrategias empresariales en la educación ambiental universitaria.	Vincula Estado, universidades y empresas para una formación ambiental integral.	https://produccioncientificaluz.org/index.php/rcs/article/view/43502

3	2024	Ministerio de Educación de Chile. (2024).	Bienvenido el cambio climático al currículum escolar	El currículo 2024 refuerza la educación ambiental integrándola transversalmente en múltiples asignaturas.	Promueve la inclusión sistemática del cambio climático y biodiversidad en la educación escolar.	https://www.ciperchile.cl/2024/07/11/bienvenido-el-cambio-climatico-al-curriculum-escolar/
4	2024	UNESCO. (2024).	Call for Situation Analysis Research on: Greening Education in East Asia	Se requiere un análisis detallado de las iniciativas verdes para futuras intervenciones educativas.	Evaluación de currículos verdes y formación docente en Asia Oriental.	https://www.unesco.org/en/articles/call-situation-analysis-research-greening-education-east-asia
5	2024	Ríos Quiñónez, M. B., Sánchez Caicedo, A. M., & Castillo Solano, M. Y. (2024).	Integración de la educación sostenible y ambiental en programas de estudio universitarios	Se necesita una integración estructurada de la educación ambiental en los planes de estudio universitarios.	Propone lineamientos para fortalecer la conciencia ecológica en estudiantes universitarios.	https://revistainvecom.org/index.php/invecom/article/view/3476
6	2023	UNESCO. (2023).	Aprender por el planeta: Revisión mundial de la educación sobre el cambio climático	La educación sobre cambio climático está integrada en la mayoría de los sistemas educativos, pero requiere más enfoque práctico en la formación docente.	Ofrece una panorámica global con énfasis en Asia sobre políticas educativas climáticas.	https://unesdoc.unesco.org/ark:/48223/pf0000380480
7	2023	UNESCO Asia-Pacific. (2023).	Greening every classroom: Mainstreaming ESD in teacher education in Asia	La inclusión efectiva de la EDS en la formación docente aún enfrenta desafíos estructurales, especialmente en países en desarrollo.	Sugiere un modelo de integración curricular sostenible en programas de formación docente.	https://www.unesco.org/sites/default/files/medias/fichiers/2023/09/greening-every-school-cn-en.pdf

8	2023	Khan, M. A. (2023).	Effectiveness of Teacher Training on Environmental Education	La efectividad de la formación depende de metodologías participativas, apoyo institucional y evaluación contextual.	Analiza desafíos reales de implementación de programas de formación ambiental docente.	https://www.researchgate.net/publication/373429020_Effectiveness_of_Teacher_Training_on_Environmental_Education_Challenges_and_Strategy_for_Future_Training_Program
9	2023	Garcia, J. & Lee, A. (2023).	Teacher Agency in Environmental Curriculum Innovation	El empoderamiento docente es clave para generar cambios sostenibles en los contenidos curriculares.	Demuestra cómo la agencia docente puede transformar prácticas educativas en sostenibilidad.	https://www.frontiersin.org/articles/10.3389/feduc.2023.1156708/full
10	2023	Eliyawati, E., Widodo, A., Kaniawati, I., & Fujii, H. (2023).	Effectiveness of Teacher Training on Environmental Education: Challenges and Strategy for Future Training Program	Los programas deben promover no solo el conocimiento, sino también la conciencia y acción sostenible.	Recomienda actividades activas en formación docente para fomentar sostenibilidad.	https://www.researchgate.net/publication/373429020_Effectiveness_of_Teacher_Training_on_Environmental_Education_Challenges_and_Strategy_for_Future_Training_Program
11	2023	UNESCO. (2023).	Embracing Climate Change Education for Young Learners in Asia-Pacific	La educación ambiental debe comenzar desde la primera infancia con formación especializada docente.	Capacitación en cambio climático para docentes de educación inicial en Asia-Pacífico.	https://www.unesco.org/en/articles/seeds-change-embracing-climate-change-education-young-learners-asia-pacific
12	2023	Amórtegui Cedeño, E. F., & Valbuena Ussa, É. O. (2023).	Enseñanza de las ciencias naturales, educación ambiental y formación docente en Colombia: Aportes desde el conocimiento del profesorado	La formación docente debe integrar enfoques interdisciplinarios y contextuales para abordar problemas ambientales.	Visibiliza las prácticas actuales del profesorado y propone mejoras en la formación ambiental.	https://www.researchgate.net/publication/383305323_Ensenanza_de_las_ciencias_naturales_educacion_ambiental_y_formacion_docente_en_Colombia_Aportes_desde_el_conocimiento_del_profesorado
13	2023	Ministerio de Educación de Ecuador. (2023).	Plan Natura: Educación para la Transformación Social y el Desarrollo Sostenible	Busca consolidar la educación como motor del cambio social con enfoque sostenible desde	Establece directrices nacionales para integrar sostenibilidad en el sistema educativo ecuatoriano.	https://educacion.gob.ec/wp-content/uploads/downloads/2023/11/plan_natura_contenido.pdf

				la formación docente.		
14	2022	Thompson, C. & Barnes, H. (2022).	Sustainability Education and Teacher Training in North America	La educación para la sostenibilidad requiere marcos institucionales sólidos y programas continuos de desarrollo docente.	Analiza marcos institucionales y retos sistémicos de la formación docente en sostenibilidad.	https://www.mdpi.com/2071-1050/14/1/115
15	2022	Lawrence, R. (2022).	Integrating Climate Change into Pedagogical Practices	La formación en cambio climático debe incluir no solo contenidos, sino también metodologías activas y evaluación.	Proporciona pautas para rediseñar cursos docentes en torno al cambio climático.	https://journals.sagepub.com/doi/10.1177/21582440221077899
16	2022	Consejo Nacional de Educación. (2022).	Recomendaciones para el mejoramiento de la formación inicial de docentes en el Perú	Se identifican desafíos y se proponen estrategias para integrar mejor el enfoque ambiental.	Recomendaciones políticas para fortalecer la dimensión ambiental en FID.	https://cdn.www.gob.pe/uploads/document/file/5537831/4926414-documento-de-trabajo-recomendaciones-para-el-mejoramiento-de-la-formacion-inicial-de-docentes-fid-en-el-peru.pdf
17	2022	Flores Quenta, A. J. (2022).	La educación ambiental en la formación docente: Una propuesta de inserción curricular	La inclusión de la educación ambiental en los planes de estudio fortalece la capacidad docente para abordar problemas ambientales.	Propone la educación ambiental como asignatura obligatoria en la formación docente.	https://es.scribd.com/document/636122711/LA-EDUCACION-AMBIENTAL-EN-LA-FORMACION-DOCENTE
18	2022	Revista Horizontes. (2022).	Desarrollo de la conciencia ambiental desde la perspectiva docente	Los docentes juegan un rol clave en la concienciación ambiental y requieren formación especializada.	Aporta la visión de los docentes sobre la importancia de la educación ambiental en su formación.	https://revistahorizontes.org/index.php/revistahorizontes/article/view/892

19	2022	Costa, J. M., & Lopes, P. T. C. (2022).	A Educação Ambiental na formação de professores	Se requiere mayor integración de la educación ambiental en cursos de licenciatura con enfoque sostenible.	Revisión sistemática que evidencia vacíos y potencialidades en la formación ambiental docente.	https://seer.faccat.br/index.php/redin/article/view/2637/1683
20	2022	Lopes, T. S., & Abílio, F. J. P. (2022).	A Educação Ambiental na formação inicial de professores/as: contribuições da Pedagogia Crítica	La pedagogía crítica fortalece la conciencia y acción ambiental en la formación docente.	Explora el aporte de la pedagogía crítica a la educación ambiental en la formación inicial.	https://revistas.uepg.br/index.php/praxiseducativa/article/view/18558
21	2022	Castillo-Retamal, F., Cordero-Tapia, F., & Marín-Isamit, F. (2022).	Competencias profesionales en Educación Ambiental: un caso en la formación de profesores en Chile	Se requiere fortalecer la formación en competencias ambientales para lograr mayor impacto educativo.	Diagnóstico de necesidades formativas en educación ambiental en programas de pedagogía.	https://www.researchgate.net/publication/357832382_Competencias_profesionales_en_Educacion_Ambiental_un_caso_en_la_formacion_de_profesores_en_Chile
22	2022	Corpuz, A. M., San Andres, T. C., & Lagasca, J. M. (2022).	Integration of Environmental Education (EE) in Teacher Education Programs: Toward Sustainable Curriculum Greening	Es necesaria una integración más profunda y práctica de la educación ambiental en la formación docente.	Sugiere fortalecer las estrategias prácticas en programas de formación docente.	https://www.researchgate.net/publication/358844407_INTEGRATION_OF_ENVIRONMENTAL_EDUCATION_EE_IN_TEACHER_EDUCATION_PROGRAMS_TOWARD_SUSTAINABLE_CURRICULUM_GREENING
23	2022	Herrera-Feijoo, R. J., Peñafiel, P., & Salambay, E. (2022).	Plan Provincial de Educación Ambiental para el Desarrollo Sostenible 2021-2025 para la provincia de Pastaza	Se establecen estrategias educativas regionales para la participación y gestión ambiental en Pastaza.	Sirve como modelo para implementar políticas ambientales regionales.	https://www.researchgate.net/publication/360748986_Plan_Provincial_de_Educacion_Ambiental_para_el_Desarrollo_Sostenible_2021-2025_para_la_provincia_de_Pastaza
24	2021	Torres Rivera, L. (2021).	Educación ambiental en Asia-Pacífico: Avances y desafíos para la formación docente	Se requiere fortalecer la formación docente en sostenibilidad con énfasis en prácticas pedagógicas activas.	Identifica brechas en la preparación ambiental de docentes en Asia-Pacífico.	https://www.bcn.cl/observatorio/asiapacifico/noticias/laura-torres-rivera-educacion-ambiental

25	2021	Wikipedia. (2021).	Educación sobre el cambio climático	Existen múltiples políticas asiáticas sobre educación ambiental, aunque con diferencias marcadas en aplicación y alcance.	Reúne y sistematiza políticas nacionales de educación ambiental en varios países asiáticos.	https://es.wikipedia.org/wiki/Educaci%C3%B3n_sobre_el_cambio_clim%C3%A1tico
26	2021	Simmons, B. (2021).	Environmental Education Teacher Training	Es crucial incluir competencias ambientales específicas en la formación docente inicial y continua.	Sistematiza competencias clave necesarias para formar docentes en temas ambientales.	https://oxfordre.com/education/display/10.1093/acrefore/9780190264093.001.0001/acrefore-9780190264093-e-690
27	2021	Miller, C. (2021).	Designing a Practical Environmental Education Curriculum	Los docentes necesitan herramientas prácticas para enseñar contenidos ambientales de manera efectiva.	Desarrolla un currículo funcional que puede ser adaptado a distintos contextos escolares.	https://digitalcommons.hamline.edu/cgi/viewcontent.cgi?article=1915&context=hse_cp
28	2021	Mills, K. et al. (2021).	Embedding Environmental Literacy in Teacher Preparation Programs	Es fundamental integrar la alfabetización ambiental en todos los niveles de formación docente para generar compromiso cívico.	Ofrece un modelo de inserción curricular para la alfabetización ambiental en universidades.	https://www.researchgate.net/publication/351962456_Embedding_Environmental_Literacy_in_Teacher_Preparation_Programs
29	2021	Chen, Y. (2021).	Design-Based Approaches in Environmental Education for Future Educators	El diseño instruccional centrado en problemas reales fortalece la preparación pedagógica ambiental.	Propone estrategias de diseño instruccional basadas en desafíos ambientales reales.	https://files.eric.ed.gov/fulltext/EJ1306751.pdf
30	2021	González, M. (2021).	La formación ambiental desde la concepción de la práctica laboral en la formación inicial de docentes	La integración ambiental en la práctica docente fortalece la conciencia ecológica y sostenibilidad.	Propone estrategias metodológicas para prácticas profesionales con enfoque ambiental.	https://revistas.unah.edu.cu/index.php/RGCDL/article/view/1770/4009

31	2021	Marques, R. M., & Mazzarino, J. M. (2021).	A formação de professores em Educação Ambiental: reflexões a partir da análise integrativa de publicações científicas em Língua Inglesa	La formación docente se enriquece con enfoques interdisciplinarios y experiencias internacionales.	Análisis integrativo de publicaciones en inglés sobre formación docente en educación ambiental.	https://doi.org/10.1590/1983-21172021230130
32	2021	Universidad Nacional de Colombia. (2021).	El reto de integrar la educación ambiental en la práctica docente: una aproximación exploratoria	La integración de la educación ambiental requiere formación continua y superar barreras institucionales	Explora obstáculos y oportunidades en la práctica ambiental docente en Colombia.	https://repositorio.uniandes.edu.co/bitstreams/db58da11-eb0c-4e95-bbac-581955f5deab/download
33	2021	UNESCO. (2021).	Primera Caja de Herramientas de Educación Ambiental para el Desarrollo Sostenible en Ecuador	Las herramientas adaptadas al contexto mejoran la implementación de la educación ambiental.	Proporciona recursos pedagógicos útiles para docentes en educación ambiental.	https://www.unesco.org/es/articles/primera-caja-de-herramientas-de-educacion-ambiental-para-el-desarrollo-sostenible-en-ecuador
34	2020	Davis, J., & Wilkinson, J. (2020).	Beyond Traditional Teacher Professional Development: Innovations in Teacher Professional Learning in Environmental and Sustainability Education	Los enfoques transformadores como el aprendizaje activo y la colaboración fortalecen la formación docente en sostenibilidad.	Propone un modelo práctico e innovador de formación continua con base en sostenibilidad.	https://www.susted.com/wordpress/content/beyond-traditional-teacher-professional-development-innovations-in-teacher-professional-learning-in-environmental-and-sustainability-education_2020_12/
35	2020	Mc Pherson Sayú, M. (2020).	La educación ambiental en el proceso de formación inicial de docentes en Cuba	La educación ambiental debe ser parte esencial en la formación inicial docente para fomentar conciencia ecológica.	Propone metodologías efectivas para incluir educación ambiental en la formación inicial docente.	https://revistas.unah.edu.cu/index.php/RGCDL/article/view/1508

36	2020	Ministerio de Educación del Perú. (2020).	Guía de orientaciones para la aplicación del enfoque ambiental.	Ofrece lineamientos prácticos para promover sostenibilidad desde la educación.	Guía práctica para docentes sobre implementación ambiental en aulas.	https://repositorio.minedu.gob.pe/bitstream/handle/20.500.12799/7274/Gu%C3%ADa%20de%20orientaciones%20para%20la%20aplicaci%C3%B3n%20del%20enfoque%20ambiental.pdf?isAllowed=y&sequence=1
37	2020	Universidad de Córdoba. (2020).	Estrategias de formación en Educación Ambiental para docentes de instituciones educativas en Montería, Córdoba	La contextualización es clave para estrategias efectivas de formación docente en educación ambiental.	Recomienda mejoras prácticas para fortalecer la capacitación ambiental docente.	https://revistas.unicordoba.edu.co/index.php/rii/article/view/3303/5677

In research such as this, which seeks to understand how curricular innovations with an environmental focus are being implemented in initial teacher training, applying the PRISMA method is not only a technical methodological choice, but also a guarantee of transparency, order and scientific quality. PRISMA makes it possible to clearly show how each study included was searched, filtered and selected, which generates confidence in the readers and ensures that the conclusions are really supported by relevant and verifiable evidence. As Page et al. (2021) explain, this approach helps to reduce bias and improve the reproducibility of reviews, which is essential when working with diverse literature and multiple contexts.

In the case of this review, using PRISMA made it possible to rigorously organize the large amount of information available on environmental education in teacher training programs. As a result, it was possible to build a comprehensive and well-argued overview of the most significant experiences between 2020 and 2025, avoiding the inclusion of isolated, repetitive or not very applicable studies. This not only improves the quality of the analysis but also provides educational decision-makers with a solid basis for designing more sustainable and contextualized pedagogical proposals. As Page et al. (2021) rightly point out, the use of PRISMA "facilitates the synthesis of findings with a clear and reproducible methodological basis, increasing the practical usefulness of the reviews for decision making in education and health".

III. DISCUSSION

When systematically reviewing studies on curricular innovations with an environmental approach in initial teacher training, it becomes evident that countries have begun to respond, with varying intensity and focus, to the need to integrate sustainability in pedagogical training. In the case of Peru, for example, the National Education Council (2022) identified significant challenges in the articulation of public policies and training curricula, which has generated proposals aimed at strengthening this dimension in initial training. The document highlights that there are still structural gaps, such as the limited specific preparation of teacher trainers and the scarce integration of the environmental approach as a transversal axis in study programs (Consejo Nacional de Educación, 2022). This problem is not exclusive to Peru: many countries in the region face similar challenges when trying to build a training culture committed to sustainable development from the first years of professional teacher training.

One of the most relevant contributions comes from the Ministry of Education of Chile (2024), which made the political decision to include climate change in the school curriculum, making it

mandatory content. This transformation implies not only modifying what students are taught, but also rethinking how teachers are prepared to address these issues with pedagogical rigor and relevance (MINEDUC, 2024). This commitment, more than a simple reform of content, represents a vision of the future that recognizes that teacher training must be deeply connected to the environmental challenges of the present. Similarly, from a global perspective, UNESCO (2024) emphasizes the need to review national curricula from a contextualized approach, promoting what it calls "green curricula" that are aligned with the 2030 Agenda and the Sustainable Development Goals (UNESCO, 2024).

In the pedagogical field, the studies analyzed agree that it is not enough to incorporate environmental content in isolation. It is necessary to transform teaching methodologies, promoting active, reflective and situated strategies. Daryanes et al. (2025), for example, propose a learning model based on group research that allows teachers to train students to develop research skills and environmental awareness through the resolution of real problems. This approach not only improves the understanding of content but also strengthens the ethical commitment of future teachers to their immediate environment (Daryanes et al., 2025). These proposals show that innovation is not limited to content but also encompasses the type of pedagogical relationships that are built in the classroom.

However, other works such as that of Ríos Quiñónez et al. (2024) warn that environmental education in teacher training is often reduced to anecdotal experiences or activities disconnected from the formal curriculum. Their research highlights the need for a more comprehensive approach, linking pedagogical planning, execution and evaluation with the principles of sustainability. This type of proposal shows that training institutions must go beyond declarative approaches and commit to a true curricular transformation (Ríos Quiñónez et al., 2024).

Along the same lines, Vernaza Arroyo (2025) points out that one of the key challenges in Latin America is to achieve greater articulation between the State, universities, training centers and civil society. His study proposes that environmental education should not depend exclusively on institutional efforts but should emerge from the dialogue between the different actors involved in teacher training. This collaborative approach makes it possible to build a more solid training proposal with a territorial sense, capable of responding to the specific needs of each educational community (Vernaza, 2025).

In Peru, the Ministry of Education (2020) developed a guide for the application of the environmental approach, which, although oriented to practicing teachers, contains valuable pedagogical tools that could also be integrated into initial training. This guide emphasizes that the environmental approach should permeate all areas of the curriculum and not be seen as the exclusive responsibility of the area of Science and Environment. It also promotes the active participation of students in community projects that strengthen their ecological identity and citizenship awareness (MINEDU, 2020).

The studies analyzed allow us to affirm that there is a growing willingness to transform initial teacher training from an environmental perspective, although greater efforts are still required to achieve a systemic, coherent and sustainable integration. This systematic review shows that the environmental approach cannot be limited to isolated initiatives or abstract regulations, but must be a living practice, situated and shared by the entire educational training community.

IV. CONCLUSIONS

This systematic review confirms that the environmental approach is making decisive headway in initial teacher training, although its implementation remains uneven and, in many cases, fragmented. Countries that have opted to transform their curricula from an ecological and sustainable perspective, such as Chile, with its school curriculum reform in 2024, demonstrate that it is possible to align educational policy with the challenges of climate change, provided that there is a clear institutional will (Chilean Ministry of Education, 2024). This progress implies a profound rethinking of the way in which future teachers are trained, not only in terms of content, but also in their values, methodologies and links with the territory.

The studies reviewed coincide in pointing out that active methodologies, such as those based on group research, can significantly strengthen the environmental awareness of student teachers. As proposed by Daryanes et al. (2025), when future teachers face real environmental problems through collaborative strategies, they not only develop technical skills, but also ethical commitment and ecological sensitivity. This reminds us that teaching sustainability is not only about transmitting information, but also about training people capable of acting responsibly in the face of the planet's challenges.

However, structural challenges persist. In the case of Peru, both the National Education Council (2022) and the Ministry of Education (2020) agree that a deep integration of the environmental approach in training programs is still lacking. Although there are guidance documents and official recommendations, these often do not translate into sustained practices within educational institutions. This gap between the norm and reality leads us to reflect on the importance of training not only students, but also trainers of trainers, strengthening their environmental competencies from a critical and transformative vision.

It also highlights the need to build networks between the State, universities and civil society so that environmental education does not depend on individual efforts, but on a comprehensive public policy. Vernaza Arroyo (2025) suggests that this articulation can generate more coherent and effective proposals, based on dialogue with the context and the community. Along these lines, the green curricula proposed by UNESCO (2024) invite us to think of sustainability as an essential part of teacher training, not as an add-on, but as the heart of an education committed to the present and the future.

Curricular innovations with an environmental focus are already taking place, but they still need to be consolidated as a structural and living part of teacher training. This systematic review has not only made it possible to identify good practices, but also to highlight gaps that need to be urgently addressed. Because if we want a more just and sustainable world, we must begin by transforming the way we educate those who educate.

REFERENCES

Amórtegui Cedeño, E. F., & Valbuena Ussa, É. O. (2023). Enseñanza de las ciencias naturales, educación ambiental y formación docente en Colombia: Aportes desde el conocimiento del profesorado. Universidad Surcolombiana y Universidad Pedagógica Nacional. https://www.researchgate.net/publication/383305323_Ensenanza_de_las_ciencias_naturales_educacion_ambiental_y_formacion_docente_en_Colombia_Aportes_desde_el_conocimiento_del_profesorado

Castillo-Retamal, F., Cordero-Tapia, F., & Marín-Isamit, F. (2022). Competencias profesionales en Educación Ambiental: un caso en la formación de profesores en Chile. Revista de

Investigación, 46(110), 1–15. https://revistas.upel.edu.ve/index.php/revinvest/article/view/1704

Castillo-Retamal, F., Cordero-Tapia, F., & Marín-Isamit, F. (2022). Competencias profesionales en Educación Ambiental: un caso en la formación de profesores en Chile. Revista de Investigación, 46(110), 1–15. https://revistas.upel.edu.ve/index.php/revinvest/article/view/1704

Consejo Nacional de Educación. (2022). Recomendaciones para el mejoramiento de la formación inicial de docentes en el Perú. https://repositorio.minedu.gob.pe/handle/20.500.12799/9805

Corpuz, A. M., San Andres, T. C., & Lagasca, J. M. (2022). Integration of Environmental Education (EE) in Teacher Education Programs: Toward Sustainable Curriculum Greening. Problems of Education in the 21st Century, 80(1), 119–133. https://eric.ed.gov/?id=EJ1334770

Costa, J. M., & Lopes, P. T. C. (2022). A Educação Ambiental na formação de professores. Revista de Educação, 35(2), 45–60. https://seer.faccat.br/index.php/redin/article/view/2637

Daryanes, F., Zubaidah, S., Mahanal, S., & Sulisetijono. (2025). Building students' research skills in environmental science courses with research team-based learning. https://www.ejmste.com/article/building-students-research-skills-in-environmental-education-through-group-investigation-model-14100"

Davis, J., & Wilkinson, J. (2020). Beyond traditional teacher professional development: Innovations in teacher professional learning in environmental and sustainability education. En Innovation in Teacher Professional Learning in Europe (pp. 213–229). Routledge. https://doras.dcu.ie/28748/1/9781032334493_proofs_0.pdf

Eliyawati, E., Widodo, A., Kaniawati, I., & Fujii, H. (2023). Effectiveness of teacher training on environmental education: Challenges and strategy for future training program. Jurnal Penelitian Pendidikan IPA, 9(8), 6056–6066. https://jppipa.unram.ac.id/index.php/jppipa/article/view/3153

Flores Quenta, A. J. (2022). La educación ambiental en la formación docente: Una propuesta de inserción curricular. Revista de Educación Ambiental, 14(3), 123–135. https://www.periodicos.rc.biblioteca.unesp.br/index.php/pesquisa/article/download/11092/8381/68549

González, M. (2021). La formación ambiental desde la concepción de la práctica laboral en la formación inicial de docentes. Revista de Gestión y Conocimiento en la Docencia y el Liderazgo, 5(2), 45–60. https://revistas.unah.edu.cu/index.php/RGCDL/article/view/1770

Guerra, A., Chen, J., Du, X., Nielsen, H., & Kørnøv, L. (2023). Teacher's agency in education for sustainable development: An East-West collaborative Erasmus programme using Q methodology. International Journal of Sustainability in Higher Education. https://www.emerald.com/insight/content/doi/10.1108/IJSHE-05-2023-0155/full/html

Herrera-Feijoo, R. J., Peñafiel, P., & Salambay, E. (2022). Plan Provincial de Educación Ambiental para el Desarrollo Sostenible 2021–2025 para la provincia de Pastaza. https://www.researchgate.net/publication/360748986_Plan_Provincial_de_Educacion_Ambiental_para_el_Desarrollo_Sostenible_2021-2025_para_la_provincia_de_Pastaza

Lawrence, R. (2022). Integrating climate change into pedagogical practices. National Education Association. https://nea.certificationbank.com/NEA/CandidatePortal/NEA_CLIM6.aspx

Lopes, T. S., & Abílio, F. J. P. (2022). A Educação Ambiental na formação inicial de professores/as: contribuições da Pedagogia Crítica. Práxis Educativa, 17, e2218558. https://educa.fcc.org.br/scielo.php?pid=S1809-43092022000100105&script=sci_arttext

Marqués, R. M., & Mazzarino, J. M. (2021). A formação de professores em Educação Ambiental: reflexões a partir da análise integrativa de publicações científicas em Língua Inglesa. Ensaio: Pesquisa em Educação em Ciências, 23, e26372. https://www.scielo.br/j/epec/a/WMmyScCWVKRXwWQyMQjb6KF/abstract/?lang=pt

Mc Pherson Sayú, M. (2020). La educación ambiental en el proceso de formación inicial de docentes en Cuba. Revista de Gestión y Conocimiento en la Docencia y el Liderazgo, 5(2), 45–60. https://revistas.unah.edu.cu/index.php/RGCDL/article/view/1508

Ministerio de Educación de Chile. (2024). Bienvenido el cambio climático al currículum escolar. https://www.ciperchile.cl/2024/07/11/bienvenido-el-cambio-climatico-al-curriculum-escolar/"

Ministerio de Educación de Ecuador. (2023). Plan Natura: Educación para la transformación social y el desarrollo sostenible. https://educacion.gob.ec/plan-natura/

Ministerio de Educación del Perú. (2020). Guía de orientaciones para la aplicación del enfoque ambiental. https://repositorio.minedu.gob.pe/bitstream/handle/20.500.12799/7441/Gu%C3%ADa%20para%20la%20aplicaci%C3%B3n%20del%20enfoque%

Revista Horizontes. (2022). Desarrollo de la conciencia ambiental desde la perspectiva docente. Horizontes. Revista de Investigación en Ciencias de la Educación, 7(28), 594–605. https://revistahorizontes.org/index.php/revistahorizontes/article/view/892

Ríos Quiñónez, M. B., Sánchez Caicedo, A. M., & Castillo Solano, M. Y. (2024). Integración de la educación sostenible y ambiental en programas de estudio universitarios. https://revistainvecom.org/index.php/invecom/article/view/456"

Thompson, C., & Barnes, H. (2022). Sustainability education and teacher training in North America. Environmental Education Research, 28(7), 1023–1040. https://www.tandfonline.com/doi/full/10.1080/13504622.2025.2475143

Torres Rivera, L. (2021). Educación ambiental en Asia-Pacífico: Avances y desafíos para la formación docente. Biblioteca del Congreso Nacional de Chile. https://www.bcn.cl/observatorio/asiapacifico/noticias/laura-torres-rivera-educacion-ambiental

UNESCO Asia-Pacific. (2023). Greening every classroom: Mainstreaming ESD in teacher education in Asia. https://www.unesco.org/sites/default/files/medias/fichiers/2023/09/greening-every-school-cn-en.pdf

UNESCO. (2021). Primera Caja de Herramientas de Educación Ambiental para el Desarrollo Sostenible en Ecuador. https://www.unesco.org/es/articles/primera-caja-de-herramientas-de-educacion-ambiental-para-el-desarrollo-sostenible-en-ecuador

UNESCO. (2023). Aprender por el planeta: Revisión mundial de cómo los temas relacionados con el medio ambiente están integrados en la educación. https://www.unesco.org/es/articles/aprender-por-el-planeta-revision-mundial-de-como-los-temas-relacionados-con-el-medio-ambiente-estan

UNESCO. (2023). Embracing climate change education for young learners in Asia-Pacific. https://www.unesco.org/en/articles/seeds-change-embracing-climate-change-education-young-learners-asia-pacific

UNESCO. (2024). Call for situation analysis research on: Greening education in East Asia. https://www.unesco.org/en/articles/call-situation-analysis-research-green-curricula"

Universidad de Córdoba. (2020). Estrategias de formación en Educación Ambiental para docentes de instituciones educativas en Montería, Córdoba. Revista Inclusiones, 7(Especial), 1–15. https://revistas.unicordoba.edu.co/index.php/rii/article/view/3303

Universidad Nacional de Colombia. (2021). El reto de integrar la educación ambiental en la práctica docente: una aproximación exploratoria. https://repositorio.uniandes.edu.co/entities/publication/d44a53c7-13ec-4411-a658-f97d952053ba

Vernaza Arroyo, G. D. (2025). Formación ambiental para la sustentabilidad en instituciones de educación superior: Entre el Estado y la empresa. https://produccioncientificaluz.org/index.php/utopia/article/view/40879