

Environmental Teaching Proposal to Promote Knowledge, Attitudes and Sustainable Consumption Habits in Secondary School

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ABSTRACT:

This study aimed to design an environmental education teaching proposal, with student participation, to promote meaningful learning about knowledge, attitudes, and sustainable consumption habits in secondary education. A qualitative interpretive approach was adopted, with participatory action research (PAR) as the methodological framework. The design was built through documentary review and semi-structured interviews conducted with 95 students from sixth to ninth grade at a public school in Florencia, Caquetá, Colombia. The results identified four design criteria: contextual relevance, progression between understanding and practice, participation of students from a public school, and coherence between the problem, activities, products, and assessment. Student voices revealed a general understanding of environmental education, partial appropriation of concepts such as sustainable consumption and the circular economy, a gap between awareness and action, and a strong appreciation for active and experiential methodologies. Based on these findings, a seven-session proposal was designed, organized around project-based learning (PBL). The instructional design offers a situated pedagogical pathway to strengthen sustainable consumption in secondary school by articulating critical reflection, participation, and transfer to everyday life..

Keywords: environmental education; sustainable consumption; project-based learning; participatory action research; secondary education.

1. Introduction

The contemporary socio-ecological crisis has turned education into a decisive field for reviewing the relationship between society, nature and consumption. The increase in research on education for sustainable development shows that the incorporation of these contents into school curricula is no longer understood as a

thematic add-on, but as a training requirement linked to the 2030 Agenda and the environmental, social and economic challenges that go through everyday life (Mavuso and Olawumi, 2026). In this trajectory, Environmental Education (EE) has moved from approaches focused on understanding the natural environment to broader perspectives that

integrate global, community and personal scales, favoring a more complex understanding of sustainability (Glavič, 2020).

However, the gap between what is known, what is valued and what is finally done remains one of the most persistent problems in AD. Studies on environmental literacy show that strengthening pro-environmental knowledge, values, and behaviors requires interventions that act on several levels simultaneously, and not only on the information dimension (Maurer et al., 2020). Hence, the construction of knowledge, attitudes and habits of Sustainable Consumption (CS) requires training sequences capable of relating critical reflection, practice and decision-making.

Waste management represents, in this framework, a particularly relevant gateway to address CS in school contexts. The available evidence shows that the problems of inappropriate disposition and low culture of separation continue to be associated with daily practices that affect health and the environment, and that EE is directly related to the possibility of reversing them (Amatari-Breford et al., 2025). At the same time, participatory educational models oriented to waste demonstrate that children and young people can understand complex issues and influence their families when creative, playful, and collaborative strategies are integrated (De Feo, 2026).

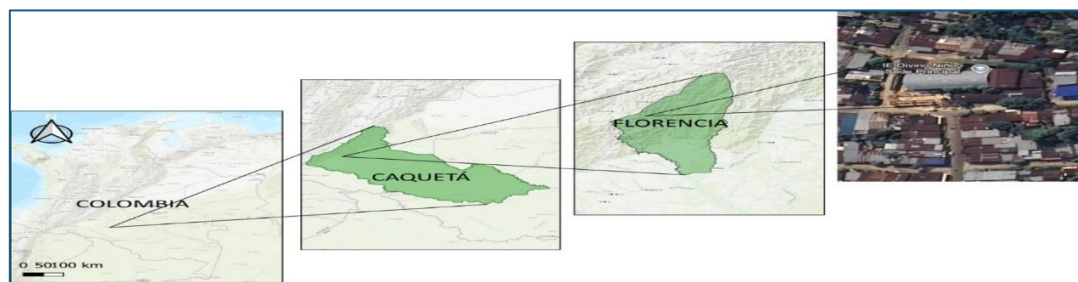
From this conceptual base, this article presents the design of a didactic proposal in EE aimed at promoting knowledge, attitudes and habits of CS with the active participation of students. Such a design responds not only to the need for a transformative education in the face of consumption, but also to the previous evidence obtained in the school context, where the students' perceptions showed a general

understanding of the environmental problem, but also difficulties in translating this awareness into consistent practices and a marked valuation of active and experiential methodologies. The proposal is based on the articulation between updated theoretical references and the voices of the students as a pedagogical input for a transversal, contextualized experience oriented to meaningful learning.

2. Methodology

Design: The research was reoriented from a qualitative approach of an interpretative nature, suitable for understanding the meanings that students attribute to consumption, waste and the possibilities of change in their school environment. From this framework, participatory action research (PAR) was assumed as a methodological orientation so that the design of the proposal did not emerge as an external prescription, but as a situated construction, sensitive to youth voices and open to pedagogical review. This decision made it possible to understand the methodology as a process of reading the context, deliberating on everyday problems, and formulating didactic mediations with transformative potential (Pervin & Mokhtar, 2022).

Participants: The study was located at the Divino Niño Educational Institution, an official establishment located in Florencia, Caquetá, Colombia, in the Colombian Amazon. It is located at coordinates 1.617219, -75.593360 and serves the school population of predominantly low socioeconomic context, a condition that makes visible the relationship between consumption decisions, waste disposal and daily life. Figure 1 presents the geographical representation.

Figure 1. Divino Niño Educational Institution

Source: Own elaboration (2026).

Consequently, the research was conceived as a pedagogical mediation based on the analysis of the perceptions of 95 secondary school students and the principle of real participation in the definition of problems and work alternatives (Da Silva et al., 2025).

From this perspective, the school environment was assumed as a formative laboratory to observe practices, tensions and possibilities for intervention linked to SDG 12 "*ensure sustainable consumption and production patterns*" and to daily waste management (Owojori et al., 2022).

Instruments: To capture the perceptions and needs of the participants, a qualitative interpretative approach was chosen that prioritizes the understanding of the meanings that the participants attribute to their environment and their daily consumption practices. In this sense, the techniques used were:

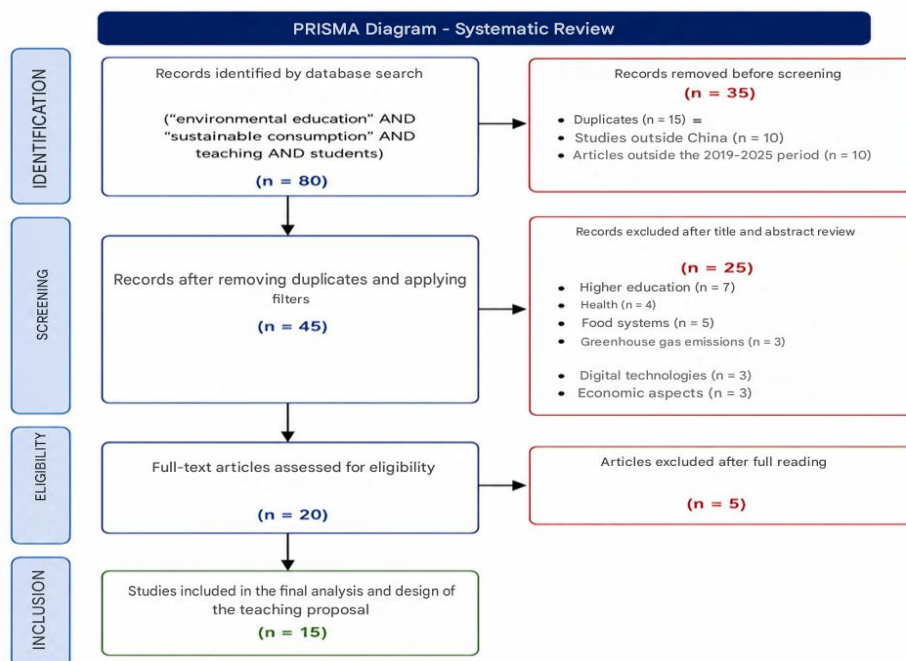
- **Documentary review:** It complemented the empirical information with relevant background information obtained from the Scopus database, including previous studies on environmental education, sustainable consumption and design of didactic proposals in secondary education, as well as research on project-based learning and participatory action research in school contexts.

- **Semi-structured interview:** Selected because it allows students to deepen their experiences, knowledge and attitudes towards sustainable consumption and waste management. Individual interviews were conducted with a flexible script

that facilitated open responses, allowing us to explore the meanings that the participants attribute to the environment, consumption and the possibilities of change in their school and family environment.

Procedure: First, a systematic documentary review of literature indexed in Scopus was carried out in order to identify theoretical approaches, didactic strategies and research trends related to education for sustainable consumption in a school environment. The review information was obtained from Scopus with a year filter between 2019 and 2025, which carried out a Boolean search strategy in the Scopus database using the following equation: ("environmental education" AND "sustainable consumption" AND "teaching" AND "students"). In addition, filters were applied to include articles published between 2019 and 2025, open access and written in English or Spanish. Initially, 80 articles were identified. Subsequently, after the application of inclusion and exclusion criteria, as well as the review of titles, abstracts and thematic relevance, 15 articles were selected for the final analysis (Figure 2).

Likewise, studies affiliated with China and some focused on higher education, health, food systems, greenhouse gas emissions, digital technologies or economic aspects were excluded, in order to ensure thematic coherence with environmental education and sustainable consumption in school contexts.

Figure 2. PRISMA diagram of the process of selecting articles for systematic documentary review

Source: Own elaboration (2026).

Second, fieldwork was implemented with the intentional sample described, through semi-structured interviews. This procedure made it possible to articulate the theoretical references, the voices of the students, and the conditions of the institutional context, strengthening the interpretative coherence of the design (Pervin & Mokhtar, 2022)

Data analysis: The analytical treatment was carried out through qualitative content analysis (Mayring, 2019). In the first phase, categories were constructed from the students' perceptions regarding the understanding of CS, the distance between awareness and practice, the assessment

of active didactic strategies and perceptions about waste management. In a second phase, these categories were contrasted with the documentary review on AE, PAR and PBL to derive pedagogical criteria for the design of the proposal.

3. Results

The systematic review identified 15 publications that constituted the theoretical and methodological foundation of the design, as presented in Table 1.

Table 1 Articles as references for the design of the didactic proposal

Authors	Title	Contribution to the design of the proposal
Kopnina, H. (2022)	<i>Exploring posthuman ethics: opening new spaces for postqualitative inquiry within pedagogies of the circular economy</i>	The biggest challenge for students is to understand how to decouple the production system from consumer assemblies, the conceptual basis of the circular economy.

Authors	Title	Contribution to the design of the proposal
Lo Iacono et al. (2024)	<i>Testing the Effectiveness of an Ecomedia Literacy Environmental Education Lesson</i>	It evaluated pro-environmental attitudes through critical analysis of advertising and videos on plastic consumption, promoting intentions for behavior change.
Kalla et al. (2022)	<i>Expanding Formal School Curricula to Foster Action Competence in Sustainable Development</i>	Pro-environmental behavior is a key result of successful environmental education. It proposes experiential, self-directed and participatory learning to develop competence for action.
Maurer et al. (2020)	<i>Green Awareness in Action—How Energy Conservation Action Forces on Environmental Knowledge, Values and Behaviour</i>	The GAIA project articulates knowledge, observation of behaviors and concrete action to transform energetic behaviors in school adolescents.
Simon et al. (2023)	<i>Multi-level education for sustainability through global citizenship, territorial education and art forms</i>	Difference between sustainable art and ecological art as pedagogical frameworks for sustainability education from artistic expressions and global citizenship.
Hobson & O'Byrne (2024)	<i>Sharing and Repairing at University: On Student Practices, and the Future of the Circular Campus</i>	It shows that attitudes of repair and reuse reflect broad population patterns; proposes experiential learning that questions socio-material relationships outside the classroom.
Rüdele et al. (2025)	<i>Empirical perspectives on approaches to teach life cycle assessment in higher education</i>	Life Cycle Assessment (LCA) allows students to understand and quantify consequences of production and consumption patterns.
Parejo et al. (2021)	<i>Plastics as an Educational Resource for Sustainable Development: A Case Study in Ghana</i>	Plastic as an educational resource increased environmental awareness and developed reduction and reuse skills in climate emergency contexts with low recycling.
Pisuttu et al. (2024)	<i>A Master's Course Can Emphasize Circular Economy in Municipal Solid Waste Management</i>	Solid waste management requires active citizen participation and circular economy models; changing consumption and production patterns is the most effective way.
García-González et al. (2022)	<i>Transformative Education for Sustainable Consumption</i>	PBL linked to real problems related to SDG 12 encourages critical thinking about consumption habits and empowers students for change.

Authors	Title	Contribution to the design of the proposal
Calvo et al. (2024)	<i>A Methodology to Introduce Sustainable Development Goals in Engineering Degrees by Means of Multidisciplinary Projects</i>	Multidisciplinary projects focused on real, student-relevant issues increase awareness of the SDGs and develop applicable competencies.
Amatari-Breford et al. (2025)	<i>The Nexus Between Environmental Education and Sustainable Solid Waste Management Practices</i>	It recommends incorporating environmental education into the school curriculum and community initiatives to improve sustainable waste management practices.
De Feo, G. (2026)	<i>Engaging Environmental Education for Sustainable Waste Management—The Greenopoli Education Framework</i>	The Greenopoli participatory method empowers students as agents of change through learner-centered pedagogies that integrate sustainable values, attitudes, and behaviors.
Mavuso & Olawumi (2026)	<i>Global Research Trends in Integrating Education for Sustainable Development into School Curricula: A Bibliometric Analysis (2015–2024)</i>	ESD should be integrated transversally into the curriculum addressing SDGs 4, 12, 13, 14 and 15, developing transformative competencies, values and behaviours.
García-Saravia et al. (2023)	<i>The CIRCULAR pathway: a new educational methodology for exploratory circular value chain redesign</i>	The transition to the circular economy requires future professionals to acquire knowledge about systems and life cycle thinking through collaborative and challenging PBL.

Source: Own elaboration (2026)

The 15 identified referents provided the theoretical and methodological foundations of instructional design, particularly in relation to active pedagogical strategies, circular economy and education for sustainable consumption. However, the proposal was not built exclusively from literature: in coherence with the orientation of the PAR, the design also required starting from the perceptions, tensions and needs expressed by the students themselves. Therefore, in parallel to the documentary review, the empirical corpus obtained through semi-structured interviews with

the 95 participants was analyzed. The findings of that analysis are presented below.

Findings of the empirical corpus

The analysis of the interviews allowed us to recognize four decisive aspects for the construction of the proposal. Figure 3 visually synthesizes this tension: terms such as environment, garbage, recycle, and waste occupy the semantic center of the student discourse, while structuring concepts such as circular economy or responsible consumption are absent or peripheral.

Figure 3. Network of words expressed by high school students



Source: Own elaboration (2026)

The first of these aspects was the persistence of a still partial understanding of the environmental problem, focused on immediate clean-up actions or on definitions restricted to the 3Rs. In interviews, some students defined the circular economy as "*Reducing, reusing and recycling resources to minimize environmental pollution*", while others responded simply "*I don't know*" or "*I don't understand*" when referring to this concept. This coexistence between operational approaches and conceptual gaps showed that the starting point was not homogeneous and that the proposal needed a progressive scaffolding to move from a hygienist or fragmentary logic to a broader understanding of the relationship between consumption, waste and the environment, as required by instructional design based on the diagnosis of previous knowledge (Grant, 2011; Kalla et al., 2022).

The second aspect was associated with the gap between declared awareness and sustained practice. Likewise, the students expressed concern for the environment and recognized desirable actions; however, their own voices showed that such practices did not always translate into habits. Some pointed out: "*I usually separate them and put them in the respective bin*," while others emphasized contingent motivations, for example: "*I sell it and thus help the environment and earn money*." This contrast made it possible to

interpret that the pedagogical problem did not lie only in informing, but in favoring processes of self-regulation, contrast between need and desire, and follow-up of daily decisions (Owojori et al., 2022).

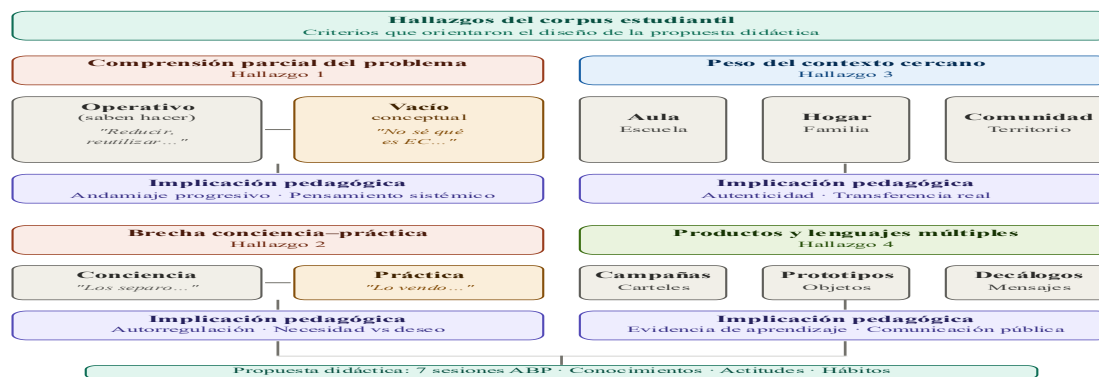
The third aspect was related to the weight of the home, the school and the nearby territory in the construction of meaning. The students' voices showed that the understanding of the problem became denser when it was linked to close experiences, as expressed in the statement "*In my house we try to reuse the bags, separate the garbage and not waste*". In the same way, other participants expressed that "*the accumulation of garbage in classrooms, desks, halls, dining area and the schoolyard*" appears as a repeated problem of the school environment, which confirmed that the proposal should simultaneously work on the scales of classroom, home and immediate community. This decision made it possible to sustain the authenticity of the problem and reinforce the possibility of transfer beyond school activity (Grant & Tamim, 2019).

The fourth and last aspect was the importance of visible products, cooperative work and multiple languages to sustain the involvement of the group. In the interviews, several students associated environmental learning with creative and concrete actions, for example: "*Make crafts*

with plastic bottles" or "Reuse waste like doing with bottles plants pots". These expressions showed that participation increased when the activity did not end in an abstract explanation, but in campaigns, graphic pieces, prototypes or socializable messages. For this reason, the proposal assumed

collaborative products as evidence of learning and as mediation to articulate conceptual understanding, ethical positioning, and public communication, while also maintaining the transversal perspective of design (Grant, 2011).

Figure 4. Findings from the corpus of secondary school students



Note: Authors' elaboration based on the content analysis of the empirical corpus (Mayring, 2019). CE = circular economy.

The articulation between the findings of the corpus and the referents of the systematic review allowed us to derive four pedagogical criteria that guided the design of the proposal. The first finding, "*partial understanding of the problem*", was articulated with the references of Kalla et al. (2022) and García-Saravia et al. (2023) to define the need for a progressive scaffolding that transitions from operational notions to systemic thinking. The second finding "*gap between consciousness and practice*" was connected with Maurer et al. (2020) and Owojori et al. (2022) to incorporate self-regulation mechanisms, contrast between need and desire, and verifiable commitments. The third finding, "*weight of the close context*", dialogued with Grant and Tamim (2019)

and García-González et al. (2022) to sustain the authenticity of the problem by simultaneously working on the classroom, home, and community scales. The fourth finding, "*valuation of visible products and multiple languages*", was supported by Parejo et al. (2021) and De Feo (2026) to assume collaborative products as evidence of learning and as a mediation between conceptual understanding and public communication. The convergence of these two sources "*student voices and literature*" is what gives the internal coherence of the didactic proposal.

According to this situation and context described, the following instructional design is presented, followed by the reason for its approach (Table 2).

Table 2 Instructional Design

Session	Pedagogical objectives
1. Emotional awareness and anchoring	Promote dialogue with experts in Environmental Education (EE) and sustainable consumption. Generate an emotional anchor with the environmental problems of the school environment.
2. Delimitation of the task	Select an environmental problem of interest to each group.

	Build the problem tree (causes, consequences, alternatives).
3. Planning the inquiry procedure	Develop conceptual understanding of sustainable consumption (CS): reduction, reuse, separation and final disposal of waste. Analyze the relationship between need, desire and purchase. Examine close cases and real situations from the school and family context.
4. Resource Selection	Build a basic glossary of key terms (circular economy, ecological footprint, life cycle). Prepare materials and supporting data for the project.
5. Conceptual and technical scaffolding	Produce the creative deliverables of the project: campaigns, posters, scripts, capsules, signage, reuse prototypes or family decalogues.
6. Cooperative learning	Publicly present the products made to the group. Promote critical dialogue between teams.
7. Reflection and transfer	Reflect on the learning constructed, the findings of the project and the conditions to sustain them.

Source: Own elaboration (2026).

Design of the didactic proposal

Based on the findings, a cycle of seven sessions was organized under the PBL approach with the mediation of PAR, taking up the components proposed by Grant (2011) and developed for school education by Grant and Tamim (2019). The first three sessions address the dimension of knowledge and progressive scaffolding; sessions four and five mobilize attitudes through critical resource selection and creative production; and sessions six and seven consolidate habits through verifiable commitments, sustained reflection, and transfer to everyday life.

Emotional awareness and anchoring: This stage seeks to promote dialogue with experts in EE and sustainable consumption, and to generate an emotional anchorage with the environmental problems of the school environment through experiences of observation and analysis of everyday situations. Lo Iacono et al. (2024) point out that participatory activities and collective reflection strengthen pro-environmental attitudes and behavioral changes regarding the use of plastics and waste disposal, a condition that this

stage fulfills by anchoring awareness in the specific school and community space of the participants.

Delimitation of the task: This step seeks that students select an environmental problem of interest and build a tree of problems that structures its causes, consequences and alternatives. García-González et al. (2022) point out that working in small groups on real problems related to one's own consumption facilitates the critical examination of habits and promotes more sustainable practices, while Kalla et al. (2022) identify participatory approaches in the definition of the problem as determinants of an EE oriented to competence for action.

Planning the inquiry procedure: The teams develop conceptual understanding of sustainable consumption, reduction, reuse, separation and final disposal of waste, analyze the relationship between need, desire and purchase, and examine cases close to the school and family context. Maurer et al. (2020) show that when students understand and monitor their own consumption behaviors, they are in a position to make informed decisions, while García-González et al.

(2022) argue that linking content to real life is an essential condition for transformative consumer education.

Resource selection: Students build a basic glossary of key terms circular economy, ecological footprint, life cycle and develop supporting materials and data for the project. Lo Iacono et al. (2024) documented that critical analysis of messages and products allows for the development of awareness of the strategies that shape purchasing decisions, while García-Saravia et al. (2023) point out that students must acquire knowledge about the principles of the circular economy and life cycle thinking in order to redesign value chains.

Conceptual and technical scaffolding: In this phase, teams produce their creative deliverables: campaigns, posters, scripts, and reuse prototypes. Teacher accompaniment enhances the student's agency without replacing it. De Feo (2026) describes pedagogies focused on relational learning as the most appropriate framework for sustainability education, whose outcomes transcend knowledge and include values, attitudes, and behaviors.

Cooperative learning: This stage seeks for students to publicly present their products and promote critical dialogue between teams. Hobson and O'Byrne (2024) argue that education for sustainability should facilitate experiential learning that questions socio-material relationships outside the classroom, which occurs precisely when students present their productions and assume a position of active interlocutors with others.

Reflection and transfer: The closing of the cycle seeks to encourage students and teacher-researchers to reflect on the learning constructed, the findings of the project and the conditions to sustain them, through group discussions and a field diary. Maurer et al. (2020) show that the analysis of the impact of one's own actions is a condition for environmental learning to be consolidated as a behavior. The field diary fulfills a double function within the PAR: a data collection instrument and a training tool that develops reflective capacity. The final reflection is not a closure but a new

starting point towards sustained action in everyday life.

4. Conclusions

The objective of the study was fulfilled through the design of a didactic proposal in EE aimed at promoting knowledge, attitudes and habits of CS. From the adjustments made, it can be stated more clearly that the central value of the proposal lies in having been built from a situated reading of the perceptions, tensions and needs expressed by the students. The voices in the study showed general understanding of EE, partial appropriation of notions such as CS and circular economy, recognition of the importance of certain environmental practices and, at the same time, difficulties in sustaining them in everyday life. On this basis, the proposal organized a cycle of seven sessions that articulates inquiry, reflection, collaborative production and transfer, instead of being limited to the transmission of content.

One of the main contributions of the work is to show that the identification of needs not only serves to diagnose shortcomings, but also to guide pedagogical decisions. The preference for active strategies, the relevance given to the home and school as learning scenarios, the concern for waste management and the existence of a gap between assessment and practice were translated into design criteria such as contextual relevance, progression between understanding and action, participation and coherence between problem, activities, products and assessment. Consequently, the proposal offers a contextualized pedagogical route that can be useful in other school scenarios with similar problems, especially where the relationship between sustainability, curriculum and daily life is sought to be strengthened.

The scope of the research remains at the level of didactic design, so the conclusions are not aimed at assessing implementation effects, but rather at highlighting the methodological and pedagogical soundness of the process followed. Therefore, the need remains open for future studies that implement the proposal, examine the

permanence of changes in knowledge, attitudes and habits, and assess which mediations are most effective in sustaining transformations over time. Even with this delimitation, the study makes a clear contribution: the formulation of an environmental didactic proposal built on

participatory action research and project-based learning, whose relevance is strengthened precisely because it is based on the experience, language and concerns expressed by the students themselves.

Bibliographic References

- Agirreazkuenaga, L. (2022). Environmental and sustainability education: A critical analysis of evaluation instruments through a research-practice partnership. *Environmental Education Research*, 28(5), 695-714. <https://doi.org/10.1080/13504622.2022.2031898>
- Ahmad, M., & Wilkins, S. (2025). Purposive sampling in qualitative research: A framework for the entire journey. *Quality & Quantity*, 59(2), 1461-1479. <https://doi.org/10.1007/s11135-024-02022-5>
- Alkaher, I., Goldman, D., & Aram, I. (2024). An environmental and sustainability education center in Israel as a "street-level policy entrepreneur" for promoting teachers as change agents for sustainability. *Environmental Education Research*, 30(10), 1684–1709. <https://doi.org/10.1080/13504622.2024.2335612>
- Amatari-Breford, S. A., Imaitor, E. E., & Chiaka, O. S. (2025). The nexus between environmental education and sustainable solid waste management practises. *Advance Journal of Education and Social Sciences*, 10(11), 1–16. <https://doi.org/10.5281/zenodo.17610677>
- Ashraf, M. W., & Alanezi, F. (2020). Incorporation of sustainability concepts into the engineering core program by adopting a micro curriculum approach: A case study in Saudi Arabia. *Sustainability*, 12(7), 2901. <https://doi.org/10.3390/su12072901>
- Calvo, I., Carrascal, E., González, J. M., Armentia, A., Gil-García, J. M., Barambones, O., Basogain, X., Tazo-Herran, I., & Apiñaniz, E. (2024). A methodology to introduce sustainable development goals in engineering degrees by means of multidisciplinary projects. *Education Sciences*, 14(6), 583. <https://doi.org/10.3390/educsci14060583>
- Da Silva, E. M., Schneider, D., Miceli, C., & Correia, A. (2025). Encouraging sustainable choices through socially engaged persuasive recycling initiatives: A participatory action design research study. *Informatics*, 12(1), 5. <https://doi.org/10.3390/informatics12010005>
- De Feo, G. (2026). Engaging environmental education for sustainable waste management—The Greenopoli education framework. *Recycling*, 11(1), 2. <https://doi.org/10.3390/recycling11010002>
- Donovan, D. (2016). How children represent sustainable consumption through participatory action research and co-design of visual narratives. *International Journal of Consumer Studies*, 40(5), 562-574. <https://doi.org/10.1111/ijcs.12301>
- dos Santos, T. L., & Stephens, P. R. S. (2026). Environmental education for Elementary School II: creation of an application for environmental pollution classes. *Free Text*, 19, e57811. <https://doi.org/10.1590/1983-3652.2025.57811>
- Fettahlioğlu, P., & Aydoğdu, M. (2020). Developing environmentally responsible behaviours through the implementation of argumentation- and problem-based learning models. *Research in Science Education*, 50, 987-1025. <https://doi.org/10.1007/s11165-018-9720-0>
- García-González, E., Albareda-Tiana, S., Solís-Espallargas, C., & Jiménez-Fontana, R. (2022). Transformative education for sustainable consumption. *Trends in Higher Education*, 1, 1–15. <https://doi.org/10.3390/higheredu1010001>
- García-Saravia Ortiz-de-Montellano, C., Ghannadzadeh, A., & van der Meer, Y. (2023). The CIRCULAR pathway: A new educational methodology for exploratory circular value chain redesign. *Frontiers in Sustainability*, 4, 1197659. <https://doi.org/10.3389/frsus.2023.1197659>

-
- Glavič, P. (2020). Identifying key issues of education for sustainable development. *Sustainability*, 12(16), 6500. <https://doi.org/10.3390/su12166500>
- Grant, M. M. (2011). Learning, beliefs, and products: Students' perspectives with project-based learning. *Interdisciplinary Journal of Problem-Based Learning*, 5(2), 37-69. <https://doi.org/10.7771/1541-5015.1254>
- Grant, M. M., & Tamim, S. R. (2019). PBL in K-12 education. In M. Moallem, W. Hung, & N. Dabbagh (Eds.), *The Wiley handbook of problem-based learning* (pp. 221-243). Wiley. <https://doi.org/10.1002/9781119173243.ch10>
- Guevara-Herrero, I. (2024). Is consuming avocados equally sustainable worldwide? An activity to promote eco-social education from science education. *Education Sciences*, 14(6), 560. <https://doi.org/10.3390/educsci14060560>
- Hobson, K., & O'Byrne, M. (2024). Sharing and repairing at university: On student practices, and the future of the circular campus. *Circular Economy and Sustainability*, 4, 2579–2598. <https://doi.org/10.1007/s43615-024-00403-4>
- Jones, N., Horton, G., Guppy, M., Brown, G., & Boulton, J. (2025). Pedagogical strategies for supporting learning and student well-being in environmentally sustainable healthcare. *Frontiers in Medicine*, 12, 1446569. <https://doi.org/10.3389/fmed.2025.1446569>
- Kalla, M., Jerowsky, M., Howes, B., & Borda, A. (2022). Expanding formal school curricula to foster action competence in sustainable development: A proposed free-choice project-based learning curriculum. *Sustainability*, 14(23), 16315. <https://doi.org/10.3390/su142316315>
- Kanetaki, Z., Tousi, E., Proestakis, E., & Jacques, S. (2025). Thermal performance modeling of Mediterranean school building stock for sustainable urban retrofit strategies. *Discover Applied Sciences*, 7, 1390. <https://doi.org/10.1007/s42452-025-07924-z>
- Kopnina, H. (2022). Exploring posthuman ethics: Opening new spaces for postqualitative inquiry within pedagogies of the circular economy. *Australian Journal of Environmental Education*, 38, 361–374. <https://doi.org/10.1017/aee.2021.16>
- Kopnina, H., & Bedford, T. (2024). From pseudo to genuine sustainability education: Ecopedagogy and degrowth in business studies courses. *Australian Journal of Environmental Education*, 40, 574–587. <https://doi.org/10.1017/aee.2023.39>
- Lema-Blanco, I., & García-Mira, R. (2025). Nurturing sustainable consumption: Social learning and behavioral change fostered by grassroots food initiatives in Galicia, Spain. *Sustainability*, 17(22), 10372. <https://doi.org/10.3390/su172210372>
- Lo Iacono, L., López, A., & Visintin, E. P. (2024). Testing the effectiveness of an ecomedia literacy environmental education lesson. *Social Sciences*, 13(12), 645. <https://doi.org/10.3390/socsci13120645>
- Lorek, E., Lorek, A., & Koczur, W. (2023). Education for sustainable development in Polish institutions of higher education—present and future. *Economics and Environment*, 1(84), 116–132. <https://doi.org/10.34659/eis.2023.84.1.513>
- Martínez-Acosta, M., Vázquez-Villegas, P., Mejía-Manzano, L. A., Soto-Inzunza, G. V., Ruiz-Aguilar, K. M., Kuhn Cuellar, L., Caratozzolo, P., & Membrillo-Hernández, J. (2023). The implementation of SDG12 in and from higher education institutions: Universities as laboratories for generating sustainable cities. *Frontiers in Sustainable Cities*, 5, 1158464. <https://doi.org/10.3389/frsc.2023.1158464>
- Maurer, M., Koulouris, P., & Bogner, F. X. (2020). Green awareness in action—How energy conservation action forces on environmental knowledge, values and behaviour in adolescents' school life. *Sustainability*, 12(3), 955. <https://doi.org/10.3390/su12030955>
- Mavuso, M. P., & Olawumi, K. B. (2026). Global research trends in integrating education for sustainable development into school curricula: A bibliometric analysis (2015–2024). *Interdisciplinary Journal of Education Research*, 8(1), a06. <https://doi.org/10.38140/ijer-2026.vol8.1.06>
- Mayring, P. (2019). Qualitative content analysis: Demarcation, varieties, developments. *Forum: Qualitative Social Research*, 20(3). <https://doi.org/10.4135/9781036231798>
-

-
- Owojori, O. M., Mulaudzi, R., & Edokpayi, J. N. (2022). Student's knowledge, attitude, and perception (KAP) to solid waste management: A survey towards a more circular economy from a rural-based tertiary institution in South Africa. *Sustainability*, 14(3), 1310. <https://doi.org/10.3390/su14031310>
- Parejo, J.-L., Corton-Heras, M.-O., Nieto-Blanco, A., & Segovia-Barberan, C. (2021). Plastics as an educational resource for sustainable development: A case study in Ghana. *Sustainability*, 13(12), 6727. <https://doi.org/10.3390/su13126727>
- Pervin, N., & Mokhtar, M. (2022). The interpretivist research paradigm: A subjective notion of a social context. *International Journal of Academic Research in Progressive Education and Development*, 11(2), 419-428. <https://doi.org/10.6007/IJARPED/v11-i2/12938>
- Pisuttu, C., Adducci, F., Arena, S., Bigongiali, D., Callea, L., Carmignani, P., Cavicchi, A., Chianura, M., Ciulli, L., Contaldo, M., Cotrozzi, L., D'Alessandro, C., Ferrara, A., Fiaccadori, I., Gajda, B., Guarnieri, C., Landi, M., Lanini, L., Lomuto, R. R., ... Lorenzini, G. (2024). A master's course can emphasize circular economy in municipal solid waste management: Evidence from the University of Pisa. *Sustainability*, 16(5), 1966. <https://doi.org/10.3390/su16051966>
- Rüdele, K., Schnaitter, V., Viere, T., Väisänen, S., & Wolf, M. (2025). Empirical perspectives on approaches to teach life cycle assessment in higher education. *Discover Sustainability*, 6, 631. <https://doi.org/10.1007/s43621-025-01529-7>
- Šáľková, D., Čábelková, I., & Hommerová, D. (2024). Ethical consumption. What makes people to buy "ethical" products. *Central European Business Review*, 13(2), 1–25. <https://doi.org/10.18267/j.cebr.346>
- Setiawan, H., Surtikanti, H. K., Kusnadi, & Riandi. (2023). Sustainability awareness, engagement, and perception of Indonesian high school students during sustainability project based learning implementation in biology education. *Journal of Science Education Research*, 9(6), 4227-4236. <https://jppipa.unram.ac.id/index.php/jppipa/article/view/3971>
- Shen, Y. M., Sulaiman, M., Chen, G. L., Weng, H. C., Huang, C. M., Jamaludin, N. S., & Kadir, M. F. Z. (2025). Integrating biodiverse edible school practices: Enriching undergraduate liberal education for elevated learning outcomes. *Frontiers in Education*, 10, 1472179. <https://doi.org/10.3389/feduc.2025.1472179>
- Simon, S., Vieira, I., & Jecu, M. (2023). Multi-level education for sustainability through global citizenship, territorial education and art forms. *Frontiers in Education*, 8, 1129824. <https://doi.org/10.3389/feduc.2023.1129824>
- Vasconcelos, C. (2012). Teaching environmental education through PBL: Evaluation of a teaching intervention program. *Research in Science Education*, 42(2), 219-232. <https://doi.org/10.1007/s11165-010-9192-3>
- Yolcu, H. H. (2023). Using project-based learning in an environmental education course and revealing students' experiences: A case study. *Science Activities*, 60(3), 119-125. <https://doi.org/10.1080/00368121.2023.2205825>
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