

EXPERIENCE REPORT


Educational technology applied to environmental education: innovating to tackle climate change


HIGHLIGHTS


1. Environmental issues can be implemented through extension.
2. Artificial intelligence can mediate pedagogical skills.
3. Artificial intelligence must be mediated by critical actions.
4. It has the potential to personalize pedagogical practices and customization.

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ABSTRACT

Objective: to report the experience of the process of creating an educational booklet on environmental health education using artificial intelligence in a university extension project. **Method:** an experience report of an advanced university extension program at the Universidade Federal do Pará, Brazil, carried out in 2024 in a Non-Governmental Organization, based on Donald Schön's reflective practice based on records of reports. **Results:** three reflective actions were identified, such as first action, reflection on the action and innovation in the course of the action, related, respectively, to booklet development, reflection on the need to create educational material on environmental health education and application of generative artificial intelligence. **Conclusion:** innovative tools' potential, such as generative artificial intelligence, was demonstrated to empower nursing students in environmental health themes.

DESCRIPTORS: Educational Technology; Environmental Health Education; Climate Change; Education, Nursing; Generative Artificial Intelligence.

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INTRODUCTION

The 2030 Agenda, which establishes, among its Sustainable Development Goals (SDGs), the need to ensure health and well-being (SDG 3) and to promote climate action (SDG 13), reaffirms the interdependence between human health and environmental balance¹⁻². In Brazil, this issue is highlighted in the Federal Constitution of 1988, in its article 225, in the Brazilian National Policy on Environmental Education (Law 9,795/1999) and in the Brazilian National Policy on Climate Change (Law 12,187/2009). Both reinforce the importance of environmental education (EE) as an essential tool to ensure health promotion³.

In the context of the Brazilian Amazon region, due to its immense biodiversity and the challenges of deforestation, environmental racism and social impacts resulting from large enterprises' economic activities^{1,4}, the issue of EE is paramount. Moreover, populations living in the Amazon, especially the vulnerable ones, are directly affected, highlighting the need for public policies that integrate health, environment, and education⁴.

In this regard, higher education institutions therefore have a fundamental role in training healthcare professionals capable of facing these challenges critically and innovatively, based on an educational praxis for social emancipation⁵. Training, especially for nurses, must therefore incorporate environmental health knowledge to understand the challenges arising from environmental degradation and climate change.

However, there is a significant gap in nursing training on EE and its impacts on human health⁶⁻⁷. In this sense, EE emerges as an indispensable tool for training healthcare professionals who are aware of the effects of climate change on the demands of healthcare services⁸. In response to this gap, the creation of educational materials, through different types, based on innovation and a dialogic process⁹, is a promising path¹⁰ when aligned with the idea of autonomy.

These processes have the potential to develop personalized educational materials that respond to temporal needs¹¹. One example is the processes involving the use of generative artificial intelligence (GAI), which has been implemented in the areas of health¹² and education¹³⁻¹⁵, and which can be a tool at the service of emancipation, given its impact on nursing education¹⁴⁻¹⁵ and on EE¹⁶. On the other hand, as it is adopted in the health sector, its use is indicated for decision support in emerging themes¹² and creation of personalized illustrations, through potential means to integrate diverse social contexts and provide critical awareness¹²⁻¹⁴.

In view of this, with climate change, intensified by anthropogenic actions¹ and increasingly frequent extreme events¹⁷, it is important to provide opportunities for the creation of educational materials capable of filling existing gap in the training of healthcare professionals on the subject ethically and critically¹². In this scenario, innovation in EE becomes essential to train healthcare professionals who are capable of acting preventively⁶ and adapting their practices to new realities, with the opportunity to produce technologies that are beyond innovative, especially contextualized, personalized¹⁸⁻²⁰, capable of problematizing issues regarding tackling climate change^{12,16}.

Thus, this study aimed to report the experience of the process of creating an educational booklet on environmental health education using artificial intelligence in a university extension project.

METHOD

This is an experience report from a Non-Governmental Organization (NGO) called “*Movimento República do Emaús*”, located in the Metropolitan Region of Belém, state of Pará. This NGO serves young people and their families, and people in situations of social vulnerability. The actions took place from March to April 2024, and the data sources were reports.

The experience was carried out through the implementation of a program entitled “*Pequenos Amazônidas*”, linked to a nursing school and a master’s degree course of the *Universidade Federal do Pará* Graduate Program in Nursing. Five undergraduate nursing students participated, two scholarship holders and three volunteers, enrolled between the fourth and eighth semesters, whose role was to develop educational processes and technologies to support debates on environmental health. In addition to these, two master’s students in nursing and two professors in public health participated, who had the role of guiding the processes involved in the stages of the actions.

These participants’ experience was carried out with high school students from the NGO who were from two different classes, enrolled in the afternoon period, with an average of 20 students per class. During the experience, biweekly meetings were held, totaling six in person and virtual in the NGO classroom, with progressive activities that composed the experience methodological trajectory presented here in three actions, of which two activities were carried out with high school students who received the educational action on concepts about EE.

The first action was carried out in three meetings in total. The first was remote, aimed at research on environmental health for nursing students. In the second and third meetings, in person, nursing students were instructed to identify the knowledge of the NGO’s high school students on the theme. In the second action, defined in one meeting, the GAI was chosen as the innovative dialogic tool based on Dall-E® from OpenAI®. To this end, descriptive texts were defined using prompts with descriptors, as seen in Figure 1. The last two meetings were to implement the booklet, and were held remotely via Google Meet.

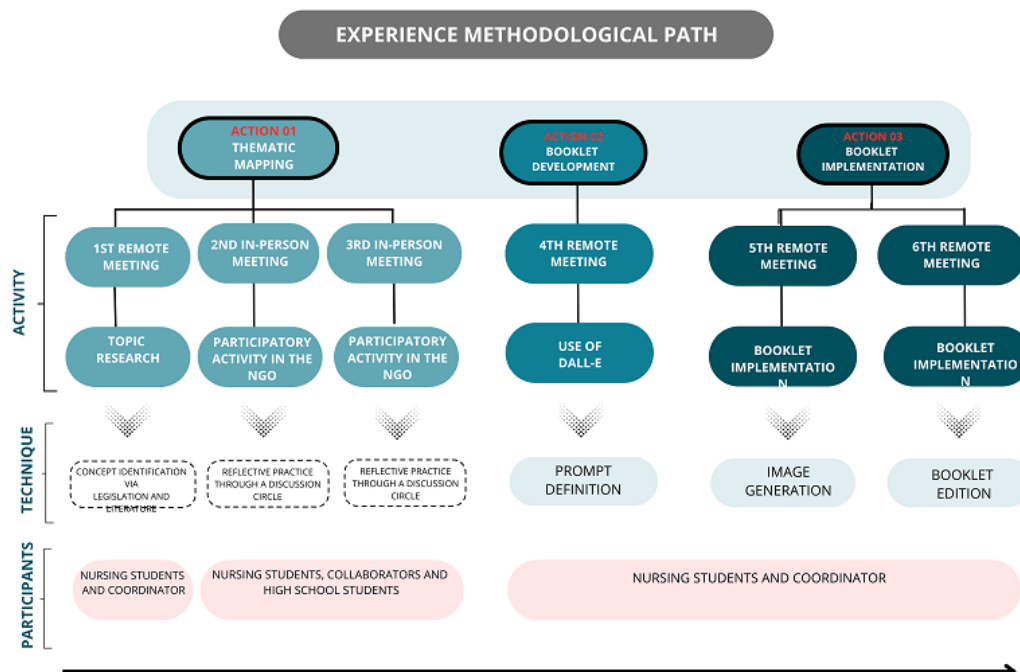


Figure 1. Flowchart of the methodological trajectory of the experience. Belém, PA, Brazil, 2025

Source: Castro et al. (2025).

The experience structure is based on the proposal on reflective practice²¹, in order to emphasize the importance of reflecting on practice in order to, based on this reflection, adjust and improve actions. To this end, this report is described from three perspectives, as first action, reflection on the action and new action in the course of the action, in which guiding questions were applied based on concepts about EE: environment; sustainability; sustainable development; climate change; global warming; environmental health; and natural resources. These questions were formulated based on the legislation on the subject.

RESULTS

First action

To develop the booklet, nursing students were first instructed to conduct research on the main subthemes to be addressed, such as the relationship between humans and nature, environmental impacts, and environmental legislation. These themes were chosen through prior planning, as seen in Figure 2, and generated the themes to be mediated with high school students.



Figure 2. Process of developing the booklet. Belém, PA, Brazil, 2025

Source: Castro et al. (2024).

The meetings with students indicated a lack of knowledge about concepts and pointed out relevant themes for the target audience and prospects for innovation in teaching materials. The suggestion of a digital material for use on cell phones was considered, with images that represented the Amazon, using GAI. Regarding the choice of typography, the booklet was chosen, considering its hybrid nature (printed or digital), accessibility and potential for editing and insertion of innovative images.

Reflection on the action

During the process of creating the "*Ambientando*" booklet, we reflected on the need to create educational material capable of engaging students and communities through the integration of educational technologies with new image generation tools (Figure 3).

In particular, the use of GAI allowed the creation of visually appealing illustrations, designed to encourage curiosity and encourage reflection on the content, especially when different races and ethnicities are presented. As an emerging instrument in education, the application of GAI revealed that nursing students use and are familiar with different artificial intelligences. On the other hand, it supported discussion based on the coordinator's intervention on innovation and ethical use in the assimilation and application of knowledge under the application of GAI.

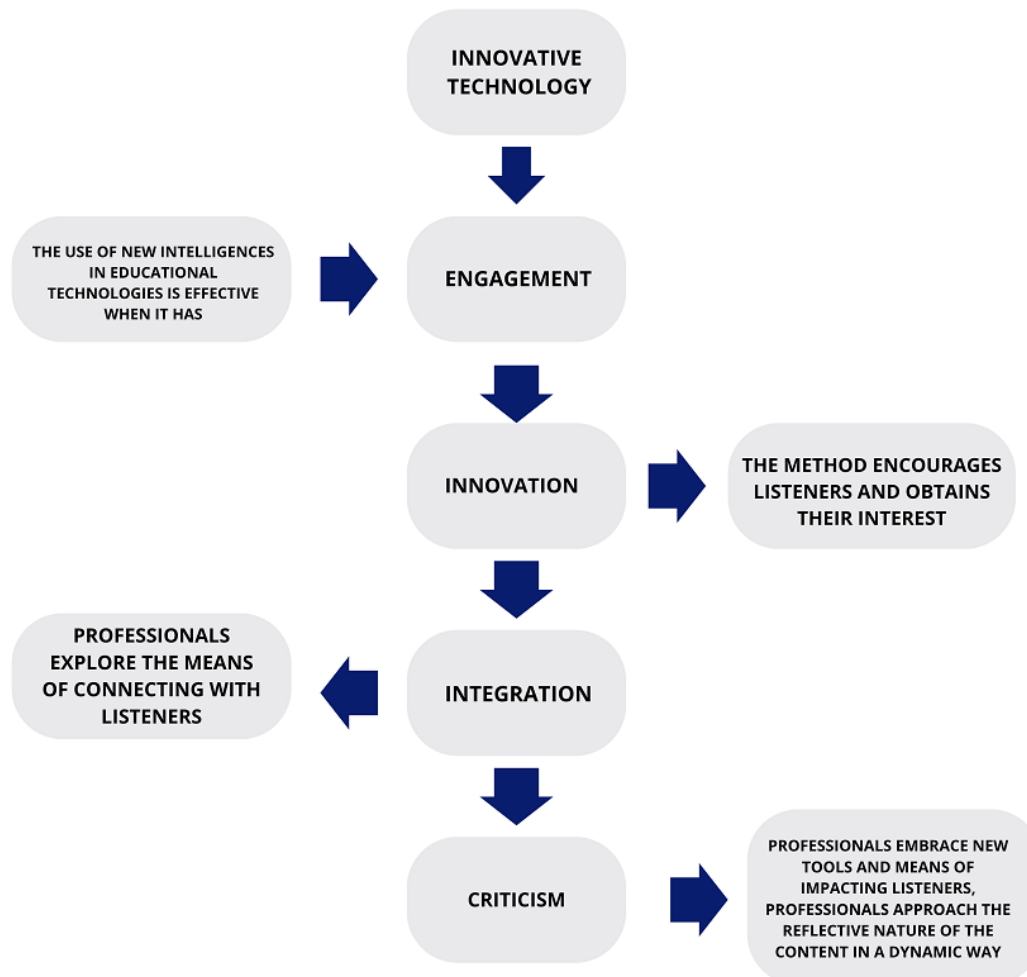


Figure 3. Process of including generative artificial intelligence innovation in the training process. Belém, PA, Brazil, 2025

Source: Castro et al. (2024) adaptado de Clarke (1994); Canva Pro (2025).

Innovation on the product of the action

The “Ambientando” booklet stands out not only for its content, but also for the images created and integrated, using GAI to generate visual representations that reflect racial diversity and the Amazon environment. Figure 4 shows the use of different resources that allow the development of different levels of critical awareness (Graphic Editor and GAI). The representation in illustrations from different races and ethnicities can be noted, reflecting the region’s rich cultural diversity (Figure 4).

CREATIVE PROCESS

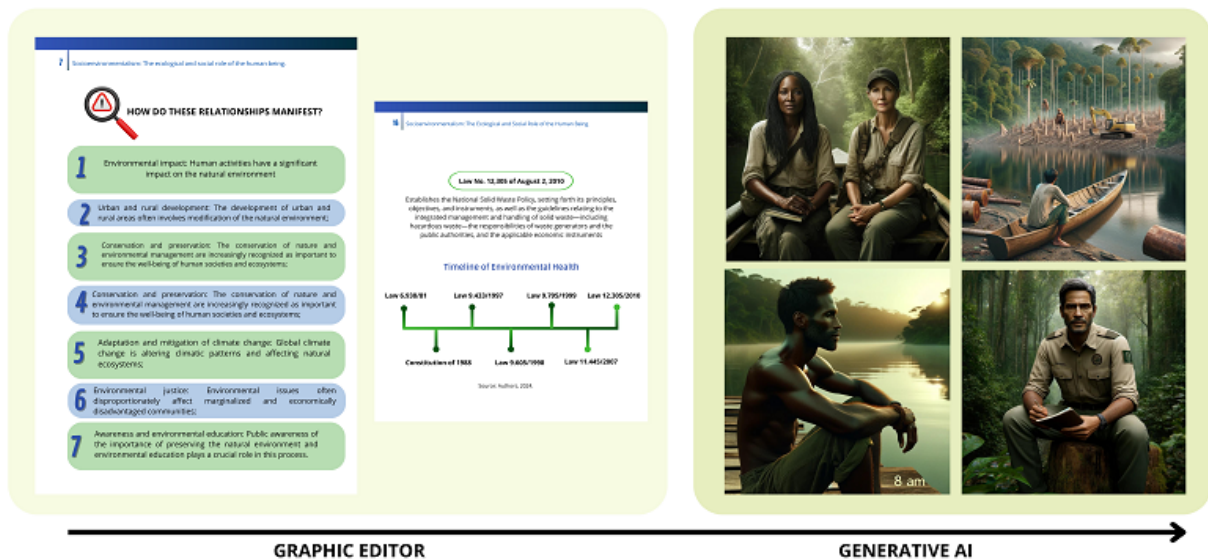


Figure 4. Panel about the booklet and its illustrations. Belém, PA, Brazil, 2025

Source: Castro et al. (2024); Canva Pro (2025).

DISCUSSION

The creation and development of an environmental health booklet represents a significant innovation in the context of nursing training, noting that it is an emerging theme^{6,19-20}. It is significant as a product constructed within the dialogical training process for regions such as the Amazon, which involves different thematic areas, and is essential for future professionals to be prepared to act in a proactive and preventive manner⁶⁻⁷.

The aim, therefore, is to train professionals who are aware of their role as citizens. This is because, by integrating concepts attributed to EE and the teaching-learning process, it empowers nursing students to act as agents of change. Furthermore, by promoting the encounter with conceptual frameworks and legislation, it subsidized criticality in training, due to orientation based on the response to public systems from an environmental perspective⁸.

In terms of innovation in the educational process, the use of GAI to create images, as proposed, represents innovative dialogic creation, given that generation of illustrations reflects cultural and environmental diversity, making the material potentially representative. It is confirmed that the use of GAI in education is an emerging trend that can transform the way educational content is developed and assimilated^{18-19,22}, while at the same time providing an opportunity for dialogue on ethics and adaptation in the use of GAI, due to the advancement of its use with different resources that mediate care and life cycles¹².

However, the process of integrating GAI into the creation of the manual was not without its challenges. The learning curve for operating GAI tools was one of the first obstacles faced by the team, requiring an initial period of adaptation for those involved in the development stage. It was demonstrated that technical issues related to digital solutions¹²⁻¹³, in addition to ethical and equitable issues, using GAI^{12,14}, must be considered in training processes, particularly those involving privacy and data security¹², in addition to the innovative solutions proposed.

Furthermore, ensuring that the images generated were culturally appropriate and representative of Amazonian diversity required constant adjustments and revisions, highlighting the limitations of technological tools in identifying all the nuances that encompass different cultures and human groups²³. This occurred when there was a need for continuous review of generated images, as some presented stereotypes or did not accurately reflect the diversity of human groups in the region, which was perceived in feedback during meetings 4 and 5.

For this purpose, different prompts were adopted that included descriptors and keywords related to race, color, and ethnicity, when there was an illustration of individuals, as already observed in another study¹⁵. There was the insertion of those that signal interventions in the environment, such as deforestation, tractors with traction and contamination of rivers.

In addition to its representativeness, the booklet's flexibility in being used in different formats – printed or digital – increases its potential for educational impact and demonstrates how the typology is easy to apply^{11,24}. This adaptability allows the material to be applied in different educational contexts, from classrooms with virtual connectivity to community activities where this reality does not extend, making it a versatile and effective tool in EE. The ability to customize the material according to the target audience's specific needs is one of the strengths of the educational technology used¹¹.

However, the process revealed the need to discuss, during the implementation process, the careful reading of the scope of Health Sciences Descriptors used in the definition of prompts when replicating experiences with this tool. On the other hand, experience, by following alignment with engagement, innovation, integration and criticism, showed that prompt-guided approaches can be a mechanism to improve learning¹⁵.

Another fundamental aspect discussed was the practical applicability of the booklet. The booklet was designed not only as an educational resource for the community, but also as a pedagogical tool for the training of environmental nurses⁶⁻⁷ prepared to face contemporary challenges such as climate change¹. This occurred because it overcame traditional methods that rely on pre-existing and widely used materials, allowing the creation of personalized and visually attractive content that can significantly increase student engagement and retention of information²³.

The inclusion of EE concepts, when incorporated into the nursing curriculum, not only prepares students to deal with impacts of climate change, but also raises awareness to contribute to sustainability and public health promotion in their communities^{2,25}. The application of GAI contributes to interdisciplinarity¹²⁻¹⁵ practice among nursing students, undergraduate students and technology specialists, observing how different areas of knowledge can complement each other to create innovative educational solutions²⁶ on the subject, observing the different scenarios with disasters²⁷ and approaches that integrate digital solutions²⁸.

FINAL CONSIDERATIONS

The experience reinforces the importance of integrating educational innovations into the training process, preparing professionals capable of contributing significantly to health and sustainability in a context of climate change by personalizing pedagogical

practices with the critical use of GAI. It demonstrated that the use of the booklet, combined with the use of GAI, can significantly impact nursing students' learning, expanding their understanding of environmental health due to culturally adapted illustrations and associated vulnerabilities.

However, the experience faced limitations, such as the learning curve associated with the use of GAI and the need for cultural adjustments in illustrations, highlighting the importance of technical support and cultural awareness in the development of educational materials. Further studies on the impact of the use of GAI on learning are recommended, assessing how the generation of illustrations and visual materials influences content assimilation and how cultural adequacy of illustrations and educational materials for groups of different races and ethnicities should be applied in the simulation of learning environments.

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Conflicts of interest:

The authors have no conflicts of interest to declare.

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