

ENVIRONMENTAL EDUCATION AND INTEGRATING PROJECTS: NEW HIGH SCHOOL STUDENTS' PERCEPTIONS OF BASIC SANITATION IN THE MUNICIPALITY OF PELOTAS/RS

EDUCAÇÃO AMBIENTAL E PROJETOS INTEGRADORES: PERCEPÇÃO DE ESTUDANTES DO NOVO ENSINO MÉDIO SOBRE SANEAMENTO BÁSICO NO MUNICÍPIO DE PELOTAS/RS

EDUCACIÓN AMBIENTAL Y PROYECTOS INTEGRADORES: PERCEPCIÓN DE ESTUDIANTES DE LA NUEVA EDUCACIÓN SECUNDARIA SOBRE EL SANEAMIENTO BÁSICO EN EL MUNICIPIO DE PELOTAS/RS

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Abstract: The new Brazilian high school curriculum implements "integrative projects," which incorporate topics such as environmental education and focus on real-world challenges, such as basic sanitation. This study aims to understand the role of environmental education and the integrative project in developing critical thinking among first-year high school students at Escola Estadual Coronel Pedro Osório, in relation to basic sanitation in the municipality of Pelotas, RS. The research follows a mixed-methods approach, both descriptive and exploratory, using a questionnaire to identify students' perceptions of environmental issues. The results showed that 67.7% of students perceive environmental problems, with improper waste disposal and open sewage being the most frequent. Most participants (40.4%) attributed responsibility for environmental problems jointly to the population, public authorities, and companies. Nearly 65% of students reported changes in their views and habits following the Integrative Project, sharing what they learned with family and friends. The internet was identified as the main source of environmental information, ahead of school, highlighting the need to strengthen this topic within the school environment. Open-ended responses revealed that students identify waste collection, awareness-raising, and community participation as priority actions to improve the environment in the municipality. The results reinforce the importance of integrative projects as tools for critical environmental education, aligned with the Sustainable Development Goals of the 2030 Agenda.

Keywords: Learning. School. Awareness-raising.

Resumo: O novo modelo de ensino médio brasileiro implementa os "projetos integradores", que incorporam temas como a educação ambiental e têm foco em desafios reais, como o saneamento básico. Este estudo busca compreender o papel da educação ambiental e do projeto integrador no desenvolvimento do pensamento crítico de alunos do 1º ano do ensino médio da Escola Estadual Coronel Pedro Osório, em relação ao saneamento básico no município de Pelotas/RS. A pesquisa segue uma abordagem de métodos mistos, descritiva e exploratória, utilizando um questionário para identificar as percepções dos alunos sobre questões ambientais. Os resultados mostraram que 67,7% dos alunos percebem problemas ambientais, sendo o descarte inadequado de resíduos e o esgoto a céu aberto os mais frequentes. A maioria dos participantes (40,4%) atribuiu a responsabilidade pelos problemas ambientais de forma conjunta à população, às autoridades públicas e às empresas. Cerca de 65% dos alunos relataram mudanças em suas visões e hábitos após o Projeto Integrador, compartilhando o que aprenderam com familiares e amigos. A internet foi identificada como a principal fonte de informação ambiental, à frente da escola, evidenciando a necessidade de fortalecer esse tema no ambiente escolar. As respostas abertas revelaram que os alunos apontam a coleta de resíduos, a conscientização e a participação comunitária como ações prioritárias para a melhoria ambiental no município. Os resultados reforçam a importância dos projetos integradores como ferramentas para uma educação ambiental crítica, alinhada aos Objetivos de Desenvolvimento Sustentável da Agenda 2030.

Palavras-chave: Aprendizagem. Escola. Sensibilização.

Resumen: El nuevo modelo de educación secundaria en Brasil implementa "proyectos integradores", los cuales incorporan temas como la educación ambiental y se centran en desafíos reales, tales como el saneamiento básico. Este estudio busca comprender el papel de la educación ambiental y del proyecto integrador en el desarrollo del pensamiento crítico de estudiantes de primer año de secundaria de la Escuela Estatal Coronel Pedro Osório, en relación con el saneamiento básico en el municipio de Pelotas, RS. La investigación es de métodos mixtos, descriptiva y exploratoria, y utiliza un cuestionario para identificar las percepciones de los estudiantes sobre cuestiones ambientales. Los resultados mostraron que el 67,7% de los estudiantes percibe problemas ambientales, siendo la eliminación inadecuada de residuos y las aguas residuales a cielo abierto los más frecuentes. La mayoría (40,4%) atribuyó la responsabilidad conjuntamente a la población, las autoridades públicas y las empresas. Cerca del 65% reconoció cambios en sus perspectivas y hábitos tras el Proyecto Integrador, compartiendo lo aprendido con familiares y amigos. Internet se identificó como la principal fuente de información ambiental, superando a la escuela, lo que evidencia la necesidad de reforzar este tema en el ámbito escolar. Las respuestas abiertas revelaron que los estudiantes señalan la recolección de residuos, la sensibilización y la participación comunitaria como acciones prioritarias para la mejora ambiental del municipio. Los resultados refuerzan la importancia de los proyectos integradores como herramientas para una educación ambiental crítica, alineada con los Objetivos de Desarrollo Sostenible de la Agenda 2030.

Palabras clave: Aprendizaje. Escuela. Sensibilización.

1 INTRODUCTION

The accelerated growth of urbanization, combined with population increase, intensifies pressure on environmental problems in urban centers, such as pollution related to improper solid waste disposal and ecosystem degradation, which highlights the lack of efficient basic sanitation systems (Mendes & Moreira, 2022). Consequently, basic sanitation stands out as one of the main challenges in Brazil, especially in medium-sized municipalities, where difficulties in water supply, sewage treatment, solid waste management, and urban drainage remain common (Dos Santos; Kuwajima & Santana, 2020).

These factors directly compromise the population's quality of life and highlight the need for integrated strategies that combine public policies, urban planning, and educational actions (Friede, 2022). Moreover, the implementation of these educational actions must take place during the individual's early stage of environmental awareness formation, that is, embedded in basic education curricula (Brasil, 2024).

Alongside urban environmental issues, the Brazilian educational field is undergoing significant changes, especially with the implementation of the new high school model, established by the National High School Policy (PNAEM), Law N°. 14,945/2024 (Brasil, 2024). This policy proposes an integrated, equitable education aligned with students' needs, expanding the workload of Basic General Education (FGB) to 2,400 hours and establishing In-Depth Formative Pathways (IFA), with a minimum workload of 600 hours (MEC, 2026).

The IFA was created to enable students to deepen their knowledge in areas of interest. These pathways are developed through integrating projects, which aim to link different areas of knowledge and encourage interdisciplinarity and scientific investigation of real-world problems, such as those related to local environmental issues (MEC, 2026).

In this context, different content areas are expected to be addressed in high school, among which environmental education stands out, in accordance with the National Environmental Education Policy, Law N°. 9,795/1999 (Brazil, 1999), and the guidelines of the National Common Curricular Base (Brazil, 2017). This

content should be developed in an interdisciplinary manner within the school environment, enabling students to understand the complexity of socio-environmental issues and recognize their role as agents of social transformation (Reis *et al.*, 2022; Rodrigues *et al.*, 2023).

Environmental education is therefore a fundamental tool for building values, knowledge, and attitudes geared toward environmental conservation, fostering the development of critical and responsible awareness (Souza *et al.*, 2025). Furthermore, young people's environmental perception is influenced both by their everyday experiences and by the pedagogical practices developed at school, with active and interdisciplinary methodologies being especially effective in developing critical thinking (De Souza *et al.*, 2023; Santos, Santos & Silva, 2022).

In this regard, in the field of environmental education, researchers such as Souza (2025), Gomes (2024), and Beyer (2022) point out that integrating projects are relevant because they bring schools and communities closer together, strengthening formative processes aimed at reflecting on local socio-environmental problems and building an ethical and responsible stance toward the environment.

On the other hand, studies also point to challenges in implementing the new high school model and, consequently, the integrating projects. According to Silva, Krawczyk & Calçada (2023), this implementation took place without an adequate assessment of the conditions of elementary education and the needs of young people. This has led to a lack of integration with elementary education, the possible marginalization of basic general education, and disagreements related to the reduction of time and content in certain subjects.

Thus, the limitations found in the Brazilian educational and environmental spheres challenge the fulfillment of the Sustainable Development Goals (SDGs) of the 2030 Agenda (UN, 2015). Among these, SDG 4, quality education, stands out, especially target 4.7, which aims to ensure that all students acquire the knowledge needed to promote sustainable development. It is also linked to SDG 12, responsible consumption and production, target 12.8, which seeks to ensure that people everywhere have the relevant information and awareness for sustainable development, as well as SDG 6, target 6.3, which aims to improve water quality by reducing pollution, increasing treatment, and expanding the recycling and reuse of waste.

In the municipality of Pelotas-RS, these SDGs face obstacles to being achieved. Problems related to basic sanitation, including deficiencies in sewage systems, historically recorded waterborne diseases, and urban infrastructure, highlight the importance of educational initiatives that promote awareness and engagement of the school community in facing local environmental challenges (Aguiar; Cecconello & Centeno, 2019; Ribeiro, Kruger & Guimarães, 2018).

This research is justified by its contribution to filling an existing gap in the scientific field, since, although there are articles on the new high school model in general contexts, on integrating projects in higher and technical education (Ramos, Ypiranga & Gomes, 2025), curricular analyses (França *et al.*, 2026), and studies on environmental education in schools (Santos, 2024), articles that directly relate environmental education and integrating projects with a focus on high school students' environmental perception remain scarce. This finding is consistent with Feitoza, Mota & Gomes (2024), who emphasize the lack of more specific scientific research

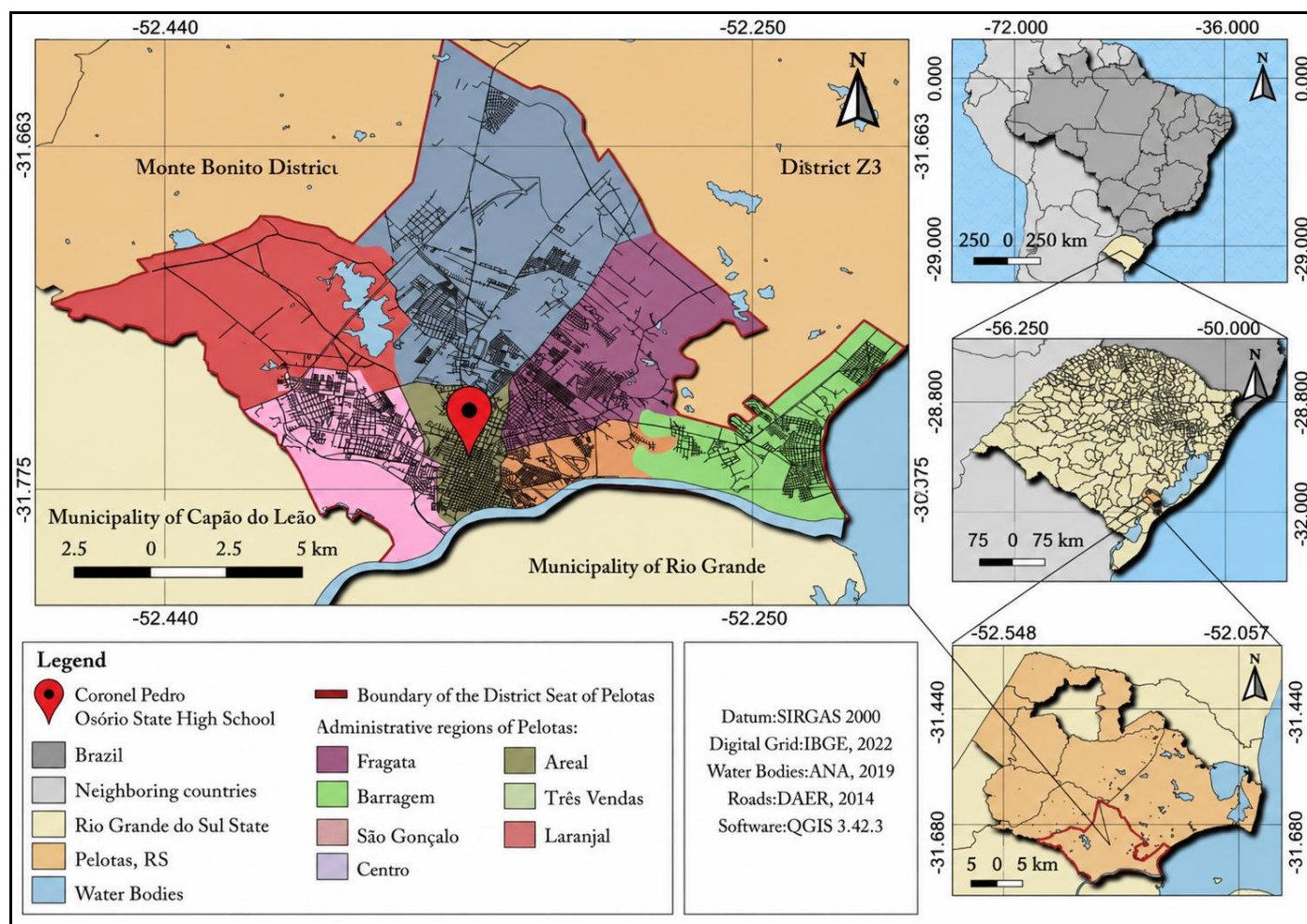
on the new high school model.

Given this scenario, the present study aims to understand the role of environmental education in developing critical thinking among students at a state high school, Escola Estadual Coronel Pedro Osório, regarding basic sanitation problems in the municipality of Pelotas/RS, based on the analysis of a questionnaire applied within the context of an integrating project.

2 MATERIALS AND METHODS

This is a quantitative and qualitative (quali-quantitative) study (Creswell, Creswell, & J. David, 2021), of a descriptive and exploratory nature. The research was carried out at Escola Estadual de Ensino Médio Coronel Pedro Osório, located in the municipality of Pelotas, in the southern region of Rio Grande do Sul (Figure 1), with an estimated population of 325,685 inhabitants (IBGE, 2022).

Figure 1 - Map of Coronel Pedro Osório State High School, Pelotas-RS.



Source: The authors, 2026.

A total of 94 students from four first-year high school classes at the institution took part in the study. Data were collected through a structured questionnaire, developed within the context of an integrating project, comprising 12 questions (Table 1): 10 multiple-choice questions, two of which allowed multiple selections, and 2

open-ended questions aimed at identifying students' perceptions of basic sanitation problems in the municipality.

Table 1 - Questions applied to the first-year high school classes at Coronel Pedro Osório State High School.

Questions
When did you start noticing environmental problems in your neighborhood?
Which environmental problems do you notice most in your community? (multiple choice)
In your opinion, who is mainly responsible for the environmental problems in your neighborhood?
How do you think these problems affect your quality of life?
What are your main sources of information on environmental issues? (multiple choice)
Did the integrating project change your view of environmental problems, as well as some of your daily habits that caused environmental impacts?
Do you consider that you have sufficient knowledge about environmental conservation?
Did you share information or practices learned in the project with friends or family?
Before the integrating project, had you already studied environmental topics at school?
In your opinion, what do you think of the teaching method used in the integrating project?
What types of actions would you like to see carried out in the community?
In your opinion, what is needed to get more people involved in environmental conservation?

Source: The authors, 2026.

The multiple-choice questions were organized to assess different dimensions of students' environmental views, including the identification of environmental problems present in the community, understanding of impacts on quality of life, and sources of information on environmental issues in relation to knowledge about environmental conservation. In addition, some questions sought to assess the importance of the integrating project in building new knowledge, changing daily habits, and sharing environmental practices with family and friends.

For the application of the questionnaire, it was submitted to the Plataforma Brasil portal, the national, unified database of records for research involving human subjects for the entire Research Ethics Committee (REC) system. Plataforma Brasil, in turn, forwarded the project to the Research Ethics Committee of the School

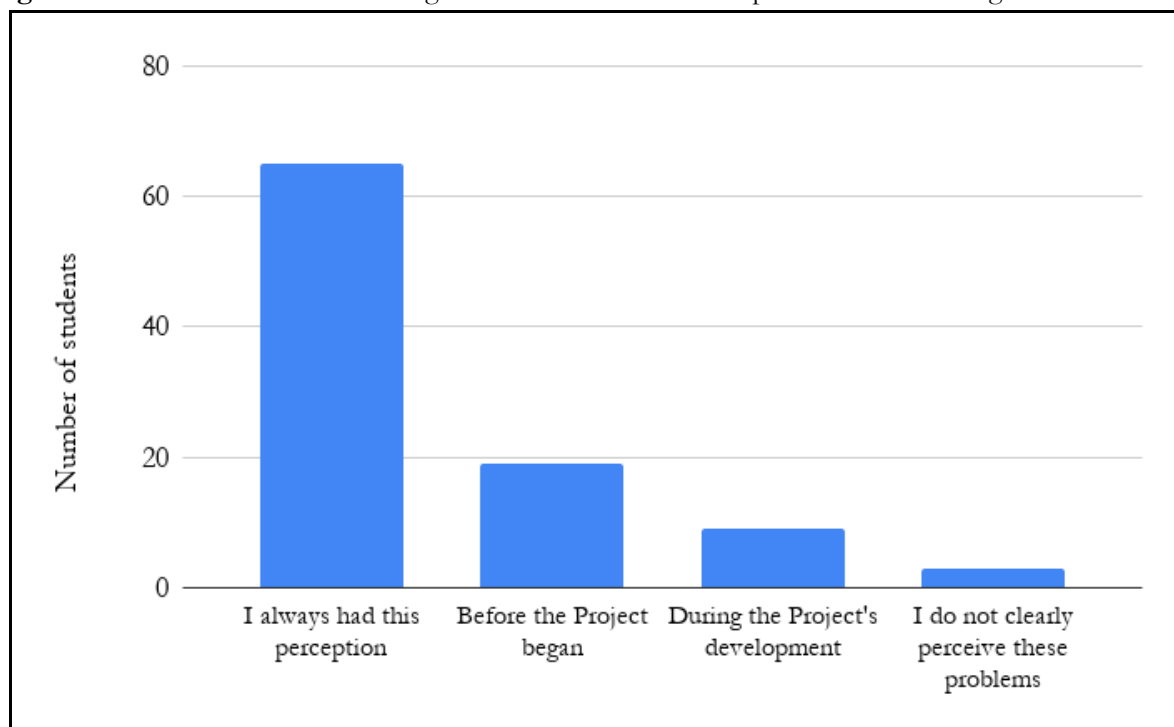
of Medicine at the Federal University of Pelotas. The Certificate of Presentation for Ethical Appraisal (CAAE) number is as follows: 44762721.6.0000.5317.

After the questionnaires were applied, the quantitative data were tabulated and represented through charts and tables, allowing for descriptive statistical analysis of the responses obtained. The open-ended questions were analyzed interpretively, seeking to identify students' perceptions, prior knowledge, and critical stance regarding local environmental issues.

3 RESULTS AND DISCUSSION

When analyzing the point at which students began to notice environmental problems in their neighborhood, it was found that 67.7% reported always having this perception. In addition, 19.8% reported having noticed it before the start of the integrating project, 9.4% began noticing it during its development, and only 3.1% reported still not clearly perceiving these environmental issues (Figure 2).

Figure 2. Period in which students began to notice environmental problems in their neighborhood.



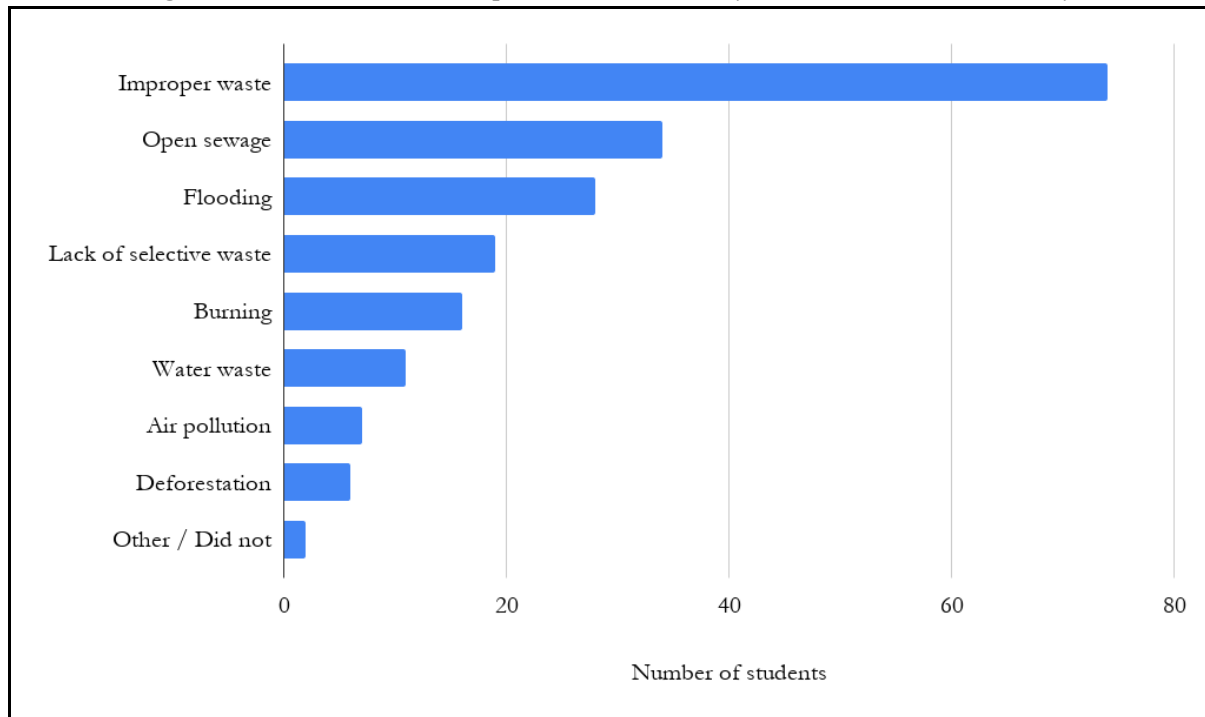
Source: The authors, 2026.

The high percentage of students who reported always noticing environmental problems around them suggests that environmental perception is strongly linked to the length of time living in the local reality. Everyday experiences have a direct influence on the formation of environmental awareness, as pointed out by Santos, Santos & Silva (2022), who found that public school students have prior, albeit superficial, knowledge of the environmental obstacles in their community.

Regarding the environmental problems students encounter in their community, certain predominant issues were observed. Seventy-four participants cited "improper waste disposal by the population," 34 cited "open sewage," and 28 mentioned "flooding," with others citing "lack of selective waste collection" (19),

“burning” (16), “water waste” (11), “air pollution” (7), “deforestation” (6), and “other / no answer” (2) (Figure 3).

Figure 3. Main environmental problems identified by students in their community.

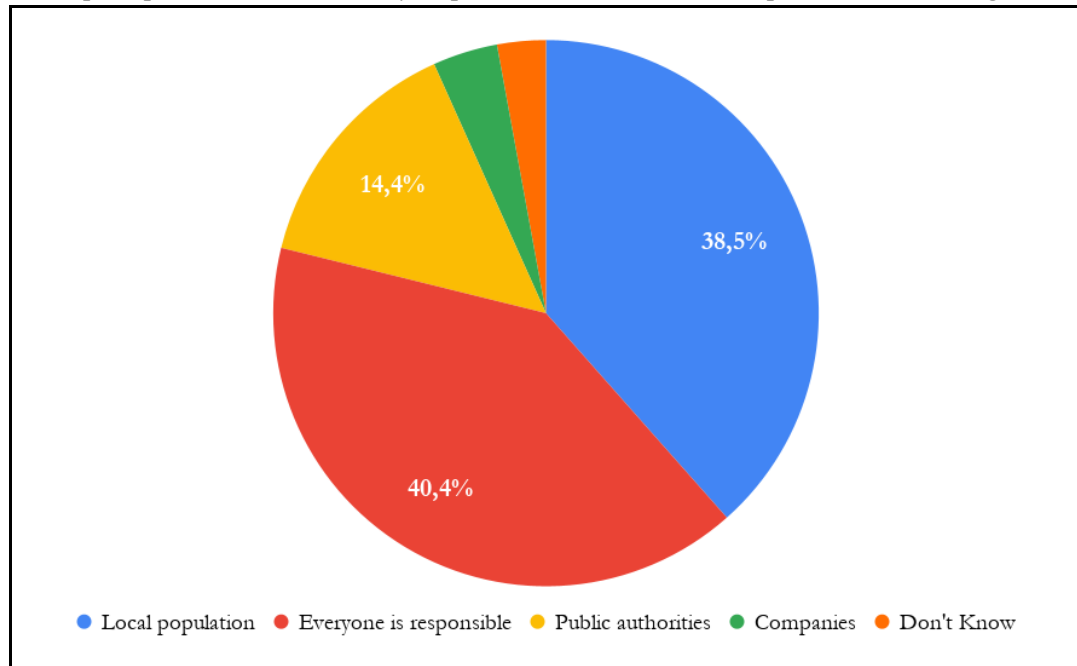


Source: The authors, 2026.

The emphasis on improper waste disposal and open sewage is linked to the reality of Pelotas, a municipality that has historically faced challenges related to basic sanitation, including waterborne diseases such as diarrhea, hepatitis A, and leptospirosis (Aguiar, Ceconello & Centeno, 2019). The significant number of responses citing flooding also reflects difficulties associated with urban changes faced by the municipality. In this regard, Lhamas, Silva & Mendes (2019) point out that basic sanitation can be linked to Critical Environmental Education within the school setting, allowing students to gain a broader understanding of the sanitation reality in which they live and to act as critical citizens in demanding quality services.

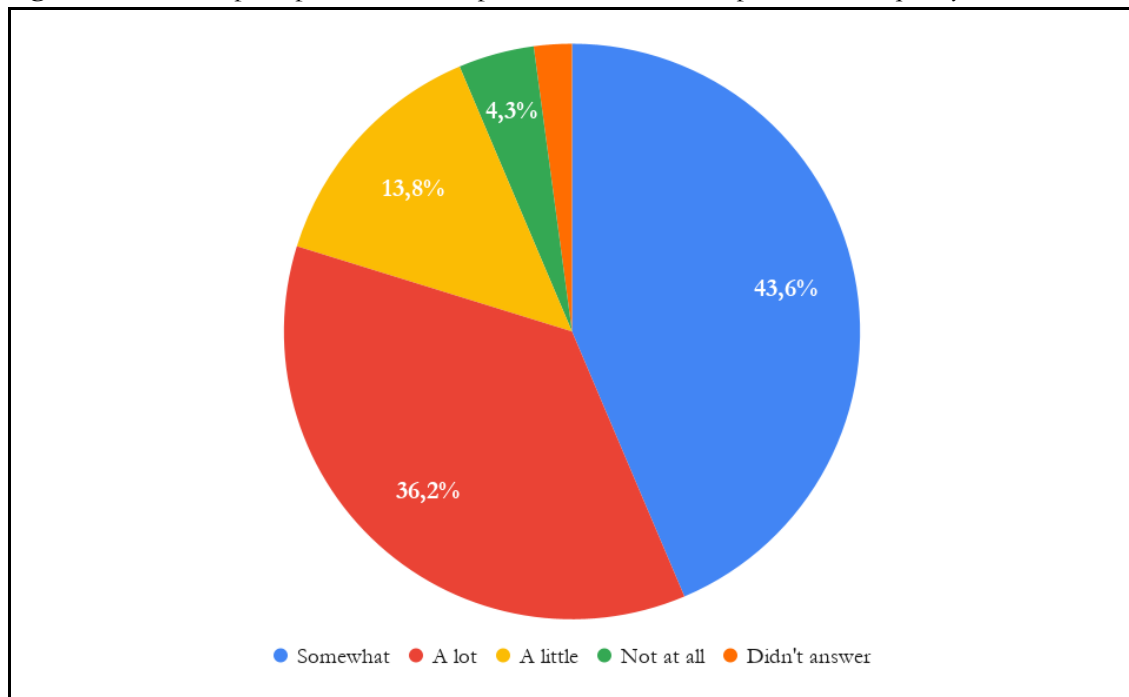
In order to relate environmental problems to their causes, students were asked who was mainly responsible for the obstacles observed in their neighborhoods. The option “everyone is responsible” was the most frequently selected, at 40.4%, followed by “local population” (38.5%), “public authorities” (14.4%), “businesses” (3.8%), and “don’t know” (2.9%) (Figure 4).

This result shows that most students attributed responsibility jointly to the population, public authorities, and businesses, reflecting an understanding of collective responsibilities in environmental management. At the same time, the significant percentage pointing to the local population as the main party responsible (38.5%) indicates that young people acknowledge the role of individual attitudes in the structure of environmental problems.

Figure 4. Students' perceptions of who is mainly responsible for environmental problems in the neighborhood.

Source: The authors, 2026.

The study also sought to identify how students perceive the impact of environmental problems on their quality of life. For 43.6% of participants, these problems have “a little” impact on quality of life, while 36.2% stated that the impact is “a lot” (Figure 5).

Figure 5. Students' perceptions of the impact of environmental problems on quality of life.

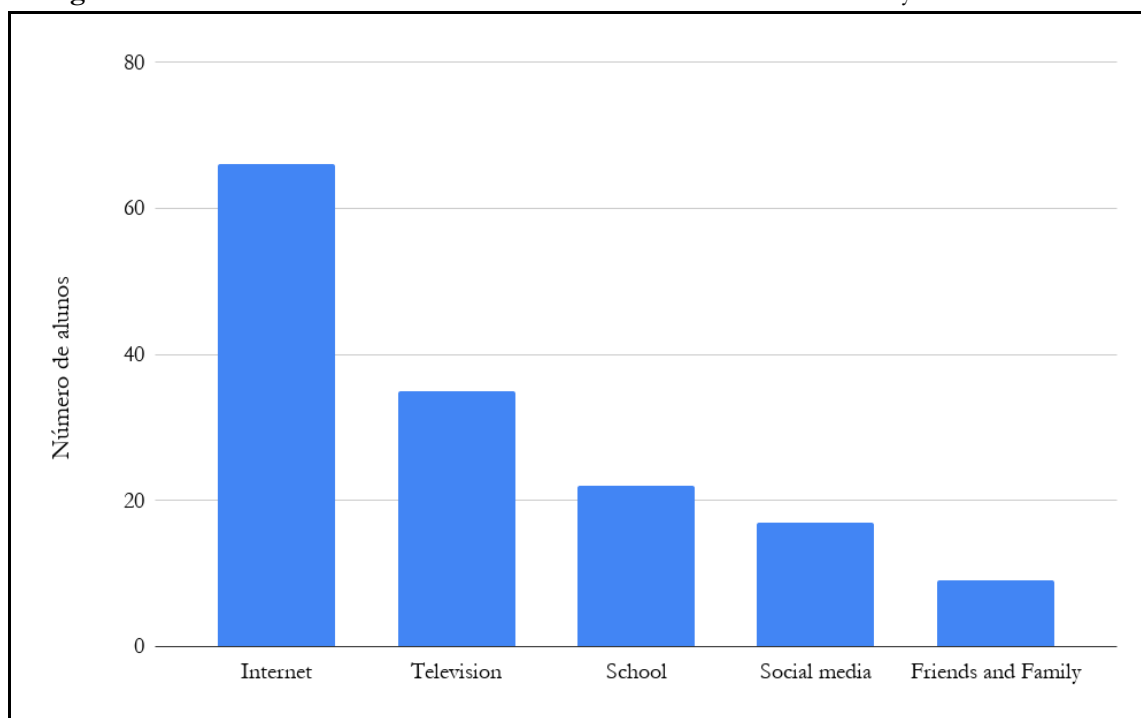
Source: The authors, 2026.

The fact that nearly 80% of students recognize some degree of impact of environmental problems on their quality of life is consistent with Lopes, Damo & Lipp-Nissinen (2025), who, in analyzing the perceptions of

545 high school students in Rio Grande do Sul, found that most young people recognize environmental impacts in their daily lives, although they are not always able to link them to individual mitigation actions.

Regarding students' main sources of information on environmental issues, the internet was the most frequently cited source, with 66 mentions, followed by television (35) and school (22) (Figure 6).

Figure 6. Main sources of information on environmental issues indicated by students.

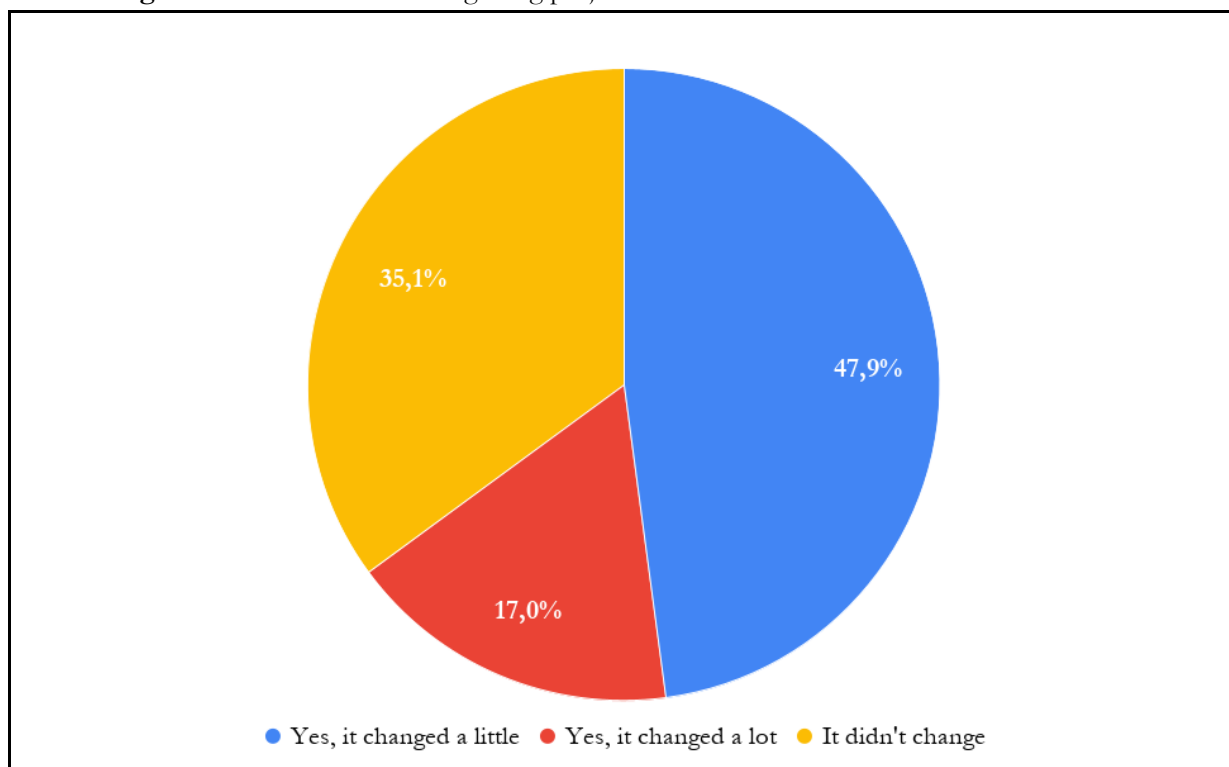


Source: The authors, 2026.

Unlike Lopes, Damo & Lipp-Nissinen (2025), who identified school as the main source of environmental information among students in Rio Grande do Sul, in this study the internet ranked first, followed by television. School ranked third, indicating the need to strengthen the approach to environmental topics in the school setting in order to complement and improve the quality of the information students access through digital media.

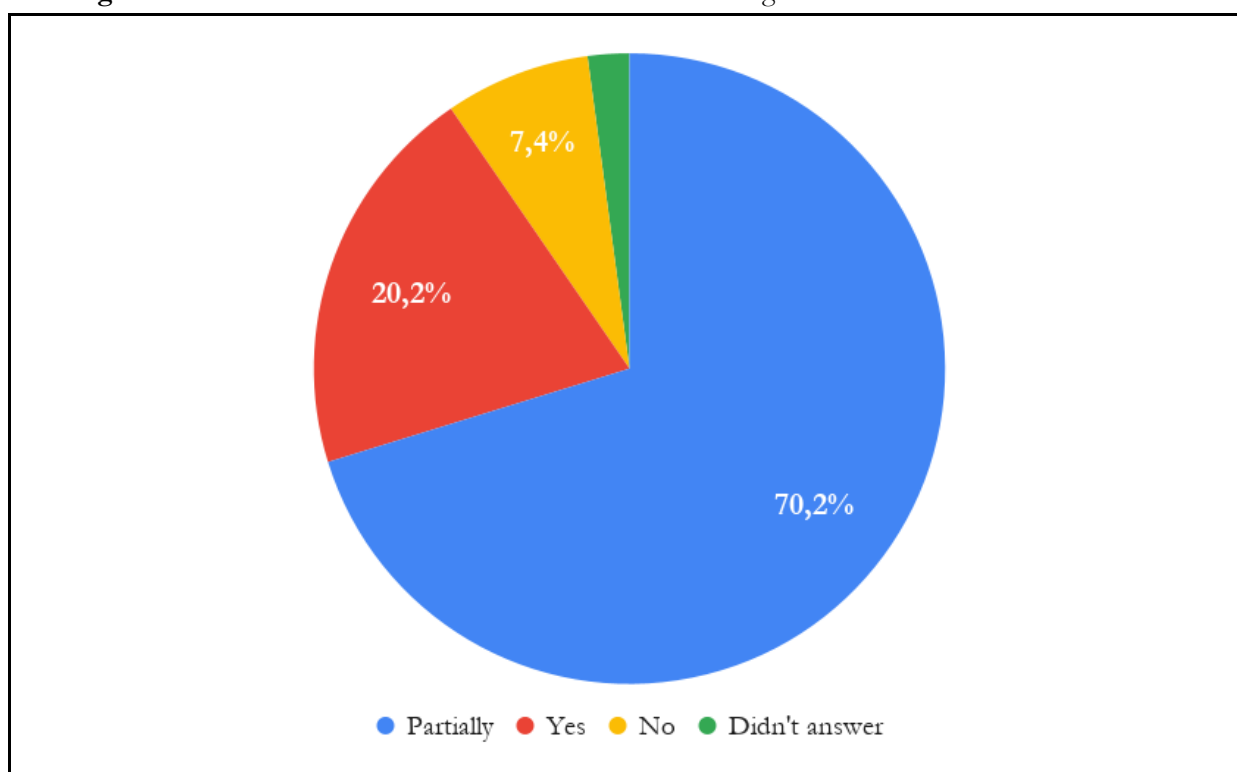
The integrating project changed students' views on environmental issues and influenced their daily habits with environmental impact. For 47.9% of participants, the project changed their views and habits "a little," 17.0% reported that it changed them "a lot," and 35.1% stated that it "did not change" them (Figure 7).

Combined, nearly 70% of students acknowledged some degree of change after participating in the integrating project. These findings are consistent with Carmo *et al.* (2025), who concluded that project-based teaching and participatory methodologies foster greater student engagement and improved learning, providing greater autonomy and problem-solving skills. Accordingly, the 35.1% who reported no change suggest that isolated actions may be insufficient and that more continuous and integrated educational actions are needed.

Figure 7. Influence of the integrating project on students' environmental views and habits.

Source: The authors, 2026.

Regarding knowledge of environmental conservation, 70.2% of students rated their knowledge as only partial, while 20.2% considered their knowledge sufficient and 7.4% reported having no knowledge of the topic (Figure 8).

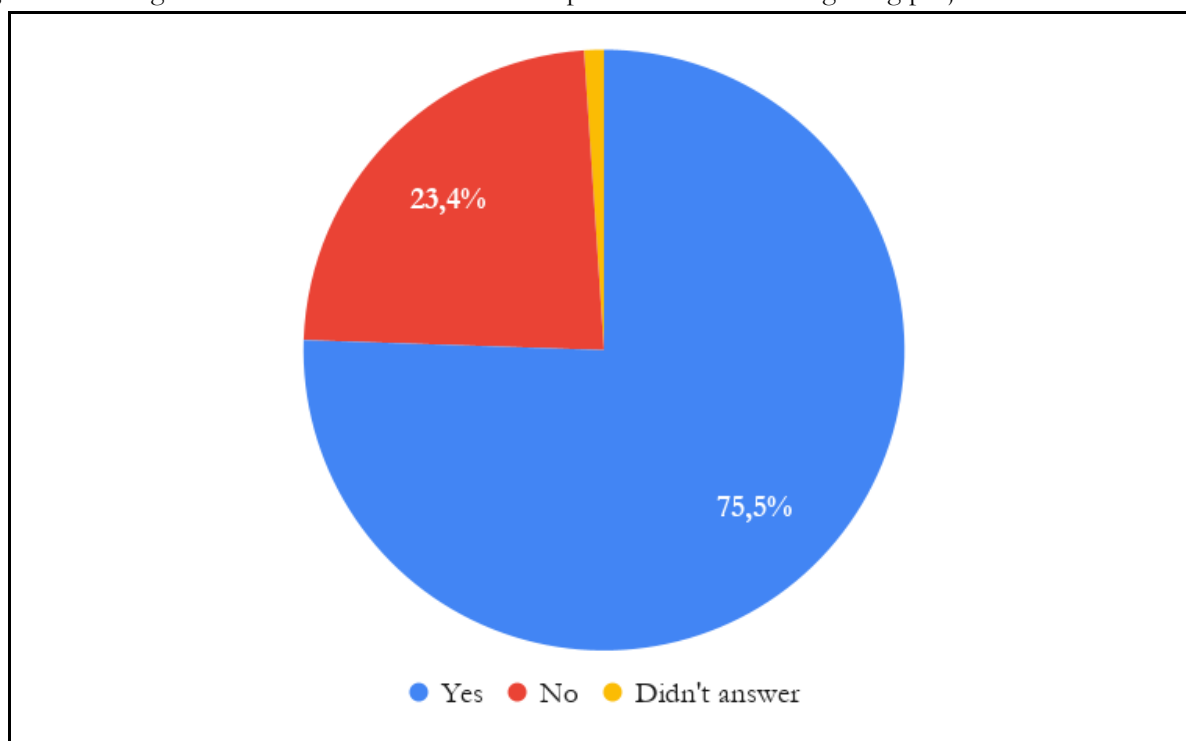
Figure 8. Students' self-assessment of their level of knowledge about environmental conservation.

Source: The authors, 2026.

This result reaffirms the findings of Silva, Elali & Karrow (2023), who, in a study with 187 high school students in Rio Grande do Norte, concluded that young people understand environmental issues but have not truly internalized this knowledge, so that it is rarely translated into everyday attitudes and practices. Similarly, Dos Santos & Royer (2020) found that high school students hold a conservative view of the environment, establishing the need for teachers to broaden discussions on this topic in a critical and reflective manner. The fact that more than 70% of students report having only partial knowledge reaffirms the need for continuous and contextualized educational practices

Regarding the sharing of information and environmental practices acquired during the integrating project, 71 students reported having passed on the knowledge they gained to friends or family, while 22 reported not having done so (Figure 9).

Figure 9. Sharing of information and environmental practices from the integrating project with friends and family.



Source: The authors, 2026.

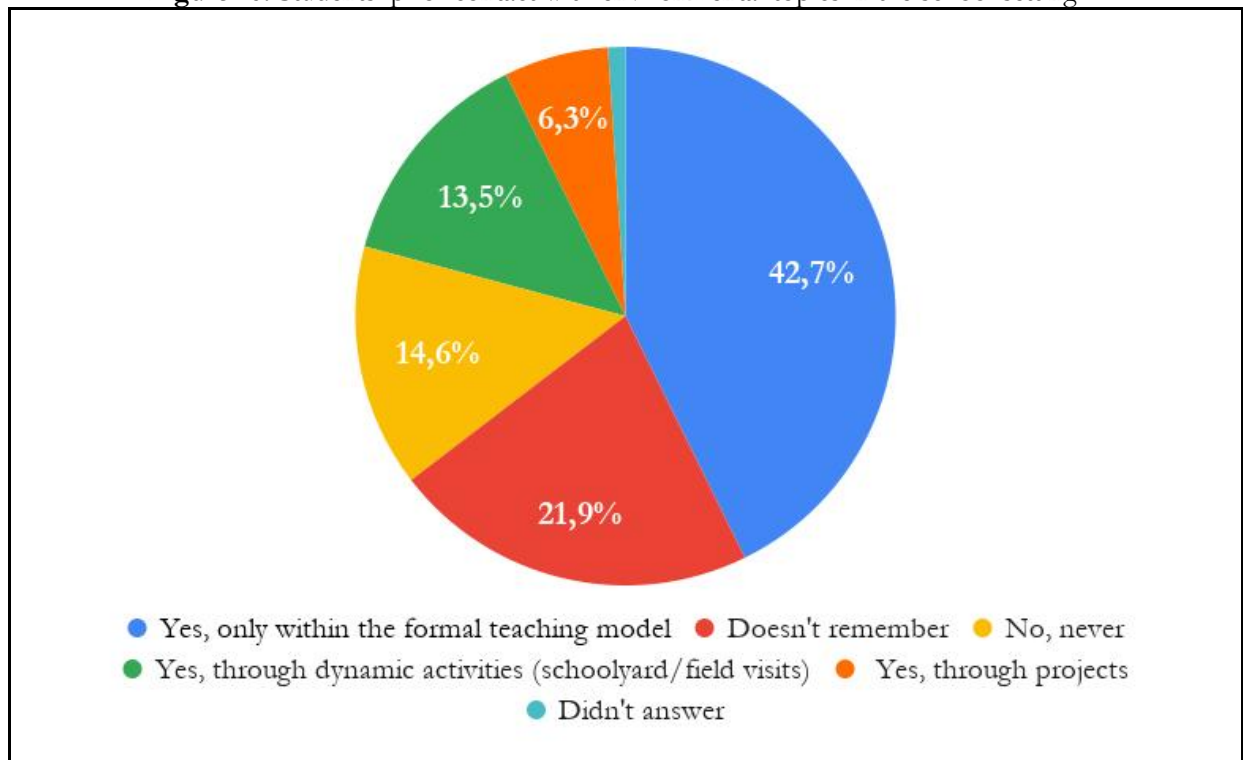
Most students shared what they had learned, reinforcing the potential of the integrating project as a tool for multiplying environmental knowledge beyond the school setting. This aspect is highlighted by De Souza *et al.* (2023), who found that environmental perception activities with high school students led to the proposal of actions to improve environmental quality in their communities.

Thus, the results suggest that environmental education initiatives based on active methodologies can help train students capable of acting as multipliers of sustainable knowledge and practices in their social contexts.

Regarding prior contact with environmental topics in the school setting, 41 students reported having addressed it only in a formal way, while 21 reported not remembering such contact. In addition, 14 stated they

had never studied the topic, 13 indicated having participated in practical activities, field trips, or visits, six reported experiences through projects, and one participant did not answer the question (Figure 10).

Figure 10. Students' prior contact with environmental topics in the school setting.

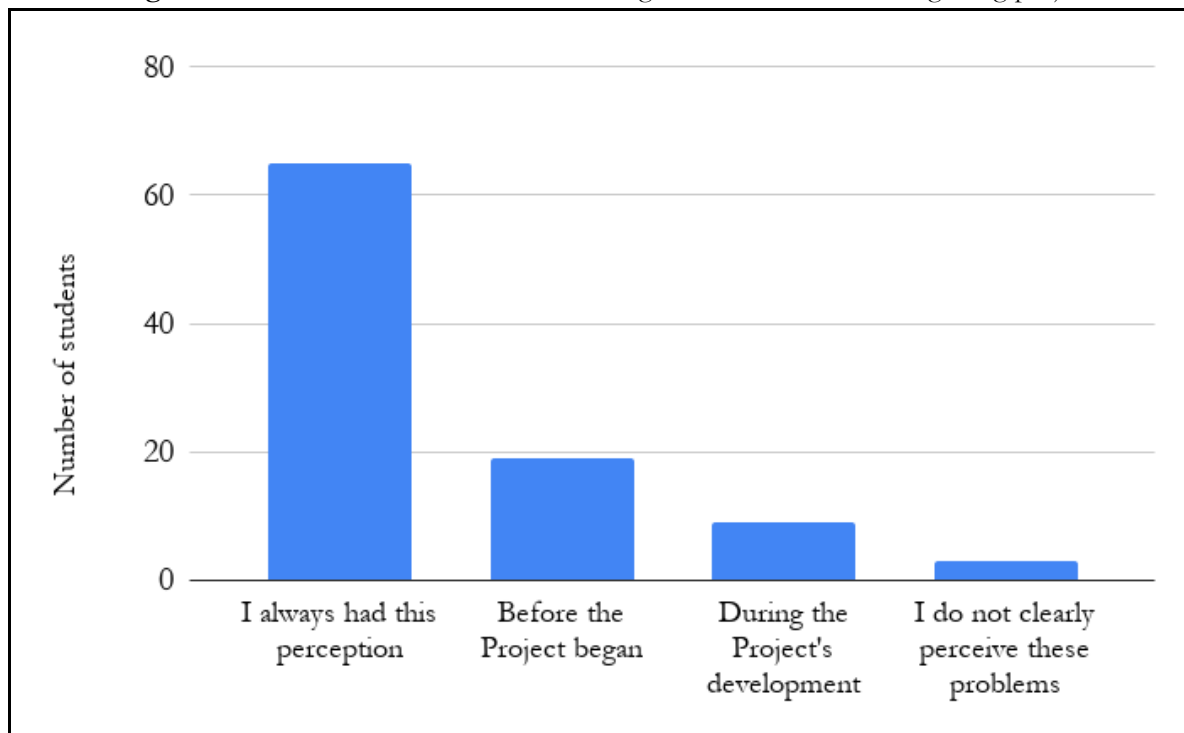


Source: The authors, 2026.

The fact that most students had contact with environmental topics only in a formal way, and that a significant portion (14) had never worked on the topic, reinforces the relevance of initiatives such as the integrating project, which offers a more active and contextualized approach. Environmental topics should be addressed in an integrated manner, articulated with different subjects in the school curriculum, as established by the National Environmental Education Policy and the BNCC (Reis *et al.*, 2022; Rodrigues *et al.*, 2023).

Regarding the evaluation of the teaching method adopted in the integrating project, the option most frequently selected by students was “provided better understanding than the traditional method,” with 55 responses, followed by “sparked critical thinking and creativity” (49), “provided greater integration among students” (21), and “did not improve learning” (10) (Figure 11).

The predominantly positive evaluation by students reaffirms the findings of Brod & Duarte (2022), who found that project-based learning in high school, applied in an interdisciplinary manner, enabled the integration of the content addressed with students' daily lives, in addition to fostering collaborative work. The small number of students who did not perceive any improvement in learning (10) indicates that the integrating project was well received by the vast majority of participants.

Figure 11. Students' evaluation of the teaching method used in the integrating project.

Source: The authors, 2026.

The open-ended questions sought to identify which actions students would like to see implemented in the community and which factors they considered necessary to increase population involvement in environmental conservation. The responses were grouped into thematic categories, presented in Table 2.

Table 2. Students' responses to the open-ended questions.

Category	Example
Waste collection and disposal	"More waste collection," "Put trash where it belongs," "Selective collection"
Urban cleaning	"Street cleaning," "Community clean-up drives," "Trash collection"
Urban infrastructure	"Fix the sewage system," "Paving," "Improve plumbing"
Environmental education	"Lectures," "More study," "School projects"
Awareness-raising	"Greater awareness," "Compassion for the future," "Common sense"
Campaign dissemination	"More information," "Advertising," "Public outreach"
Community participation	"Unity," "Community actions," "Everyone helping each other"

Source: The authors, 2026.

It was observed that most responses related to improved waste collection and disposal, as well as the need for greater environmental awareness among the population. This result is consistent with the study by Sousa, Silva & Rodrigues (2023), who observed a significant change in students' responses following an educational intervention on solid waste in São Luís (MA), highlighting the importance of environmental education in schools for fostering more critical citizens.

In addition, specific suggestions were made for carrying out educational actions and expanding the dissemination of information on the topic. Needs for improvements in urban infrastructure, including basic

sanitation and paving, were also mentioned, showing that students understand the relationship between environmental conditions and quality of life.

Overall, the results indicate that students have an initial critical perception of the municipality's environmental issues, albeit with gaps regarding more specific aspects of basic sanitation, such as sewage treatment and urban drainage. These data reinforce the importance of initiatives such as the integrating project in fostering more active and participatory environmental awareness.

4 CONCLUSION

The results showed that most students have a prior perception of the environmental problems in their neighborhood, with particular emphasis on improper solid waste disposal and open sewage, directly related to the inefficiency of basic sanitation in the municipality. The attribution of shared responsibility among the population, public authorities, and businesses demonstrates that young people have an initial critical understanding of environmental management, although a deeper understanding of more specific dimensions of sanitation, such as urban drainage and sewage treatment, still needs to be developed.

It was observed that the integrating project contributed to changing the perceptions and habits of nearly 65% of students, in addition to fostering the sharing of environmental knowledge with family and friends, extending the reach of the activity beyond the school setting. Students' positive evaluation of the method, which highlighted better understanding compared to traditional teaching and the awakening of critical thinking, reaffirms the potential of active methodologies and integrating projects as tools for developing environmental education.

On the other hand, the fact that the internet was identified as the main source of environmental information, ahead of school, indicates the need to strengthen the approach to this topic in the school environment in a continuous and integrated manner, articulated with different subjects, as established by the PNEA and the BNCC. Likewise, the 35.1% of students who did not perceive any change after the project indicates that isolated actions, although relevant, must be accompanied by more continuous and integrated educational actions.

In this sense, environmental education proves indispensable for training aware and engaged citizens, capable of understanding socio-environmental aspects and contributing to the transformation of their reality. For this to be effective, public authorities need to develop and strengthen public policies that ensure the permanent inclusion of environmental topics in the school curriculum, with investment in teacher training, teaching materials, and adequate infrastructure. In addition, basic sanitation policies must go hand in hand with educational actions, since the problems identified by students, such as improper waste disposal and open sewage, reflect structural shortcomings that have slowed the attention given by municipal and state authorities.

Thus, it is important to highlight the need for educational actions focused on basic sanitation and environmental conservation to be permanently incorporated into the school curriculum, valuing the contextualization of content based on students' local reality and encouraging young people's active participation

in the search for solutions to the socio-environmental problems of their community. This aspect could be explored in future research with a larger number of participants, assessing the long-term impacts of these practices on young people's development.

Finally, this study contributes to a better understanding of local characteristics related to basic sanitation and environmental topics in Pelotas, providing data that can support the planning of more effective public policies and educational actions. Strengthening initiatives such as the integrating project, combined with public authorities' commitment to sanitation and environmental education, is an indispensable strategy for building more critical, aware, and engaged cities, contributing effectively and contextually to the advancement of the Sustainable Development Goals.

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Conflicts of interest

The authors declare that there are no conflicts of interest. All authors are aware of the submission of this article.

Author contributions

Isadora Rasera Silveira: data collection, data curation and writing; Lauren de Arrial Lovato: data collection, data curation and writing; Maria Vitória Rebelo Vieira: data collection, data curation and writing; Érico Kunde Corrêa: formal analysis and supervision; Luciara Bilhalva Corrêa: formal analysis and supervision

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