

COMPOSTING AS AN ENVIRONMENTAL EDUCATION TOOL: A PRACTICAL WORKSHOP WITH STUDENTS FROM THE FEDERAL INSTITUTE OF MARANHÃO

 <https://doi.org/10.63330/aurumpub.073-005>

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Abstract

The growing generation of municipal solid waste represents a significant environmental challenge, particularly in urban areas. Composting has emerged as an effective alternative for managing the organic fraction of this waste by transforming it into high-quality fertilizer. This study aims to assess the impact of a practical home-composting workshop held at the Federal Institute of Maranhão on the development of environmental awareness among high school students. The methodology included a theoretical

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introduction to composting, followed by the group assembly of compost bins using recyclable materials and organic waste from the school cafeteria. The results show that the students broadened their understanding of composting and its importance in reducing waste. The sharing of results enabled discussions about the benefits of the practice and critical reflection on the use of chemical inputs. The workshop integrated knowledge from Chemistry, Agricultural Sciences, and Geography, enriching the students' experience and fostering a proactive attitude toward sustainability. In conclusion, the workshop not only provided technical learning but also developed meaningful environmental awareness, demonstrating the students' ability to mobilize sustainable actions within their communities. Composting therefore constitutes a powerful tool for Environmental Education.

Keywords: Composting, Environmental awareness, Environmental education, Solid waste, Sustainability.

INTRODUCTION

The growing generation of municipal solid waste represents one of the major environmental challenges of the twenty-first century, particularly in urban areas, where the improper management of these materials can result in serious public health problems and environmental degradation.

According to Monteiro (2016), “[...] composting is a dynamic process through which organic matter is transformed by living organisms and is also influenced by ideal conditions of moisture, temperature, aeration, and light.” In this context, composting has emerged as an effective alternative for managing the organic fraction of waste, not only reducing the volume of refuse sent to landfills but also transforming this waste into high-quality fertilizer. The practical home-composting workshop held at the Federal Institute of Maranhão (Instituto Federal do Maranhão - IFMA) sought to explore and implement this technique among high school students, providing an educational experience that combined theory and practice.

This project is justified by the need to develop environmental awareness among young people and encourage them to adopt sustainable practices that can be replicated in their communities. The National School Feeding Program (Programa Nacional de Alimentação Escolar - PNAE), whose guidelines promote family farming and food education, provides a pathway for incorporating composting into educational institutions and broadening the positive impact of this practice.

The general objective of this study is to assess the impact of a practical home-composting workshop held at the Federal Institute of Maranhão on the development of environmental awareness among high school students. Specifically, the objectives are to: (I) present the fundamental concepts of composting and its environmental importance; (II) provide a practical experience in assembling compost bins; (III) promote discussion of the benefits of composting and sustainable waste management; and (IV) encourage critical reflection on the use of chemical inputs and environmental responsibility.

Through this interdisciplinary approach, involving fields such as Chemistry, Agricultural Sciences, and Geography, the students are expected not only to acquire technical knowledge but also to develop a proactive attitude toward sustainability, thereby contributing to a more responsible and environmentally conscious future.

THEORETICAL FRAMEWORK

The increase in municipal solid waste generation and the limited capacity of sanitary landfills entail high maintenance costs, making it urgent to disseminate and implement household composting and encourage families to reduce the disposal of food scraps. Waste management should be preventive and multidisciplinary, with shared responsibility, and composting constitutes a simple and effective alternative that transforms organic matter into compost rich in humus and nutrients. Factors such as oxygenation, moisture, and temperature influence the process, which must prevent contamination by unsuitable materials such as batteries and plastics. The result is a nutrient-rich fertilizer that improves the soil, reduces the amount of waste sent to landfills, and fosters environmental citizenship. Household

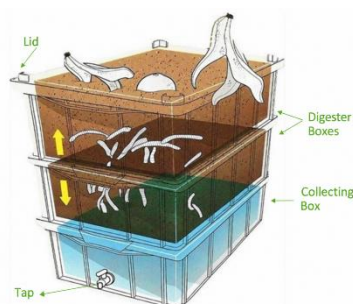
composting is therefore both feasible and sustainable and contributes to environmental conservation, provided that it is supported by public policies and changes in habits (Pereira; Gonçalves, 2011).

Law No. 12,305/2010, known as the National Solid Waste Policy (Política Nacional de Resíduos Sólidos - PNRS), aims to implement significant changes in solid waste management in Brazil, stipulating that these materials must be sent for recycling and composting.

According to Oliveira and Fernandes (2018), composting is a biological process that recycles organic matter from animal and plant waste, generating organic compost that improves soil structure and reduces the amount of waste sent to landfills. This method gives agricultural, industrial, and household waste a useful destination and promotes soil fertility without posing environmental risks. The practice, which may include vermicomposting with earthworms, transforms organic waste into humus and leachate, both of which are rich in nutrients. Although composting has traditionally been used in rural areas, it is expanding into urban environments, where residents can help reduce organic waste and promote more sustainable waste management. Figure 1 shows a compost bin.

Figure 1

Assembly of a compost bin.



Source: Oliveira; Fernandes, 2018.

There are several ways to assemble a compost bin, which can be adapted to the space available. On a small farm or in a yard with exposed soil, for example, waste can be arranged in windrows. In smaller spaces, such as apartments, cans, drums, plastic containers, or even used tires can be employed for composting (Santos, 2007).

Ferreira, Borba, and Wizniewsky (2013) emphasize that home composting is a viable alternative for treating organic waste because it is a natural process of biological decomposition that can be controlled and managed, resulting in high-quality organic fertilizer for home gardens. In addition to composting, encouraging households to establish gardens is essential to promoting the production and consumption of healthier food. Several other points are presented in Table 1.

Table 1

Key aspects of household composting of organic waste.

Aspects	Descriptions
Environmental problem	Growing generation of solid waste in Brazil (63 million metric tons/year), low recycling rate (only 3%), and improper disposal, which causes environmental impacts such as pollution and methane emissions from landfills.
Definition of composting	Natural process of aerobic decomposition of organic matter, mediated by microorganisms and invertebrates, which returns nutrients to the soil and reduces environmental impacts.
Socioenvironmental benefits	- Reduces public collection costs; - Reduces resource waste; - Extends the useful life of landfills; - Reduces soil, water, and air pollution; - Recycles nutrients; - Produces fertilizer for home gardens; - Strengthens social and environmental responsibility.
Final product (organic compost)	Material rich in humus that is light, dark, and nutritious for plants; improves the soil's physical, chemical, and biological properties; increases water and mineral salt retention; and, unlike synthetic fertilizers, does not contaminate the soil or plants.
Technical aspects of composting	- Ideal C/N ratio: approximately 30:1; - Need for oxygen (aeration); - Moisture of approximately 50%; - Temperature control; - Fragmentation of waste to accelerate decomposition.
What can be composted	Fruit, leafy vegetable, other vegetable, and root scraps; coffee grounds; tea bags; eggshells; manure from herbivorous animals; dry leaves; untreated sawdust; among other materials.
What should not be composted	Meat, bones, fat, dairy products, human or pet feces, cooked and salted foods, toilet paper, chemicals, metals, plastics, glass, among other materials.
Forms of use	- Solid compost: fertilizer for vegetable gardens, orchards, and ornamental gardens; - Liquid compost: diluted biofertilizer for irrigation; - Possibility of household use, community exchange, or even sale of the surplus.
Environmental Education	Involvement of families, children, and communities to strengthen sustainable practices, conscious consumption, and collaborative networks in support of sustainability.

Source: Monteiro, 2016; adapted by the authors (2025).

Home composting is a sustainable solution that helps mitigate the effects of waste accumulation by converting organic matter into a humus-rich fertilizer that enriches the soil without harming the environment. In addition to reducing costs and waste, this practice extends the useful life of landfills,

provides social and environmental benefits, and promotes Environmental Education by engaging families and communities in responsible consumption and the pursuit of sustainability.

With increasing residential waste generation in urban areas, home composting constitutes a viable solution for managing the organic fraction of this waste at its source (Wangen; Freitas, 2010). This raises the following question: why not expand this practice to schools and universities?

The National School Feeding Program is Brazil's oldest public policy focused on Food and Nutrition Security (Segurança Alimentar e Nutricional - SAN). In recent years, it has gained prominence through significant advances, including the decentralization of service provision, universal access, support for family farming, and the inclusion of food education initiatives in schools (Brambilla; Matsushita, 2014). Through this program, composting practices can be implemented in educational institutions, provided that its guidelines are observed.

METHODOLOGY

The practical home-composting workshop was structured in two main stages. In the first stage, high school students from the Federal Institute of Maranhão participated in a theoretical introduction in which they were presented with the fundamental concepts of composting, including the decomposition of organic waste and the environmental importance of this practice. This stage also included dynamic interaction designed to foster student engagement.

The practical component followed. The 26 participants were divided into five groups, resulting in groups with nearly equal numbers of members. Each group received recyclable containers that served as compost bins and assembled these structures by hand. In an outdoor setting, they used organic waste from the school cafeteria while observing the necessary precautions, such as avoiding acidic products.

After assembly, the compost bins were taken back to the classroom, where the results were shared and final considerations were presented. Thus, the students not only learned about composting but also developed environmental awareness by applying their knowledge in practice, as shown in Figure 2.

Figure 2

Mosaic of the stages involved in conducting the composting workshop.

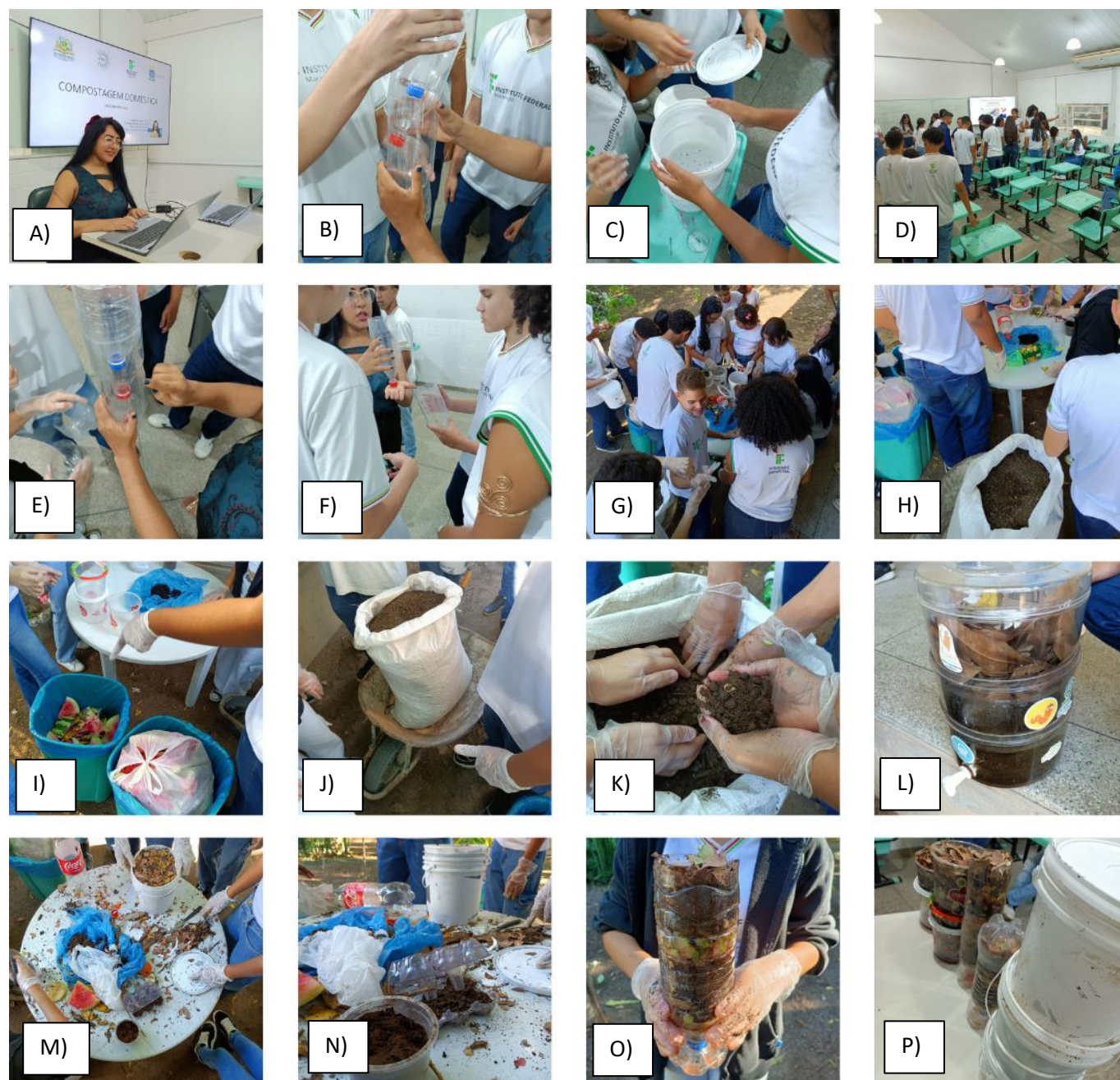


Figure 2A – Presentation on household composting; Figure 2B – Preparation of the PET bottle for the experiment; Figure 2C – Organization of the materials in buckets; Figure 2D – Classroom prepared for the composting workshop; Figure 2E – Cutting and adaptation of the PET bottle; Figure 2F – Initial assembly of the composting system; Figure 2G – Students gathered for the outdoor practical activity; Figure 2H – Separation of organic waste; Figure 2I – Proper disposal of waste; Figure 2J – Transportation of organic fertilizer in a burlap sack; Figure 2K – Analysis of soil and organic matter; Figure 2L – Sample compost bin for the students; Figure 2M – Separation of waste on the worktable; Figure 2N – Mixing of composting materials; Figure 2O – PET bottle used as an individual compost bin; Figure 2P – Display of containers with finished compost. Source: The authors (2025).

From the perspective of Chemistry, the workshop was grounded in the study of organic matter decomposition processes, with an emphasis on the biochemical reactions that transform waste into nutrients and humus. Factors such as chemical equilibrium, temperature, moisture, and the activity of microorganisms were considered. In Agricultural Sciences, composting was approached as a sustainable management practice through which the fertilizer produced can enrich the soil, reduce dependence on chemical inputs, and strengthen more balanced production systems. Finally, in Geography, emphasis was placed on the socio-spatial and environmental dimensions of the practice, highlighting proper solid waste management, the mitigation of environmental impacts, and the promotion of sustainability within school and community settings. The activity thus integrated the three fields through an interdisciplinary approach, providing both a scientific understanding and the practical application of knowledge.

RESULTS AND DISCUSSION

The results and discussions arising from the study of the practical home-composting workshop at the Federal Institute of Maranhão provided significant insights into the students' knowledge and experience. During the theoretical introduction, the students were presented with the fundamental concepts of composting and organic waste decomposition, which broadened their prior knowledge and sparked their interest in participating in related projects. During the practical component, the 26 students, divided into five groups, assembled compost bins using recyclable containers and organic waste from the cafeteria. This hands-on experience enhanced their understanding of the feasibility of implementing composting systems.

Furthermore, sharing the results in the classroom enabled the students to discuss the benefits of composting and recognize its importance in reducing waste and improving the soil. The workshop also addressed the students' views on pesticide use, with many expressing a critical stance toward chemical inputs, which was consistent with the environmental responsibility observed throughout the activity. The integration of Chemistry, Agricultural Sciences, and Geography further enriched the experience, allowing

the students to understand the biochemical reactions involved, the importance of sustainable management, and the proper management of solid waste.

The workshop therefore not only provided theoretical and practical learning but also fostered meaningful environmental awareness among the students, highlighting their willingness to mobilize initiatives for reusing organic waste and promoting sustainability within the school community.

CONCLUSIONS

Conducting composting activities in the classroom can be challenging for students, but it also provides a highly valuable learning experience. In addition to learning about the composting process, students come to understand the importance and value of food, realizing that even simple materials can be reused rather than merely discarded. This knowledge can also extend beyond the school, as students can take what they have learned home and share it with their families, thereby broadening the reach of the learning experience. In this way, the activity demonstrates how these materials can be transformed and returned to nature in a useful form. Composting therefore contributes not only to student learning but also to environmental awareness by demonstrating that everything can be transformed.

Home composting can be adapted for different grade levels in basic education, rather than being limited to high school. Workshops can incorporate field activities and hands-on learning using materials already available on school grounds, such as leaves, branches, banana plant stems, and small pieces of wood. Students can also be taught to transform this organic waste into humus for school gardens. The process includes selecting a suitable location and opening a pit in the soil or using a composting container to facilitate decomposition. It relies on support from the entire school staff and may involve not only the students but also external partners, including the Municipal Department of the Environment, families, and the community at large. This collective effort helps raise awareness of the importance of reusing organic waste through composting.

The practical home-composting workshop held at the Federal Institute of Maranhão proved to be an effective initiative for promoting environmental awareness among high school students. By integrating theory and practice, the students not only learned about the fundamental concepts of composting but also directly experienced the benefits of this sustainable practice.

In summary, the workshop demonstrated that artisanal composting constitutes an effective teaching strategy for connecting scientific knowledge and socioenvironmental responsibility with the realities experienced in the school setting. Discussions of waste management moved beyond the abstract and gave way to a practical understanding of the matter cycle and sustainable soil management, fostering youth agency both within the Federal Institute of Maranhão and in the surrounding community. The continuous institutionalization of these initiatives within the curriculum and school routines is therefore recommended to ensure that technical learning develops into lasting habits of conservation and ecological citizenship.

The results indicate that the students broadened their understanding of the importance of composting for waste reduction and improvements in soil quality. Critical reflection on the use of chemical inputs and the proper management of solid waste was a positive aspect that emerged from the classroom discussions. This interdisciplinary approach, involving Chemistry, Agricultural Sciences, and Geography, enriched the students' experience and strengthened their ability to implement sustainable initiatives in their communities.

Moreover, composting not only helps reduce the amount of waste sent to landfills but also promotes broader social and environmental responsibility. By engaging students and their families, it is possible to create a virtuous cycle of awareness and action in support of sustainability.

In this regard, the experience demonstrates the importance of connecting Environmental Education (Educação Ambiental - EA) with situations that students encounter in their daily lives. By transforming organic waste generated within the school itself into a useful resource, composting makes it possible to relate scientific knowledge to tangible environmental problems and may help students

understand their role in reducing waste and developing more sustainable practices inside and outside the school.

In light of the evidence presented, it is recommended that similar workshops be continued and expanded to other educational institutions and that composting practices be incorporated into educational policies such as the National School Feeding Program. In this way, composting can be consolidated as a powerful Environmental Education tool that empowers young people to become agents of change in their communities.

Composting projects thus enrich learning because they extend beyond instruction within the school environment and provide a foundation for educating environmentally responsible citizens. By directly experiencing the transformation of waste into nutrients, students develop a different understanding of the matter cycle, prompting them to reconsider resource use in their homes. This brings schools and communities into closer dialogue and strengthens educational institutions as genuine ecosystems of socioenvironmental innovation. In this context, teaching practices fulfill Environmental Education guidelines, sow knowledge within communities to encourage sustainable attitudes, and contribute to environmental conservation.

The experience also demonstrates that composting can be incorporated continuously into daily school life rather than being limited to a one-time activity. The use of recyclable materials and organic waste generated by the institution itself shows that simple initiatives can contribute to the development of educational practices focused on reducing, reusing, and properly disposing of waste. In this regard, schools can play an important role in developing sustainable habits by enabling students to apply the knowledge they acquire in different social settings.

Finally, the workshop reinforces the importance of methodologies that connect school content with situations experienced by students, fostering more meaningful and participatory learning. By integrating scientific knowledge, management practices, and environmental and social issues, composting constitutes a strategy capable of strengthening Environmental Education through an interdisciplinary

approach. The continuation of these initiatives can therefore help increase student participation, engage the school community, and encourage responsible attitudes toward the generation and disposal of organic waste.

It is concluded that classroom composting constitutes an important Environmental Education tool, providing students with a meaningful, hands-on experience in the reuse of organic waste. The activity helped them understand that materials previously discarded can be transformed into useful resources for soil and plants. Furthermore, the knowledge acquired can extend beyond the school setting and be shared by students with their families and communities. The practice can also be adapted to different grade levels and school spaces using materials available in the immediate environment. Composting therefore helps reduce waste, promote the value of natural resources, and develop sustainable attitudes. The integration of Chemistry, Agricultural Sciences, and Geography broadened the students' understanding of the process. Composting thus constitutes a simple, educational, and effective strategy for promoting environmental awareness in the school context.

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