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COLLABORATIVE COMMUNITIES OF SOCIO-ENVIRONMENTAL RESPONSIBILITY: LEARNING AND SOCIAL TRANSFORMATION DYNAMICS IN DETENTION CENTERS MEDIATED BY EDUCATIONAL DIGITAL TECHNOLOGIES

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ABSTRACT: This study explores the dynamics of learning and social transformation in detention centers, focusing on the 'Rota da Compostagem' project. The initiative promotes social reintegration, environmental sustainability, and income generation through education, composting, and family entrepreneurship. The general objective of the study was to analyze how these practices contributed to social transformation and environmental sustainability, adapting to the needs of different audiences. The methodology adopted was a case study, structured in three phases: (1) initial training in composting, combining theory and practice; (2) practical development with the production of organic compost and derived products; and (3) technical support for the creation of family-managed businesses, based on the family entrepreneurship model. The project received support from the National Penitentiary Fund (FUNDOPEN), in accordance with Law No. 7.210/1984, and utilized Educational Digital Technologies (EDT) to disseminate content in environments with restricted internet access. The results indicate that the project trained inmates in sustainable practices and enabled the creation of family microenterprises, promoting economic autonomy and community strengthening. In addition, it reduced recidivism and promoted social inclusion. It is concluded that 'Rota da Compostagem' is an effective model for learning and creating opportunities, with the potential to be replicated in other institutions, expanding its benefits.

Keywords: Educational Digital Technologies (EDTs), composting, social reintegration through education, family entrepreneurship, environmental education.

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INTRODUCTION

This case study explores the dynamics of learning and social transformation that occurred in several cities in Brazil and abroad. The 'Rota da Compostagem' project started in the city known as Matão/SP - Brazil, with 79. 033 inhabitants (Instituto Brasileiro de Geografia e Estatística [IBGE], 2022), where since 2020 a teaching practice on home composting has been carried out, led by a group of organized civil society, known as Rotary Club, the Superintendência de Água, Esgotos e Meio Ambiente de Votuporanga - SAEV, and a company called Zelo Ambiental, to promote an efficient management of organic waste and its conversion into natural compost, it seeks to promote sustainable practices both at the domestic and community level. This initiative not only contributes to the reduction of greenhouse gas emissions and the reduction of the amount of waste sent to landfills, but also strengthens environmental education, boosts the circular economy, and stimulates the active participation of citizens in actions of socio-environmental responsibility (SAEV, 2024), as shown in Figure 1.

Figure 1

Plant Composting Project

Note. Archive image of Zelo Ambiental, 2024.

During the interview, the creator of the 'Rota da Compostagem' project reported that, among the main results, the following stand out (free translation):

> [...] popularize the use of home composting, which can ensure a considerable reduction of waste generated in households, generating savings for the municipality, which will collect and treat less garbage, in addition to the resident obtaining a fantastic fertilizer for their plants and vegetables (Rotary Club de Matão, 2021).

The project is recognized by other actors of the organized civil society, such as the Federação das Indústrias de São Paulo (FIESP), chapter Limeira/SP - Brazil, which awarded the initiative, as reported on the Acomarcanet site (Schiavetto, 2021, free translation), where it is mentioned that "o Rotary de Matão was awarded in the category ‘Services’ thanks to the project ‘Rota da Compostagem’ that stimulates the practice of vegetable composting in households. More than 100 families participate in the project [...]", as shown in Figure 2. Likewise, in the city of Limeira/SP - Brazil, with 310,783 inhabitants (IBGE, 2022), the project took another direction, being taken to the inmates' recovery houses, where, through learning the practice of organic waste composting, it seeks the professionalization of inmates in the parole stage, in line with the Lei de Execução Penal N. 7.210 of 1984, which provides for the reduction of sentences for inmates involved in labor and educational activities, offering them an opportunity for personal, social and labor re-signification. This project follows the same line of others carried out in penal establishments, such as in the Colônia Penal Agrícola de Santa Izabel, in the Região Metropolitana de Belém/PA - Brazil (Agência PARA, 2019). Composting, in this context, becomes a powerful means for the creation of new life opportunities for those seeking to rebuild their trajectories, simultaneously strengthening community cohesion and resilience, as pointed out by Wenger (1998), when describing communities of practice as a means for learning and social integration, and as described by Freire (1970) in his pedagogical theory on liberating education, which seeks to transform the lives of individuals and society.

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Figure 2

Rota da Compostagem' Project Award Ceremony

Note. Image from the Zelo Ambiental archive, 2021.

The ‘Rota da Compostagem’ project, in June 2024, participated in the 1st Latin American Meeting on Composting and its Impact on the Environment, where the possibilities for action in learning communities in other Latin American countries were discussed, see Figure 3. The international expansion of these initiatives amplifies their impact, demonstrating that composting can be a viable and effective model for promoting sustainability and social justice on a global scale (Ellen MacArthur Foundation, 2013).

Figure 3

International meeting on composting practices

Note. Image from the Zelo Ambiental archive, 2024.

Therefore, it can be stated that composting is not only considered an environmental solution but also a tool for social inclusion and a pillar of the circular economy. According to Ellen MacArthur Foundation (2013), the circular economy seeks to redefine local growth by focusing on positive benefits for society as a whole, reducing waste, and regenerating natural systems. In this context, the practice of composting transforms organic waste into valuable resources, closing the cycle of production and consumption and contributing to the transformation of community members.

Also, according to Law No. 12,305 of 2010, which establishes the Política Nacional de Residuos Sólidos (PNRS), composting is an essential practice for the proper management of organic waste and for the promotion of environmental sustainability. The circular economy, according to Stahel (2019), integrates perfectly with this vision by promoting the reuse and regeneration of natural resources, minimizing environmental impact, and maximizing economic and social value, as shown in Figure 4. The teaching project on practices associated with composting applied in these communities exemplifies how sustainable practices can be integrated with social initiatives to promote both environmental sustainability and social inclusion and development.

Figure 4

Organic Material, Composting and Composting

Note. Image from the Zelo Ambiental archive, 2024.

This practical approach, validated in different contexts, not only demonstrates its effectiveness but also serves as an example of how applied knowledge can transform communities, boost local economies, and create a more sustainable future for all.

DEVELOPMENT

Online and face-to-face education

When referring to the composting learning project in the Limeira/SP - Brazil Detention House, the aim is to expand the scope of this initiative to other detention houses anywhere in the world, since, mediated by Digital Educational Technologies (TEDs) (Altmann et al., 2024), it will have no limits of scope (Lévy, 1995, 1997, 2001).

The project obtained Brazilian government support and became partially financed by the Fundo Penitenciário Nacional (FUNDOPEN), which, according to Law No. 7,210 of 1984, can be used to promote the training and social reintegration of inmates. These funds, which come from fines and bails imposed for minor offenses, are intended to finance workshops and courses within the inmates' recovery houses, guaranteeing access to materials and

instructions necessary for their education and reeducation (Lei 7.210, 1984). The effective management of these resources underscores the importance of investing in programs that promote social reintegration, reduce recidivism, and generate a positive impact on the community.

The project is structured in three phases, as illustrated in Figure 5: (1) opening of the enterprise (including an analysis of the market and potential consumer); (2) training in composting processes and their application in the production of organic products; and (3) monitoring of business activities. The basis for the opening of the enterprises was based on family entrepreneurship plans (FEP), supported by authors such as Peris-Ortiz et al. (2016); Poutziouris (2007); Zellweger (2017) and Calabrò et al. (2017), since, although inmates have authorization to open an enterprise, due to their condition of restriction of freedom, the management of these enterprises falls on family members or close people.

Figure 5

Phases of the project 'Rota da Compostagem'.

Note. Own elaboration.

For this reason, the adoption of Educational Digital Technologies (EDT) is of utmost importance to make the contents taught accessible to those who did not participate in the course inside the detention houses (Bates, 2015). In these cases, given that in detention houses internet access is not always available, the contents are offered on offline computers, allowing viewing videos, photos, and using spreadsheets for learning calculations related to business topics. For business 'partners' who are not in deprivation of liberty, content is

available on all types of digital media, local or remote (Salmon, 2000), organized in computer-mediated educational learning environments (Garrison and Kanuka, 2004).

The use of educational digital technologies (EDT) in learning composting

In contemporary times, the integration of digital technologies in learning environments has changed the way in which knowledge is transmitted. According to Altmann et al. (2024), Educational Digital Technologies (EDT) have a direct influence on the implementation of new pedagogical practices, as well as on educational dynamics, providing a more dynamic learning.

Furthermore, according to the same authors, EDTs have the potential to promote the personalization of teaching, allowing content to be adapted to the needs and pace of each student. Tools such as online teaching platforms and educational applications not only diversify the means of access to knowledge but also facilitate interaction and collaboration between students and teachers, regardless of geographical barriers.

This technological integration also plays a crucial role in the development of 21st-century skills such as critical thinking, problem solving, and digital literacy, preparing students for the challenges of an increasingly connected and dynamic world (World Economic Forum [WEF], 2022). However, for these technologies to be fully effective, educators must be trained to use them strategically and intentionally, promoting not only the use of the tools but also the actual transformation of pedagogical practices. Therefore, EDTs should not be considered only as instruments to support traditional teaching, but as central elements in the construction of learning ecosystems that are more inclusive, interactive, and aligned with the demands of contemporary society (Altmann et al., 2024).

The Composting Courses initiative as an Educational Process

The design of educational processes for the contexts presented seeks to facilitate the acquisition of key competencies that promote autonomy, social inclusion, and resilience. In this context, Freire (1970), with his focus on liberating education, provides an essential foundation by promoting an education that emancipates and empowers individuals to become active agents of their development. The transformative learning theory proposed by Mezirow

(1991) complements this vision, emphasizing the importance of critical reflection so that participants can reconfigure their life perspectives and achieve meaningful social reintegration.

The study also benefits from the theory of communities of practice proposed by Wenger (1998), which highlights the importance of collaborative learning and a sense of belonging, fundamental elements in social reintegration, where community support and shared learning are crucial. In addition, the theory of multiple intelligences proposed by Gardner (1983) offers an enriching perspective, suggesting that programs should be designed to address the diverse abilities of individuals, promoting more personalized and effective learning.

The ethical and spiritual dimension of the project is enriched by the inclusion of Pope Francis' encyclical Laudato Sí' (Francisco, 2015), which stresses the importance of environmental responsibility and social justice as pillars of any educational and productive initiative. Pope Francisco (2015) highlights the need to care for our "common home" and calls for an integral and solidary ecological conversion, principles particularly relevant in the context of this social reintegration project, where the production of organic compost is aligned with the promotion of sustainable practices and the generation of income for a dignified life.

In addition, this initiative seeks to integrate the green competencies promoted by United Nations Educational, Scientific and Cultural Organization - UNESCO (2024a, 2024b), which include critical thinking and problem-solving skills related to environmental sustainability, the ability to work collaboratively, and awareness of the ecological impacts of human activities. These competencies are essential to train participants not only in the production of organic compost but also in the adoption of sustainable practices that benefit their communities and the environment.

Goffman (1961) also contributes to the conceptual framework by highlighting how total institutions, such as prisons, can affect the identity of individuals. This analysis is crucial to understanding the challenges individuals face in attempting to rebuild their lives outside of confinement, a process that is addressed through the transformative, community-based education mentioned above.

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Finally, research conducted by Blazich (2007) on education in incarceration contexts highlights the importance of developing educational programs that consider the structural and social barriers faced by these populations. Their focus on the challenges and opportunities present in these contexts reinforces the relevance of adapting pedagogical practices to the specific needs of individuals.

METHODOLOGY

The 'Rota da Compostagem' initiative was analyzed using the case study approach proposed by Yin (2018). This methodology is particularly effective for exploring contemporary phenomena in depth and within their real contexts, especially when the boundaries between phenomenon and context are not clearly defined. The project, initiated in Matão/SP - Brazil, is a representative example of how composting practices can integrate environmental sustainability, social inclusion, and local economic development, achieving significant impacts in different communities.

According to Yin (2018), the case study is suitable for answering "how" and "why" questions, allowing a detailed analysis of complex phenomena. The choice of this approach is justified by the interest in understanding how the practice of home composting, led by local organizations and supported by private companies, transformed the socioeconomic dynamics of Brazilian and international communities.

For the development of the study, a qualitative approach was adopted based on documentary analysis and indirect observation of the actions carried out within the framework of the initiative. Institutional materials, technical reports, informative content, audiovisual records, and publications in digital media produced by the actors involved in the project were collected and examined. This documentation was organized and analyzed using content analysis techniques, which made it possible to identify patterns, emerging categories, and significant dynamics related to sustainability, community participation, and the circular economy. The methodological procedure was aligned with the case study approach proposed

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by Yin (2018), allowing a deep understanding of the phenomenon in its real context, without direct intervention of the researcher.

The project was studied in two main scenarios, first, in Matão/SP, where it promoted the reduction of organic waste, the creation of community gardens and the sale of compost as a complementary source of income. Second, in Limeira/SP, the initiative was extended to inmates' recovery houses, integrating the practice of composting with professionalization and social reintegration, by Lei de Execução Penal nº 7.210 of 1984. The overall aim of the study was to analyze how these practices contributed to social transformation and environmental sustainability, adapting to the needs of different audiences.

ANALYSIS AND DISCUSSION OF RESULTS|

The 'Rota da Compostagem' project presented significant results in the context of the detention houses where it was implemented, evidencing the positive impact of the combination of sustainable practices, transformative education, and family entrepreneurship (Venter et al., 2012). This section addresses the main results obtained, analyzing them from three main dimensions: technical and sustainable training, socioeconomic impact, and community transformation.

One of the most evident results was the technical training of inmates in composting practices and the production of organic inputs. During the first phase of the project, participants were introduced to the theoretical and practical basics of composting, learning about the proper management of organic waste, the natural degradation processes, and the environmental benefits of the compost generated. This training allowed the inmates to acquire knowledge applicable to both sustainable production and waste management.

In addition, the use of educational digital technologies (EDT) was essential to make learning feasible in an environment with connectivity restrictions. The availability of content through offline computers, with videos, spreadsheets, and interactive materials, facilitated access to information and ensured that participants could follow the activities even in adverse

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conditions. This format proved to be highly effective, maximizing learning and knowledge retention (Altmann et al., 2024).

The project also generated significant socioeconomic impacts by enabling the inmates, with the support of their families, to develop microenterprises based on the production and marketing of organic compost and derived products, such as natural fertilizers and medicinal herbs. The second phase of the project was devoted to the practical application of learning, with the development of products that meet local and regional market demands.

To make these activities viable, the businesses were structured following family entrepreneurship plans (FEP), ensuring that family members or people close to them assumed the management of the businesses, given the context of restriction of freedom of the inmates reclusos (Hamilton, 2011). This approach not only generated alternative sources of income for the families involved but also contributed to economic autonomy and the valorization of collective work.

The financial support of the National Penitentiary Fund (FUNDOPEN), provided for by Law No. 7,210 of 1984, was crucial to the success of the initiative, enabling the acquisition of materials, tools, and inputs necessary for the implementation of business activities. This support evidenced the potential of well-applied public policies to foster social and economic reintegration.

The impact of the project extended beyond the direct participants, promoting a significant transformation in local communities. Composting was adopted as a sustainable practice that not only reduces the amount of waste sent to landfills but also contributes to environmental regeneration and organic food production in community gardens. This sustainable practice strengthened community ties by bringing together different social actors around a common aim: environmental valorization and mutual support (Francisco, 2015).

Another relevant aspect was the recovery of the dignity of the participants, both inmates and family members, by enabling them to see themselves as active agents of change in their own lives and in their communities. This result is in line with the principles of transformative

education proposed by Freire (1970) and transformative learning proposed by Mezirow (1991), by encouraging critical reflections and the resignification of individual trajectories.

Through income generation and productive inclusion, the project demonstrated its potential to reduce criminal recidivism. By offering concrete opportunities for social reintegration, participants were able to envision a future outside the cycle of criminality, contributing to the construction of a more just and inclusive society. The adoption of innovative educational practices, such as active methodologies and EDT (Altmann et al., 2024), was essential for this process to be carried out effectively and sustainably.

The results achieved by the 'Rota da Compostagem' project highlight the effectiveness of integrative initiatives that combine environmental sustainability, transformative education, and entrepreneurship. The technical training, socioeconomic impact, and community transformation achieved show that well-structured educational practices can have a profound impact in contexts of deprivation of liberty. Moreover, replication of this model in other detention centers has the potential to scale up these benefits, promoting social reintegration, sustainability, and social justice nationally and globally.

CONCLUSIONS

The findings obtained allow us to affirm that the analyzed initiative promoted concrete transformations in the environmental and social practices of the communities involved, especially with regard to organic waste management, the valorization of local knowledge, and the articulation between public, private, and community actors. Evidence was identified of a formative and organizational process that transcends the technical dimension of composting, projecting itself as a territorial development strategy with an impact on the solidarity economy and the socio-environmental awareness of the participants.

Thus, the 'Rota da Compostagem' project proved to be a transformative initiative by integrating innovative educational practices, composting, and family entrepreneurship in detention houses. Through technical training, the strategic use of Educational Digital Technologies (EDT), and support for the development of micro-enterprises managed by

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family members, the project succeeded in promoting not only the social reintegration of inmates but also environmental sustainability and economic inclusion.

The results showed that composting, in addition to being an environmental solution, can be a central axis for rebuilding life trajectories and strengthening community ties. By empowering participants to manage waste sustainably and generate income from organic products, the project provided a perspective of autonomy and dignity for inmates and their families. The use of WBS, even in environments with restricted internet access, demonstrated that technology-mediated education can overcome structural barriers and expand the reach of learning. From these results, it is concluded that composting, integrated with training processes mediated by digital educational technologies, is a powerful tool to promote social reintegration, environmental awareness, and the generation of economic opportunities in vulnerable contexts. The analyzed experience reveals that well-articulated socio-environmental initiatives can activate individual and collective transformation processes, even in traditionally excluded spaces such as detention centers. Within this framework, we reaffirm the potential of socio-environmental education as a strategy for human development, capable of redefining identities, broadening horizons for the future, and strengthening the social fabric from a logic of inclusion, equity, and sustainability.

The replicability of the ‘Rota da Compostagem’ project in other institutions presents significant potential to positively impact diverse communities. The model not only reduces recidivism but also prepares individuals for productive reintegration into society, aligning the pillars of social justice, sustainability, and transformative education. Thus, it is concluded that projects such as this one are fundamental to promoting structural changes in contexts of vulnerability, contributing to a more sustainable, inclusive, and humane future.

Although the 'Rota da Compostagem' project has demonstrated significant impacts in terms of environmental sustainability, social inclusion and income generation, some limitations were identified that should be considered. First, the implementation in the detention houses faced challenges related to infrastructure and connectivity, which restricted the full use of Educational Digital Technologies (EDT). Although solutions such as the use of offline computers proved effective, the lack of internet access limited the reach of more advanced

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and interactive educational resources. Another relevant limitation was the dependence on public funding, especially from the National Penitentiary Fund (FUNDOPEN), for the acquisition of materials and supplies needed for the activities. This highlights the need to diversify funding sources, including partnerships with the private sector, to ensure long-term sustainability. In addition, replication of the model in other institutions may require significant adaptations due to the different socioeconomic and cultural conditions of each location.

Finally, the impact assessment relied primarily on qualitative indicators, such as participant narratives and direct observations. While these data offer valuable insights, the absence of a more robust quantitative analysis limits the generalizability of the results and the accurate measurement of the extent of the transformations promoted by the project.

Future research can focus on several key areas. For example, longitudinal studies could assess the sustainability of the impacts achieved, especially with regard to the social reintegration of inmates and the continuity of microenterprises run by their families. It would also be relevant to explore the development and implementation of technological solutions that are more accessible and adapted to environments with infrastructure constraints, which would further enhance the use of WBS. In addition, research on the feasibility of public-private partnerships and crowdfunding could offer alternatives to ensure the expansion and sustainability of similar initiatives in other contexts. On the other hand, studies that integrate pedagogical, social, and environmental aspects would allow a more holistic understanding of the transformations promoted by projects such as this one, analyzing how the different dimensions complement each other to achieve the proposed objectives. Finally, research dedicated to replicating the model in other countries or regions could identify the necessary adaptations and explore how cultural, economic, and political variables influence the implementation and results of the project. Addressing these issues will not only strengthen the existing model but also contribute to the development of more inclusive and sustainable public policies and educational practices. This research has the potential to consolidate composting as a transformative tool in contexts of vulnerability, promoting significant structural changes on a global scale.

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