

Teaching the Circular Economy in Schools: Contributions to Citizenship and the Sustainable Transition

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ABSTRACT

The discussion on the circular economy has gained increasing prominence in the educational field due to its direct relationship with the environmental, social, and formative challenges faced by contemporary society. Within the context of basic education, this debate is particularly relevant as it enables the articulation of curricular content, pedagogical practices, and values oriented toward sustainability and citizenship, thereby contributing to the development of critical and socially responsible individuals. For the development of the research, a qualitative approach was adopted, as it allows for an interpretative understanding of the meanings, concepts, and orientations present in the academic production analyzed. The methodological procedure employed was a bibliographic review, understood as a rigorous process of identifying, selecting, and critically analyzing scientific literature related to environmental education, the circular economy, interdisciplinarity, and citizenship education within the school context. The general objective of the study is to analyze how the teaching of the circular economy in basic education can contribute to citizenship formation and to the construction of a school culture oriented toward a sustainable transition. Overall, the analyses indicate that teaching the circular economy, when articulated with pedagogical practices and the dimensions of socio-environmental citizenship, promotes the development of a school culture committed to more responsible forms of interaction with the environment and with the community. By integrating strategies appropriate to the different stages of basic education, the theme proves capable of connecting curricular content, concrete experiences, and ethical values, contributing to the role of the school as a space for critical education and social engagement. Thus, the article demonstrates that the circular economy is not limited to a specific environmental topic, but rather is consolidated as a formative axis that engages with citizenship education and with the need to rethink social and educational practices in light of contemporary challenges.

Keywords: circular economy; basic education; citizenship; sustainability.

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I. INTRODUCTION

The increasing intensification of debates on sustainability has expanded the role of formal education in shaping individuals who are aware of the relationships between society, the economy, and the environment. Within this context, the circular economy emerges as a relevant educational framework, as it proposes practices oriented toward waste reduction, responsible use of natural resources, and the reorganization of modes of production and consumption. Integrating these concepts into everyday school life represents a concrete opportunity to bring students closer to contemporary problems and to promote critical reflection from the early stages of basic education.

In the school setting, the approach to the circular economy directly engages with environmental education and citizenship formation by encouraging values such as collective responsibility, care for the environment, and social participation. By articulating curricular content with contextualized pedagogical practices, schools can help children and young people understand sustainability not merely as a cross-cutting theme, but as a guiding principle for individual and collective attitudes capable of influencing community life.

For the development of this article, a qualitative approach was adopted, as it allows for an interpretative understanding of the meanings, concepts, and orientations present in the academic production analyzed. The methodological procedure employed was a bibliographic review, understood as a rigorous process of surveying, selecting, and critically analyzing the existing literature on the investigated topic, making it possible to map theoretical and educational contributions related to the teaching of the circular economy in basic education.

The general objective of the study is to analyze how the teaching of the circular economy in basic education can contribute to citizenship formation and to the construction of a school culture oriented toward a sustainable transition. The specific objectives are to identify pedagogical strategies for introducing circular economy concepts in primary education in a manner appropriate to students' age range and cognitive development; to examine how secondary education can deepen the study of the circular economy through interdisciplinary projects and experimental practices related to sustainability; and to assess how teaching the circular economy can strengthen citizenship by fostering socio-environmental responsibility and critical participation within the community.

The article has four parts. The first part is the introduction, which talks about the context of the theme, the method used, and the study's goals. The second part talks about the research's materials and methods. The third section is about the theoretical framework. It is organized around three main themes: environmental education, interdisciplinary work, and citizenship. Lastly, the fourth section puts together the final thoughts, which sum up the ideas that were developed during the study.

II. MATERIAL AND METHODS

The research supporting the article *Teaching the Circular Economy in Schools: Contributions to Citizenship and the Sustainable Transition* is based on the understanding that schools play a pivotal role in educating individuals about the environmental and social challenges that define the modern world. The circular economy, in conjunction with environmental education, serves as a developmental framework that fosters educational practices aimed at communal responsibility, efficient resource utilization, and the cultivation of citizenship. This study is positioned within contemporary educational discussions by examining scientific literature related to sustainability, environmental education, interdisciplinarity, and pedagogical methods in primary school.

The adopted methodology is qualitative, facilitating an interpretative comprehension of the meanings, conceptions, and orientations inherent in the investigated academic production. Sixteen scientific works were reviewed, comprising journal articles, electronic books, and institutional documents that focus on environmental education across various educational levels, interdisciplinary practices, ecological citizenship, pedagogical methodologies, and international sustainability guidelines. For analytical organization, these works were categorized into four thematic groups: environmental education in early childhood and basic education; sustainability, citizenship, and the circular economy; interdisciplinarity and curriculum; and methodologies and pedagogical practices in environmental education. This classification facilitated a methodical and coherent analysis of the chosen material.

The adopted methodology was a bibliographic review, defined as a systematic process of discovering, selecting, and critically interpreting the existing literature on the subject under investigation. John W. Creswell (2014) asserts that qualitative research facilitates the exploration of educational phenomena by analyzing their contexts, meanings, and linkages, making it especially suitable for investigations of pedagogical concepts and formative practices. The bibliographic review facilitates the identification of consensus, tensions, and views

within the scientific literature, so providing a coherent interpretative framework for comprehending the instruction of the circular economy in educational settings.

Furthermore, Eva Maria Lakatos and Marina de Andrade Marconi (2017) assert that the bibliographic review is a fundamental procedure in scientific research, since it establishes the theoretical framework for the study and directs the formulation of the research topic. This strategy promotes the dissemination of knowledge, facilitates debate among diverse methodologies, and strengthens comprehensive theoretical frameworks in global educational research. Consequently, by employing a qualitative methodology with a bibliographic survey, the study aims to enhance academic and pedagogical discourse on environmental education and the circular economy as educational frameworks directed towards citizenship and sustainable transition.

III. THEORETICAL FRAMEWORK

The theoretical framework of the study was structured to ensure a coherent and well-articulated conceptual progression, organized into three complementary axes. Section 3.1 addresses environmental education in early childhood, emphasizing the initial introduction of sustainability concepts as a formative foundation for the development of responsible attitudes from the earliest years of schooling. Subsequently, Section 3.2 discusses interdisciplinarity and the development of practical projects in environmental education aimed at young people, highlighting the integration of different fields of knowledge as a pedagogical strategy for understanding socio-environmental challenges. Finally, Section 3.3 focuses on education for socio-environmental citizenship, examining formative processes related to the construction of sustainable values and the conscious engagement of students in social life, thereby consolidating the articulation between knowledge, educational practice, and citizenship formation.

3.1 Environmental Education in Childhood and the Introduction of Sustainability Concepts

Environmental education during childhood is a recognized domain of theoretical inquiry and educational practice, especially concerning the cultivation of values, attitudes, and behaviors associated with sustainability. Recent research suggests that early engagement with environmental topics cultivates a type of civic awareness attuned to the interconnections among society, nature, and consumption (Gomes & Chagas, 2024; Silva, 2021). In this context, schools play a key role by providing educational experiences that go beyond just teaching facts and are closely related to the moral and social development of children, while also taking into account how they learn and interact with the world (Seribelli & Wiziack, 2024).

In basic education, particularly in primary education, addressing sustainability necessitates pedagogical strategies that align with children's cognitive development. The literature emphasizes meaningful learning as a fundamental basis for the internalization of environmental concepts, as it links new knowledge to students' daily experiences (Silva, 2021). Playful practices, hands-on activities, and problem-based situations facilitate the comprehension of concepts such as environmental stewardship, collective responsibility, and mindful consumption, thereby creating opportunities for principles related to the circular economy to be explored in an accessible and contextualized manner (Seribelli & Wiziack, 2024).

Playfulness and habit formation frequently arise in discussions regarding Environmental Education in childhood. Schools help kids develop sustainable habits that fit with their everyday lives by getting them involved in things like separating trash, reusing materials, and thinking about how wasteful they are (Costa & Alves, 2021; Gomes & Chagas, 2024). These practices are not limited to the school setting; they often extend into familial and communal contexts, enhancing the role of children as active participants in promoting behaviors consistent with sustainability (Hoffmann & Pilau Sobrinho, 2018).

In this context, the principles of the circular economy can be gradually integrated through straightforward, educational initiatives that focus on reuse, recycling, and minimizing consumption. The literature demonstrates that the intentional incorporation of these practices into the curriculum facilitates the enhancement of cognitive and socio-emotional competencies associated with the comprehension of cycles, interdependence, and social responsibility (Costa & Alves, 2021; Silva, 2021). Table 1 summarizes pedagogical strategies from recent studies that address the incorporation of circular economy principles into basic education, considering the distinct characteristics of childhood.

Table 1. Pedagogical strategies for the introduction of circular economy principles in basic education.

Pedagogical strategy	Description	Contributions to the circular economy
Play-based activities using reusable materials	Use of games, toys, and workshops with repurposed materials	Understanding of reuse and waste reduction
Waste separation practices	Introduction of selective collection within the school environment	Development of awareness regarding recycling

Pedagogical strategy	Description	Contributions to the circular economy
Interdisciplinary projects	Integration of environmental themes across different fields of knowledge	Systemic perspective and understanding of cycles
Sustainable routines at school	Adoption of habits such as resource conservation and care for shared spaces	Formation of habits aligned with sustainability
Engagement of the school community	Participation of families and the community in environmental actions	Expansion of the reach of sustainable practices

Sources: Gomes and Chagas (2024); Silva (2021); Seribelli and Wiziack (2024); Costa and Alves (2021); Hoffmann and Pilau Sobrinho (2018).

With that being said, the idea of citizenship education that is supported by this study is compatible with the connection that exists between environmental education, the cognitive development of children, and the circular economy. According to Hoffmann and Pilau Sobrinho (2018) and Seribelli and Wiziack (2024), schools contribute to the development of a school culture that is centered on the sustainable transition by ensuring that the content they teach is in accordance with what children are able to comprehend. As a result of this line of thinking, the concept that education can assist children in acquiring the values and abilities that will enable them to live more responsibly and socially responsibly from a young age is strengthened.

3.2 Interdisciplinarity and Practical Projects in Environmental Education for Young People

The literature extensively examines environmental education in secondary schools as a unique domain for the synthesis of knowledge and the cultivation of a more comprehensive understanding of the interconnections among society, the environment, and production methods. Lima and Alves (2022) assert that interdisciplinarity, as delineated in national curricular frameworks and bolstered by the National Common Core Curriculum, fosters the amalgamation of scientific, social, and ethical content, thereby facilitating students' comprehension of the intricacies of modern environmental challenges. In this context, the circular economy emerges as a unifying framework that connects various domains of knowledge to address specific challenges faced by youth.

Interdisciplinary approaches in secondary education are closely aligned with inquiry-based methodologies that promote active student engagement in the learning process. Research examined by Nogueira and Megid Neto (2020) demonstrates that project-based pedagogical methodologies promote critical analysis of environmental issues while reinforcing the connection between theory and practice. These approaches enhance students' ability to comprehend intricate processes and connect them to the social and environmental issues within their local contexts by exploring topics such as material cycles, waste management, and productive sustainability.

Projects, workshops, laboratories, and case studies have been recognized as a reliable pedagogical approach for tackling more complex material in Environmental Education. Lopes et al. (2025) contend that interdisciplinary projects focused on sustainable citizenship empower students to examine productive systems, evaluate data, and formulate proposals for socially responsible interventions. Table 2 shows examples of teaching methods that are often talked about in the literature. These methods are important for teaching the circular economy in high school.

Table 2. Interdisciplinary strategies and pedagogical practices for teaching the circular economy in secondary education.

Pedagogical strategy	Description	Contributions to the circular economy
Interdisciplinary projects	Integration of different subject areas around environmental problems	Systemic understanding of productive cycles
Thematic workshops	Practical activities focused on waste, consumption, and materials	Analysis of reuse and recycling
Investigative laboratories	Experiments and collection of environmental data	Development of critical analysis
Case studies	Analysis of real sustainability experiences	Understanding of reverse logistics
Active methodologies	Problem- and project-based learning	Proposal of sustainable solutions

Sources: Lima and Alves (2022); Nogueira and Megid Neto (2020); Lopes et al. (2025); Santos, Azevedo, and Almeida (2024).

The literature also shows that active methodologies are an important part of making these practices more common in secondary education. Santos, Azevedo, and Almeida (2024) contend that methodologies such as project-based learning and problem-solving cultivate student engagement and promote intellectual autonomy. By engaging with data, hypotheses, and tangible scenarios, youth cultivate analytical skills that facilitate their comprehension of the social, environmental, and economic ramifications of modern productive systems.

Finally, interdisciplinary projects in secondary education that incorporate the circular economy help students develop a critical and citizenship-oriented view of sustainability. By integrating investigation, practice, and reflection, schools facilitate students' comprehension of material circularity and the shared responsibilities inherent in the sustainable transition, as emphasized by Lima and Alves (2022) and Lopes et al. (2025). This viewpoint strengthens the function of education as a domain for cultivating individuals equipped to analyze, interrogate, and deliberately engage with the environmental issues of modern society.

3.3 Education for Socio-Environmental Citizenship and the Formation of Sustainable Values

Education for socio-environmental citizenship has been identified as a foundational element of modern Environmental Education, as it encompasses ethical development, social engagement, and shared accountability. Costa and Aguiar (2020) contend that ecological citizenship is developed through educational practices that interrogate the interactions between society and nature, promoting awareness of the social and environmental consequences of individual and collective decisions. In this regard, the instruction of the circular economy in primary education directly contributes to citizenship development by fostering contemplation on consumption, production, and disposal.

The literature suggests that citizenship-oriented environmental education expands the learning focus beyond mere content acquisition, integrating values and attitudes associated with socio-environmental justice. Corrêa and Ashley (2021) assert that a critical examination of sustainability aids in identifying the social disparities linked to development models and fosters a collective consciousness dedicated to equity. In this context, the circular economy offers a conceptual foundation that facilitates contemplation on collective responsibility and the constraints of linear production systems.

Recent studies also show that environmental education, citizenship, and the Sustainable Development Goals are all related. Silva et al. (2025) emphasize that SDG 4, which focuses on quality education, underscores the necessity for pedagogical approaches that foster sustainability and social engagement. The integration of the circular economy into the school curriculum fosters alignment by promoting mindful consumption, waste minimization, and student involvement in initiatives aimed at the collective welfare, in accordance with the principles of the 2030 Agenda (United Nations Brazil, 2022).

Literature on educational experiences shows that students who actively participate in community-based projects are better able to internalize socio-environmental values. Miranda et al. (2021) demonstrate that educational initiatives concerning the rational use of water enhance awareness and collective mobilization, thereby augmenting students' sense of belonging and social responsibility. These experiences align with the principles of the circular economy by promoting stewardship of natural resources and fostering comprehension of environmental cycles as a collective obligation.

Digital technologies and social networks have also been recognized as pertinent pedagogical tools for enhancing students' critical engagement. Oliveira, Freitas Júnior, and Cardoso (2023) contend that educational applications and digital platforms can enhance the dissemination of information, foster debate, and promote the collective development of solutions to environmental challenges. When used in conjunction with the teaching of the circular economy, these tools enhance opportunities for community involvement and reinforce citizenship practices aimed at sustainability. Table 3 organizes the aspects of socio-environmental citizenship that are connected to teaching the circular economy, as shown in the literature that was looked at.

Table 3. Dimensions of socio-environmental citizenship articulated with the teaching of the circular economy.

Dimension	Description	Relation to the circular economy
Socio-environmental responsibility	Recognition of the impacts of individual and collective actions	Waste reduction and conscious consumption
Community participation	Involvement in local actions and projects	Engagement in circular practices
Socio-environmental justice	Understanding of inequalities associated with development models	Questioning of productive systems
Critical awareness	Reflective analysis of production and consumption	Responsible decision-making
Educational use of technologies	Circulation of information and social mobilization	Expansion of the debate on sustainability

Sources: Costa and Aguiar (2020); Corrêa and Ashley (2021); Silva et al. (2025); Miranda et al. (2021); United Nations Brazil (2022); Oliveira, Freitas Júnior, and Cardoso (2023).

To incorporate the circular economy into school curricula, it is essential to recognize that environmental education emphasizing citizenship transcends mere technical instruction. Costa and Aguiar (2020) and Corrêa and Ashley (2021) contend that it is more accurate to define it as the development of beliefs, attitudes, and behaviors that foster social participation and socio-environmental responsibility. Schools help individuals become people

who can actively contribute develop a society that is dedicated to sustainable transition by teaching them how to think critically, get involved in their communities, and be morally responsible.

IV. DISCUSSION AND CONCLUSION

The last ideas have to do with the article's main idea, which was to look into how to teach the circular economy in elementary school as part of a bigger movement toward citizenship education and policies in schools that are better for the environment. The study was conducted on the premise that schools significantly contribute to the education of individuals regarding values, knowledge, and attitudes related to environmental issues. This is especially true in a world where problems with society and the environment are getting worse. The study successfully achieved all its objectives. An examination of academic literature investigated the pedagogical incorporation of the circular economy into primary and secondary education. The importance of the circular economy in enhancing civic engagement and socio-environmental responsibility was also underscored.

The bibliographic review facilitated the integration of concepts, pedagogical approaches, and theoretical frameworks, yielding a coherent and evidence-based perspective on the examined topic. The results indicated that, in the early years, methods such as enjoyable activities, consistent routines, and the involvement of the school community foster the development of habits that promote waste reduction and resource management. Examples of these strategies are grouped in Table 1. Table 2 shows that using interdisciplinary practices, active methodologies, and case studies in high school helps students understand productive cycles better and encourages them to think critically about consumption models. Table 3 showed that teaching people about the circular economy makes them better socio-environmental citizens by teaching them about community involvement, critical thinking, and standing up for social justice. Moreover, it links moral values, public involvement, and environmental education.

Overall, the studies show that teaching about the circular economy, along with good teaching methods and the different parts of being a good socio-environmental citizen, helps to create a school culture that is dedicated to being more responsible with the community and the environment. The theme successfully integrates curricular content, experiential learning, and ethical frameworks, thereby facilitating schools to serve as platforms for critical education and social mobilization. This is done by using strategies that work for all levels of basic education. The article shows that the circular economy is not just about one environmental issue; it is a basic idea that connects to citizenship education and the need to look at social and educational processes in light of current issues.

The study paves the way for subsequent research aimed at enhancing the practical implementation of the circular economy in particular educational settings. This study will encompass empirical investigations across multiple tiers of primary education. To enhance comprehension of the impact of these activities on students' daily educational practices and their engagement with sustainability and citizenship, longitudinal studies of pedagogical initiatives and evaluations of teacher education for the circular economy may be undertaken.

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