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Review Article

Integrating Education, Digital Culture, and Sustainability: An Integrative Review of Technologies for Global Citizenship Skills

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ABSTRACT

The integration between education, digital culture, and sustainability has stood out as a central axis for the development of skills aimed at global citizenship. Recent studies indicate that digital educational ecosystems enhance personalized and critical learning, articulating pedagogical innovation and socio-environmental responsibility. This article aims to analyze education, digital culture and sustainability: impacts of technologies on the development of competencies for global citizenship, through an integrative literature review. The methodology consisted of searches in international databases (Scopus, Web of Science, Google Scholar, and SciELO), considering productions between 2020 and 2025, with criteria of methodological rigor and thematic adherence. The results revealed that digital technologies increase academic engagement, inclusion, and ecological awareness, but challenges related to inequality of access, institutional resistance, and conceptual fragility persist. It is concluded that digital ecosystems represent a promising path, but still lack methodological systematization and political-educational support to consolidate themselves as transformative practices.

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1. INTRODUCTION

The integration between education, digital culture and sustainability has been consolidated as a strategic axis for the formation of skills aligned with global citizenship. Recent studies show that digital educational ecosystems not only favor personalized learning, but also amplify critical engagement around sustainability and social justice (Ramírez-Montoya *et al.*, 2025).

This perspective reinforces the need to prepare students for a complex world, in which digital technologies act as mediators of socio-environmental awareness.

Bhattacharyya (2025) argues that contemporary education must transcend the mere transmission of content, assuming a transformative role capable of promoting human empowerment, equity, and sustainability.

In addition, Abdulganeey *et al.* (2025) argue that twenty-first century curricula should integrate critical thinking, creativity, digital literacy and global citizenship, structuring competencies that respond to the demands of an interconnected educational and social scenario.

In view of this, this article proposes to analyze education, digital culture and sustainability: impacts of technologies on the development of competencies for global citizenship, through an integrative literature review.

However, despite the growing number of studies addressing the intersection between education, technology, and sustainability, the literature remains fragmented regarding how digital culture effectively contributes to the development of global citizenship skills. This fragmentation reveals a research gap that justifies the need for an integrative analysis capable of connecting these dimensions under a unified perspective. Therefore, this study aims to integrate evidence from recent research to understand how digital culture, educational innovation, and sustainability interact in promoting global citizenship skills. Specifically, it seeks to (i) map the main theoretical and methodological approaches present in the literature, (ii) identify the technological tools most frequently associated with the development of global competencies, and (iii) highlight research gaps and future directions in this interdisciplinary field.

2. LITERATURE REVIEW

Contemporary education has been influenced by processes of globalization and technological transformation that broaden the horizons of teaching and learning. According to Rocha and Lamônica (2025), recent literature points out that inclusive education needs to articulate cultural, social, and digital dimensions to promote equity, overcoming traditional visions centered only on instruction. On the other hand, critical authors note that rapid digitalization can generate new inequalities if it is not accompanied by inclusion policies. Thus, digital transformation emerges as both an enabler and a potential reproducer of inequalities, depending on how it is mediated by social and institutional contexts.

In the field of digital culture, Zhanguzhinova *et al.* (2025) state that education should incorporate multicultural and technological perspectives to prepare conscious and socially responsible citizens. The proposal of ethnofuturism in educational programs, for example, seeks to broaden critical views on diversity and contemporary art. This cultural turn in digital education connects directly with the challenges of pluralism and representation in global learning contexts. On the other hand, there are those who argue that digitalization tends to homogenize pedagogical practices, weakening local cultural expressions and limiting pedagogical plurality. This duality reinforces that the digital field, while global in reach, must remain locally grounded to avoid epistemic uniformity.

Sustainability emerges as a strategic axis in contemporary education. According to Mejía-Cáceres *et al.* (2023) the notion of sustainability should not be restricted to the environmental field, but expanded as a transversal principle that connects economy, society, and culture. This perspective favors integrated curricula, but faces resistance from fragmented educational models that are still poorly prepared for structural changes. Thus, sustainability appears as a promise and a simultaneous challenge. When read together with digital culture, sustainability gains new layers of meaning, positioning education as a mediator between technological progress and socio-environmental responsibility.

According to Education Reimagined & History Co:Lab (2023), learning ecosystems are key to aligning education, digital culture, and global citizenship. They defend the importance of four dimensions: people, practices, connections, and conditions. In dialogue, Rocha and Lamônica (2025) reinforce that intersectoral collaboration is essential for the impact of technology to be accompanied by social justice. The counterpoint is that such ecosystems still depend on robust infrastructure, which limits their adoption in developing countries. These converging analyses reveal that without equity in access and governance, digital ecosystems risk reinforcing, rather than mitigating, educational disparities.

Authors such as Santos *et al.* (2023) highlight that digital culture expands student autonomy and favors critical learning processes, but warn of gaps in teacher training and technological fatigue. In consonance, Zhanguzhinova *et al.* (2025) emphasize that global education will only make sense if connected to concrete cultural practices. In contrast, technocentric views argue that the greatest emphasis should be on digital skills, even if they are detached from broader cultural and social contexts. This contrast demonstrates the epistemological divide between instrumentalist and critical perspectives in digital education—one focused on employability, the other on emancipation.

Rocha and Lamônica (2025) argue that digital global citizenship depends on the integration between respect for cultural diversity and the development of digital skills. In this sense, the school must assume the role of ethical and social mediation. On the other hand, some more pragmatic currents suggest that training should prioritize technical and digital skills, responding to market demands, even if to the detriment of critical training. The debate thus oscillates between humanistic and utilitarian paradigms of formation, a balance that defines the quality of global citizenship education.

According to Zhanguzhinova *et al.* (2025), sustainable digital education should foster social and environmental responsibility. This perspective connects digital culture and sustainability, arguing that global learning requires ecological awareness. On the other hand, authors such as to Mejía-Cáceres *et al.* (2023)

warn that sustainability, when appropriated by superficial institutional discourses, can be reduced to a rhetoric without effective practice. This indicates a gap between discourse and implementation, suggesting that the transformative potential of education depends on political coherence and institutional engagement.

At the intersection between digital culture and sustainability, Dann (2025) proposes a conceptual model of open education, in which collaborative networks enhance inclusive and innovative practices. This model dialogues with the idea of global citizenship, but it depends heavily on political and economic conditions. The counterpoint lies in the fragility of public policies in emerging contexts, where the digital divide is still significant. This reinforces that inclusion in digital and sustainable education is not only a pedagogical challenge but also a governance and equity issue.

In the context of values, Rocha and Lamônica (2025) suggest that global citizenship depends on valuing cultural diversity and respect for difference. In dialogue, Education Reimagined & History Co:Lab (2023) argue that inclusive pedagogical practices are the key to sustainable ecosystems. The counterpoint lies in the risk that digital culture, by prioritizing performance metrics, weakens collaborative and empathetic practices. Hence, the ethical dimension becomes indispensable for reconciling efficiency with empathy in digital educational ecosystems.

In summary, the state of the art reveals that the articulation between education, digital culture, sustainability and global citizenship constitutes an expanding field, with promises and contradictions. While part of the literature highlights the conceptual integration and social relevance of these axes, another part warns of structural barriers, technocentrism, and fragility of public policies. Therefore, the synthesis of these perspectives reinforces that contemporary education must operate in an integrative and critical manner, seeking balance between innovation, equity, and human development. Thus, before moving on to the analysis of results, the understanding that contemporary education requires critical and integrated approaches to respond to the challenges of the twenty-first century is consolidated.

3. METHODOLOGY

The present research adopted as a method the integrative literature review (ILR), as it is an approach that allows gathering, analyzing and synthesizing evidence from scientific productions of different natures, providing a broad and critical view of the investigated phenomenon. The time frame comprised the period between 2020 and 2025, in order to privilege recent studies that address the interface between education, digital culture, and sustainability in the development of skills aimed at global citizenship.

The searches were carried out in internationally recognized databases — Scopus, Web of Science, Google Scholar, and SciELO — using descriptors in Portuguese and English. Boolean operators (AND, OR) were employed to refine the search and ensure the retrieval of works pertinent to the theme.

Table 1. presents the main search strings applied in each database.

Database	Search String	Language	Period
Scopus	(“*digital education*” AND “*culture*”) OR (“*educational sustainability*” AND “*global citizenship*”)	English	2020–2025
Web of Science	(“*learning ecosystems*” OR “*digital culture and citizenship*”) AND “*education*”	English	2020–2025
SciELO	(“*educação digital*” AND “*cultura*”) OR (“*sustentabilidade educacional*” AND “*cidadania global*”)	Portuguese	2020–2025
Google Scholar	(“*digital technologies in education*” AND “*sustainability*”) OR (“*education for global citizenship*”)	English/Portuguese	2020–2025

The inclusion criteria included peer-reviewed articles, theses, and dissertations published in open access, in Portuguese, English, and Spanish, which presented methodological rigor and thematic adherence to the object of study. Duplicates, documents without peer review, or works that did not address the intersection between education, digital culture, and sustainability were excluded.

After the initial collection, titles and abstracts were screened independently by the authors to verify adherence to inclusion criteria. Subsequently, the full texts were read critically and interpretively, based on the guidelines of Whittemore and Knafl (2005) for ILR.

No formal coding software was used; instead, a thematic analysis was applied, identifying recurring concepts and theoretical convergences.

From this process, three analytical categories emerged inductively: (1) digital transformation and education, (2) sustainability and pedagogical integration, and (3) global citizenship and cultural plurality.

To ensure interpretative consistency, the categories were triangulated with classical and contemporary theoretical frameworks discussed in the state of the art, allowing the identification of convergences, divergences, and gaps in the field.

4. RESULTS AND DISCUSSION

Da Silva (2025) presents a study on the adoption of digital microcredentials in the Brazilian public sector, highlighting that such tools strengthen environmental governance and develop skills associated with global citizenship. The author shows that digital certifications are capable of expanding continuous training and stimulating socio-environmental responsibility,

although the application lacks greater institutionalization. This result converges with Holtz (2025), who argues that digital ecosystems in education depend on structured innovation policies and collaborative environments.

Taken together, these findings indicate that the rise of microcredentials reflects a broader economic rationality in education, in which technological efficiency and credentialism are prioritized over reflective and humanistic competencies. This trend exposes the risk of reducing lifelong learning to a measurable process rather than a transformative one.

On the other hand, Ribeiro *et al.* (2024) warn that the centrality of technologies can obscure critical dimensions of education, which indicates the need to balance innovation with pedagogical reflection. This balance problem illustrates how digital transformation, when guided by productivity rather than purpose, may reproduce the same inequalities it intends to solve.

Irannezhad *et al.* (2025) explore a virtual citizenship program, showing that digital educational initiatives promote more conscious behaviors on social media and strengthen digital citizenship practices. However, the authors warn that, without public policy support, the sustainability of these actions remains limited.

This analysis dialogues with Correa and Costa (2025), who discuss the distance between the legal recognition of socio-environmental citizenship practices and their practical effectiveness in Brazilian schools. Thus, while Irannezhad *et al.* (2025) highlight the potential, the state of the art reinforces the institutional weaknesses that prevent its consolidation. These comparative perspectives reveal a persistent implementation gap: digital citizenship advances in discourse but stagnates in practice, reflecting the absence of structural support for socio-environmental innovation in education.

Zanganeh *et al.* (2024) discuss the concept of "agile city", linking digital culture, urban education and sustainability. The results indicate that the implementation of educational urban ecosystems depends on the integration between technological innovation and participatory policies. This picture is supported by Di Paolo (2025), who expands the concept of educational ecosystems as eco-sustainable communities, highlighting the articulation between learning and values of social and environmental responsibility. However, Mateus and Tavares (2024) observe that environmental practices in ecosystems still lack theoretical systematization, indicating that, although promising, the "agile city" faces conceptual and institutional barriers.

Together, these findings suggest that sustainable education in urban contexts remains more rhetorical than operational. The absence of theoretical cohesion weakens the transformative capacity of the "agile city" paradigm, making it dependent on political will rather than pedagogical innovation.

Juniarni and Noviani (2025) analyze educational practices in the context of society 5.0, showing that the use of digital literacies strengthens both the preservation of cultural values and the construction of global citizenship. This approach is connected to Moreira (2025), who identifies trends in innovation and educational games as vectors of engagement, but which depend on pedagogical intentionality so as not to become superficial. As a counterpoint, Cunha *et al.* (2025) warn that, without critical mediation, digital practices can only reinforce motivational aspects, without promoting deep learning.

This tension reveals a key challenge of contemporary education: while gamified and immersive tools enhance engagement, they may dilute the reflective component of learning if not anchored in ethical and cultural awareness.

Rocha *et al.* (2025) investigate cross-sectoral collaborations in inclusive education, revealing that digital platforms expand access and strengthen cultural diversity as part of global citizenship. This result converges with Ferreira *et al.* (2024), who defend the quality of distance education from an ecosystem perspective as a means of articulating collaboration and inclusion. However, Santos (2024) observes that poorly integrated methodologies in non-formal spaces can compromise student engagement, showing that digital inclusion still encounters practical resistance.

This synthesis suggests that inclusion through technology depends not only on access but also on coherence among pedagogical, cultural, and institutional dimensions. In contexts lacking coordination, digital inclusion becomes symbolic rather than transformative.

Wuersch *et al.* (2024) analyze international digital partnerships between universities, showing that these collaborations promote academic engagement and global citizenship competencies. This evidence is supported by Education Reimagined & History Co:Lab (2023), which highlights living networks of human relationships and inter-institutional connections as pillars of learning ecosystems. However, Lima and Assis (2022) recall that, in Brazilian contexts, there are still structural and cultural weaknesses that limit such practices, revealing disparities between developed and emerging countries.

These disparities underline the asymmetry of the global digital order, where nations with limited infrastructure risk becoming passive consumers of innovation rather than co-creators of educational technologies.

Hassan and Shehata (2024) highlight the relevance of public libraries in strengthening digital citizenship, as they act as spaces for cultural and technological training. This result converges with Fonseca (2024), who shows how tools such as concept maps can contribute to collaborative ecosystems, but which require pedagogical intentionality. However, Vilhena *et al.* (2025) warn of institutional resistance to socio-emotional education, demonstrating that even spaces that are recognized as inclusive face implementation barriers.

This shows that even the most inclusive educational environments can become bureaucratic when institutional inertia limits the cultivation of empathy and affective skills — dimensions increasingly vital for sustainable digital citizenship.

Pliogou *et al.* (2025) discuss digital strategies to combat gender-based violence in schools, showing that digital citizenship integrated with equity values strengthens the commitment to human rights. This approach connects to the perspective of Guerrero Támara and Penadillo Lirio (2025), who show how practical experiences strengthen both learning and socio-environmental awareness. On the other hand, Santos (2025) warns that playful practices, when not integrated into a structured pedagogical ecosystem, can be perceived as

peripheral, limiting their effects.

Collectively, these studies indicate that ethical and affective dimensions remain the blind spots of digital pedagogy. Without them, technological education risks becoming technically competent but socially indifferent.

Nuryadi (2024) explores digital strategies in communities on Instagram focused on ecological citizenship, highlighting youth engagement in sustainability practices. This finding is supported by Teixeira (2025), who analyzes school meliponiculture as a local experience of environmental education, also limited by didactic resources. In dialogue, Mendes *et al.* (2024) point out that creative practices such as caving have potential, but still lack curricular systematization, which reinforces the need to institutionalize such initiatives.

Mohseni *et al.* (2025) analyze citizen science experiences mediated by digital platforms, showing that these practices strengthen community belonging and sustainability. This result dialogues with Correa and Costa (2025), who reinforce the role of climate education in the formation of critical citizenship. However, Vilhena *et al.* (2025) warn that the conceptual imprecision of socio-emotional competencies hinders their full integration into learning ecosystems, which also weakens the potential of citizen science initiatives.

These grassroots practices illustrate how localized and low-cost educational innovations can promote sustainability from the bottom up, but they remain fragile without curricular recognition and institutional legitimacy.

This combination of evidence points to the need for an epistemological convergence between cognitive and socio-emotional learning dimensions, enabling sustainability education to move beyond information transmission toward active citizenship.

Pedone *et al.* (2025) discuss trust in organizational communication in digitalized higher education, highlighting that student engagement depends on transparent and inclusive practices. This finding converges with Veloso *et al.* (2025), who identify curricular flexibility as essential for pedagogical sustainability. On the other hand, Santos (2023) shows that digital ecosystems can face teacher fatigue and resistance, indicating that transparent communication is necessary, but insufficient if it is not accompanied by supportive policies.

These results suggest that institutional trust operates as the backbone of sustainable educational ecosystems. Without it, transparency becomes performative and innovation becomes a source of exhaustion rather than empowerment.

Ardakani *et al.* (2025) analyze the use of digital data analysis for sustainable city planning, highlighting the formation of competencies for ecological citizenship. This result dialogues with Dann (2025), who defends a conceptual model for open education ecosystems anchored in public policies and structural conditions. However, Mateus and Tavares (2024) observe that many of these environmental practices have not yet been theoretically systematized, evidencing the distance between innovation and conceptual consolidation.

The predominance of data-driven approaches in sustainability education reflects a technocratic bias that values quantification over participation. Bridging this gap requires repositioning education as a dialogical process that integrates ethics, ecology, and technology.

In summary, the synthesis of findings reveals that integrative studies in education, digital culture, and sustainability converge on a paradox: while technology expands the frontiers of inclusion and innovation, it simultaneously reproduces social and epistemic inequalities. The authorial interpretation thus reinforces that the challenge of 21st-century education is not to digitize learning, but to humanize digital transformation through critical, ethical, and sustainable pedagogies.

5. CONCLUSION

This study aimed to analyze how learning ecosystems in contemporary education, in dialogue with digital culture and sustainability, contribute to the development of skills aimed at global citizenship, through an integrative literature review. The methodological path allowed us to gather recent evidence (2020–2025) and confront it with classical and contemporary conceptual frameworks, ensuring a critical and comprehensive analysis.

The results revealed that digital and hybrid ecosystems offer conditions to enhance engagement, personalization of learning, and integration of socio-environmental and cultural values. Studies such as those by Da Silva (2025), Irannezhad *et al.* (2025), and Wuersch *et al.* (2024) highlight significant advances in digital citizenship, academic collaboration, and pedagogical innovation, while authors such as Ribeiro *et al.* (2024) and Lima and Assis (2022) warn of risks of technocentrism, conceptual fragility, and digital inequality. Convergences point to the need for integration between pedagogical, social and technological dimensions, while divergences focus on institutional conditions and long-term impacts, especially in emerging contexts.

It is concluded, therefore, that the objective of the study was partially met, since the review allowed mapping advances and limitations of learning ecosystems in strengthening global citizenship, but also highlighted gaps in conceptual systematization and implementation mechanisms.

This partial achievement does not reflect a methodological weakness, but rather the heterogeneity of the reviewed studies and the predominance of short-term or context-specific evidence. The literature remains fragmented across disciplines and regions, with few longitudinal analyses capable of confirming sustained impacts on socio-emotional and ecological competencies. Consequently, while theoretical integration between education, digital culture, and sustainability is evident, empirical validation of this integration is still emerging.

It is recommended that future research deepen comparative analyses between developed and developing countries, explore the long-term impacts on socio-emotional and ecological skills, and investigate the role of public policies in consolidating inclusive, critical, and sustainable learning ecosystems.

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