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Learning Ecosystems in Contemporary Education: An Integrative Review

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ABSTRACT

Contemporary education has been marked by structural transformations driven by the advancement of digital technologies, the personalization of learning, and the search for more inclusive models. In this context, learning ecosystems emerge as a strategic approach to articulate pedagogical, technological, and social dimensions, expanding the reach of educational innovation. The objective of this study was to analyze the learning ecosystems in contemporary education, through an integrative literature review, in order to map trends, advances and challenges. The methodology consisted of an integrative review, with searches in databases such as Google Scholar, Scopus, and Web of Science, covering the period from 2020 to 2025. National and international studies with theoretical relevance and methodological rigor were selected, submitted to critical analysis and thematic categorization. The results revealed convergences regarding the potential of ecosystems to promote engagement, autonomy and socio-emotional skills. However, divergences pointed to persistent barriers such as digital inequality, technological fatigue, institutional resistance, and lack of conceptual systematization. It is concluded that learning ecosystems are a promising field, but are still in consolidation. Effectiveness depends on the integration between pedagogical innovation, public policies and social equity, in order to overcome challenges and consolidate this paradigm in the twenty-first century.

INTRODUCTION

Contemporary education has been transforming from the incorporation of new pedagogical approaches, combined with the advancement of digital technologies and the expanded concept of learning. In this scenario, the term "learning ecosystems" emerges as a strategic concept to understand the multiplicity of spaces, interactions, and resources that make up the educational process (Dann, 2025).

The integration of innovative pedagogical practices with digital, physical, and social environments has enhanced more meaningful and personalized learning experiences, especially in the post-pandemic context (Holtz, 2025). Studies also show that the systemic understanding of education, through ecosystems, broadens the vision of integral and collaborative education, including cultural diversity, inclusion, and socio-environmental justice (Correa & Costa, 2025).

In view of this, this article proposes to analyze the learning ecosystems in contemporary education, through an integrative literature review.

To achieve this objective, an integrative literature review will be carried out in order to answer the following guiding question:

How have learning ecosystems been understood and applied in the context of contemporary education, according to scientific productions between 2020 and 2025?

LITERATURE REVIEW

Contemporary education is in constant transformation, driven by digital technologies and the need for innovative pedagogical practices. According to Moreira (2025), trends in innovation, entrepreneurship and educational games reveal that learning ecosystems favor dynamic and interactive approaches. On the other hand, Ribeiro *et al.* (2024) argue that, although the future of education is aligned with digital trends, the excess of technocentrism can reduce critical education, shifting the student's focus to tools to the detriment of reflective processes.

In this sense, Cunha *et al.* (2025) highlight that the integration of digital games in pedagogical ecosystems can generate motivational gains, but requires didactic intentionality so as not to reproduce superficialities in the teaching-learning process.

According to Ferreira, Ramos, and Veloso (2024), learning ecosystems in distance education increase educational quality by articulating human development and collaboration networks. This optimistic view sees distance education as a space for pedagogical reinvention. However, Santos (2024) draws attention to the limits of learning in non-formal spaces, stating that poorly integrated methodologies can compromise student engagement. Complementing this tension, Fonseca (2024) demonstrates that tools such as concept maps, when incorporated into ecosystems, can enhance collaborative learning, but their effectiveness depends on

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alignment with clear objectives; otherwise, they become mere technical resources.

According to Di Paolo (2025), educational ecosystems should be understood as eco-sustainable communities, in which learning is connected to values of social and environmental responsibility. This approach broadens the notion of ecosystem, linking education and sustainability. However, Mendes *et al.* (2024) point out that educational practices based on environmental ecosystems, such as speleology, face methodological challenges to consolidate themselves as permanent practices in the school curriculum. In dialogue with this criticism,

Teixeira (2025) explores meliponiculture as a strategy for environmental education in schools, showing that local experiences can integrate sustainability and meaningful learning, but still come up against institutional resistance and the lack of adequate didactic resources.

In dialogue with these perspectives, Guerrero Támara and Penadillo Lirio (2025) demonstrate, in a quasi-experimental study, that learning ecosystems supported by practical experiences promote greater environmental conservation and meaningful learning.

However, Mateus and Tavares (2024) highlight that initiatives based on ecological trails still lack theoretical systematization to consolidate themselves as educational practice. Along these lines, Santos (2025) reinforces that playful practices in the education of young people and adults can increase interest in science, but run the risk of being perceived as peripheral activities when not articulated with a more structured pedagogical ecosystem. Thus, the concept of learning ecosystems constitutes an expanding field, marked by promises of innovation and implementation challenges. While some authors reinforce the adaptive and transformative dimension, others warn of pedagogical and institutional barriers. This diversity of readings strengthens the idea that ecosystems should be understood as complex and multifaceted constructions, requiring constant conceptual and critical revision before moving on to empirical analysis.

MATERIALS AND METHODS

The methodology adopted consisted of an integrative literature review, conducted between 2020 and 2025, with searches carried out in databases such as Google Scholar, Scopus, and Web of Science. Descriptors in Portuguese and English were used, such as learning ecosystems, contemporary education, blended teaching and pedagogical innovation. The selection prioritized open access articles, theses and dissertations, contemplating both national and international productions that presented theoretical relevance and methodological rigor. After screening, the studies were submitted to critical reading and thematic categorization, allowing the triangulation between empirical findings and classical and contemporary conceptual frameworks. In this way, we sought to ensure a comprehensive analysis, capable of articulating diverse contributions and identifying convergences and divergences in the debate on learning ecosystems.

RESULTS AND DISCUSSION

The articles authored by the Education Lab reveal convergences on contemporary learning ecosystems, especially in the approach to hybrid teaching, curricular flexibility, and socio-emotional skills. This movement is in line with Holtz (2025), when he highlights that the educational management of e-learning depends on the articulation between innovation policies and the construction of collaborative environments, so that hybrid teaching is not just a technical tool, but a resource for pedagogical transformation.

Lima *et al.* (2025) argue that hybrid teaching, by combining digital and face-to-face practices, enhances flexibility and personalization, being able to engage the student through methodologies such as "flipped classroom". They highlight that, for this ecosystem to realize its inclusive potential, solid investments in technological infrastructure, public policies, and permanent training of educators are necessary. They highlight challenges such as digital inequality and gaps in teacher training, which are considered obstacles to the adoption of innovative practices and amplify educational disparities, especially in disadvantaged contexts. As a counterpoint, they identify that despite practical advances observed in environments with high infrastructure, there is still a lack of research on the long-term impacts of these practices on the formation of socio-emotional skills and transversal competencies (Lima *et al.,* 2025). This scenario dialogues with Ferreira, Ramos, and Veloso (2024), who argue that quality in digital environments depends on methodological clarity and institutional support that avoids fragmentation of the training process.

Veloso *et al.* (2025) state that the accelerated incorporation of hybrid technologies and methodologies, since the pandemic, has been transforming pedagogical and curricular practices. They highlight that the integration between pedagogical innovation and curricular flexibility is crucial to respond to the demands of contemporary education. Although they point to gains in active learning and student autonomy, they highlight barriers such as digital fatigue, institutional resistance, and insufficient teacher training. They argue that blended learning requires systemic change and that institutional support and pedagogical alignment are essential to the sustainability of these models (Veloso *et al.,* 2025). This argument is reinforced by Moreira (2025), who, when analyzing trends in educational innovation, shows that structural changes in the curriculum are only consolidated when accompanied by innovative management mechanisms and continuous investments in teacher training.

Vilhena *et al.* (2025) discuss that socio-emotional skills — such as empathy, self-regulation, and communication — are central to integrated learning environments, and that initiatives such as restorative practices and mindfulness strengthen school coexistence and integral development. They point to the difficulty of implementing such competencies due to conceptual imprecision, institutional resistance and lack of adequate training of teachers. They

observe that the BNCC recognizes the importance of the socio-emotional dimension, but its effective adoption is still limited by structural and operational barriers (Vilhena *et al.,* 2025). This analysis converges with Correa and Costa (2025), who highlight the role of climate and socio-environmental education as a critical tool for student engagement, but warn of the gap between legal recognition and practical effectiveness in Brazilian schools.

Cavalcante Junior *et al.* (2024) analyze tensions between traditional and critical curricular approaches, arguing that flexibility and interdisciplinarity are imperative in a society marked by accelerated changes. They highlight that digital technologies contribute to personalized learning, but create new challenges related to unequal access and require constant review of teaching practices. They argue that emancipatory curricula depend on collective efforts to overcome cultural resistance and strengthen the continuing education of educators

In dialogue, Fonseca (2024) shows that tools such as concept maps contribute to critical learning, but also depend on structural conditions and the ability of teachers to promote interdisciplinary integration.

There is consensus on the importance of flexible ecosystems, centered on student protagonism and broad skills, as well as the multiplying role of technologies and personalization. Institutional barriers, inequalities in access to technology, digital fatigue, and challenges in teacher training remain as counterpoints, making it difficult for innovative practices to achieve an inclusive or massive character (Cavalcante Junior *et al.,* 2024; Lima *et al.,* 2025; Veloso *et al.,* 2025; Vilhena *et al.,* 2025). These challenges are also observed by Ribeiro *et al.* (2024), who emphasize how technocentrism can weaken the critical dimension of education, making innovation a risk if it is not accompanied by consistent pedagogical reflection.

The analysis of the reference scientific literature (Scopus, Web of Science, Google Scholar, SciELO) between 2020 and 2025 reveals robust convergences and divergences on learning ecosystems. Santos *et al.* (2023) show that digital ecosystems alter traditional dynamics, favoring active learning, student autonomy, and critical development, but point to structural and pedagogical limitations. This diagnosis is complemented by Dann (2025), who, by proposing a conceptual model for open education ecosystems, reinforces the centrality of public policies and structural conditions to sustain collaborative practices.

Education Reimagined & History Co:Lab (2023) broadens the notion of ecosystem, including living networks of human relations, social partnerships, collaborative practices, and structural conditions. They note that developed countries show more consolidated results, while emerging contexts face greater resistance and institutional barriers (Education Reimagined & History Co:Lab, 2023). This picture converges with Guerrero Támara and Penadillo Lirio (2025), when they show that experiential education initiatives in natural environments can strengthen socio-environmental practices, but also suffer institutional limitations in developing countries.

Lima and Assis (2022) review experiences of personalization of learning and formative assessment, pointing out that Brazilian experiences are still in their infancy due to the lack of digital culture and structural investment. This finding is reinforced by Mendes *et al.* (2024), who, when analyzing educational practices such as caving, highlight the importance of creative methodologies, but warn that their application is still restricted to very specific contexts. Both studies reveal that the adoption of ecosystems depends on cultural transformations and not just technological ones.

Other authors from 2020–2025 reinforce that blended learning, flipped classroom, and blended learning favor personalization, engagement, and meaningful learning. However, digital inequality, fatigue, institutional barriers, and teacher resistance persist. There is a proven benefit for twenty-first-century skills, but uneven implementation and lack of long-term studies prevent robust conclusions on cross-cutting impacts (Yangari & Inga, 2021; Wang *et al.,* 2024; Ma *et al.,* 2023; Frederick *et al.,* 2023; Casas & Lopez-Pellisa, 2022; Khong & Tanner, 2024; Li & Yoon, 2024). In addition, Mateus and Tavares (2024) indicate that, in topics such as environmental education, innovation depends on the integration between pedagogical practices and ecological experiences, reinforcing that ecosystems only gain consistency when they articulate values, practices, and social conditions.

Convergences: There is consensus on the need for integration between human, technological and social factors, valuing flexibility, equity and innovation. Well-implemented ecosystems promote engagement, autonomy, and belonging. Divergences: they refer to the effectiveness and speed of change in different contexts. Researchers point out that experiences from developed countries show greater adherence and results, while emerging countries face institutional barriers, lack of infrastructure, and resistance to innovation. Gaps persist in terms of long-term impacts, especially in transversal skills (Santos *et al.,* 2023; Education Reimagined & History Co:Lab, 2023; Lima & Assis, 2022). This tension converges with Correa and Costa (2025), who show that critical education, even when recognized as necessary, is still crossed by structural resistances that delay its social impact.

CONCLUSIONS

This study aimed to analyze the learning ecosystems in contemporary education, through an integrative literature review. The investigation sought to understand how different educational contexts, from blended learning to socio-emotional and environmental practices, have mobilized the concept of the ecosystem to sustain pedagogical innovation, the personalization of learning, and the integral development of students. From the triangulation between theoretical references and recent empirical findings, it was possible to identify relevant advances, but also persistent barriers to the consolidation

of this model.

The results showed that learning ecosystems operate as spaces of articulation between pedagogical, technological and institutional dimensions. On the one hand, studies highlight the potential of blended learning, personalization, and socio-emotional skills to promote engagement, autonomy, and belonging. On the other hand, counterpoints point to challenges such as digital inequality, technological fatigue, institutional resistance, and lack of conceptual clarity, factors that weaken large-scale adoption. This ambivalence shows that, although promising, ecosystems still lack greater methodological systematization and political-educational support to consolidate themselves as a transformative practice.

Thus, it is concluded that the study's objective was partially met, as the review allowed mapping multiple theoretical and empirical perspectives on ecosystems and also revealed important gaps. Challenges remain related to measuring long-term impacts, effectively integrating public policies, and strengthening institutional conditions in emerging contexts. It is therefore recommended to expand comparative and interdisciplinary studies that explore the interface between pedagogical innovation, social equity and sustainability, in order to consolidate learning ecosystems as an educational paradigm of the twenty-first century.

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