

OUTDOOR LEARNING AND DIGITAL GAMIFICATION: EDUCATIONAL TECHNOLOGIES FOR SUSTAINABLE AND AWARE LEARNING

OUTDOOR LEARNING E DIGITAL GAMIFICATION: TECNOLOGIE EDUCATIVE PER UN APPRENDIMENTO SOSTENIBILE E CONSAPEVOLE

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ABSTRACT

The integration of outdoor learning and digital gamification opens new perspectives for addressing contemporary educational challenges, shaped by social acceleration, digital transformation, and ecological urgency. Through praxeological approaches and media literacy practices, it highlights how nature, technology, and ludic dynamics can foster inclusive and sustainable learning environments, promoting critical and ecological citizenship.

L'integrazione tra outdoor learning e digital gamification apre nuove prospettive per affrontare le sfide educative contemporanee, segnate da accelerazione sociale, trasformazioni digitali e urgenze ecologiche. Attraverso approcci prasseologici e pratiche di media literacy, si mostra come natura, tecnologia e dinamiche ludiche possano generare ambienti di apprendimento inclusivi e sostenibili, capaci di promuovere cittadinanza critica ed ecologica.

KEYWORDS

Outdoor learning; digital gamification; media literacy; education for sustainability; inclusive education; ecological citizenship

Outdoor learning; gamification digitale; media literacy; educazione alla sostenibilità; inclusione educativa; cittadinanza ecologica

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Introduction – Rethinking education between nature and technology

In recent years, the international pedagogical debate has been marked by urgent questions concerning the capacity of educational systems to respond to increasingly rapid and pervasive transformations. Global market dynamics, the climate emergency, the widening of social inequalities, and technological acceleration have reshaped the contours of everyday life, producing new opportunities for learning but also risks of fragmentation, alienation, and loss of meaning. In this scenario, it becomes essential to rethink educational models not as mere instruments for the transmission of knowledge, but as dynamic spaces of critical resistance, reflection, and transformative project-making.

The theory of “social acceleration” developed by Hartmut Rosa (2015) offers a particularly fruitful interpretive framework: contemporary society is traversed by processes that continuously demand greater speed and flexibility, fostering the perception of compressed and insufficient time. Learning itself risks being reduced to the rapid and superficial accumulation of notions, at the expense of deeper reflection and the construction of lasting meanings. In this context, education must reclaim the slow time of experience and the value of meaningful relationships.

Outdoor learning can be situated within this perspective as a paradigm capable of restoring to education its experiential and relational dimension. Nature becomes not simply the backdrop, but the protagonist of the formative process, offering students opportunities to learn through the body, the senses, direct observation, and cooperation. Pedagogical and psychological literature has widely documented the benefits of outdoor education: enhancement of cognitive abilities, strengthening of socio-emotional competences, development of critical and creative thinking, and promotion of psychophysical well-being (Beames, Higgins, & Nicol, 2012; Louv, 2016). John Dewey (1938) emphasized that direct experience is a fundamental condition for authentic learning; Maria Montessori (1965) highlighted the foundational value of movement and contact with nature in child development; and Célestin Freinet (1977) underscored the cooperative and community-based dimension of learning rooted in the local environment. These historical perspectives acquire renewed relevance today in light of current environmental and social challenges.

At the same time, the advent of digital technologies has profoundly transformed processes of communication, relationships, and knowledge construction. Students live immersed in a media ecosystem that shapes both their worldview and their identities. To speak of education today therefore means engaging with the need to integrate digital technologies in a critical and conscious manner, avoiding both technophobic rejection and uncritical technocentrism (Rivoltella, 2017; Jenkins, 2009). The challenge lies in striking a balance that

enables digital tools to act as amplifiers of bodily and environmental experience, rather than as substitutes that risk impoverishing or replacing it.

Within this horizon, digital gamification emerges as the application of game-based dynamics to educational contexts supported by mobile and interactive technologies. Originating in the fields of economics and marketing (Pelling, 2002), gamification has progressively been adapted to education, where it has proven effective in fostering intrinsic motivation, engagement, and peer cooperation (Deterding et al., 2011; Kapp, 2012). Badges, challenges, levels of progression, and interactive narratives function as tools to make learning more engaging and meaningful. Outdoor learning and digital gamification together delineate a possible pedagogical paradigm shift, oriented towards a fruitful dialogue between nature and technology. Educational geocaching, citizen science projects, and augmented reality pathways demonstrate how the environment can become a dynamic laboratory of knowledge, in which digital devices serve as narrative and reflective mediators. In this way, the educational experience acquires a situated, collaborative, and sustainable dimension.

Nevertheless, certain critical issues remain: the risk of gamification reduced to extrinsic mechanisms, the potentially dispersive use of technologies, and—most importantly—the question of equity in access to digital resources. This requires teacher training that integrates technical expertise with pedagogical sensitivity. Only a balanced and reflective approach can generate learning ecosystems capable of fostering creativity, responsibility, and ecological competence, thereby opening new avenues to confront the challenges of contemporary education.

2. Outdoor education and digital gamification: new pedagogical synergies

The integration of outdoor education and digital gamification represents a growing field of research and experimentation that opens new perspectives for contemporary teaching and learning. Outdoor learning, understood as an approach that values natural environments and open spaces as contexts for education, is rooted in the tradition of active pedagogy and in the idea of knowledge constructed through direct experience. It does not consist merely of transferring classroom activities outdoors, but rather of embracing a paradigm that attributes formative value to the body–environment relationship, contact with nature, and situated learning (Beames, Higgins, & Nicol, 2012). John Dewey (1938) already emphasized the role of individual–environment interaction as a foundation for personal and social growth; Maria Montessori (1965) identified movement, manipulation, and the natural environment as essential conditions for the development of children’s autonomy; and Célestin Freinet (1977) insisted on the cooperative value of authentic experiences rooted in community life and everyday practice.

Recent literature (Louv, 2016; Rivoltella, 2017) has highlighted how direct contact with nature promotes not only cognitive development but also emotional, social, and physical growth, counteracting the risks of alienation stemming from excessive indoor and digital life. In this light, outdoor education emerges as a response to global challenges such as the ecological crisis, climate change, and growing social fragmentation. At the same time, the pervasiveness of digital technologies has reshaped learning modalities, requiring a pedagogical reflection on how to integrate tools that, if used consciously, can enrich and amplify the educational experience.

At this crossroads, gamification plays a central role. Originating as a marketing strategy (Pelling, 2002), it has been adapted to education as a set of methodologies that employ game dynamics—challenges, rewards, levels, collaboration—to increase motivation and engagement (Deterding et al., 2011; Kapp, 2012). It is important to clarify that gamification is not synonymous with “play” in the strict sense, but represents the intentional application of ludic logics in non-ludic contexts, such as schools. In its digital form, gamification integrates interactivity, technological mediation, and motivational dynamics, opening innovative opportunities for exploration, documentation, and sharing.

The relationship between outdoor education and digital gamification should not be seen as a substitution process, in which technology replaces bodily experience, but rather as a synergy where the two elements reinforce each other. When framed within a clear pedagogical vision, technology becomes an amplifier of experience, capable of stimulating narration, critical reflection, and collaboration. Experiences of citizen science supported by biodiversity-recognition apps, educational geocaching with mobile devices, and nature explorations enriched by augmented reality show how digital tools can be employed in an ecological way, contributing to the construction of authentic and transformative learning.

Educational geocaching, for example, employs geolocation systems to create exploration routes based on clues and rewards. Research highlights how this practice fosters situated learning, critical thinking, orientation skills, and peer collaboration (Fitz-Walter, Tjondronegoro, & Wyeth, 2011). In Italy, forest schools have provided privileged contexts for experimenting with technologies as narrative and documentary tools: students have used tablets and smartphones to record images, sounds, and videos of outdoor activities, creating digital diaries that enrich reflection on lived experiences. The introduction of badges, challenges, and levels of progression has made it possible to include gamification elements without undermining direct contact with nature, but rather reinforcing its educational dimension through practices of co-design and collective narration (Zuccolo & Frabboni, 2020).

Another promising area is gamified citizen science, which engages students in participatory scientific research projects through mobile applications. Platforms such as iNaturalist or Seek offer missions, leaderboards, and symbolic rewards to incentivize the collection and classification of environmental data. Such activities develop scientific competences and ecological responsibility, creating a bridge between schools and research communities (Silvertown, 2009). In this way, digital gamification contributes not only to disciplinary learning but also to the development of an active ecological consciousness, aligned with the Sustainable Development Goals of the 2030 Agenda (UNESCO, 2017).

Augmented reality (AR) represents yet another frontier of experimentation: AR applications allow learners to visualize geological processes or rock stratifications directly in the field, making complex phenomena more accessible and understandable. When integrated with game dynamics such as collective missions or exploratory challenges, augmented reality transforms experience into immersive and memorable learning, uniting the bodily and digital dimensions (Wu et al., 2013).

These practices demonstrate how the integration of outdoor education and digital gamification enables not only the acquisition of disciplinary knowledge but also the development of transversal competences such as problem-solving, cooperation, time management, resilience, and critical thinking. This form of learning is centered on experience, motivation, and responsibility, in continuity with the active pedagogy of Freinet (1977), who already emphasized cooperative work and the authenticity of educational practice.

It must be stressed that effective integration requires careful instructional design, capable of maintaining a balance between bodily experience and technological mediation. If not consciously managed, technology risks becoming a source of distraction or an artificial superstructure. The goal is the construction of a synergic educational ecosystem, in which nature, technology, and ludic dynamics collaborate harmoniously. In this regard, the synecological perspective (Paparella, 2023) proves particularly valuable, as it recognizes the interdependence and co-evolution of relationships between people, environment, and tools, thereby fostering dynamic and sustainable learning.

3. Media literacy, sostenibilità e inclusione nell'integrazione tra outdoor learning e digital gamification

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Conclusions

The interplay between outdoor learning and digital gamification demonstrates that contemporary pedagogy can no longer be confined to preserving the past, but must also assume the responsibility of imagining possible futures. Nature and technology, far from being conceived as irreconcilable spheres, can become interwoven nodes of an educational fabric that integrates bodily experience, ecological awareness, and digital competence. The challenge is not merely methodological but cultural: to redefine education as a space of dynamic balance, where sustainability meets creativity and critical reflection is inseparably linked with action.

Looking in this direction means envisioning schools and educational contexts as true laboratories of planetary citizenship, where students learn not only to acquire knowledge but to inhabit the world responsibly. Within this perspective, outdoor learning and digital gamification—supported by an ecological media literacy—can become not just teaching strategies, but authentic instruments of social transformation.

Authors' contributions

A. Lo Piccolo: Introduction and Conclusion; L. Pistone: Section 1 and Section 2. All authors approved the final version of the manuscript.

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