

Digital citizenship and ecological citizenship.

Pedagogical and relational implications

Daniela Persechini¹

¹ Lecturer at the University of Cassino e del Southern Lazio; d.persechini@unicas.it

Abstract: The convergence between Ecological (or "We-cological") and digital citizenship requires a new understanding of "Citizenship", which is no longer defined by territorial boundaries or limited to physical interactions, but extends to virtual spaces and the planetary ecosystem. This critical convergence calls for a profound transformation of pedagogy and of the educational relationship through the concept of systemic responsibility. This concept implies the awareness that every action, both online and offline, triggers a domino effect with repercussions across complex, socio-cultural, economic and environmental networks, thus requiring a paradigm shift from individualism to interdependence. Within this framework, a new educational model for the *onlife* era is emerging, in which pedagogical action must overcome the dichotomy between the real and the virtual, integrating Mortari's "philosophy of care" with Floridi's ethics of information. Through a theoretical and critical analysis, the paper shows that care for natural and digital ecosystems constitutes a unified relational posture, essential for educating citizens capable of consciously inhabiting the complex contemporary world. A phenomenological–hermeneutic methodology was adopted in the pedagogical research, proving appropriate for the interpretation of educational experience. The results highlight the need for a pedagogy of systemic regeneration aimed at enabling citizens to manage interdependence and to build a sustainable future.



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1. Introduction

The contemporary era is marked by the "*Twin Transition*", that is, the inextricable interconnection between digital transformation and green transition, which calls for overcoming a fragmented vision of education. Through the concepts of the "*infosfera*" and of the "*onlife*" dimension (Floridi, 2017, 2020), it becomes clear that digital and physical spaces are no longer separate, making every action carry a concrete material and environmental footprint. The pedagogical challenge of the twenty-first century thus consists of moving from the mere acquisition of technical skills to an

“ecosystemic citizenship”, based on the awareness that the Internet itself is part of the biosphere. This paradigm shift would require shifting attention from isolated entities to relationships, fostering an ethics of responsibility that links digital actions to their global socio-environmental consequences, including extractivism and democracy. This approach, referred to as “We-ecological” (a synthesis of community, web, and ecology), aims to educate citizens capable of critically inhabiting a hybrid system, combining technological efficiency with the philosophy of care and the recognition of the universal interdependence among human beings, technology, and nature (Mortari, 2024).

The hypothesis underlying this heuristic reflection is that formal education tends to treat digital citizenship, understood as “digital skills”, as a set of technical competences, and ecological citizenship as “ecological sensitivity,” that is, a self-contained scientific or value-based domain. This separation prevents an understanding of the systemic nature of the contemporary crisis.

The very concept of “citizenship” therefore needs to be radically reconsidered, as it is better understood as “educational action” (Perla & Riva, 2024): being citizens today means acknowledging that actions carried out in digital spaces have immediate physical consequences. Accordingly, a systemic and holistic model should be embraced as to move beyond traditional educational approaches (transmissive and anthropocentric). Drawing on Floridi’s observation (2020) that we live in an “infosphere” in which the analogue and the digital are indissolubly intertwined, the paper arrives at a conclusion that parallels Mortari’s claim (2015, 2022) that the essence of the human being lies in care and relationships. Educating to systemic responsibility therefore means educating to interdependence.

2. The Era of Convergence between digital and ecological citizenship

The transition from traditional to contemporary citizenship marks a shift from the individual–State relationship to the individual–system relationship, in which human identity is redefined as “relational” and education is oriented towards a hybrid ecosystem known as the *onlife*, where biological and digital dimensions are now indissolubly intertwined (Floridi, 2017, 2020). In this scenario, “systemic responsibility” becomes an ethical framework necessary to overcome the fragmentation between digital skills and ecological sensitivity: technology is not immaterial but has a tangible physical footprint—from the energy consumption of data centres to the disposal of electronic waste—while the environment calls for a form of care that pedagogy must extend from the “I” to the “We” (We-ecological), encompassing all living species. The educator should therefore act as a critical filter and a model of care, transforming the transmission of knowledge into a process of meaning-making that acknowledges the interdependence among processes: actions carried out in virtual spaces generate immediate material repercussions, thereby making an ecology of relationships essential, which integrates technological rationality with the ethics of planetary stewardship.

Educating for systemic responsibility in the field of digital and ecological citizenship thus emerges as a pedagogical imperative, aimed at educating individuals capable of acting ethically and sustainably in an interdependent world. The goal is to overcome the current fragmented approach to problems and to adopt a holistic perspective that recognizes the long-term consequences of our actions, both online and offline.

A new educational paradigm therefore needs to be developed: an “ecology of relationships” (Ingold, 2024) aimed not only at the transfer of skills but also at fostering a critical consciousness capable of integrating technological rationality with care for the environment.

For Bateson (1972, 1979), the challenge is to develop an “ecology of mind” that acknowledges the unity between biological and communicative processes. When this concept is reinterpreted from a contemporary perspective, education can be understood as the art of making visible the invisible threads that connect our smartphones to rare earth mines and our online words to the health of democracy.

3. The theoretical framework: from competence to citizenship

European education policy has sought to codify the challenges of the new millennium by developing specific competence frameworks: the *DigComp* (Digital Competence Framework) and, more recently, the *GreenComp* (European Sustainability Competence Framework). A critical analysis reveals that a form of digital competence promoting the intensive use of cloud technologies without adequate consideration of the energy impact of servers (addressed in the *GreenComp*) is incomplete, if not harmful. The concept of citizenship, unlike “competence”, requires an ethical synthesis: it is not enough to be able to use a tool; it is essential to be able to critically evaluate its political and biological sustainability. The transition from competence to citizenship therefore implies the integration of these two frameworks into a single ecosystemic competence (ISPRA, Italian Higher Institute for Environmental Protection and Research).

To fully understand this integration, it is necessary to draw on the reflections of critical posthumanism. Braidotti (2024) suggests that the traditional concept of “Man”, understood as the rational and dominant centre of the world, is undergoing a profound crisis. Once the individual is recognised as being immersed in a network of non-hierarchical relationships with technological and natural agents, citizenship is no longer an individual possession but a process of interconnection.

The starting point for redefining contemporary citizenship lies in the deconstruction of the dichotomy between the physical and the digital worlds. Floridi (2017, 2022) argues that, in the *onlife* era, digital technologies cease to be interpreted as mere communication tools (instrumentalism) and are instead recognised as environmental forces shaping the ecosystem we live in, the infosphere.

Floridi’s most innovative contribution to ecological citizenship lies in overcoming the immaterial conception of digital technologies. The philosopher advocates the need to combine the “Blue” (digital technologies and spaces and their transformative potential) with the “Green” (ecology and sustainability). Even when appearing ethereal in the cloud, technology relies on material infrastructures with a deep environmental impact. Floridi’s notion of systemic responsibility therefore implies a “governance of the human being”, capable of using the potential of digital technologies to monitor and protect the biosphere while simultaneously reducing entropy (understood as informational and material disorder) within the overall system (Floridi, 2020).

While Floridi provides a map of the *onlife* era by describing the hybrid environment we are immersed in, Mortari offers the ethical compass required to inhabit it. The connection between the two authors lies in the shift of responsibility from the purely informational level to the existential level. While, according to Floridi,

technology functions as an environmental force, according to Mortari the environment (whether physical or digital) is the space in which human essence unfolds through care.

Mortari (2015) defines care as a fundamental ontological practice: we are what we take care of. From the perspective of integrated citizenship, care is articulated across three inseparable levels: care for the self (the management of one's digital presence), care for the other (digital level: ethics of communication), and care for the world (ecological level: responsibility towards the biosphere). Prior to Mortari, Tronto (1993) had also discussed about care for the world, defining care as the activity that enables us to preserve the world so that human beings may live in it under the best possible conditions.

Postulating care as a pedagogical foundation means transforming civic education from a list of duties into a “practice of attention”. The digital and ecological citizen is one who pays attention to what is invisible: to the data they provide, to the labour hidden behind algorithms, and to the scars the digital economy leaves on physical territories. This “pedagogy of care” represents the most viable alternative to the logic of extraction and consumption that characterises both digital capitalism and environmental exploitation (Mortari, 2022).

Systemic responsibility thus finds its concrete pedagogical application in the act of caring: caring for the digital other and for the non-human other. According to Mortari (2015, 2022), care is not a vague feeling but a fundamental ontological practice. The human being is constitutively “lacking” and in need of care; citizenship, therefore, is not merely a set of rights but an ongoing practice of caring for the world. In this sense, educating for ecological citizenship means shifting the focus from the sovereign individual (anthropocentrism) to relationships of interdependence. This perspective aligns closely with the We-ecological approach (Mortari, 2023): an ecology of the “We”, in which individuals recognise themselves as part of a vital network. Within this network, the other is not only the human being but also the biological environment and, by *onlife* extension, those encountered through screens.

4. Relational Implications: the ethics of interdependence

The concept of care implies a form of systemic responsibility that operates consciously within the *onlife* dimension. There is no digital citizenship without the ecological sensitivity inherent in care, and no ecological citizenship today without the critical competence required to manage the impact of digital technologies. Educators should act as the weavers of this relational “warp and weft”, teaching how to “live within the system” with a gaze capable of looking beyond the screen, towards the biological roots of human existence. In this complex context, with reference to relationships, Bauman (2000) develops the concept of “liquid modernity”, arguing that it has become difficult to build lasting bonds in the field of online ecological activism. The inherent risk of digitally-mediated ecological relationships lies in what Bauman calls “aesthetic sociality”, a form of bonding based on immediate gratification rather than enduring responsibility.

In order to alter this condition, transformation must first address the educational relationship itself. As Spina (2018) emphasizes, an education of listening thought needs to be fostered and carefully cultivated, meaning that educators should engage in authentic listening towards the other. This constitutes a fundamental quality of the educational relationship, which should be based on communicative reciprocity.

Within such a relationship based on listening, educators recognize students' anxieties and listen to them without bias (active listening); they should also be the first "model citizens", demonstrating coherence in their use of technology and respect for the environment (exemplarity).

Educational relationships should therefore be transformed into a collaborative research pact. In this perspective, educators are required to take on new roles: they acknowledge that they do not know everything, positioning themselves within a stance of collaborative inquiry; they act as critical filters, guiding students in the analysis of sources and in the management of screen time; they listen to students' anxieties without bias (active listening); they become models of care (caregivers) who embody an ethics of responsibility towards the living (exemplarity); and they function as system catalysts, facilitating an understanding of the long-term consequences of collective actions. "Relational responsibility" thus extends empathy to the "digital other" (e.g., combating cyberbullying) and to the "non-human other" (e.g., the protection of biodiversity). The development of relational responsibility therefore represents the overcoming of pedagogical individualism. If systemic responsibility constitutes the structure, the educational relationship functions as its lifeblood. Consequently, the role of educators shifts from transmitters of knowledge to directors of interdependencies, establishing an ethical framework that simultaneously embraces the infinitely small world of the pixel and the infinitely large world of the planetary ecosystem. From a pedagogical perspective, Floridi (2020) suggests that educators should educate individuals as "architects of the infosphere", that is, persons capable of designing and managing the infosphere in an ethical and responsible manner.

In addition, drawing on Mortari's reflections, educators should demonstrate responsibility towards the living not only in words but also through everyday school practices: from the way technological devices are treated (maintenance rather than disposal) to the ways in which physical space is inhabited. The educational relationship thus includes the environment as a "third educator" (Malaguzzi, 1996). Caring for a plant in the classroom or monitoring an urban beehive through digital sensors are practices that transform empathy from an abstract feeling into a political practice. The most ambitious challenge lies in the extension of the empathic arc. The "pedagogy of systemic regeneration" proposes a threefold orientation of empathy (Mortari, 2015, 2022): towards the digital other (recognising that behind every datum or profile there is a sentient body); towards the non-human other (entities that cannot act but nevertheless suffer the consequences of human actions, such as biodiversity); and towards future generations (relational responsibility extended across time). The educational relationship thus becomes a safe harbour in which complexity is enacted as a conscious practice (Mortari, 2023).

The convergence between Floridi and Mortari synthesizes a renewed profile of the systemic citizen, characterised by the awareness that the world is an interconnected information-material system (Floridi) and that, through an ethical disposition, one takes care of those connections (Mortari). To achieve this aim, it is essential to develop qualitative and quantitative metrics that educators can use to assess not only isolated digital competences or environmental knowledge, but also the capacity for systemic agency—that is, students' actual ability to exert a positive influence on the interconnected dynamics of their communities (Mortari, 2022).

5. Pedagogical implications

Systemic responsibility is not a static moral notion, but a cognitive, ethical, and operational capacity that should be actively developed. Its pedagogical implications require the adoption of a critical and constructive approach, a departure from transmission models, as well as the adoption of active and transdisciplinary pedagogical methodologies.

In this way, students develop critical thinking and awareness of the interconnections between technology, society, and nature. This shift requires the adoption of a “transformative epistemology” and a “pedagogy of complexity”, which are essential tools to overcome the fragmentation of individual disciplines in favour of transdisciplinarity (Mortari, 2015). In this context, school transforms itself into a laboratory in which every action is assessed according to a non-linear logic (the butterfly effect), contributing to a renewed form of citizenship that integrates digital ethics and care for the environment within a single educational pathway aimed at safeguarding the global common good. Schools become a “community of practice” (Alessandrini, 2007), where liberatory democracy is experienced through engagement with environmental and digital issues.

In order to avoid transmission models and foster this form of responsibility, experiential and design-oriented methodologies are required to connect theory, practice, and emotion. For instance, educational projects can be carried out integrating the use of digital technologies for environmental monitoring with concrete actions (e.g., circular economy initiatives, online awareness campaigns), thereby enabling learners to experience directly both co-responsibility and the effectiveness of their actions. As Richard Louv (2005) argues, direct experience in nature reduces “nature-deficit disorder”; in this process, educators guide slow observation, in contrast to the frenetic pace of digital environments.

Pedagogical proposals for integrated education should therefore adopt a transdisciplinary and challenge-oriented approach. In practical terms, this entails designing curricula that address real-world problems—such as urban sustainability, climate resilience, and digital justice—requiring students to make use of diverse competences in an integrated manner. It also means creating hybrid learning environments that combine immersive experiences in nature with the creative use of digital technologies for documentation, analysis, and communication. Finally, it entails developing “authentic assessments” that measure not only declarative knowledge but also applied competences, ethical dispositions, and transformative agency capacity.

6. Conclusive remarks

The analytical path developed in the paper has enabled a thorough exploration of the theoretical foundations, the applied practices, and the pedagogical and relational implications of digital and ecological citizenship. The paper has highlighted that these two dimensions, far from being separate domains, represent complementary facets of the civic competence required in the twenty-first century.

From a theoretical perspective, the analysis was based on the integration of the frameworks proposed by Floridi (infosphere and digital ethics) and Mortari (relational pedagogy and care), with the aim of developing a holistic understanding of contemporary citizenship.

At the level of practical implications, the following have mainly emerged: identification of transversal (soft) skills, innovative pedagogical methodologies, and models of educational intervention.

With regard to future perspectives, this work advocates an orientation towards transdisciplinary education, the development of hybrid learning environments, and participatory governance models aimed at fostering sustainable global citizenship.

The main results of the analysis can be summarised in the following key points:

- digital and ecological citizenship share common ethical foundations, namely responsibility towards others (both human and non-human entities), critical thinking to navigate complexity, and a commitment to social and environmental justice;
- the competences required for these two forms of citizenship are largely overlapping, including information literacy, systemic thinking, collaboration, creative problem-solving, and transformative agency;
- digital technologies can be powerful allies of sustainability, but only when guided by ethical values and governed through democratic processes;
- education for digital–ecological citizenship requires profound transformations in pedagogical paradigms, moving beyond transmission-oriented approaches and disciplinary fragmentation towards experiential, transdisciplinary, and action-oriented models.

The task of education, therefore, should not be to prepare new generations for a predetermined future, but to enable them to become co-creators of possible futures, equipping them with the critical competences, ethical sensitivities, and transformative agency required to face uncertainty with wisdom and responsibility.

Several directions for further research emerge from this analysis. At the theoretical level, the intersections between digital ethics, environmental ethics, and the ethics of care would require deeper investigation, with the aim of developing an integrated framework of responsibility for complex socio-technical–ecological systems. At the empirical level, longitudinal studies should be conducted to assess the effectiveness of different pedagogical approaches in fostering digital–ecological citizenship competences and promoting enduring behavioural change. At the methodological level, authentic assessment tools need to be developed to identify not only declarative knowledge, but also applied competences, ethical dispositions, and capacities for agency. At the policy level, educational governance models should be examined, which may support pedagogical innovation, continuous professional development for educators, and partnerships among schools, universities, local authorities, businesses, and the non-profit sector.

The pedagogical imperative, therefore, is to educate for systemic responsibility by shifting from fragmented education to a “pedagogy of regeneration”. Such an approach requires pedagogical courage, a willingness to experiment, and the capacity to learn from errors. Above all, however, it requires a clear ethical vision: the belief that every student can, and must, become a key agent of positive change, contributing to the construction of more just, sustainable, and flourishing societies for all the inhabitants of the planet.

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