THE PARADOX OF SUSTAINABILITY: COMPENSATORY STRATEGIES VS. TRANSFORMATIVE EDUCATION. SINCRONY IN A CRITICAL ANALYSIS

IL PARADOSSO DELLA SOSTENIBILITÀ: STRATEGIE COMPENSATIVE VS. EDUCAZIONE TRASFORMATIVA. UN'ANALISI CRITICA DELLA METODOLOGIA SINCRONY

Arianna Fogliata[1]
Department of Mental and Physical Health and Preventive Medicine, University of Campania "Luigi Vanvitelli"
fogliataarianna@gmail.com
https://orcid.org/0000-0003-0899-6749
Mariapia Mazzella[2]
Department of Human Science, Social Science and Health of University of Cassino, Lazio Meridionale
Mariapia.mazzella@unicas.it
https://orcid.org/0009-0000-1757-1422
Antinea Ambretti[3]
Department of Psychological, Pedagogical and Educational Sciences, Università telematica Pegaso,
antinea.ambretti@unipegaso.it

Double Blind Peer Review

Fogliata, A., Mazzella, M., Ambretti, A. (2025). The Paradox of Sustainability: Compensatory Strategies Vs. Transformative Education. Sincrony in a Critical Analysis. Italian Journal of Health Education, Sports and Inclusive Didactics, 9(3).

Doi:
https://doi.org/10.32043/gsd.v9i3.1618

gsdjournal.it
ISSN: 2532-3296
ISBN: 978-88-6022-522-1

ABSTRACT

Sustainability education often relies on compensatory strategies without rethinking learning models. This study explores the paradox of sustainability in education, arguing that integrating environmental competencies into curricula is ineffective unless supported by an epistemological and methodological transformation. A three-round Delphi study aimed to identify effective strategies that integrate bodily experience and environmental awareness

L'educazione alla sostenibilità si basa spesso su strategie compensative senza ripensare i modelli di apprendimento. Questo studio esplora il paradosso della sostenibilità in ambito educativo, sostenendo che l'integrazione delle competenze ambientali nei curricula risulti inefficace se non accompagnata da una trasformazione epistemologica e metodologica. Uno studio Delphi in tre fasi, ha cercato di individuare strategie efficaci che integrano l'esperienza corporea e la consapevolezza ambientale

KEYWORDS
Inglese: didactics; transformative learning; education; embodied learning; environmental engagement.
Italiano: didattica; apprendimento trasformativo; educazione; apprendimento incarnato; impegno ambientale.

Received 24/09/2025
Accepted 28/10(2025
Published 07/11/2025

1The work is the result of joint reflections by all the authors. 4-5-6.
2The work is the result of joint reflections by all the authors. 1-2-3.
3 The work is the result of joint reflections by all the authors. 7-8 and supervision.

Introduction

In recent decades, the concept of sustainability has become a crucial element in educational, managerial, and political discourse, finding terminological and practical application in various fields, from corporate governance to pedagogical practices. In this scenario, the risk is that resources are limited to compensatory solutions which, while representing progress, merely alleviate the visible effects without addressing the underlying environmental, economic, and social problems (Latouche, 2009; Klein, 2014). In the educational context, this often translates into training programmes aimed at developing "green" skills without questioning the growth model that necessitated such training in the first place. However, sustainability cannot be treated as a mere curricular update or an additional skill to be acquired; it requires a profound rethinking of teaching methodologies and the values imparted to students (Shiva, 2016). This chapter explores the paradox of attempting to improve sustainability while adapting it to systems that are inherently unsustainable. It reflects on critical approaches that seek to integrate sustainability as a fundamental educational principle rather than as a compensatory measure introduced retrospectively. Rather than fostering critical awareness, the education system conforms to existing paradigms, equipping students to navigate an unsustainable system rather than question it (Orr, 1994). Digital saturation is reshaping students' ability to engage deeply with sustainability. The increasing prevalence of digitalisation is reducing students' capacity to manage complexity and process information critically and systematically. The Sincrony methodology, by integrating bodily awareness with environmental connection, aims to help students develop competencies aligned with the second pillar of the GreenComp framework the ability to understand and navigate complex systems. The use of proprioception and interoception extends beyond mere bodily perception exercises; it serves as a means of fostering holistic, less fragmented thinking, essential for addressing environmental challenges (Lilly, 2013). In response to these issues, "digital detox" programmes, attention-enhancing methodologies, and technological tools aimed at reducing the negative effects of digital overexposure are becoming increasingly widespread (Carr, 2011). However, these strategies bypass the root of the problem: the education model itself, which continues to be shaped by market-driven logic rather than by principles of balance and human well-being. Scholars argue that sustainability education requires a shift from technical training to systemic change (Sterling, 2010; Mezirow, 2000). The concept of transformative learning suggests that only education that encourages a critical reassessment of one's assumptions can truly generate change (Wals & Corcoran, 2012). From this perspective, education aimed at increasing sustainable behaviours and choices should promote systemic rethinking, moving beyond the current extractive and unsustainable model (Bateson, 1972). Education, in this

sense, should involve a critical exercise of subtraction rather than the mere addition of competencies. Scholars such as Biesta (2010) highlight the risk of modern education becoming a continuous input strategy, where students are trained to respond to market demands rather than to develop authentic awareness. Similarly, Gough (2021) argues that sustainability should not be conceived as another adaptation tool but as a redefinition process of the relationship between knowledge, economy, and nature. Kahn (2010) also underscores the importance of eco-pedagogy, which moves beyond the accumulation of information towards a more systemic awareness. Along this line, Jickling & Wals (2008) propose that education should foster systemic thinking over consumption-driven learning. Thus, the education of young people should be seen as an opportunity to nurture new values, behaviours, and practices that foster a balance between individual and collective development. The GreenComp framework, developed by the European Commission (Bianchi et al., 2022), identifies four key areas: embedding values, understanding complexity, envisioning futures, and acting responsibly. This approach emphasises the need to move beyond content-driven education, promoting educational practices that develop critical analysis, systemic connection, and long-term vision (Sterling, 2010). For sustainability education to be truly effective, it must question which tools and methodologies foster holistic, non-fragmented learning, promoting attention, reflection, and connection with context. In this perspective, the increasing digitalisation of knowledge and the early introduction of technological tools in family life raise important questions. Recent studies (Louv, 2008; Gray, 2013; Lieberman et al., 2009) indicate that early and prolonged exposure to digital tools may influence attention span, self-concept formation, and relational dynamics. Additionally, numerous studies highlight that direct contact with the natural environment and experience-based learning are essential factors in developing critical and systemic thinking (Heft, 2012; Kuo et al., 2019). Within this context, the rediscovery of educational practices that prioritise free play, manual skills, and connection with the natural world could be a valuable opportunity to enhance children's emotional and relational competencies. Without these, the ability to act sustainably may remain ineffective. Approaches such as forest schooling (Knight, 2013) and place-based education (Sobel, 1996) offer models where learning occurs through direct experiences, fostering the development of empathy and a sense of responsibility towards the environment (Chawla, 2015; Whitebread, 2017).

1. The paradox of sustainability in education

The paradox of sustainability education emerges from the attempt to promote transformative learning models without modifying the structures that regulate learning and knowledge transmission. The current education system incorporates sustainability as a set of technical competencies without critically examining the

epistemological and pedagogical models that have contributed to the identity crisis, also reflected in environmentally and socially unsustainable behaviours (Vare et al., 2022). This approach highlights the need to reflect on the relationship between sustainability education and the institutional structures in which it is implemented. On the one hand, education promotes green skills acquisition to address global challenges; on the other, schools and universities remain bound by logics of efficiency, measurability, and productivity, which rarely allow for a real transformation in thinking and behaviour (Bascopé et al., 2021). One of the central aspects of this paradox is the belief that sustainability can be taught as an additional subject without requiring a transformation of the educational model itself. The dominant approach is based on transmitting knowledge and technical skills, assuming that educating informed individuals will automatically lead to sustainable behaviours (Huckle & Wals, 2015). However, this overlooks the reality that individual and collective choices are shaped by cultural and economic systems that perpetuate the Western status quo (Stevenson et al., 2017). A truly sustainable education must question the foundations of learning and foster a transformation in students' cognitive and relational processes. The use of digital technology in sustainability education is often justified by its potential to enhance access to information and personalize learning (Selwyn, 2022). However, research indicates that hyper-digitalization reduces attention span, critical thinking, and emotional engagement, key factors for fostering empathy and environmental awareness (Kirschner & Neelen, 2018). Ironically, reliance on digital tools can undermine sustainability education by diminishing direct sensory and relational experiences with nature, limiting the development of responsibility and belonging (Louv, 2019). A related paradox is the reliance on compensatory strategies to address issues stemming from rigid, performance-driven education models. Many institutions respond to declining attention, conceptual processing, and social interaction with short-term fixes that fail to address systemic causes of fragmented learning (Fullan & Langworthy, 2014; Fisher et al., 2020). True reform requires embedding sustainability as a core educational principle rather than an adjunct topic (Rieckmann, 2018). This involves revising curricula, prioritizing experiential learning, and integrating ethical and practical dimensions of knowledge. Additionally, recognizing the connection between body and mind in learning is crucial to fostering holistic engagement with sustainability (Lotz-Sisitka et al., 2015).

2. Deconstructing the educational myth: from the "Takers" narrative to transformative education

Another often overlooked aspect of the paradox of sustainability education is the fact that education itself is built upon a cultural myth, an invisible narrative that shapes our perception of the world and our way of learning. Daniel Quinn (1992) highlights how Western civilisation is founded on a grand story, the myth of the

"Takers", in which humanity is separate from nature and destined to dominate it through progress and knowledge. This narrative is implicitly transmitted through the education system and is never questioned: students are taught to integrate into an economic and social model that assumes infinite growth and the accumulation of knowledge as unquestionable values. The problem, however, is that this very model has generated the environmental and cultural crises that we now attempt to mitigate through compensatory strategies. If sustainability education is to be truly transformative, it must begin with a radical rethinking of educational narratives, shifting from a "Taker" model to one more aligned with the "Leaver" paradigm. According to Quinn, Leaver societies are not based on dominance and accumulation but on a symbiotic relationship with the environment, where knowledge is not a tool for controlling the world but for living harmoniously within it. This requires an education system that redefines the way we conceive knowledge, our relationship with the planet, and our own identity, beyond simply teaching technical skills for "managed sustainability". To achieve this, it is necessary to abandon the idea that knowledge is a product to be transmitted in a linear, quantitative manner and instead embrace a relational and discovery-based learning process. Models such as place-based learning (Sobel, 1996), experiential education, and forest schooling (Knight, 2013) align with the Leaver philosophy, offering learning experiences that go beyond mere information transfer, fostering direct interaction between the individual, community, and environment. However, this transformation cannot occur without explicitly deconstructing the dominant educational myth. Schools and universities must question not only what they teach but how and why they teach it. As long as sustainability is treated as a curricular module within a system that prioritises competition, measurable performance, and economic growth as primary objectives, the paradox of sustainability education will persist. Conversely, if education successfully promotes systemic thinking and a critical reconsideration of the human-nature relationship, it can truly become a tool for transformation, rather than simply an adaptation to an unsustainable model.

3. Sincrony and sustainability education: from abstract thought to the body as a learning experience

One of the critical aspects of today's educational system is the separation of mind and body, reflected in the dominance of teaching methodologies that prioritise abstract thinking and disembodied content delivery. Furthermore, as previously highlighted, technology overuse in childhood exacerbates this disconnection. As a result, young people accustomed to predominantly digital, fragmented learning experiences devoid of direct bodily and sensory engagement may grow into adults with imbalanced relationships with the environment. This aligns with the "Taker" perspective, where knowledge is detached from lived experience. The integration of the Sincrony methodology (2008) could serve as a transformative educational

alternative, as it recognises and utilises movement as a tool for transformation (Feldenkrais, 1972; Sheets-Johnstone, 2011). In the context of sustainability education, the body cannot be considered separate from learning, just as humans cannot be disconnected from the natural environment, particularly during growth phases. Movement is an integral part of thought, a tool for self-structuring, empathy development, and relational awareness (Fischer & Bidell, 2006). The Sincrony approach (2008) offers a concrete response to the challenges posed by hyper-digitalisation and fragmented learning. The Sincrony methodology promotes learning through bodily experience, fostering a reconnection between the individual and the environment. By engaging in interoceptive listening and proprioception, students develop greater sensitivity towards their own bodies and, consequently, their surroundings. This process aligns with the first pillar of the GreenComp Framework, which emphasises the need to embed sustainability values not only at a theoretical level but as an integral part of everyday experience. In practice, this translates into increased awareness of resource management and environmental impact reduction, resulting from a perceptual and bodily transformation. Based on the premise that movement is a fundamental element of cognitive and emotional development, Sincrony proposes bodily and perceptual experiences to counterbalance an increasingly abstract and digitally mediated education system (Feldenkrais, 1972; Sheets-Johnstone, 2011). Digital education often fosters fast, superficial learning methods, reducing direct experience and relational interaction (Carr, 2011; Kirschner & Neelen, 2018). This affects identity formation, which is increasingly shaped through virtual interactions, leading to a sense of disconnection from the physical self and the environment. The Sincrony methodology seeks to restore balance, fostering awareness of one's body in relation to surrounding space and creating learning experiences where the body is not merely a passive container of knowledge but an active medium of understanding (Zull, 2002). In the context of "Leaver" culture (Jickling & Wals, 2008), Sincrony provides an opportunity to move away from knowledge accumulation and cognitive overstimulation, which are characteristic of digital society. Through practices that prioritise the quality of experience over the quantity of information, this approach fosters harmonious knowledge development and sustainability competencies (Wals & Corcoran, 2012). Learning experiences based on movement and interaction with the natural environment promote self-awareness, interpersonal awareness, and environmental consciousness, key elements of sustainability education that is not merely conceptual but transformative (Sterling, 2010). In an era where digitalisation has made information instantly accessible, it is essential to recover the value of time, presence, space, and environmental connection. These elements are integrated into Sincrony's educational practices, enabling deeper learning rooted in lived experience.

4. Methodology

The study was conducted using the Delphi method, structured into three sequential rounds to gather expert consensus in the fields of education, neuroscience, and pedagogy regarding strategies for sustainability education. The process was carried out anonymously to reduce bias and mutual influence among participants. The expert panel consisted of 20 professionals, selected based on specific competence and scientific relevance criteria. The selection criteria: a minimum of 10 years of proven experience in their respective fields; verified expertise in sustainability education, cognitive neuroscience, pedagogy, or innovative curricular teaching (through publications, projects, or professional activities); inclusion of experts with multidisciplinary backgrounds. Demographic characteristics: age range: 39–59 years (mean 48 ± 3 years); gender balance: 50% male, 50% female. Education level: all participants held at least a PhD or equivalent qualification; professional sectors: 60% university academics/researchers, 40% independent professionals in relevant fields. The study phase was divided into four rounds: first Round: distribution of an exploratory questionnaire with open-ended and closed-ended questions regarding transformative educational strategies, digital overload reduction, and experiential methodologies. Qualitative analysis of open-ended responses to identify key thematic categories. Second Round: development of a structured questionnaire based on first-round themes, featuring statements rated on a 5-point Likert scale; statistical analysis of responses to identify areas of convergence and divergence. Third Round: presentation of aggregated results from the second round to participants. Reassessment of statements, allowing participants to adjust responses in light of emerging consensus. Definition of priority strategies, with a ≥75% agreement threshold set as the convergence criterion.

5.1 Analysis of Delphi Data

The data collected across the three Delphi rounds were analysed using a mixed-methods approach, combining qualitative analysis for the first round and statistical methods for the subsequent structured questionnaires. The primary goal was to determine the level of expert consensus and identify any divergences in opinion. In the first round, open-ended responses were subjected to inductive thematic analysis following Braun and Clarke's (2006) approach. Through an iterative process of reading and coding, several key themes emerged, reflecting experts' perspectives on sustainability education and the reduction of hyper-digitalisation. Responses were categorised based on their recurrence and relevance, allowing for the structuring of the questionnaire for subsequent rounds. The software NVivo 12 was used to support this analytical phase, facilitating data organisation and identification of the most relevant themes. In the later rounds, quantitative data from the structured questionnaires were analysed using descriptive and inferential statistical methods. For each Likert-scale item (5 points), the mean (M), standard deviation (SD), median, and interquartile range (IQR) were calculated to describe

response distributions and assess central tendencies and variability. The level of consensus among participants was measured using Kendall's coefficient of concordance (W), with values interpreted as follows:

Below 0.3: Low agreement

0.3 to 0.5: Moderate agreement

0.5 to 0.7: Strong agreement

Above 0.7: High agreement

Results indicated that most statements reached a concordance level of ≥ 0.6, demonstrating a strong convergence of expert opinions on various aspects of the topic. To identify variations in responses between the second and third rounds, the Wilcoxon signed-rank test was applied to assess whether statistically significant differences ($p < 0.05$) were present between response distributions across rounds. Findings showed that, for statements where agreement increased, the variation in scores was significant ($p < 0.05$), confirming that the iterative process facilitated the alignment of participants' opinions. The data analysis thus identified areas of strong consensus, offering key insights for defining sustainable educational strategies and mitigating the impact of hyper-digitalisation in education. At the same time, areas of disagreement emerging in the final rounds suggest potential directions for future research, particularly concerning the implementation of transformative strategies in education.

4.2 Pilot study: implementing a transformative educational model using the Sincrony methodology

In light of the Delphi analysis results, it became necessary to empirically test the effectiveness of the identified educational strategies, with particular attention to their influence on the development of sustainable and responsible behaviours towards the environment. For this reason, a pilot study was conducted in a lower secondary school (24 students) to evaluate whether the Sincrony methodology could foster increased environmental awareness and more sustainable decision-making among students. To ensure a more accurate assessment of the influence of transformative educational strategies on sustainable behaviours, the 24 students were classified based on their digital usage levels, in accordance with the World Health Organization (WHO) guidelines, using the Digital Exposure Questionnaire (DEQ) (Domoff et al., 2020). The WHO recommends a maximum of two hours of screen time per day for children and adolescents. Based on these guidelines, students were divided into three distinct categories:

•Excessive technology use: Students exceeding the recommended limit by more than an hour (more than 3 hours per day of digital device usage).

•Moderate technology use: Students falling within the WHO guidelines (between 1 and 2 hours per day).

•Minimal technology use: Students using digital devices for less than 1 hour per day.

Following initial classification, the 24 students were divided into a Experimental Group and a Control Group, ensuring balanced representation of students with different levels of digital exposure within each group. Each group consisted of: 4 students with excessive technology use, 4 students with moderate technology use, 4 students with minimal technology use. This structure allowed for a comparative analysis of differences in response to the adopted educational strategies.

4.3 Experimental intervention

Although the Sincrony methodology is a broad and complex methodology, this pilot study focused on a specific aspect: the development of interoception, proprioception, and kinesthesia. The objective was to verify whether greater bodily awareness, in various states of stillness and movement, could enhance environmental awareness and consequently lead to more sustainable behaviours. Over the course of six weeks, students in the experimental group followed a progressive pathway, structured into four phases, gradually guiding their bodily awareness from a static state to dynamic interaction with space, the surrounding environment, and others.

•Static awareness phase

In the initial sessions, students were guided through bodily perception exercises in a state of immobility. While sitting or lying on the ground, they learned to recognize their body's position in space, perceive contact with the surface, and observe physical sensations without altering them. The focus was on awareness of muscle tension and tactile sensations, with moments of silence to refine perception.

•Breathing phase

After establishing an initial level of bodily awareness, breathing was introduced as a central element of internal-external connection. Students experimented with different breathing techniques (slow, deep, rhythmic) to explore their impact on relaxation and concentration. Exercises were proposed to synchronize breathing with environmental elements, such as the movement of leaves in the wind or the rhythm of their heartbeat, perceived through touch.

•Conscious movement phase

Next, students began to translate their bodily awareness into movement. Exercises included slow walking with a focus on posture, blindfolded movements to refine proprioception, and activities promoting motor coordination. At this stage, natural materials were introduced, such as walking barefoot on different surfaces (grass, gravel, floor), to stimulate the sense of contact with the surrounding environment.

•Play and interaction phase

The final part of the intervention involved structured playful activities, where students explored the relationship between their body and the surrounding space. Balance and interaction games stimulated a greater perception of the relationship between individual movement and the environment. Students were asked to move without altering the space, observing their actions in relation to others and the natural elements present.

The control group carried out regular school activities, without receiving any specific guidance on bodily awareness and environmental connection. The impact of the intervention was assessed using two main tests, administered to all students before and after the experimentation period: Environmental Engagement Test (EET). This test was divided into two sections: a perceptual and a behavioural section. In the first section, students were asked to describe their engagement in outdoor activities, comparing their experiences before and after the intervention. The questions aimed to detect changes in sensitivity to the natural environment, such as: greater perception of sounds and environmental sensations, more active participation in observing nature, a deeper awareness of the relationship between movement and interaction with natural space. In the second section, students were asked to report the number of concrete actions taken to reduce their environmental impact (Nisbet et al., 2009). And Proprioceptive and Environmental Awareness Scale (PEAS). This test was used to evaluate whether the bodily awareness pathway promoted by the Sincrony methodology had influenced students' environmental sensitivity. It assessed two key aspects: awareness of one's body in space and the surrounding environment, the connection between movement and the environment. Regarding bodily awareness, students were asked to provide feedback on their perceptions, assessing whether they had developed a greater attention to their body and its relationship with space. Questions explored their ability to: perceive movements more precisely, feel contact with different surfaces, improve bodily coordination. The second aspect of the test focused on the relationship between movement and the environment. Students were asked whether, after the Sincrony pathway, they perceived a stronger connection between their body and the surrounding environment (Mehling et al., 2012).

5. Results

Statistical analysis was conducted using non-parametric tests, given the small sample size (N = 24) and the asymmetrical distribution of the measured variables. To compare the scores obtained in the EET (Environmental Engagement Test) and PEAS (Proprioceptive and Environmental Awareness Scale) before and after the intervention, the Wilcoxon signed-rank test for paired samples was used, while the Mann-Whitney U test was employed to compare the experimental group with the control group. The experimental group showed a significant increase in environmental engagement (EET: $p < 0.01$) and proprioceptive awareness (PEAS: $p < 0.05$), while the control group showed no meaningful changes ($p > 0.3$). Subgroup analysis revealed that students with minimal technology use exhibited the highest gains ($p < 0.01$), while those with excessive digital exposure showed marginal improvement ($p = 0.12$). However, a subgroup analysis based on digital usage revealed that the most significant improvements were observed among students with minimal technology use, whose post-intervention scores increased significantly in both EET (Mdn pre = 3.3, Mdn post = 4.8, $W = 17$, $p < 0.01$) and PEAS (Mdn pre = 3.0, Mdn post = 4.6, $W = 14$, $p < 0.01$). Conversely, among students with excessive technology use, the improvement was marginal and not statistically significant (EET: Mdn pre = 2.8, Mdn post = 3.3, $W = 21$, $p = 0.12$; PEAS: Mdn pre = 2.7, Mdn post = 3.1, $W = 19$, $p = 0.18$), suggesting a resistance to change and a lower responsiveness to the Sincrony intervention.

6.1 Qualitative observations and Post-Hoc analysis

During the pilot study, teachers and researchers began to observe that some students in the experimental group showed reduced participation in activities, despite following the same pathway as their peers. Initially, it was hypothesized that these differences were solely attributable to the level of digital exposure. However, as the intervention progressed, it emerged that even among students with minimal digital use, responses to bodily awareness and environmental connection activities varied significantly. Student engagement varied, with some showing enthusiasm while others remained indifferent. This discrepancy led to a systematic observation of student behaviour in class and during outdoor activities. Teachers observed lower engagement among students from families with less sustainability awareness. These students struggled to connect with sustainability activities and demonstrated reduced spontaneous interaction with nature. To verify whether family context might be an influencing factor, a post-hoc analysis was conducted by introducing the Family Sustainability Sensitivity Questionnaire (QSFS). This tool gathered data on household habits related to resource management, digital use regulation, and family involvement in eco-friendly practices. The results showed that students from families with low QSFS scores

were the same individuals who had difficulty actively engaging with the Sincrony program. Spearman's correlation test confirmed a significant relationship between QSFS scores and improvements in EET and PEAS scores ($\rho = 0.42$, $p < 0.05$ for EET; $\rho = 0.38$, $p < 0.05$ for PEAS). Kruskal-Wallis test revealed significant differences in final scores among students grouped by family sustainability sensitivity (EET: $H(2) = 8.34$, $p < 0.05$; PEAS: $H(2) = 7.92$, $p < 0.05$). This analysis quantified the link between family context and intervention effectiveness, preventing reliance solely on qualitative impressions. Findings suggest that the level of environmental sensitivity within a family can influence a student's predisposition to internalize sustainable practices, regardless of their initial level of digital use. However, given the small sample size, further studies are needed to determine the actual weight of family context in the effectiveness of bodily awareness-based educational methodologies. Overall, students who participated in the Sincrony intervention showed a significant increase in sustainable behaviours, particularly in: waste reduction practices, awareness of environmental impact.

6. Discussion

Results confirm that proprioceptive awareness enhances sustainability engagement, particularly among students with low digital exposure. This aligns with research indicating that sensory learning fosters environmental connection (Kirschner & Neelen, 2018; Louv, 2019). However, minimal impact on high-digital-use students suggests a need to balance screen time with embodied learning experiences. This raises critical questions about the need to balance digital use with direct bodily experiences, ensuring that sustainability education is not merely conceptual but is internalized through sensory experience. Family sustainability sensitivity influenced student engagement, with eco-conscious households showing better results. Future research should explore GreenComp integration and digital exposure effects. Further investigating the relationship between hyper-digitalization, bodily perception, and environmental connection. Exploring how Sincrony can serve as an innovative methodology to challenge the paradox of sustainability education, shifting from informative approaches to perceptual transformation that translates into substantial, non-instrumental actions.

Conclusions

The analysis highlights a paradox of educational sustainability: while the educational system advocates for change, it remains structurally incapable of achieving deep transformation. This gap between stated aims and actual impact reflects the system's role in preserving social and economic order. As Foucault (1975) noted, educational institutions do not merely transmit knowledge; they reinforce societal norms and structures, often maintaining inequalities rather than challenging them. Although policies promote sustainability, they remain tied to

traditional teaching models. Education functions as a "closed system": it claims to cultivate critical and innovative citizens but primarily shapes individuals to adapt rather than transform their socio-cultural context. Dewey (1916) argued that education should drive social change, yet sustainability remains marginal, often treated as an "add-on" rather than an integral educational principle. This limits its transformative potential, reinforcing the status quo. At the pedagogical level, sustainability is frequently framed as an extracurricular module rather than a core aspect of learning. Even when international frameworks for sustainability competencies are introduced, their implementation remains superficial unless curricula and evaluation systems shift away from traditional educational logics. Without a fundamental rethinking of objectives, sustainability education risks becoming a rhetorical exercise with minimal tangible impact. In this context, innovative tools like Sincrony attempt to challenge systemic inertia by fostering participatory education. However, even these efforts encounter institutional constraints that limit their transformative reach. While Sincrony creates spaces for sustainability as a deliberative practice, it remains subject to broader systemic resistance. Ultimately, as long as sustainability is treated as a secondary concern rather than a foundational value, the education system will maintain its existing logic, resisting genuine transformation. Every innovative proposal risks being absorbed back into pre-existing structures, neutralizing its potential for change. Only a paradigm shift, a philosophical repositioning of educational goals, and a coherent pedagogical restructuring can break this cycle. For sustainability to become truly embedded in education, we must reconsider the role of learning in society and the kind of individuals it seeks to develop, critical thinkers, conscious citizens, and architects of a sustainable future. Without systemic change, sustainability education will remain superficial

References

Amicone, G., Petruccelli, I., De Dominicis, S., Gherardini, A., Costantino, V., Perucchini, P., & Bonaiuto, M. (2018). Green Breaks: The Restorative Effect of the School Environment's Green Areas on Children's Cognitive Performance. *Frontiers in psychology,* 9, 1579. https://doi.org/10.3389/fpsyg.2018.01579

Amicone, G., Petruccelli, I., De Dominicis, S., Gherardini, A., Costantino, V., Perucchini, P., & Bonaiuto, M. (2018). Green Breaks: The restorative effect of the school environment’s green areas on children’s cognitive performance. *Frontiers in Psychology,* 9, 1579. https://doi.org/10.3389/fpsyg.2018.01579

Bascopé, M., Perasso, P., & Reiss, K. (2021). Systematic review of education for sustainable development at an early stage: Cornerstones and pedagogical approaches for teacher professional development. *Sustainability*, 13(14). https://doi.org/10.3390/su11030719

Bateson, G. (1972). Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology. *University of Chicago Press.*

Beames, S., Higgins, P., & Nicol, R. (2012). Learning outside the classroom: Theory and guidelines for practice. *Routledge.*

Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp: The European sustainability competence framework. *Publications Office of the European Union*.

Biesta, G. (2010). Good education in an age of measurement: Ethics, politics, democracy. *Routledge*.

Carr, N. (2011). The Shallows: What the Internet Is Doing to Our Brains. W. W. *Norton & Company*.

Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature*, 30(4), 433–452.

Christakis, D. A., Ramirez, J. S. B., & Ferguson, S. M. (2018). How early media exposure may affect cognitive function: A review. *JAMA Pediatrics,* 172(5), 415–421.

Dewey, J. (1916). Democracy and education: An introduction to the philosophy of education. *Macmillan*.

Domoff, S. E., Harrison, K., Gearhardt, A. N., Gentile, D. A., Lumeng, J. C., & Miller, A. L. (2019). Development and Validation of the Problematic Media Use Measure: A Parent Report Measure of Screen Media "Addiction" in Children. *Psychology of popular media culture,* 8(1), 2–11. https://doi.org/10.1037/ppm0000163

Feldenkrais, M. (1972). Awareness through movement: Health exercises for personal growth. Harper & Row.

Fischer, K. W., & Bidell, T. R. (2006). Dynamic development of action and thought. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology* (6th ed., Vol. 1, pp. 313–399). Wiley.

Foucault, M. (1975). Surveiller et punir: Naissance de la prison. *Gallimard.*

Fullan, M., & Langworthy, M. (2014). A rich seam: How new pedagogies find deep learning. *Pearson.*

Gopnik, A. (2020). Childhood as a solution to explore–exploit tensions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 375(1803), 20190502. https://doi.org/10.1098/rstb.2019.0502

Gough, S. (2021). Sustainability education: Perspectives and practice across higher education. *Routledge.*

Heft, H. (2012). Affordances and the perception of landscape: An inquiry into environmental perception and aesthetics. *Ecological Psychology,* 24(1), 29–49.

Huckle, J., & Wals, A. E. J. (2015). The UN Decade of Education for Sustainable Development: Business as usual in the end. *Environmental Education Research*, 21(3), 491-505.

Illich, I. (1971). Deschooling Society. *Harper & Row*.

Immordino-Yang, M. H., & Damasio, A. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education. *Mind, Brain, and Education*, 1(1), 3-10. https://doi.org/10.1111/j.1751-228X.2007.00004.x

Jickling, B., & Wals, A. E. J. (2008). Globalization and environmental education: looking beyond sustainable development. *Journal of Curriculum Studies*, 40(1), 1–21. https://doi.org/10.1080/00220270701684667

Kahn, R. (2010). Critical pedagogy, ecoliteracy, and planetary crisis: The ecopedagogy movement. *Peter Lang*.

Kirschner, P. A., & Neelen, M. (2018). Evidence-informed learning design: Creating training to improve performance. *Kogan Page Publishers*.

Klein, N. (2014). This Changes Everything: Capitalism vs. The Climate. *Simon & Schuster.*

Knight, S. (2013). Forest school and outdoor learning in the early years. *SAGE*.

Kruskal, W. H., & Wallis, W. A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*, 47(260), 583-621. https://doi.org/10.2307/2280779

Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? *Frontiers in Psychology*, 10, 305. https://doi.org/10.3389/fpsyg.2019.00305

Latouche, S. (2009). Farewell to Growth. *Polity Press*.

Lieberman, D. A., Demartino, C., & So, J. (2009). Young children's learning with digital media. *Computers in the Schools*, 26(4), 271-283. https://doi.org/10.1080/07380560903360194

Lilly, T. (2013). The Anti-Education Era: Creating Smarter Students Through Digital Learning. *International Journal of Educational Psychology*, 2(3), 353-355.

Lotz-Sisitka, H., Wals, A. E. J., Kronlid, D., & McGarry, D. (2015). Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Current Opinion in Environmental Sustainability*, 16, 73-80. https://doi.org/10.1016/j.cosust.2015.07.018

Louv, R. (2019). Our wild calling: How connecting with animals can transform our lives and save theirs. *Algonquin Books*.

Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *The Annals of Mathematical Statistics,* 18(1), 50-60. https://doi.org/10.1214/aoms/1177730491

Mehling, W. E., Price, C., Daubenmier, J. J., Acree, M., Bartmess, E., & Stewart, A. (2012). The Multidimensional Assessment of Interoceptive Awareness (MAIA). *PLOS ONE*, 7(11), e48230. https://doi.org/10.1371/journal.pone.0048230

Montessori, M. (2013). The absorbent mind. *Holt Paperbacks*.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, 41(5), 715-740. https://doi.org/10.1177/0013916508318748

Noddings, N. (2005). The Challenge to Care in Schools: An Alternative Approach to Education. *Teachers College Press.*

Orr, D. (1994). Earth in Mind: On Education, Environment, and the Human Prospect. *Island Press.*

Quinn, D. (1992). Ishmael: An adventure of the mind and spirit. *Bantam Books*.

Rieckmann, M. (2018). Education for sustainable development goals: Learning objectives. UNESCO Publishing.

Selwyn, N. (2022). Should robots replace teachers? AI and the future of education. *Polity Cambrige*. 9781509528967

Sheets-Johnstone, M. (2011). The primacy of movement. *John Benjamins Publishing.*

Shiva, V. (2016). Who Really Feeds the World? The Failures of Agribusiness and the Promise of Agroecology. *North Atlantic Books*.

Sobel, D. (1996). Beyond ecophobia: Reclaiming the heart in nature education. *Orion Society.* Brigton. 9780913098509

Spearman, C. (1904). The proof and measurement of association between two things. *The American Journal of Psychology*, 15(1), 72-101. https://doi.org/10.2307/1412159

Sterling, S. (2010). Transformative learning and sustainability: Sketching the conceptual ground. Learning and Teaching in Higher Education, 5, 17-33.

Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. J. (2017). International handbook of research on environmental education. Routledge.

Twenge, J. (2017). iGen: Why Today's Super-Connected Kids Are Growing Up Less Rebellious, More Tolerant, Less Happy and Completely Unprepared for Adulthood. *Atria Books.*

Vare, P., Lausselet, N., & Rieckmann, M. (2022). Competences in education for sustainable development: From pedagogy to governance. *Sustainability,* 14(5), 2714. European Commission https://ec.europa.eu/

Wals, A. E. J., & Corcoran, P. B. (2012). Learning for sustainability in times of accelerating change. *Wageningen Academic Publishers*.

Whitebread, D., Neale, D., Jensen, H., Liu, C., Solis, L., Hopkins, E., Hirsh-Pasek, K., & Zosh, J. (2017). The role of play in children's development: A review of the evidence. *MLA, Chicago*,https://doi.org/10.13140/RG.2.2.18500.73606

Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics Bulletin*, 1(6), 80-83. https://doi.org/10.2307/3001968

Zull, J. E. (2002). The art of changing the brain: Enriching the practice of teaching by exploring the biology of learning. *Stylus Publishing*.