9

Comparing younger and older students' understanding of educational innovation for sustainable development

Rafael Robina-Ramírez
Universidad de Extremadura (España)
rrobina@unex.es

Susana Quirós-Alpera
Universidad Internacional de La Rioja (España)
susana.quiros@unir.net

Aloysius OSB Roets
Universidad de Extremadura (España)
alroets@alumnos.unex.es

9.1. Introduction

Since the 1960s, sustainability has become a significant focus within educational innovation, reflecting a growing awareness of the impacts of the industrial revolution, globalization and social inequality (Robina-Ramírez *et al.*, 2021). These historical and socio-economic changes underscored the need to educate future generations in sustainable practices, aiming to restore a harmonious balance with nature (Robina-Ramírez *et al.*, 2020a; Robina-Ramírez *et al.*, 2020b; Robina-Ramírez & Cotano-Olivera, 2020; Robina-Ramírez & Medina-Merodio, 2019; Roets & Robina Ramirez, 2024, 2024a).

In recent years, the integration of sustainability into education has been increasingly facilitated by advances in information and Communication Technology (ICT) (Sanchez *et al.*, 2021).

This digital shift not only excites both young and mature students but also broadens their engagement with the topic, making sustainability education more relevant and accessible. The current study aims to explore how educational innovations in sustainability can bridge generational differences and foster a deeper understanding of sustainable development across age groups.

The study's goals include interpreting the roles and social applications of innovative educational methodologies, studying and designing new educational approaches that promote social inclusion, and creating open virtual environments like MOOCs, virtual courses and collaborative spaces. These digital platforms are envisioned as vital tools for implementing educational innovations and engaging students in social projects. Furthermore, the study seeks to explore the potential social applications of educational innovations through experiential learning models, such as service-learning. This model emphasizes practical experiences that link classroom learning with real-world applications, thereby enriching students' understanding of sustainability's societal impact. By fostering a hands-on approach to learning, these innovations aim to cultivate a generation of students equipped to address complex environmental and social challenges.

To achieve these objectives, the study will assess several key issues. Firstly, it will examine the attitudes and motivations of students toward understanding educational innovation for sustainable development. This includes exploring how different generations perceive and engage with sustainability education. Secondly, it will analyze the two generational models of thinking regarding nature conservation, highlighting how age-related differences influence environmental perspectives. Thirdly, the study will investigate access to technology as a critical factor in understanding and expanding the scope of sustainability. Additionally, it will delve into the critical thinking skills that both generational groups apply to sustainability learning, noting differences in their approaches and receptiveness to new ideas. The study will also assess the collaborative mindset necessary for restoring nature, exploring how intergenerational cooperation can enhance conservation efforts. Lastly, it will consider the future orientation of students regarding respect for nature, focusing on how contemporary environmental challenges shape their long-term views on sustainability. By addressing these issues, the

study aims to provide a comprehensive understanding of how educational innovations can foster a more sustainable and inclusive future.

9.2. Objectives

General objectives:

- Analysing how young and mature generations understand and get involved in educational innovation according to sustainability, by searching specialised literature.
- Comparing both groups' points of view, in terms of understanding and implication in educational innovation sustainability, by perceiving main differences between models of thinking to preserve nature.

General objectives are intended to be found out by means of assessing the following issues:

- Reviewing literature in databases related to, on the one side, generational gap and, on the other side, sustainability awareness.
- Detecting both groups' approaches to sustainability regarding thinking models for nature preservation.
- Matching findings from literature and thinking models to engage students of any age to sustainability.

9.3. Methodology

Since addressing the topic needs a deep literature review, on the issues referred to comprehend and to commit to sustainability from an educational innovation perspective, several sources reveal priceless information for this research. All information collected is displayed matching the former issues.

The type of literature review used is exploratory. This approach aims to provide an overview of a broad topic or to identify key concepts, gaps, and the nature of the evidence available. It is particularly useful in areas where research is still emerging

or not yet clearly defined, offering a preliminary understanding and mapping of the subject.

Once the topic is placed in context, variables are set to design a self-explanatory scheme. Gathered models, concerned with preserving nature, are subjected to both groups' criteria in order to contrast the outputs. The objectives of the study align with the expected outputs as follows:

- Analyzing generational understanding and involvement: this objective corresponds to the output of Understanding Educational Innovation and Attitudes. The study aims to review literature and assess how young and mature generations perceive and engage with sustainability education, highlighting differences in their approaches to educational innovation for sustainability and their attitudes toward nature conservation.
- Comparing generational perspectives on sustainability: This objective is connected to the output of Technological Access and Critical Thinking. By comparing the thinking models of both groups, the study will analyze how generational differences influence critical thinking skills and access to technology in the context of sustainability education.
- Matching literature findings with thinking models: This objective aligns with the output of Collaborative Mindset and Future Orientation. The study will integrate findings from the literature with generational thinking models to engage students of all ages in sustainability, fostering a collaborative mindset and shaping future-oriented views on environmental challenges and nature restoration.

9.4. Results

Different databases are consulted, and the findings are organized and shown alongside the related main topics:

Attitudes and motivations to understanding of educational innovation for sustainable development

Younger students today are growing up in an era where sustainability issues, like climate change, are more prominent in public

discourse. As such, they often show attitudes and higher support and motivation for sustainability education compared to previous generations. As Barnes *et al.* (2021) note, younger generations display strong environmental attitudes, consciousness and demand for sustainability curriculum, presenting a sharp contrast with the campus climate activism of the 1960s. Younger generations tend to view environmental protection and social equity as pressing issues compared to older generations who did not experience this sense of urgency around sustainability in their youth.

In contrast, more mature students have had decades of life experience and may be more sceptical and less motivated about the latest educational innovations and movements. As Carucci & Epperson (2011) observes, «maximising experiential diversity in the classroom can highlight generational differences in priorities and perspectives toward sustainability education» (p. 428). Older students may question whether sustainable development deserves so much attention in education compared to traditional academic subjects. They tend to be less focused on how sustainability skills and knowledge translate to jobs and careers.

The two generational models of thinking to preserve nature

With growing awareness of the climate crisis, education systems worldwide are emphasising sustainability mindsets aimed at preserving nature. The effectiveness of conservation-focused learning approaches depends significantly on student motivation and attitudes. Comparing younger and older learners reveals how age-based emotional and cognitive differences pertaining to environmentalism shape the assimilation of nature-protective mental models. By responsively nurturing students' pro-environmental passions, while addressing apathy or biases, emerging generational cohorts can progressively advance educational philosophies for achieving global sustainability.

Fundamentally, children's sensory curiosity and affection for animals or plants predisposes optimism toward conservation goals (Sobel, 1998). Their affinity for hands- on outdoor discovery-based learning also boosts engagement with ecological systems compared to digital content, laying development foundations for environmental care (Kellert, 2002). In contrast, many

adults may retain outdated reductionist perspectives of nature as resources for human use instilled through historical productivist social paradigms (White Jr., 1967). The tendency of the ageing to reflect on legacy can motivate revised environmentally conscious principles (Uhl, 2003). Hence appropriately timed interventions that leverage students' cognitive-emotional orientations can optimally instil nature-connected worldviews across ages.

Cultivating early childhood propensities for ecological appreciation is vital for avoiding distorted anthropocentric assumptions that enable later apathy (Louv, 2005). Tactile exposure to harvesting gardens, raising butterflies or recycling builds sensorymotor foundations for sustainability values in ways abstract curricula cannot (Sobel, 2016). Enriching adolescents' idealism and anti-establishment attitudes also empowers political ecoactivism counteracting institutional inertia (Ojala, 2012). Consequently, sequencing experiential learning opportunities to align with age-based social-emotional capacities allows educational systems to effectively nurture conservation mindsets longitudinally.

Overly pressuring young students with ominous environmental data risks demotivating engagement (Strife, 2012). Traumatized youth consequently resort to denialism as coping or dissociate through digital immersion, thwarting sustainability principles (Hicks & Holden, 1995). While urgency can catalyse older students' responsibility, helplessness from escalating expectations also exacerbates eco-anxiety and resignation (Olsen *et al.*, 2024). Therefore, balancing gravity with inspiration and self-efficacy is essential for mobilising age-appropriate climate action.

Positively, online networks allow generational collaboration where youth voices counteract elders' tendencies to downplay environmental threats from vested interests (Jia *et al.*, 2017). Younger generations mentor their parents in home renewable transitions while inheriting wisdom for community organizing (Lestar & Pellegrini-Masini, 2023). Neuro- plasticity also means environmental education continually reshapes adult perspectives, undoing outdated conditioning (Uhl, 2003). Hence reciprocal dialogue and innovation partnerships between students of all ages can dynamically advance collective sustainability visions.

Overall patterns suggest early learners' innate human-nature affiliation and older cohorts' big-picture reasoning synergistical-

ly deepen eco-literacy scaffolds over time if supported appropriately (Inoue, 2020). However, grounding conceptual learning in experiential contexts and cooperative relationships remains essential for translating critical awareness into pro-conservation motivation and behaviors (Jeronen *et al.*, 2017), enabling profound global mindset shifts.

Addressing complex sustainability issues requires systems thinking skills to understand multidimensional problems holistically. Research suggests younger generations demonstrate more innate abilities with complex and adaptive systems thinking compared to their elders. Yunus (2021) states that early immersion in visual digital media environments culminates in stronger cognitive capacities among younger generations for systems thinking and handling ambiguity. Young students outperform their older counterparts at visualizing and assessing complex sustainability challenges.

Meanwhile, more experienced mature students excel at applying narrow systems frameworks. Seemiller & Grace (2017) explains that «the intellectual maturity of senior students enables them to adeptly analyse sustainability issues through established theoretical frameworks whereas young students better navigate uncertainty» (p. 215). Older cohorts are grounded in specialised knowledge that aids structured analysis but can inhibit them from perceiving broader interdependencies and unpredictability associated with sustainability issues.

Access to technology to better understand the innovation to improve sustainability

Younger, 21st-century students are «digital natives» who have grown up using technologies like smart-phones, laptops, apps and social media platforms. They are generally skilled at navigating digital tools and show openness to technological innovation being integrated across education. As Amanah *et al.* (2023) explains, younger generations thrive when interactive, stimulating digital media is incorporated strategically into course design. They are comfortable with online learning and can even demand more educational technologies to be implemented.

In contrast, mature students face more barriers with adopting new educational technologies and online learning formats. As

Evans-Agnew (2015) states, «the sudden shift to online learning during the pandemic was considerably more disruptive and isolating for older students who lack the technological skills and social media affinity of their younger peers» (p. 77). Older students may be accustomed to more traditional teaching methods and struggle with fully transitioning to education for sustainability that requires new technical skills and digital fluency.

The collaborative mindset to restore nature

Environmental sustainability has become an increasingly important issue in education, with schools emphasising the need to preserve nature and natural resources for future generations. This has led to the development of various models of thinking aimed at promoting more environmentally conscious mindsets and behaviors. The implementation of these sustainability models affects students' access to technology as well as the development of their critical thinking skills. This section analyses how models of thinking to preserve nature influence access to technology and critical thinking in younger versus older students for enabling their understanding of educational innovations that support sustainable development.

Promoting sustainable ways of living often requires reductions in the use of electronics and digital devices to curb energy consumption and e-waste. As a result, schools that strongly embed sustainability into their curriculum tend to limit students' technology access and use (Selwyn, 2021). While this allows students to discover alternative hands-on and outdoor activities, it also minimizes their opportunities to leverage technology for learning and developing modern skills. Consequently, students from highly sustainability- focused schools may lack sufficient technology fluency later in their education or careers compared to peers from traditional schools (Radovanović *et al.*, 2020).

However, limiting technology can enable deeper critical thinking about real-world issues related to sustainability. For instance, asking students to reflect on how reducing device usage cuts carbon footprints and electronic waste prompts more complex cognitive analysis than just consuming digital content (Straková & Cimermanová, 2018). Students also think more critically when tackling hands-on sustainability challenges like designing

gardens or solutions to environmental issues devoid of extensive computer aids (Vilches *et al.*, 2008). Hence, models of thinking prioritising conservation over technology access cultivate strong critical reasoning, evaluation and problem-solving competencies transferable to sustainable innovation.

Interestingly, sustainability-driven limits on technology pose greater critical thinking development opportunities for younger children over older learners. According to Piaget's theory of cognitive development, younger children in the pre-operational and concrete operational stages can still advance their critical faculties through real-world sensory experiences, making them less dependent on technology-based learning (Piaget, 1952). In contrast, older students in the formal operational stage seek to engage hypothetical-deductive reasoning, making dynamic use of technology more crucial for mastering abstract concepts and thinking skills at their level (Vygotsky *et al.*, 1978).

Hence, minimal technology models positively impact younger children's critical reflection on sustainability issues through direct experiences in nature, creative play or hands-on building projects. However, the same models may constrain older students' intellectual growth by depriving experiential learning opportunities offered uniquely by interactive simulations, programming complex sustainability computational models or participating in online collective intelligence knowledge communities (Huang *et al.*, 2023; Sebba *et al.*, 2009). Therefore, while limiting technology could bolster sustainability mindsets, balance is needed to ensure age-appropriate cognitive advancement.

Integrating sustainability and technology enables innovation in education for sustainable development (ESD). For example, digital platforms that use virtual reality to provide students with immersive experiences of ecosystems, extreme environmental changes or green technology innovations enhance engagement as well as critical thinking on sustainability issues (Ebinger *et al.*, 2022). Game-based mobile apps also combine entertainment with simulations of solving real-world sustainability challenges that foster problem-analysis, strategic decision-making and evaluating environmental consequences (Rodrigues *et al.*, 2023). Such Ed-Tech innovations utilise technology's strengths while aligning to sustainability models and ESD priorities holistically without age-related learning constraints.

Thought needs to be given regarding risks of over reliance on simulating sustainability issues digitally instead of experiencing them physically, which could undermine genuine critical reflection especially in younger students (Lange & Santarius, 2020). ESD innovations should aim for balanced synergies between hands-on and digital technology to drive sustainability mindsets while continually advancing students' critical thinking and solution-building capacities collaboratively.

Models of thinking prioritising environmental conservation and technology moderation cultivate stronger critical faculties in children by enabling hands-on experiential learning, but could limit older students' intellectual advancement. Integrating modern technology innovations into ESD frameworks can enrich sustainability education for all ages when implemented wisely. Ultimately, finding holistic synergies between environmental and digital spaces, tools and pedagogies can optimise learning outcomes. Schools need to continually evaluate their sustainability models based on enabling technology access and building critical thinking across developmental stages. This will empower the next generation with the mindsets, compassion and capabilities to understand and collaboratively advance educational innovations for addressing pressing real-world ecological challenges.

Effective sustainability education requires collective action, so the ability for students to collaborate and build community is essential. Young students display considerable talent with using digital platforms and networks to mobilise interest and engagement in sustainability initiatives. Zatwarnicka-Madura *et al*. (2022) states that young students have developed exceptional skills at harnessing online communities to enable collaborative action - they cooperate to advance social and environmental causes across digital spaces. From online forums to apps to wikis, younger generations leverage technologies to foster connections.

While adept with digital spaces, mature students excel at building community through in- person relationships and networking. As Corcoran *et al*. (2014, p.16) explains, «older students contribute maturity and emotional intelligence derived from past professional experience, enabling them to lead hands-on sustainability collaborations». They take advantage of their well-developed people skills and rely less on digital media for

community building. Thus, intergenerational teams that allow younger and older students to combine their complementary strengths show promise for sustainability education.

The two models' critical thinking about sustainability's learning

Younger sustainability students also tend to demonstrate critical thinking by questioning norms, systems and authority. Li (2015) notes that younger generations displays a strong ability to critique ingrained social and educational conventions and envision alternatives aligned with sustainability values. Rather than passively accepting what is taught in sustainability courses, younger generations critically analyse what is presented to them and may demand more progressive or radical ideas for achieving sustainable development. Their questioning nature can propel innovation as they are unwilling to simply perpetuate the *status quo*.

By comparison, older students tend to show more trust and conformity with existing educational conventions and experts. According to Sterling (2013), «the life experience and wisdom that mature students bring to sustainability education is invaluable. However, they are also more entrenched in certain mindsets and less likely to challenge established authorities» (p. 340). Older students may add helpful contextualisation but be less disruptive in advancing alternative visions for sustainability education compared to their younger peers. Their experiential maturity can be beneficial but also more conforming with dominant paradigms in the field.

The future orientation about respecting nature

How students perceive risks and future uncertainties has implications for their outlooks on sustainability education priorities. Nkoana (2020) observes that younger generations show greater support for sustainability policies as their futures are more clearly threatened by climate destabilisation trends. Younger students demonstrate stewardship for the planet as they face existential risks from environmental perils that could severely disrupt their own livelihoods. They take proactive stances to mitigate risks over long-term horizons.

In comparison, mature sustainability students have already experienced more years unaffected by environmental collapse which moderates their risk perceptions. As Kougias *et al.* (2023) notes, «having lived majority of their lives during climatically stable times, older learners exhibit lower sensitivity to prepare for uncertain climate impacts» (p. 220). With retirement ahead, older students take more incremental, as opposed to radical precautionary perspectives regarding sustainability education for the future. These contrasting risk orientations across generations influence their receptiveness to educational innovations that tackle emerging uncertainties.

9.5. Discussion

In the context of educational innovation for sustainable development, younger students often exhibit strong attitudes and motivations towards sustainability. This generational shift is driven by the increasing visibility of climate issues, which has led to heightened awareness and engagement among the youth. Barnes *et al.* (2021) emphasize that younger generations possess a marked environmental consciousness, demanding comprehensive sustainability curricula—a trend that stands in stark contrast to the more politically charged campus activism of the 1960s. Carucci & Epperson (2011) adds that this contemporary student engagement is not just a reflection of growing environmental concerns but also an indication of a deeper, more intrinsic motivation to integrate sustainability into everyday life and education. This strong motivation and support for sustainability education are critical in shaping the pedagogical approaches and curriculum development in modern educational institutions.

The generational differences in understanding and approaching environmental conservation are notable. Educational systems have adapted to promote sustainability mindsets, catering to both younger and older students through various models of thinking. Sobel (1998) and Kellert (2002) highlight that children's innate sensory curiosity and affection for nature foster a positive outlook towards conservation efforts. Uhl (2003) further notes that this optimism is often more pronounced in younger students, who are emotionally and cognitively more receptive to

environmental messages. In contrast, older students may approach sustainability with a more measured perspective, influenced by a longer history of environmental narratives and personal experiences. The contrast between these generational models underscores the importance of tailored educational strategies that consider emotional and cognitive developmental stages when imparting conservation-focused knowledge and practices.

Access to technology significantly influences how students engage with and understand educational innovations for sustainability. As digital natives, younger students are adept at using various technological tools, including smartphones, laptops, and digital apps, which enhance their learning experiences. Amanah *et al.* (2023) explains that the integration of interactive and stimulating digital media into educational content can significantly boost younger students' engagement and comprehension of sustainability topics. Evans-Agnew (2015) concurs, noting that the strategic incorporation of technology in education not only facilitates access to vast resources but also fosters innovative thinking and problem-solving skills. However, there is also a growing recognition of the need to balance technology use with sustainability goals. Selwyn (2021) and Radovanović *et al.* (2020) discuss how schools with a strong focus on sustainability often encourage students to limit their use of digital devices to reduce energy consumption and electronic waste. Ebinger *et al.* (2022) add that promoting a collaborative mindset towards nature restoration involves not only leveraging technology for education but also encouraging mindful consumption of digital resources. This dual approach helps inculcate a sense of responsibility towards both technological advancement and environmental conservation, equipping students with the necessary skills and attitudes to tackle future sustainability challenges.

9.6. Conclusions

In summary, after thoroughly diving into specialized literature, this essay has highlighted key differences between younger and older students in understanding educational innovation for sustainability, from their motivation and attitudes to technology adoption to critical thinking abilities. While tensions can arise

across generations in the classroom, bridging these generational divides through cooperation and co-learning is vital for spurring the educational transformations needed for sustainable development. Synthesizing the assets of both youth and experience can power progress in sustainability education.

Whilst younger and older student generations both bring valuable strengths to sustainability education, their contrasting characteristics, experiences and perspectives shape how they understand and engage with educational innovation in this space. As revelations about environmental tipping points accelerate, developing sustainability education that synthesises the promise of youthful inquiry, idealism and digital fluency with the wisdom of lived experience and grounded analysis from mature scholars will be critical. Nurturing empathy, cooperation and insight exchange across generations in the classroom is instrumental for spurring the educational transformations needed to enable sustainable futures.

As long as educational innovation is aimed to consciousness on preserving nature, the worked-out paradigm is to bear in mind for earning respectful students aware of sustainable issues.

References

Amanah, S., Sadono, D., Fatchiya, A., Sulistiawati, A., Aulia, T., & Seminar, A. U. (2023). Strengthening the Competencies of Gen-Z Students as Future Change Agents: Learning from Extension Science and Communication of Innovation Course (KPM121C). *International Journal of Information and Education Technology*, 13 (10), 1646-1655. https://doi.org/10.18178/ijiet.2023.13.10.1973

Barnes, M., Moore, D., & Almeida, S.Ch. (2021). *Empowering teachers through Environmental and Sustainability Education: Meaningful change in educational settings.* Routledge. https://doi.org/10.4324/9780429352447

Carucci, R. A., & Epperson, J. J. (2011). Bridging the leadership divide: Forging meaningful relationships between generations of leaders. *Journal of Leadership Studies*, 5 (3), 63-71. https://doi.org/10.1002/jls.20234

Corcoran, P. B., Hollingshead, B. P., Lotz-Sisitka, H., Wals, A. E., & Weakland, J. P. (Eds.) (2014). *Intergenerational learning and transformative leadership for sustainable futures*. Wageningen Academic.

Ebinger, F., Buttke, L., & Kreimeier, J. (2022). Augmented and virtual reality technologies in education for sustainable development: An expert-based technology assessment. TATuP-Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis. *Journal for Technology Assessment in Theory and Practice*, 31 (1), 28-34. https://doi.org/10.14512/tatup.31.1.28

Evans-Agnew, R., Compson, J., & Lower, C. S. (2015). Bridging the interdisciplinary divide: co-advancing the pedagogy of environmental justice through a digital common initiative. *Interdisciplinary Environmental Review*, 16 (2-4), 158-174. https://doi.org/10.1504/IER.2015.071017

Hicks, D., & Holden, C. (1995). Exploring the future: A missing dimension in environmental education. *Environmental Education Research*, 1 (2), 185-193. https://doi.org/10.1080/1350462950010205

Huang, W., Li, X., & Shang, J. (2023). Gamified project-based learning: A systematic review of the research landscape. *Sustainability*, 15 (2), 940. https://doi.org/10.3390/su15020940

Inoue, M. (2020). Fostering an ecological worldview in children: Rethinking children and nature in early childhood education from a Japanese perspective. In A. Cutter, K. Malone, & E. Barrat (Eds.). *Research handbook on childhoodnature: Assemblages of childhood and nature research* (995-1024). Springer. https://doi.org/10.1007/978-3-319-67286-1_55

Jeronen, E., Palmberg I., & Yli-Panula, E. (2017). Teaching methods in biology education and sustainability education including outdoor education for promoting sustainability. A literature review. *Education Sciences*, 7 (1), 1-19. https://doi.org/10.3390/educsci7010001

Jia, F., Soucie, K., Alisat, S., Curtin, D., & Pratt, M. (2017). Are environmental issues moral issues? Moral identity in relation to protecting the natural world. *Journal of Environmental Psychology*, 52, 104-113. https://doi.org/10.1016/j.jenvp.2017.06.004

Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development, in children. In P. H. Kahn Jr. & S. R. Kellert (Eds.). *Children and nature: Psychological, sociocultural and evolutionary investigations* (pp. 117-152). The MIT.

Kougias, K., Sardianou, E., & Saiti, A. (2023). Attitudes and perceptions on education for sustainable development. *Circular Economy and Sustainability*, 3 (1), 425-445. https://doi.org/10.1007/s43615-022-00174-w

Lange, S., & Santarius, T. (2020). *Smart green world? Making digitalization work for sustainability.* Routledge.

Lestar, T., & Pellegrini-Masini, G. (2023). The Agency of Children and Young People in Sustainability Transitions: Eco-Spiritual Events on Hare Krishna Eco-Farms in Europe. In H. Seraphin (Ed.). *Events Management for the Infant and Youth Market* (pp. 85-99). Emerald.

Li, L. (2015). *Collaborative me. Explorative study to create desirable collaborative experience for Generation Z in the coming workplace* (Doctoral dissertation, Politecnico di Milano Facolt del Design). https://www.politesi.polimi.it/retrieve/a81cb05c-4412-616b-e053-1605fe0a889a/2017_04_Li.pdf

Louv, R. (2005). *Last child in the woods: Saving our children from nature-deficit disorder.* Algonquin Books.

Nkoana, E. M. (2020). Exploring the effects of an environmental education course on the awareness and perceptions of climate change risks among seventh and eighth grade learners in South Africa. *International Research in Geographical and Environmental Education*, 29 (1), 7-22. https://doi.org/10.1080/10382046.2019.1661126

Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology*, 32 (3), 225- 233. https://doi.org/10.1016/j.jenvp.2012.02.004

Olsen, E. K., Lawson, D. F., McClain, L. R., & Plummer, J. D. (2024). Heads, hearts, and hands: a systematic review of empirical studies about eco/climate anxiety and environmental education. *Environmental Education Research*, 1-28. https://doi.org/10.1080/13504622.2024.2315572

Piaget, J. (1952). *The origins of intelligence in children* (M. Cook, Trans.). International Universities.

Radovanović, D., Holst, C., Belur, S. B., Srivastava, R., Houngbonon, G. V., Le Quentrec, E., Miliza, J., Winkler, A. S., & Noll, J. (2020). Digital literacy key performance indicators for sustainable development. *Social Inclusion*, 8 (2), 151-167. https://doi.org/10.17645/si.v8i2.2587

Robina-Ramírez, R., & Cotano-Olivera, C. (2020). Driving private schools to go "green": the case of Spanish and Italian religious schools. *Teaching Theology & Religion*, *23* (3), 175-188. https://doi.org/10.1111/teth.12547

Robina-Ramírez, R., & Medina-Merodio, J. A. (2019). Transforming students' environmental attitudes in schools through external com-

munities. *Journal of Cleaner Production*, 232, 629-638. https://doi.org/10.1016/j.jclepro.2019.05.391

Robina-Ramírez, R., Merodio, J. A., & McCallum, S. (2020a). What role do emotions play in transforming students' environmental behavior at school? *Journal of Cleaner Production*, 258, 120638. https://doi.org/10.1016/j.jclepro.2020.120638

Robina-Ramírez, R., Sánchez-Hernández, M. I., Jiménez-Naranjo, H. V., & Díaz-Caro, C. (2020b). The challenge of greening religious schools by improving the environmental competencies of teachers. *Frontiers in Psychology*, 11, 520. https://doi.org/10.3389/fpsyg.2020.00520

Robina-Ramírez, R., Sánchez-Hernández, M. I., & Díaz-Caro, C. (2021). Hotel manager perceptions about corporate compliance in the tourism industry: an empirical regional case study in Spain. *Journal of Management and Governance*, 25 (2), 627-654. https://doi.org/10.1007/s10997-020-09514-0

Rodrigues, R., Pombo, L., Marques, M. M., Ribeiro, S., Ferreira-Santos, J., & Draghi, J. (2023). *Value of a Mobile Game-Based App towards Education for Sustainability.* International Association for Development of the Information Society.

Roets O. S., & Robina-Ramírez, R. (2024, March, 11-13). *Solving complex environmental and social issues through teaching sustainability to Generations X, Y, and Z.* I International Conference on Innovation, Didactics, and Education for Sustainability, CIIDES, Alicante (Spain).

Roets O. S., & Robina-Ramírez, R. (2024a). Green transitions for changing behavior through environmental organizations engagement at religious schools. *Journal of the Sociology and Theory of Religion*, 16, 233-259. https://doi.org/10.24197/jstr.1.2024.233-259

Sánchez, M. D., De-Pablos-Heredero, C., Medina-Merodio, J. A., Robina-Ramírez, R., & Fernández-Sanz, L. (2021). Relationships among relational coordination dimensions: Impact on the quality of education online with a structural equations model. *Technological Forecasting and Social Change*, 166, 120608. https://doi.org/10.1016/j.techfore.2021.120608

Sebba, J., Griffiths, V., Luckock, B., Hunt, F., Robbinson, C., & Flowers, S. (2009). *Youth-led innovation. Enhancing the Skills and Capacity of the Next Generation of Innovators.* NESTA.

Seemiller, C., & Grace, M. (2017). Generation Z: Educating and engaging the next generation of students. *About Campus*, 22 (3), 21-26. https://doi.org/10.1002/abc.21293

Selwyn, N. (2021). Ed-Tech Within Limits: Anticipating educational technology in times of environmental crisis. *E-Learning and Digital Media*, 18 (5), 496-510. https://doi.org/10.1177/20427530211022951

Sobel, D. (1998). *Mapmaking with children: Sense of place education for the elementary years.* Heinemann.

Sobel, D. (2016). *Nature preschools and forest kindergartens: The handbook for outdoor learning.* Redleaf.

Sterling, S. (2013). Learning for resilience, or the resilient learner? Towards a necessary reconciliation in a paradigm of sustainable education. *Environmental Education Research*, 16 (5-6), 511-528. https://doi.org/10.1080/13504622.2010.505427

Straková, Z., & Cimermanová, I. (2018). Critical thinking development. A necessary step in higher education transformation towards sustainability. *Sustainability*, 10 (10), 3366. https://doi.org/10.3390/su10103366

Strife, S. (2012). Children's environmental concerns: Expressing ecophobia. *The Journal of Environmental* Education, 43 (1), 37-54. https://doi.org/10.1080/00958964.2011.602131

Uhl, C. (2003). *Developing ecological consciousness: Path to a sustainable world.* Rowman & Littlefield.

Vilches, A., Dorrío, B. V., & Gil-Pérez, D. (2008). Hands-on sustainability: How can we contribute to the construction of a sustainable future. *International Journal of Hands-on Science*, 1 (1), 15-20.

Vygotsky, L.S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (Eds.). (1978). *Mind in society: The development of higher psychological processes*. Harvard University.

White Jr., L. (1967). The historical roots of our ecologic crisis. *Science*, 155 (3767), 1203- 1207. https://www.jstor.org/stable/1720120

Yunus, R. M. (2021). Increasing human literacy for Generation Z through learning to use technology in Indonesia. *International Journal of Science and Society*, 3 (4), 245-256. https://doi.org/10.54783/ijsoc.v3i4.512

Zatwarnicka-Madura, B., Nowacki, R., & Wojciechowska, I. (2022). Influencer marketing as a tool in modern communication: possibilities of use in green energy promotion amongst Poland's generation Z. *Energies*, 15 (18), 6570. https://doi.org/10.3390/en15186570