



INTEGRATING ENVIRONMENTAL GOVERNANCE INTO EDUCATIONAL REFORM: TOWARD SUSTAINABLE FUTURES

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ABSTRACT

The accelerating impacts of climate change, environmental degradation, and the large-scale exploitation of natural resources have emerged as critical threats to human survival. In response, environmental governance has increasingly been recognized not only as a regulatory framework for mitigating ecological damage but also as a strategic platform for advancing sustainable development. This article offers a comprehensive analysis of environmental governance by exploring its theoretical foundations, operational principles, and implementation strategies across sectors. Utilizing a systematic literature review approach, the study evaluates the effectiveness of environmental interventions led by governments, corporations, and civil society actors. Furthermore, the analysis emphasizes the pivotal role of transforming education for sustainable development as an integral driver of behavioral change, ecological awareness, and long-term societal resilience. The findings reveal that the success of environmental governance is largely shaped by consistent policy implementation, cross-sectoral engagement, the deployment of green technologies, and the integration of ecological and human-centered sustainability principles. The article concludes with policy recommendations that call for transformative approaches to reinforce environmental governance and ensure harmonious coexistence between humans and nature.

Keywords: Environmental governance; sustainable development; human survival; ecological sustainability; education for sustainable development

INTRODUCTION

In recent decades, the world has been confronted with increasingly complex and interrelated environmental crises, including climate change, biodiversity loss, ecosystem degradation, and the unsustainable exploitation of natural resources. These environmental challenges not only pose serious ecological threats but also endanger long-term social and economic sustainability across generations. Such a situation reflects the inadequacy of conventional development models that prioritize economic growth while failing to address the root causes of global environmental degradation. In response, there is a pressing need for a new paradigm, one that is transformative, holistic, and cross-sectoral, namely environmental governance. This approach offers a strategic framework for designing policies, strengthening institutional capacity, and establishing collaborative mechanisms for the sustainable management of natural resources (Meadowcroft, 2007; Kopnina, 2014; Arora et al., 2018).

Environmental governance refers to a system of decision-making processes that actively involves government agencies, private sector actors, and civil society

stakeholders in addressing environmental issues. This model is grounded in key principles such as accountability, public participation, transparency, and ecological justice. Contemporary environmental governance departs from the state-centric approach by emphasizing multi-stakeholder partnerships and multi-level coordination, enabling the formulation and implementation of adaptive policies that respond effectively to dynamic environmental conditions (Lemos & Agrawal, 2006; Arora et al., 2018). In parallel with the need to strengthen environmental governance, education plays a pivotal role in shaping values, attitudes, and competencies essential for addressing sustainability challenges. Education should not only serve as a channel for knowledge transmission but also act as a catalyst for developing critical, reflective, and transformative thinking. Through the framework of Education for Sustainable Development (ESD), as advanced by UNESCO (2017), education is envisioned as a driving force for ecological and social transformation (UNESCO, 2017; Ferreira et al., 2007). ESD promotes the development of sustainability competencies, including systems thinking, anticipatory decision-making, ethical reasoning, and active participation in both community life and environmental governance (Brundiers et al., 2021; Mochizuki & Bryan, 2015).

Despite the growing recognition of ESD's importance, the integration of environmental governance into educational reform remains constrained by structural and institutional barriers. Policy gaps between the education and environmental sectors, limited inter-agency synergy, and inadequate teacher capacity to deliver sustainability-oriented pedagogy continue to hinder meaningful implementation (Borg et al., 2014; Tilbury, 2011). Addressing these challenges calls for in-depth investigation into effective integrative practices, implementation barriers, and relevant policy recommendations that support educational transformation aligned with sustainability goals (Giangrande et al., 2019).

This article aims to critically examine the interrelationship between environmental governance and educational reform as a unified strategy to address future sustainability challenges. Employing a systematic literature review approach, this study synthesizes recent academic findings to evaluate collaborative governance models, explore the role of education in advancing environmental governance agendas, and propose strategic recommendations for integrating sustainability principles into national education systems. The ultimate goal is to construct a conceptual and operational framework that strengthens the synergy between education and environmental governance in pursuit of a just, resilient, and sustainable future.

METHOD

This study adopts a Systematic Literature Review (SLR) approach, a method designed to organize, analyze, and synthesize existing scholarly works in a structured, transparent, and replicable manner. The SLR is chosen to suit the research objective, which seeks to develop both conceptual and empirical insights into the relationship between environmental governance and educational reform within the broader agenda of sustainable development. This method enables the researcher to identify thematic patterns, policy trends, and implementation challenges in efforts to integrate environmental and educational sectors. The review process employed qualitative content analysis, focusing on peer-reviewed articles and academic publications selected based on criteria such as academic credibility, direct relevance to the topic, and open access availability. Key themes explored include principles of environmental governance, pedagogical approaches to education for sustainable development (ESD), cross-sectoral

policy integration, and institutional practices that support the sustainability agenda through education.

Relevant materials were sourced from reputable academic databases using keywords such as “environmental governance,” “education reform,” “ESD,” and “sustainability policy.” The analysis did not involve statistical formulas, as the study is primarily conceptual, but methodological rigor was maintained through clear selection parameters and systematic documentation. Ultimately, the review aims to construct a conceptual framework illustrating how the education system can strategically contribute to the enhancement of environmental governance. The results are expected to provide theoretical contributions as well as practical recommendations for policymakers, educators, and institutions seeking to develop adaptive, inclusive, and sustainability-oriented educational systems.

RESULTS AND DISCUSSION

In recent decades, the concept of environmental governance has undergone a profound transformation, from a centralized, top-down technocratic model to a more decentralized, participatory, and adaptive governance paradigm. According to Lemos and Agrawal (2006), modern environmental governance is characterized by collaborative interaction among diverse stakeholders, including government bodies, private sector actors, non-governmental organizations, and local communities. This shift reflects an increasing recognition that effective environmental management cannot be achieved through state control alone, but requires inclusive, multi-level, and cross-sectoral coordination that prioritizes transparency, ecological justice, shared responsibility, and long-term resilience (Agbedahin, 2019; Arora et al., 2018). Parallel to this transformation in governance is a similar evolution within the domain of education. Contemporary education is no longer confined to the passive transmission of disciplinary knowledge. Instead, it is being redefined as a dynamic and critical platform for empowering individuals to understand complex socio-ecological challenges, engage in ethical decision-making, and participate actively in shaping a sustainable future. This new vision is encapsulated in the framework of Education for Sustainable Development (ESD) as formulated by UNESCO (2017), which calls for a holistic integration of sustainability values across educational systems. ESD advocates for embedding environmental awareness and sustainable practices into curricula, teaching methodologies, school governance, community engagement, and national education policies, thereby transforming education into a driver of systemic change.

The intersection between environmental governance and education lies in their shared objectives: cultivating informed citizens, promoting sustainable behaviors, and reshaping institutions to support long-term ecological integrity and social justice. Integrating environmental governance into education systems requires more than curricular adjustments, it demands structural transformation across pedagogical design, implementation strategies, and assessment mechanisms. However, this integration is often hindered by institutional fragmentation. As noted by Eilam and Trop (2012), environmental issues are frequently marginalized within bureaucratic educational systems, while Giangrande et al. (2019) emphasize that environmental policies are often developed in isolation from educational reforms. These siloed approaches lead to missed opportunities for cross-sector collaboration. To overcome these challenges, Arora et al. (2018) recommend adopting transdisciplinary frameworks and inter-ministerial coordination that enable context-sensitive, participatory, and equity-oriented governance

mechanisms. Such approaches facilitate the co-creation of pedagogical and institutional strategies that align with sustainability values and enhance systemic transformation .

Building on the premise that collaborative governance is vital for bridging the gap between environmental and educational sectors, it becomes increasingly evident that institutional innovation is not merely desirable, but essential. Without enabling structures that support coordination across ministerial boundaries, policy fragmentation will continue to undermine efforts to embed sustainability into education systems in a meaningful way. This is especially critical in countries where educational reform is constrained by centralized bureaucracies and environmental policy remains reactive rather than anticipatory. To overcome such systemic inertia, there must be a deliberate effort to align institutional mandates, operational frameworks, and evaluation mechanisms across both sectors. Establishing inter-ministerial task forces, integrated strategic planning units, or national platforms for Education for Sustainable Development (ESD) can facilitate this alignment (Mochizuki & Bryan, 2015). These mechanisms must be supported by clear mandates, adequate resourcing, and inclusive participation from a wide range of stakeholders, including educators, environmental experts, community leaders, and youth representatives. Furthermore, embedding environmental governance into education requires reimagining curriculum design and pedagogical practice. It involves integrating sustainability principles not only into subject matter, but also into the ethos and governance of educational institutions themselves. Schools, universities, and training centers must serve as living laboratories of sustainability, demonstrating democratic decision-making, responsible resource management, and civic participation in action. This form of whole-institution approach aligns with the transformative aspirations of ESD and positions education as an agent of systemic change. Therefore, the integration of environmental governance into education cannot be treated as a technical adjustment, but must be embraced as a structural transformation. It calls for a long-term, multisectoral commitment that reshapes how education is conceptualized, delivered, and governed. Only through such deliberate and sustained efforts can we unlock the full potential of education to support inclusive, resilient, and ecologically just futures.

Education plays a critical role not only in enhancing individuals' cognitive capacity but also in cultivating values, attitudes, and behaviors aligned with sustainability (Brundiers et al., 2021). In the context of global environmental crises, education emerges as a transformative agent of socio-ecological change, with the capacity to foster a generation that comprehends the complexity of human-nature interdependencies and is equipped to respond to ecological challenges through reflective and transformative actions. As emphasized by UNESCO (2017), Education for Sustainable Development (ESD) must instill systemic thinking, anticipatory skills, participatory competencies, and deep environmental ethics. ESD moves beyond the mere transmission of factual knowledge about climate change or pollution; it seeks to nurture ecological empathy, critical awareness of exploitative systems, and active engagement in addressing local and global sustainability issues.

One of the most effective approaches to realizing the transformative potential of education is through the integration of ecological literacy across all levels of the curriculum (Ferreira et al., 2007; UNESCO, 2017). Ecological literacy encompasses not only scientific knowledge about ecosystems and biodiversity, but also critical consciousness of social-ecological injustices, power asymmetries in natural resource governance, and the long-term consequences of collective human decisions on planetary



systems. When learners understand that issues such as deforestation, water scarcity, or marine pollution are intrinsically linked to patterns of consumption and global economic structures, they are more likely to act as engaged, reflective, and responsible citizens. Furthermore, participatory pedagogical approaches such as project-based learning, eco-schools, and citizen science initiatives have proven effective in engaging students in meaningful, context-driven learning experiences. When students are involved in local resource mapping, school energy audits, or conservation campaigns, they are not only acquiring theoretical knowledge but also internalizing sustainability values through hands-on experience. This underscores the necessity of embedding environmental governance principles into educational practice not just through formal curricula but also through lived experiences and school culture. However, education cannot fulfill its transformative role without strong policy support that enables school autonomy, curricular innovation, and sustained professional development for educators. Teachers are pivotal in translating ESD principles into classroom practices, yet without pedagogical competence and systemic backing, education risks remaining confined within traditional, mechanistic paradigms that fail to address contemporary sustainability challenges (Borg et al., 2014; Arora et al., 2018). Strengthening teachers' capacity through interdisciplinary training and reflective pedagogical methods is therefore essential for advancing education that is responsive to ecological imperatives. Ultimately, sustainable education must be understood as a process that extends beyond the classroom, influencing cultural norms, institutional practices, and broader social relations. Within the framework of environmental governance, education functions not only as a medium of awareness but also as a space for discourse production, social mobilization, and the collective formation of ecological ethics. This is where the strategic leverage of education lies, in fostering systemic reforms that pave the way toward a just, resilient, and sustainable future.

The implementation of Education for Sustainable Development (ESD) within national education frameworks requires a comprehensive and cross-sectoral strategy that transcends curriculum adjustments. It necessitates transformation across institutional management, educator competencies, and educational assessment systems. UNESCO (2017) asserts that ESD must be embedded integrally into the entire educational structure, not merely treated as an ancillary thematic subject. This integration entails three core components: the revision of curricular content, the strengthening of educator capacity, and the development of policy instruments that catalyze systemic transformation toward sustainability.

Curricular reform serves as a critical entry point for mainstreaming sustainability in education. In many countries, ESD has been incorporated into national curricula as a cross-disciplinary approach. Instead of positioning environmental issues as standalone subjects, these systems embed sustainability principles across diverse fields such as mathematics, science, geography, economics, and civics. This approach cultivates systemic competencies, including the ability to recognize interdependencies among ecological, economic, and social systems, and fosters anticipatory and integrative thinking. However, in developing countries like Indonesia, the implementation of ESD faces significant structural and capacity-related disparities across regions. While national policies may reflect an alignment with environmental conservation and character-building agendas, the disconnect between environmental and educational sectors persists. Educational policies often remain focused on standardized academic achievements, such as test scores and formal accreditation, rather than on fostering transformative

competencies aligned with long-term sustainability. To address this gap, a policy framework that facilitates institutional collaboration between the Ministry of Education, the Ministry of Environment, and other key stakeholders is imperative in designing adaptive, locally relevant learning systems.

Equally vital is the capacity building of educators who serve as pivotal agents in translating ESD principles into classroom practice. Teachers and lecturers are expected not only to understand sustainability concepts but also to design participatory, reflective, and contextual learning experiences. Countries like South Korea and Germany have pioneered national certification schemes and ongoing professional development programs focused on sustainability pedagogy. These training models emphasize interdisciplinary approaches, collaborative problem-solving, and project-based learning as essential methodologies. Indonesia holds considerable potential to emulate these efforts through national agencies such as the Quality Assurance Agency for Education (LPMP), the Center for the Development and Empowerment of Educators and Education Personnel (PPPPTK), as well as through partnerships with universities and civil society organizations. Furthermore, the educational evaluation system must evolve to align with the values and outcomes of ESD. Conventional assessment metrics that prioritize cognitive proficiency and standardized test performance are insufficient to capture the affective and behavioral dimensions of sustainability learning (Biesta, 2009; Olsson et al., 2016). Instead, evaluation models must be holistic and formative, accommodating students' development of ecological awareness, collaborative skills, and ethical decision-making. Project-based environmental evaluations, community action portfolios, and critical reflection exercises can provide authentic insights into learners' progress toward sustainability competencies. Several countries have begun to develop ESD-related assessment indicators within their national education evaluation systems. For example, Bhutan's Gross National Happiness (GNH) framework integrates environmental sustainability, cultural values, and holistic well-being into its educational indicators. This model offers an innovative paradigm for Indonesia and other countries seeking to harmonize intellectual, emotional, spiritual, and ecological development within their education systems.

The successful implementation of ESD also requires active participation from non-governmental actors, including civil society organizations, private sector entities, and religious institutions (Khataybeha et.al, 2010). Their involvement can extend the reach of ESD through community-based programs, alternative learning platforms, and innovative green financing mechanisms. This reinforces the notion that education for sustainability is not solely a governmental responsibility but a collective agenda necessitating multi-stakeholder engagement. To ensure the longevity and impact of ESD reforms, strong political commitment is essential, alongside institutional incentives for schools that adopt ESD practices and regular evaluations of policy effectiveness. A national framework must be established to underscore education as an integral pillar of sustainable development strategy, not merely a supportive sector.

The integration of environmental governance into national education systems continues to encounter substantial structural and institutional barriers that are multidimensional in nature. These challenges extend beyond technical limitations and are deeply intertwined with bureaucratic rigidity, institutional fragmentation, resistance to innovation, and the absence of supportive incentives that facilitate sustained collaboration between educational and environmental sectors. Despite the formal incorporation of sustainability narratives into national policy frameworks, implementation efforts on the



ground often remain superficial, limited to symbolic gestures rather than substantive transformation (Arora et al., 2018; Tilbury, 2004; Ferreira et al., 2007). Institutional resistance frequently stems from entrenched administrative cultures that prioritize procedural conformity over adaptive learning and innovation. Within this paradigm, transformative policies such as Education for Sustainable Development (ESD) are often regarded as peripheral responsibilities or experimental add-ons, rather than as strategic imperatives. The lack of institutional rewards and recognition mechanisms further diminishes the willingness of schools and environmental agencies to invest in meaningful sustainability practices. As a result, many initiatives are reduced to compliance exercises, aimed more at meeting project or accreditation requirements than achieving deep, long-term impact.

Fragmentation across policy sectors further exacerbates the problem. Ministries responsible for education and environment often operate under distinct policy mandates, performance indicators, and organizational logics, limiting opportunities for policy coherence and strategic alignment. The absence of integrative governance frameworks hampers efforts to design joint programs or harmonized strategies, while opportunities for cross-sectoral dialogue and policy learning remain underutilized. This disconnect significantly reduces the potential for synergistic approaches to sustainability education and environmental management. Capacity gaps also remain a critical constraint. Many educational institutions lack the pedagogical expertise necessary to embed sustainability into teaching and learning practices, while environmental agencies often do not possess the tools or frameworks to translate technical knowledge into accessible educational content. These disparities create operational gaps between environmental objectives and educational implementation, weakening the potential for institutional integration and long-term impact. The challenge is compounded by inadequate regulatory and financial frameworks. Most education systems are structured around standardized academic performance and testing outcomes, with sustainability often considered a non-core topic. Environmental education programs, therefore, receive limited funding and policy prioritization, making them vulnerable to discontinuation. Without sufficient institutional investment and budgetary support, efforts to mainstream sustainability remain fragmented and inconsistent.

Another major constraint lies in the design of assessment systems. Conventional evaluation models tend to measure cognitive achievements and standardized learning outcomes, while ESD emphasizes affective, behavioral, and ethical dimensions that are difficult to capture using traditional metrics. On the other hand, environmental governance indicators, focused on emissions, waste, or resource use, rarely capture the educational drivers behind community behavior change or cultural transformation. Addressing these obstacles requires a rethinking of how institutions collaborate, how they structure incentives, and how policy frameworks are constructed and implemented. Institutional mechanisms that promote inter-ministerial coordination and shared accountability can foster more coherent and adaptive approaches. Structures such as cross-sectoral working groups or inter-agency platforms are essential for aligning visions, synchronizing programs, and enabling joint policy formulation.

Supportive institutional incentives are also necessary to motivate actors within both sectors to embed sustainability in a substantive way (Giangrande et al., 2019). These may include targeted funding, performance-based rewards, or public recognition for innovative practices. Without such incentives, actors are unlikely to move beyond minimum compliance. Moreover, fostering a culture of experimentation and adaptive

learning in governance offers a promising pathway. Rather than waiting for ideal policy blueprints, small-scale pilot projects and collaborative models can be used to identify what works in particular contexts, to learn from iterative implementation, and to inform larger-scale reforms. Initiatives such as ESD model schools, university-community partnerships, and sustainability innovation hubs can serve as valuable learning platforms. In essence, integrating environmental governance into education systems demands more than curriculum revision; it requires a fundamental reconfiguration of institutional culture, policy logic, and stakeholder engagement. Only by addressing these institutional and structural dynamics comprehensively can education and environmental governance work in tandem to catalyze a transition toward a more sustainable, just, and resilient society.

The integration of environmental governance into educational reform is not merely an epistemological necessity, but a strategic imperative for securing the foundations of long-term sustainability. Findings from this study highlight the transformative potential of synergy between the education and environmental sectors. However, the realization of such potential depends significantly on the direction of public policy and the institutional capacity that underpins it. Consequently, well-formulated, evidence-based policies are essential for guiding the integration process. Both environmental governance and education share core principles such as participation, transparency, accountability, and intergenerational justice. Yet in practice, the alignment of these sectors is often hindered by sectoral silos, weak cross-sectoral regulatory frameworks, and limited space for local-level innovation. Bridging these divides requires a policy architecture that balances centralized mandates with decentralized, context-sensitive approaches driven by local actors.

One key strategy involves enhancing cross-sectoral policy coherence by strengthening institutional coordination mechanisms across ministries and government agencies (Arora et al., 2018; Biesta, 2009). Establishing a dedicated inter-ministerial platform or a national ESD coordination unit that includes the Ministry of Education, Ministry of Environment, Ministry of Finance, and civil society representatives could play a vital role. This body would facilitate the development of integrated policies, design cross-cutting sustainability indicators, and ensure consistent funding allocations for environmental education programs. Another critical area is the reinforcement of institutional capacity at regional and school levels. Local governments must be granted the autonomy and resources necessary to contextualize national ESD policies. This includes the ability to design place-based curricula, organize teacher training on sustainability pedagogy, and develop community-driven learning models that reflect the ecological and cultural specificities of different regions. Such decentralization fosters greater responsiveness and adaptability, enabling education systems to align more effectively with dynamic environmental and social conditions. Incentive structures and evaluation mechanisms must also be recalibrated to promote systemic institutional transformation. Recognition programs for sustainable schools, competitive grants for ESD innovation, and sustainability-focused accreditation frameworks are examples of how institutional behavior can be steered toward long-term change. Moreover, evaluation systems must go beyond cognitive assessments to incorporate affective and behavioral dimensions, such as students' ecological awareness, civic participation, and engagement in collective environmental actions. Fostering strategic partnerships across public institutions, private sectors, academic institutions, and civil society is equally essential. Non-governmental organizations, local communities, and private actors have played a



pivotal role in advancing environmental education in various international settings. Governments can support these efforts by serving as facilitators, creating enabling environments for multi-actor collaboration, providing regulatory support, and ensuring the continuity of initiatives through sustained funding and policy alignment.

Over the long term, a national framework that positions ESD as a pillar of sustainable development planning must be established (UNESCO, 2017; Giangrande et al., 2019; Mochizuki & Bryan, 2015). This would involve revising the Medium-Term National Development Plan (RPJMN) and the national education strategy to incorporate explicit sustainability indicators and mandates for integrating environmental governance. Reforms in curriculum and standards, should expand beyond academic competence to embed sustainability values as core learning outcomes within the Indonesian education system. Given the institutional complexity and the evolving interplay between education and environmental policy, the implementation of integrative strategies should be approached incrementally, flexibly, and based on continuous learning. Addressing disparities in institutional capacity, overcoming bureaucratic inertia, and responding to socio-cultural variability are necessary preconditions for success. Nonetheless, with sustained political commitment, institutional innovation, and inclusive collaboration across sectors, the integration of environmental governance into education can serve as a cornerstone for building a more just, adaptive, and ecologically resilient society.

CONCLUSION

This study affirms that the integration of environmental governance within national education frameworks constitutes a fundamental pillar in advancing long-term sustainability. The application of a systematic literature review has revealed a substantive correlation between the quality of inclusive, participatory, and transparent governance mechanisms and the effectiveness of educational systems in cultivating citizens equipped with ecological awareness, civic responsibility, and a commitment to sustainability. Education, in this regard, should not be narrowly conceptualized as a medium for transmitting factual knowledge about environmental issues, but rather as a transformative sociocultural institution that cultivates systems thinking, ecological ethics, and the competencies necessary to navigate and respond to the complexities of sustainability challenges. The Education for Sustainable Development (ESD) framework, serves as a normative and strategic reference for educational reform. However, its implementation across various national contexts, particularly in the Global South, remains impeded by structural constraints, institutional fragmentation, and policy discontinuities. Barriers such as the compartmentalization of sectoral policies, bureaucratic rigidity, and the limited pedagogical capacity of educators significantly hinder the operationalization of ESD. Consequently, the realization of integrated environmental and educational systems necessitates comprehensive policy synchronization, flexible and responsive institutional arrangements, and pedagogical strategies rooted in contextual realities and participatory methodologies.

The findings of this review further suggest that a sustainability-oriented education system cannot be conceptualized in isolation from broader environmental governance reforms. A meaningful transformation demands multi-actor engagement and shared accountability involving public authorities, civil society organizations, academic institutions, and the private sector. Such an ecosystem of collaborative learning and policy innovation is crucial to fostering environmental stewardship, critical consciousness, and collective agency. Ultimately, embedding environmental governance within the

architecture of national education systems should be viewed not as a supplementary policy initiative, but as a strategic imperative. In the face of accelerating environmental degradation, climate emergencies, and socio-ecological disruptions, this integrative pathway offers the potential to build just, adaptive, and context-sensitive futures. Through a synergy of transformative education and inclusive governance, the foundations for sustainable development can be meaningfully strengthened and institutionalized across generations.

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BIBLIOGRAPHY

- Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable Development*, 27(4), 669–680. <https://doi.org/10.1002/sd.1931>
- Arora, N. K., Fatima, T., Mishra, I., Verma, M., Mishra, J., & Mishra, V. (2018). Environmental sustainability: challenges and viable solutions. *Environmental Sustainability*, 1(4), 309–340. <https://doi.org/10.1007/s42398-018-00038-w>
- Biesta, G. (2009). Good education in an age of measurement: On the need to reconnect with the question of purpose in education. *Educational Assessment, Evaluation and Accountability*, 21(1), 33–46. <https://doi.org/10.1007/s11092-008-9064-9>
- Borg, C., Gericke, N., Höglund, H. O., & Bergman, E. (2014). Subject- and experience-bound differences in teachers' conceptual understanding of sustainable development. *Environmental Education Research*, 20(4), 526–551. <https://doi.org/10.1080/13504622.2013.833584>
- Brundiers, K., Barth, M., Cebrián, G. *et al.* Key competencies in sustainability in higher education—toward an agreed-upon reference framework. *Sustain Sci* 16, 13–29 (2021). <https://doi.org/10.1007/s11625-020-00838-2>
- Eilam, E., & Trop, T. (2012). Environmental attitudes and environmental behavior—which is the horse and which is the cart? *Sustainability*, 4(9), 2210–2246. <https://doi.org/10.3390/su4092210>
- Ferreira, J. A., Ryan, L., & Tilbury, D. (2007). Mainstreaming education for sustainable development in initial teacher education in Australia: A review of existing professional development models. *Journal of Education for Teaching*, 33(2), 225–239. <https://doi.org/10.1080/02607470701259515>
- Giangrande, N., White, R. M., East, M., Jackson, R., Clarke, T., Coste, M. S., & Penha-Lopes, G. (2019). A competency framework to assess and activate education for sustainable development: Addressing the UN sustainable development goals 4.7



- challenge. *Sustainability* (Switzerland), 11(10).
<https://doi.org/10.3390/su11102832>
- Khataybeha, A. M., Subbarini, M., & Shurman, S. (2010). Education for sustainable development, an international perspective. *Procedia - Social and Behavioral Sciences*, 5, 599–603. <https://doi.org/10.1016/j.sbspro.2010.07.149>
- Kopnina, H. (2014). Revisiting education for sustainable development (ESD): Examining anthropocentric bias through the transition of environmental education to ESD. *Sustainable Development*, 22(2), 73–83. <https://doi.org/10.1002/sd.529>
- Lemos, M. C., & Agrawal, A. (2006). Environmental governance. *Annual Review of Environment and Resources*, 31, 297–325. <https://doi.org/10.1146/annurev.energy.31.042605.135621>
- Meadowcroft, J. (2007). Who is in charge here? Governance for sustainable development in a complex world. In *Journal of Environmental Policy and Planning* (Vol. 9, Issues 3–4, pp. 299–314). <https://doi.org/10.1080/15239080701631544>
- Meadowcroft, J. (2007). National sustainable development strategies: Features, challenges and reflexivity. *European Environment*, 17(3), 152–163. <https://doi.org/10.1002/eet.450>
- Mochizuki, Y., & Bryan, A. (2015). Climate Change Education in the Context of Education for Sustainable Development: Rationale and Principles. *Journal of Education for Sustainable Development*, 9(1), 4–26. <https://doi.org/10.1177/0973408215569109>
- Olsson, D., Gericke, N., & Chang Rundgren, S. N. (2016). The effect of implementation of education for sustainable development in Swedish compulsory schools – assessing pupils’ sustainability consciousness. *Environmental Education Research*, 22(2), 176–202. <https://doi.org/10.1080/13504622.2015.1005057>
- Tilbury, D., & Wortman, D. (2004). *Engaging People in Sustainability*. Gland, Switzerland and Cambridge, UK: Commission on Education and Communication, IUCN
- UNESCO. (2017). *Education for sustainable development goals: Learning objectives*. France: United Nations Educational, Scientific and Cultural Organization. <https://doi.org/10.54675/CGBA9153>