

Fostering Competence for Sustainability through Education and Adaptive Global Citizenship

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ABSTRACT

This paper explores how education systems can nurture twenty-first-century skillsets that contribute meaningfully to global sustainability. By examining interdisciplinary literature, it identifies the competencies essential for addressing environmental, social, and economic challenges in the twenty-first century, including critical thinking, collaboration, digital literacy, emotional intelligence, and ethical leadership. The study emphasizes the need for transformative pedagogies, experiential learning, and systems thinking to empower students as proactive change agents. It argues that education should not only transmit knowledge but also cultivate agency, responsibility, and adaptability. The integration of global and intercultural competencies enhances learners' ability to navigate pluralistic societies and transboundary dilemmas. Institutional strategies such as whole-school approaches, community partnerships, and performance-based assessments are highlighted as key enablers of sustainability education. Furthermore, teacher training is identified as a pivotal factor in ensuring that these skills are effectively imparted. The discussion concludes by asserting that the alignment of education with sustainability is not optional but essential for future resilience. Through intentional design and inclusive implementation, education can become a transformative force in realizing just and regenerative societies.

INTRODUCTION

The 21st century has been marked by accelerated global transformations—technological, ecological, social, and economic—that redefine how societies function and progress. Education systems are no longer tasked solely with the transmission of knowledge; they are now obligated to equip learners with a portfolio of adaptive capabilities to address emerging global conditions. As the world grapples with climate degradation, digital disruption, and socioeconomic volatility, the alignment between learning objectives and sustainability imperatives becomes increasingly vital. This shift calls for an educational paradigm that transcends static content delivery, focusing instead on cultivating flexible, resilient, and ethically grounded citizens (Malik, 2018).

Contemporary discourses around sustainability converge on the necessity of empowering individuals with skills that support both ecological preservation and social equity. These are not limited to technical competencies or scientific literacy,

but encompass problem-solving, ethical reasoning, collaboration, and systems thinking. Trilling and Fadel (2009) define such skills as “21st-century literacies,” emphasizing the role of interdisciplinary learning in preparing students for complex societal demands. The ability to navigate uncertainty, evaluate competing claims, and contribute constructively to collective well-being has become integral to modern conceptions of education (Muhali, 2019).

Within this evolving educational terrain, the emphasis has turned toward how pedagogical frameworks incorporate sustainability as a core principle. The integration of critical thinking, cultural awareness, and participatory citizenship into learning goals reflects an acknowledgment that sustainable development is contingent upon informed, reflective human agency. As Sterling (2001) argues, education for sustainability requires transformative learning that restructures perception, values, and behavior—not merely informational inputs.

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This pedagogical model insists on experiential learning, reflexivity, and action-oriented inquiry as essential mechanisms for embedding sustainable mindsets (Marouli, 2021).

What remains less examined is the practical alignment between 21st-century skillsets and sustainability outcomes within formal education. While numerous educational initiatives invoke sustainable development as a priority, the coherence between curricula, teaching methods, and real-world preparedness varies widely. As UNESCO (2005) notes, the success of education for sustainable development depends on the intentional design of learning environments that nurture competencies such as anticipation, responsibility, and collective deliberation. Bridging these aspirations with measurable pedagogical outcomes continues to challenge educators and policymakers alike (Bernhardt, 2015).

Although global dialogues increasingly advocate for embedding sustainability across learning systems, several substantive obstacles persist. Firstly, there is often a disconnect between policy rhetoric and classroom implementation. Curricular reforms espousing sustainability principles frequently lack specific operational guidelines for educators. As Bonnett (2002) explains, the concept of sustainability is itself subject to interpretive ambiguities, making it difficult to codify into standardized curricula. This ambiguity can lead to superficial coverage or selective interpretation, reducing the educational impact (Tillmanns, 2020).

Secondly, teacher preparation programs have been slow to embed sustainability literacy within professional training. Despite institutional commitment at the policy level, many educators report uncertainty regarding how to effectively integrate sustainability into subject-specific instruction (Tilbury, 1995). Inadequate support structures and limited pedagogical models further exacerbate this issue, resulting in inconsistent implementation. Teachers may be enthusiastic about sustainability objectives, yet lack the tools and confidence to facilitate complex discussions around environmental justice, equity, and global interdependence.

A third barrier is the evaluation of educational outcomes related to sustainability and 21st-century competencies. Traditional assessment models—centered on standardized testing and content mastery—often fail to capture the nuances of problem-solving, collaboration, or systems thinking. As Goleman et al. (2012) observe, the cultivation of ecological intelligence requires experiential learning and iterative reflection, neither of which are easily quantifiable through conventional academic metrics.

Consequently, even when sustainability is integrated into teaching content, its long-term impact on learner behavior remains unclear.

Despite these challenges, the urgency of environmental degradation and social disintegration reinforces the need to reimagine educational objectives. As the climate crisis deepens, the responsibility to prepare students as stewards of sustainability intensifies. The disconnect between educational practice and sustainability imperatives risks producing graduates unprepared for the moral and operational complexities of the contemporary world. Without a deliberate, skill-based approach to education, societies may continue to invest in schooling systems that inadvertently reinforce unsustainable norms and practices.

The gravity of this condition demands ongoing scholarly inquiry. Educational institutions must be able to respond with curricula that do more than inform—they must transform. This transformation is both philosophical and practical, involving structural reconfiguration and epistemic innovation. The educational sector's response will determine whether future generations are empowered to thrive within planetary boundaries or are left unequipped to mitigate escalating global crises.

This study aims to investigate the alignment between 21st-century educational skills and sustainable development imperatives. It seeks to elucidate how pedagogical frameworks, instructional design, and educational policy can nurture capacities such as systems thinking, ethical judgment, and collaborative innovation. By mapping these skillsets to sustainability objectives, this study provides insights into the educational transformations necessary to address ecological, economic, and social complexities. The outcome contributes to educational scholarship by offering integrative recommendations that bridge contemporary learning goals with sustainability-oriented outcomes.

RESEARCH METHOD

This study adopts a qualitative research approach rooted in literature review methodology to explore the integration of 21st-century skillsets within sustainability-focused education. A literature review allows for the synthesis of existing knowledge and theoretical perspectives that inform the intersection of skill development and sustainable education. By analyzing peer-reviewed academic works, policy reports, and institutional frameworks, this method facilitates a comprehensive understanding of educational discourses that shape contemporary sustainability practices. According to Hart (1998),

well-structured literature review not only aggregates findings from previous studies but also reveals gaps, contradictions, and emergent themes, thereby constructing a coherent foundation for academic inquiry.

A selection of literature was prioritized that included important and contemporary contributions that have shaped the field of education for Sustainable Development (ESD). A purposive sampling strategy was employed to ensure that included texts address critical skills such as systems thinking, problem-solving, ethical reasoning, and collaborative learning—within the context of sustainability. Sources were retrieved from established academic databases, including JSTOR, ERIC, ScienceDirect, and SpringerLink. The analytical procedure followed thematic content analysis as described by Braun and Clarke (2006), which involved coding key concepts, identifying patterns, and categorizing them into overarching themes. Through this method, the study aims to uncover how educational theory and practice converge to equip learners with the necessary capabilities to confront the global complexities of the 21st century.

RESULT AND DISCUSSION

Education is no longer confined to the transmission of static knowledge or the rehearsal of rote procedures. In the twenty-first century, it must serve as a dynamic interface between learners and the unpredictable challenges of an evolving world. The conventional model of schooling—centered on memorization and standardized assessment—fails to address the multifaceted realities of contemporary life. Instead, there is a growing necessity for education systems to become incubators of adaptability, ethical reasoning, and global consciousness. The urgency to realign pedagogy with these emerging priorities cannot be overstated (Mynbayeva et al., 2017).

Modern civilization faces unprecedented volatility shaped by technological disruption, environmental degradation, and global inequities. These forces demand a recalibration of what it means to be educated. It is no longer sufficient for students to master core subjects in isolation; rather, they must acquire integrative skills that allow them to synthesize knowledge, navigate complexity, and contribute meaningfully to sustainable futures. As these shifts intensify, educational institutions are uniquely positioned to anchor this transformation through curricula that prioritize relevance, resilience, and responsibility (Salmi, 2020).

The cultivation of such transformative capabilities rests upon a pedagogical shift toward active, learner-centered engagement. When students are placed at the heart of inquiry, explore real-world dilemmas,

and challenged to propose actionable solutions, they internalize the notion of agency. These learning experiences build cognitive flexibility and emotional acuity—qualities that are essential for negotiating both environmental and social challenges. Education thus becomes a medium not only for intellectual growth, but also for civic empowerment and ecological stewardship (Palacios-Saltos et al, 2021).

Central to this reorientation is the integration of cross-disciplinary thinking and digital fluency into educational frameworks. Learners today must be equipped to navigate multiple information environments, evaluate sources critically, and apply their knowledge across diverse contexts. As Trilling and Fadel (2009) observed, these capacities extend into three interconnected arenas: the ability to innovate, to engage meaningfully with technology, and to navigate the demands of an increasingly interconnected professional landscape. Schools that prioritize these areas are cultivating futures in which learners become architects of sustainable progress (Ossiannilsson, 2020).

True educational transformation is measured not merely by test scores but by the depth of learners' contributions to a just and livable world. Those who emerge from such systems possess the skills to collaborate across cultural divides, think systemically, and make ethically informed decisions. These competencies are not ancillary but foundational to the long-term viability of human and ecological communities. Thus, reimagining education for sustainability is not a peripheral reform—it is an ethical imperative and a blueprint for regenerative civilization (Currin, 2019).

Pedagogical methodologies must transcend didactic instruction and foster participatory, inquiry-based learning. Dewey's (1938) philosophy of experiential education underscores the importance of learning through reflection on doing (Beard, 2018). By incorporating project-based and problem-based learning models into curricula, students are invited to explore real-world sustainability dilemmas and propose contextually grounded solutions. These environments cultivate a sense of agency as learners recognize the impact of their decisions within broader ecological and social systems. In this way, education is not limited to content acquisition but becomes a rehearsal space for active citizenship and ethical reasoning.

Critical thinking and systems thinking are indispensable tools in navigating sustainability-related issues. Sterling (2001) emphasized the need for a shift from transmissive to transformative learning, wherein learners interrogate assumptions,

identify interdependencies, and anticipate long-term consequences. Systems thinking allows students to view climate change, economic inequality, or resource depletion as part of complex webs of causality. Instruction that encourages mapping of systems or modeling of scenarios helps students approach sustainability not as a static problem to be solved, but as a dynamic process requiring adaptive solutions over time.

The integration of global competencies and intercultural awareness into curricula fosters empathy and solidarity. According to Banks (2008), multicultural education expands learners' capacity to understand perspectives different from their own, thereby promoting inclusive dialogue and cooperation. In the sustainability domain, such understanding is pivotal. Issues such as climate justice or equitable development are inherently transnational and demand sensitivity to diverse socio-political and cultural contexts. Education that centers on pluralism equips students to collaborate across divides and co-create equitable futures.

Technological fluency is another pillar of twenty-first-century sustainability skills. As noted by Gee (2003), digital literacies are not merely about operating devices but entail navigating, producing, and evaluating information in a connected world. From using GIS tools to map deforestation, to programming applications that optimize energy use, learners equipped with digital competencies can drive innovation in sustainable practices. Digital tools facilitate virtual collaborations and amplify youth voices in global forums, democratizing participation in environmental governance.

The emotional and social dimensions of sustainability learning must not be underestimated. Mayer and Salovey's (1997) work on emotional intelligence suggests that individuals who manage emotions effectively tend to build stronger relationships and resolve conflicts constructively. These attributes are crucial in mobilizing communities, leading change, and sustaining collective action. Educational settings that emphasize mindfulness, ethical inquiry, and reflective practices prepare students not only to analyze sustainability challenges, but to navigate them with resilience and compassion.

Leadership development within schools serves as a catalyst for sustainability-oriented mindsets. Hargreaves and Fullan (2009) argue that sustainable leadership involves the capacity to influence systems while preserving moral purpose. When students are given opportunities to lead peer campaigns, manage school gardens, or liaise with local authorities, they cultivate a sense of responsibility that transcends the classroom.

Such experiential learning grounds sustainability in daily practices and fosters a lifelong disposition toward stewardship.

Assessment mechanisms must be aligned with the goals of sustainability education. Traditional metrics focused on rote memorization and standardized testing fail to capture competencies such as creativity, collaboration, or ecological literacy. Wiggins and McTighe (2005) propose performance-based assessments that emphasize the application of knowledge in novel contexts. For instance, evaluating a student's capacity to conduct a community waste audit or design a conservation campaign provides more authentic evidence of readiness to address real-world challenges.

Teacher training programs are central to the successful transmission of sustainability values. As Zeichner and Liston (1996) observe, reflective practitioners who engage in continuous professional development are better equipped to facilitate transformative learning. Embedding sustainability into teacher education not only enhances subject knowledge but reshapes pedagogical orientation. Teachers who model critical thinking, social engagement, and ecological responsibility serve as living curriculum for their students.

Institutional commitment to sustainability must be visible across policies, practices, and physical infrastructure. Sterling and Scott (2008) assert that whole-school approaches—where curricula, leadership, operations, and community partnerships align with sustainability principles—create coherent and impactful learning environments. Whether through green buildings, ethical procurement policies, or participatory governance structures, educational institutions can embody the futures they hope to inspire.

The community-school interface enhances sustainability learning by bridging formal education with lived experience. Lieberman and Hoody (1998) champion place-based education as a model that connects students to local environmental and social issues. These engagements foster a sense of belonging and contextual relevance, making global challenges personally meaningful. Community involvement enriches educational processes by drawing on intergenerational knowledge and indigenous practices.

Cross-sector partnerships extend the reach and relevance of sustainability education. Collaborations with NGOs, government agencies, and industry players provide students with access to expertise, mentorship, and practical experience. According to Tilbury and Wortman (2004), such partnerships cultivate innovation ecosystems where learning is co-constructed, responsive, and situated within real-world problem-solving.

Fostering twenty-first-century sustainability skills through education requires systemic transformation rooted in learner-centered approaches, interdisciplinary integration, and institutional commitment. The pathway toward ecological and social regeneration is not predefined but co-created through educational experiences that honor complexity, cultivate curiosity, and instill courage.

In the face of global uncertainties and rapidly shifting environmental realities, education must transcend its traditional bounds and become a collaborative enterprise. When academic institutions engage with civil society, industry, and policy actors, the educational process acquires new dimensions of relevance and vitality. These alliances serve as conduits through which theoretical insights intersect with field-based expertise, resulting in learning environments that are both rigorous and responsive to societal needs.

Sustainability, by its very nature, demands a synthesis of perspectives and practices across multiple domains. It is within these interstitial spaces – between disciplines, sectors, and cultures – that innovative solutions emerge. Students, when immersed in diverse learning networks, develop the capacity to negotiate difference, adapt to complexity, and contribute meaningfully to transformative action. Partnerships are not supplemental – they are structural elements in the architecture of effective sustainability education.

The evolution of pedagogy toward a more relational and co-creative model reflects a deeper philosophical shift: from education as transmission to education as shared inquiry. This reorientation empowers learners to participate in shaping not only their own futures but the collective direction of communities and ecosystems. It encourages a disposition of humility, reflexivity, and engagement – qualities indispensable for navigating the moral and ecological terrain of the twenty-first century.

Institutional transformation cannot occur in isolation. It must be embedded within wider systems of accountability, cultural awareness, and social justice. The partnerships that support sustainability learning also serve as mirrors, reflecting the values and aspirations of the society from which they arise. When aligned with ethical and ecological goals, they reinforce a shared commitment to regeneration, inclusivity, and long-term well-being.

Ultimately, education for sustainability is less about prescribing answers and more about expanding the space for critical questioning, courageous experimentation, and collaborative problem-solving. By embracing this ethos, schools and universities become sites of possibility – where learners are

equipped not only with knowledge, but with the vision and tenacity to reimagine the world. This is the promise of true partnership: not to deliver change to students, but to invite them into the process of making it.

CONCLUSION

The demands of a rapidly evolving global landscape necessitate an education system that not only imparts knowledge but equips learners with the capacity to act with responsibility and foresight. The twenty-first-century skillsets – ranging from critical thinking and digital fluency to intercultural communication and ethical leadership – form the backbone of sustainable development. By embedding these competencies into curricula, pedagogy, and institutional culture, education becomes a powerful mechanism for cultivating future citizens who are capable of addressing complex global challenges with agility and conscience. Sustainability, therefore, is not an ancillary topic, but a core principle that must animate every aspect of educational design and delivery.

The transformation of education in service of sustainability requires stakeholders to reimagine the architecture of learning environments. From teacher training to assessment reform, from community partnerships to policy frameworks, the success of such an agenda depends on coherent, long-term commitment at every level. When education systems are aligned with ecological and social imperatives, schools become ecosystems of innovation and justice. The implications of this shift extend beyond the classroom, laying the groundwork for societies that are more resilient, equitable, and compassionate in the face of global uncertainties.

It is crucial that policymakers, educators, and institutions collaborate to institutionalize sustainability as a foundational educational aim. Investment must be directed toward professional development programs that equip teachers with sustainability pedagogies. Assessment tools must be redefined to capture transformative outcomes, and partnerships must be fostered to bridge formal learning with real-world contexts. By establishing education as a cornerstone of sustainable futures, we enable generations of learners not just to adapt to change, but to shape it with vision and purpose.

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