

Development and Practice of Sustainable Development Education (Environmental Protection) Curriculum in Primary and Secondary Schools Oriented by Core Competencies

Zeyu Sun

The Education University of Hong Kong, Hong Kong, 999077, China

ABSTRACT

Against the backdrop of the "Double Reduction" policy and the continuous deepening of curriculum reform, core literacy has become the central concept of curriculum development in primary and secondary schools. Sustainable development education, as an essential component of building green campuses and implementing ecological civilization education, is gradually moving to the center of the curriculum system. Based on the orientation of core literacy, this paper systematically analyzes the goal positioning, teaching content, implementation paths, and evaluation mechanisms of sustainable development education (environmental protection) curricula in primary and secondary schools. It clarifies their theoretical foundations and educational values while exploring specific development strategies and practical outcomes. By integrating educational cases and practical applications, this paper aims to provide theoretical support and practical reference for constructing environmental education curricula with both contemporary value and educational effectiveness, thereby promoting the rooting of ecological civilization education in basic education.

KEYWORDS

Core literacy; Sustainable development education; Environmental protection curriculum; Primary and secondary education; Curriculum development; Practice path

1 Introduction

In the context of increasingly severe global ecological and environmental challenges, sustainable development has become a key national strategy, placing new demands on basic education. Primary and secondary schools, as the crucial stage for shaping students' values and behavioral habits, shoulder an important responsibility in environmental education. Traditional environmental education suffers from fragmented content, monotonous forms, and vague objectives, making it difficult to meet the requirements of curriculum reform under the guidance of core literacy. Integrating sustainable development education deeply with core literacy not only helps to enhance students' overall qualities but also facilitates the construction of a future-oriented education system. Starting from theoretical perspectives, this paper explores the development and practice of environmental protection curricula in primary and secondary schools, aiming to provide educators with feasible curriculum construction approaches and implementation experiences.

2 The Connotation transformation and curriculum value of sustainable development education under the vision of core literacy

2.1 From knowledge transmission to literacy cultivation: the logic of curriculum transformation

In traditional environmental education, teaching often revolves around a "knowledge + lecturing" model. Students passively receive information about energy conservation, green travel, and waste sorting, which, while increasing awareness, rarely translates into ingrained habits or conscious value choices. Such knowledge-oriented instruction neglects students' active engagement and autonomous construction abilities, failing to support the mission of cultivating "responsible citizens." With the full implementation of the "core literacy" concept in basic education, the focus of curriculum reform has shifted from "what to teach" to "what kind of person to cultivate." This emphasizes not only knowing "what" but also understanding "why" and practicing "how." Consequently, the goals of sustainable development education have expanded from merely imparting environmental knowledge to fostering ecological awareness, social responsibility, and sustainable action capacity in a comprehensive curriculum system.

The core literacy framework advocates goals such as holistic development, practical application, and lifelong learning, which align closely with the orientation of sustainable development education. Core literacy stresses not only the improvement of subject competence but also the ability to solve problems in complex real-world contexts. Environmental issues, inherently interdisciplinary and complex—such as water conservation, carbon reduction, and ecological restoration—require students to develop integrated thinking, critical analysis, cooperative communication, and reflective

action abilities. Therefore, a sustainable development curriculum guided by core literacy is not a simple aggregation of environmental knowledge but an integrated system of “knowledge–ability–values.” It encourages teachers to move from “teaching textbooks” to “teaching thinking and responsibility,” and curricula to shift from “environmental topics” to “citizen literacy construction.”

2.2 The return of educational value: practical significance of sustainable development curricula

Sustainable development education is not merely an extension of traditional environmental education but a vital vehicle for embodying the educational value of core literacy. As primary and secondary students are at a critical stage in value formation, scientifically designed curricula and authentic learning scenarios can help them establish ecological awareness and a sense of responsibility across cognitive, emotional, and behavioral dimensions. For example, when designing a project on “urban waste problems,” students not only investigate local waste management practices but also analyze their impacts on community environments and residents’ health, ultimately proposing feasible solutions. Through such processes, students experience problem identification, solution design, and advocacy, thereby deepening value recognition and achieving transformation from “knowing” to “doing.”

More importantly, sustainable development education inherently functions as civic education, guiding students to transcend personal perspectives and broaden their vision toward the environment, society, and the future. Participation in community environmental campaigns, planning green initiatives, and documenting ecological changes helps students understand the interconnection between individual behavior, social systems, and natural systems. This is crucial for cultivating systems thinking, cooperation, and social participation. In the face of global challenges such as climate change, energy crises, and biodiversity loss, nurturing young people with green values and responsible action capacities is not only an elevation of educational goals but also a call of the times. Thus, sustainable development curricula under the guidance of core literacy should transcend subject boundaries and serve as a vital carrier and breakthrough point for realizing the fundamental mission of “moral education.”

3 Principles and design strategies for developing sustainable development curricula in primary and secondary schools

3.1 Clarifying curriculum structure: combining goal orientation with integrated thinking

Under the guidance of core literacy, the development of sustainable development curricula must first be driven by literacy objectives, clearly defining what “green competencies” students should acquire, rather than merely presenting environmental facts. Curriculum development should align goals, content, organization, and assessment around cultivating students’ sustainable behavior capacities. For example, goals should extend beyond “knowing about low-carbon lifestyles” to include “actively practicing energy conservation in daily life and influencing others.” Such goal-setting emphasizes the transformation from knowledge to ability and behavior, ensuring that curricula exert a profound impact on students’ sustainable living habits. Developers should construct a complete chain of “cognition–experience–action” to integrate knowledge, skills, and attitudes, facilitating the internalization, transformation, and externalization of sustainable awareness.

At the same time, the content of sustainable development education spans ecology, resources, society, equity, and the future, embodying cross-disciplinary integration. While traditional subject knowledge remains important, it must be organically integrated through “holistic thinking” to form meaningful curriculum modules. For instance, science lessons on the water cycle, geography lessons on natural disasters, language lessons on environmental-themed readings, and IT lessons on low-carbon lifestyle tracking can be combined into a “green life design” project course. In development, teacher teams should break disciplinary boundaries, conduct joint lesson planning, and build shared resources to ensure systematic and relevant content. This integration helps students form green values and problem-solving abilities in real-world contexts.

3.2 Strengthening curriculum implementation: Project-Based and Activity-Oriented teaching

At the implementation stage, sustainable development education should not stop at lecturing on environmental concepts but instead revolve around problems and tasks, turning learning into an active exploration and participation process. Project-based learning (PBL) thus becomes a primary approach. By designing challenging, authentic problem scenarios, students are guided to identify issues, gather data, collaborate in teams, design solutions, and take action. For instance, in a project on “plastic use in campus life,” students conduct surveys, design questionnaires, analyze statistics, propose alternatives, and present their findings via posters or presentations. This not only raises awareness of plastic

pollution but also enhances data analysis, public speaking, and teamwork skills, achieving coordinated literacy development.

In addition, activity-oriented teaching strategies should be extensively integrated to make learning interactive, experiential, and emotionally engaging. Activities such as “Model UN on Environmental Policy,” “Green Action Challenges,” and “Family Energy-Saving Campaigns” encourage students to leave the classroom and engage with real environmental complexities. For example, in a “green travel initiative,” students interview community residents, investigate public transportation convenience, and promote low-carbon commuting within their schools. Such activities strengthen social observation, communication, and civic responsibility. Through diverse activity designs, sustainable development concepts shift from book knowledge to student beliefs and daily practices, ultimately shaping the future citizen’s environmental literacy.

4 Practice organization and educational pathways of sustainable development curricula

4.1 Diversified practices broadening students’ environmental vision and action

The success of curricula depends on whether students have truly “done,” “thought,” and “experienced” within authentic contexts, enabling the transition from cognition to behavior. Practices should be tailored to developmental stages and living realities. In primary schools, emphasis may be on “awareness enlightenment” through tasks such as waste sorting, plant growing journals, and eco-habit trackers, often designed in playful or story-based formats. In secondary schools, focus shifts toward problem awareness and exploratory ability, with projects like “campus carbon footprint surveys,” “ecosystem-in-a-bottle experiments,” and “food packaging recyclability analysis.” These are not peripheral activities but central processes where students engage as subjects, problems serve as vehicles, and literacy guides learning.

The design of practice must be logical and authentic, with full processes from cognitive guidance, problem-raising, and action design to result presentation. For instance, in a “green campus improvement plan,” students investigate energy use and environmental habits, brainstorm feasible solutions, and present results through PPTs or posters, with suggestions submitted to school administrators. Such tasks cultivate data analysis and logical expression while strengthening students’ sense of efficacy and responsibility in driving change. Sustainable development education stresses “action orientation” over “concept indoctrination,” ensuring that environmental values evolve from cognition into enduring habits.

4.2 Collaborative mechanisms for systematic and long-term educational practice

Sustaining practices requires systematic structures and collaborative mechanisms rather than sporadic enthusiasm. Schools should design “green practice promotion plans,” establish dedicated committees, and define roles across academic, moral education, and logistics departments. Practice schedules should be institutionalized in curricula and calendars to ensure adequate time for observation, research, operation, and reflection. Environmental tasks may also be linked with comprehensive quality assessments, class performance points, or growth portfolios to sustain motivation.

Teacher collaboration is essential. Interdisciplinary teams can co-design and co-implement projects—for example, language teachers guide environmental writing, science teachers mentor experiments, IT teachers support digital presentations, and art teachers lead eco-poster design. Such collaboration breaks silos and deepens curriculum integration. Education bureaus may further organize “green curriculum workshops” to share best practices and build resource packages, ensuring continual optimization. Families and communities also play pivotal roles. Initiatives such as “family eco-task sheets,” “parent-child green weeks,” and “community eco-observation cards” extend curricula into life. For instance, a “green family challenge” may involve energy monitoring and waste sorting, strengthening students’ influence within families. Collaborations with NGOs, parks, and neighborhood committees can provide authentic contexts for participation in clean-ups, awareness campaigns, and recycling exhibitions. Such “school-family-community” cooperation expands practice boundaries and secures holistic educational impact.

5 Optimization of curriculum evaluation and operation mechanisms

5.1 Building a Development-Oriented Multi-Dimensional evaluation system

Evaluation under core literacy should move beyond exam scores toward developmental and comprehensive assessments. The aim is not only to check knowledge but also to track thinking, attitudes, participation, and reflection. A four-dimensional framework—cognition, process, behavior, and growth—can capture the breadth of environmental literacy. Tools such as eco-diaries, reflection essays, peer assessments, and group presentations allow multi-perspective

evaluations. Students should also maintain “sustainability portfolios” to track progress across school years, enabling teachers to tailor support and fostering continuous growth.

A blend of formative, performance-based, and summative assessment is recommended. Formative evaluations offer timely feedback during group discussions and project milestones. Performance-based assessments emphasize solution feasibility and civic responsibility displayed in outputs. Summative assessments encourage reflective reports on cognitive, emotional, and behavioral development. Broader participation from peers, parents, and community members can enhance objectivity and engagement. The goal of evaluation is growth promotion, not rigid ranking, creating an environment where students are motivated to act and improve.

5.2 Establishing organizational and cultural support for sustainable operation

For environmental curricula to move from pilots to long-term practice, stable systems are essential. Schools must institutionalize sustainable development education, embedding it in curriculum structures, management systems, and evaluation standards. Green practice outcomes should be incorporated into teacher performance appraisals and student assessments, ensuring accountability and recognition. “Sustainability curriculum committees” may coordinate design, resources, and quality assurance, guaranteeing coherence and continuity.

Campus culture provides the soil for curriculum sustainability. When environmental values permeate visions, policies, and norms, education transcends a subject and becomes a shared ethos. Schools may establish “green charters,” display eco-achievements, and hold “sustainability days.” Teachers should model “green professionalism,” integrating values into teaching and conduct. Partnerships with NGOs, research institutions, and enterprises can expand resources and foster open, shared, and co-constructed platforms. Institutional support and cultural synergy together ensure that sustainable development education thrives as a vital component of school education.

6 Future Prospects and Development Pathways

6.1 Promoting the digital and intelligent transformation of sustainable development education

With the rapid advancement of emerging technologies such as artificial intelligence, big data, and the Internet of Things, educational informatization has profoundly reshaped the structure and mode of school curricula. In the future, innovations in sustainable development education for primary and secondary schools will inevitably be closely integrated with digitalization and intelligentization. On the one hand, the construction of smart campuses provides abundant real-time data and actionable learning contexts for environmental education. For example, schools can use energy monitoring systems to record electricity and water consumption in real time and display the results on a “green campus dashboard.” Based on this data, teachers can design interdisciplinary lessons that guide students to conduct statistical analyses and develop optimization solutions, thus transforming abstract concepts of energy conservation into concrete research tasks. On the other hand, the introduction of virtual reality and augmented reality technologies offers students immersive learning experiences. In virtual laboratories, students can vividly simulate scenarios such as deforestation, land desertification, and chain reactions triggered by extreme climate events, gaining a deeper understanding of the complexity and urgency of global ecological crises. This helps foster a stronger sense of responsibility at both cognitive and emotional levels.

More importantly, digitalization is not merely a supplementary learning tool but a driving force for restructuring curriculum systems. Future environmental curricula should leverage intelligent platforms to achieve resource sharing, learning record-keeping, and data-driven learning analysis, enabling teachers to track students’ learning trajectories and behavioral habits more scientifically. AI-based learning analytics systems can monitor students’ engagement in environmental projects, task completion quality, and collaboration performance, generating personalized learning reports to support differentiated instruction. Moreover, digital platforms can break down geographical barriers between schools, allowing students from different regions to share research outcomes and collaborate on environmental studies through remote classrooms. For instance, students in coastal cities could collaborate with those in inland regions on comparative studies of water resource utilization, while students from mountainous areas might work with peers from plains to explore the effects of vegetation cover on carbon emissions. Such cross-regional and cross-cultural collaborations not only broaden students’ environmental perspectives but also strengthen their teamwork, communication skills, and global awareness. With the deep integration of education and technology, sustainable development education will evolve from a “closed classroom” to an “open ecosystem,” forming a multidimensional learning model that integrates online and offline learning, as well as in-school and out-of-school collaboration.

6.2 Establishing institutional support and social collaboration under national strategic guidance

Promoting the deepening of sustainable development education curricula in primary and secondary schools cannot rely solely on the exploration of frontline teachers or individual schools; it requires the establishment of a comprehensive institutional support system under the guidance of national strategies. At the macro level, educational authorities should explicitly incorporate green education into basic education curriculum standards, specifying teaching objectives, core literacy requirements, and expected learning outcomes for different school levels. This would elevate sustainable education from being a temporary educational activity to a mandatory “hard indicator” within the curriculum system. Furthermore, the implementation of environmental education should be incorporated into teacher promotion, performance evaluations, and classroom assessments, thereby encouraging educators to integrate sustainability concepts into their daily teaching practices. Local education departments should also tailor curriculum implementation schemes to align with regional economic and ecological conditions. For example, water-scarce regions could emphasize water conservation education, industrial cities could focus on air pollution management, and coastal cities could highlight marine ecological protection, ensuring that curriculum content closely matches local realities.

In addition, social collaboration is a critical guarantee for the sustainable development of curricula. Environmental education is not an isolated responsibility of schools but a shared obligation of society as a whole. Through policy incentives and innovative mechanisms, enterprises, research institutes, environmental NGOs, and community organizations should be encouraged to actively participate. For example, environmental enterprises could provide schools with green technology support and equipment sponsorship; research institutes could guide students in ecological monitoring or small-scale scientific experiments; and community organizations could offer public platforms to help students put their environmental solutions into practice. A typical example is the “Green School Alliance” promoted in some regions, where multiple schools, communities, and enterprises jointly establish resource-sharing platforms, regularly host environmental competitions, science fairs, and practice camps, thus forming an integrated educational ecosystem of “curriculum–practice–society.” This model not only enhances the openness and practicality of curricula but also helps students deeply understand the value of environmental action within real social contexts.

7 Conclusion

Sustainable development curricula in primary and secondary schools, guided by core literacy, are not simply about transmitting environmental knowledge but about shaping values and cultivating sustainable behaviors. This paper systematically examined their foundations, design, practices, and operational mechanisms, highlighting the transition from “knowledge teaching” to “literacy cultivation.” Through clear goals, diverse practices, comprehensive evaluations, and robust institutional and cultural support, environmental curricula can be embedded into educational ecosystems, fulfilling the mission of nurturing virtuous, responsible citizens. Moving forward, further curriculum integration and resource consolidation are needed to ensure widespread implementation and long-term sustainability of ecological education in basic education.

About the Author

Zeyu Sun, Master's student, Education for Sustainable Development.

References

- [1] Tilbury D. (2011). *Education for Sustainable Development: An Expert Review of Processes and Learning*. Unesco.
- [2] Wals A. E. J. (2010). Between knowing what is right and knowing that it is wrong to tell others what is right: On relativism, uncertainty and democracy in environmental and sustainability education. *Environmental Education Research*, 16(1), 143–151.
- [3] Zhao Y. C. (2021). Developing Core Competencies through Environmental Education in China's Basic Education Reform. *Sustainability*, 13(4), 2265.
- [4] UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. UNESCO Publishing.
- [5] Bourn D., Hunt F., Blum N., & Lawson H. (2017). *Primary education for global learning and sustainability*. Cambridge Primary Review Trust.