

ASSESSING THE ROLE OF SCIENCE EDUCATION IN PROMOTING SUSTAINABILITY: PERSPECTIVES OF UNDERGRADUATES

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Abstract

This study systematically reviews undergraduate perspectives on how science education promotes sustainability, guided by UNESCO’s Education for Sustainable Development (ESD) for 2030 framework and SDG Target 4.7. Thirty documents published between 2010 and 2024—including peer-reviewed articles, case studies, policy papers, and international frameworks—were analyzed using thematic analysis. The review explored curriculum alignment with sustainability goals, pedagogical strategies, institutional engagement, and opportunities for real-world application. Findings reveal that while environmental themes are common in science curricula, students often struggle to connect scientific knowledge with social, economic, and ethical dimensions essential for sustainability competence. Traditional lecture-based teaching limits systems thinking and action-oriented learning, whereas project- or inquiry-based approaches and community-engaged learning enhance sustainability awareness and critical reflection but remain inconsistently applied. Institutionally, efforts align with global sustainability agendas like UNESCO’s ESD for 2030, yet the practical implementation—such as in assessments, staff training, and partnerships—remains uneven. The review concludes that empowering undergraduates as sustainability change agents requires integrating SDG 4.7 competencies into science curricula, promoting interdisciplinary and experiential learning, and adopting whole-institution approaches that bridge policy and practice within higher education.

Introduction:

- Sustainability is a major global concern in the 21st century.
- It is driven by environmental, social, and economic challenges.
- Science education plays an important role in promoting sustainability.
- Higher education helps develop future scientists, educators, and leaders.
- It builds knowledge and skills needed for sustainable development.
- Science education encourages systems thinking, reasoning, and ethical decisions.
- Undergraduate students are key in shaping a sustainable future.
- Their learning experiences influence their attitudes and actions toward sustainability.
- Understanding students’ views helps improve teaching and curriculum design.
- This review studies how undergraduates perceive the role of science education in sustainability.
- It focuses on their knowledge, attitudes, and behaviors.

The main objectives are:

1. Evaluate undergraduate perceptions of sustainability in science education.
2. Examine how curricula align with sustainability skills.
3. Identify challenges and gaps in current practices.
4. Recommend ways to better integrate sustainability into science education.



Materials and Methods:

- The study used a “descriptive qualitative method” based on secondary data.
- “Thematic analysis” was used to identify main trends and perspectives.
- It examined how “science education promotes sustainability awareness and behavior” among undergraduates.
- “Thirty documents” from “2010 to 2024” were reviewed.
- Sources included “journal articles, case studies, policy papers,” and “educational frameworks” from UNESCO, UNEP, and the UN.
- Databases searched were “Scopus, ScienceDirect, ERIC,” and “Google Scholar”.
- Keywords included “science education,” “sustainability,” “undergraduate perceptions,” and “curriculum integration.”
- Studies on only primary, secondary, or postgraduate levels were excluded unless relevant.
- Non-English sources were used only if verified translations were available.
- Literature was organized into themes: curricular design, pedagogy, institutional support, and student engagement.
- Triangulation validated the results by cross-checking data from policies, studies, and surveys.

Results and Discussion:

- Science education helps address key sustainability issues like climate change, pollution, and biodiversity loss.
- UNESCO (2020) emphasizes that Education for Sustainable Development (ESD) requires skills such as critical thinking, ethics, and systems analysis.
- When these are included, students learn how ecological, social, and economic systems are connected and can create sustainable solutions.
- Students show both interest and frustration toward sustainability education.
- Many value its importance but feel a gap between theory and real-world application.
- Research shows students prefer interdisciplinary and hands-on learning but face fragmented curricula.
- Sustainability is often treated as optional rather than integrated across science subjects.
- Traditional systems restrict interdisciplinary and project-based learning.
- Innovative methods like problem-based learning, service learning, and fieldwork improve engagement but are not widely used.
- Barriers include limited faculty training, lack of resources, and institutional focus on research over teaching.
- Despite challenges, new initiatives such as eco-campuses and sustainability research centers show promise for universities to model sustainable practices.

Key Recommendations:

- Curriculum Reform: Include sustainability themes across all science courses with ESD-based learning outcomes.
- Pedagogical Innovation: Use active methods like project-based and experiential learning.
- Faculty Development: Train educators in sustainability-focused teaching.
- Institutional Alignment: Support SDG-based initiatives, collaboration, and student projects.
- “Policy Integration:” Encourage policies that fund and prioritize sustainability in science education.

Conclusions:

A collaborative and systems-based approach involving students, teachers, institutions, and policymakers is essential. Aligning education with the 2030 Agenda will prepare future scientists and leaders for a sustainable world.

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Acknowledgement: Mr.A.M.R.S.Bandara & Dr. W.D. Chandrasena, Science Education Unit, Faculty of Science, University of Peradeniya

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