



Qualitative Study on Strengthening Universal Science, Technology, Engineering and Mathematics Education: An Exploration of SUSTAIN-STEM Model

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Abstract

Despite global commitments to the 2030 Agenda, STEM education remains largely disconnected from pressing sustainability challenges such as climate change, energy, and waste. This conceptual paper argues that integrating sustainability is critical to strengthening universal STEM education that is equitable, relevant, and impact-driven. Drawing on the UNESCO ESD framework and Systems Thinking, the paper proposes the SUSTAIN-STEM Model: a 7-dimension framework comprising Systems Thinking, Use of Local Context, Sustainable Innovation, Teacher Capacity, Assessment for Impact, Inclusivity, and Networking. The model repositions STEM from mere content delivery to solving real-world sustainability problems through green pedagogy, community-based projects, and inclusive practices. Implications are discussed for curriculum redesign, teacher education in Colleges of Education, Policy Support, and low-cost green labs. Key challenges including resource constraints and exam-focused cultures are addressed with strategies such as partnerships and open educational resources. The paper concludes that Universal STEM education must evolve into STEM for sustainable development to achieve SDG 4 and SDG 13.

Keywords: Sustainability, STEM Education, ESD, Universal Access, Green Pedagogy.

Introduction

Science, Technology, Engineering and Mathematics (STEM) has to do with explaining natural phenomena and the technology and innovation needed to solve real world problems. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017; UNESCO, 2020) STEM educational is an interdisciplinary approach to teaching that fosters critical thinking, problem solving and innovation by integrating science, technology, engineering and mathematics. STEM education is the bedrock of development and is crucial to producing individuals who possess the knowledge and skills for collaboration and problem solving through innovative thinking. According to Ayua et al. (2023a) education is functional to the extent that it fits meaningfully into



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the society. Thus, STEM education in the 21st century must be functional by fostering sustainable development. Sustainability is the central theme of the United Nations 2030 agenda. it has become the global watch-word in virtually all areas of human endeavours especially in technology, innovation and development. Sustainability seeks to balance environmental, social and economic resources so that present needs are met without undermining the ability of future generations to meet their needs. It is in light of this that the United Nations (2015) advocated for education that promotes sustainable development practices and sustainable lifestyle in line with Sustainable Development Goal 4. Education is the heart of global culture and the instrument for social change and development. Therefore, integrating environmental, social and economic sustainability consciousness will deliver sustainable development and innovations. Sustainable Development is the viable ability of a nation to improve the lives of her citizens within the context of a growing economy with emphasis on the good of the society as a whole (Ayua et al., 2022). This implies that development that is sustainable is one that improves the lively-hood of present citizens without compromising the lively-hood of future generations. The need for sustainable development has necessitated a paradigm shift in STEM education in the 21st century to one that emphasizes creativity, critical thinking and practical problem solving. (Ayua et al., 2026). This is to facilitate global technological and scientific advancements and innovations that preserve the integrity of the environment. The global landscape is facing prevailing challenges such as global economic crisis, climate change, poverty and insecurity which threaten sustainable development and human survival (Ayua & Gamat, 2018). As a remedy for these challenges Ayua et al., (2022) prescribes education for sustainable development. Education that promotes sustainable development is sound, functional, result-oriented, problem-solving, societal need-meeting, creativity tailored and that enhances the global sustainability agenda (Ayua, 2019; Okonkwo et al., 2024, Olaleye et al., 2023). The fight for sustainability is a global endeavour therefore education for sustainable development must be universally accessible. Similarly, education for sustainable development is one that adopts a green-pedagogical approach. Green pedagogy is a sustainability-oriented pedagogical approach that integrates ecological, social and economic dimensions into teaching and learning with the aim of developing learners' sustainability competencies and capacity for environmental responsibility (Fox & Wogowitsch, 2021).

Statement of the Problem

STEM is traditionally taught as a body of knowledge and in isolation from sustainability/real-world challenges like climate change, energy and water conservation. This isolation limits students' ability in connecting STEM Knowledge to solving real world problems. Researchers have lamented on this approach, advocating for a sustainability-oriented approach that prepares learners not only with STEM knowledge but also with relevant problem-solving skills required to address the pressing global need for sustainability (Tarlochan et al., 2025; Ayua et al., 2026a). Despite these perspectives, sustainability issues are not yet sufficiently integrated into STEM teaching and learning. Since sustainability challenges are interconnected, there is a need to strengthen STEM education by integrating sustainability principles and real-world problems into teaching and learning. Such integration can promote interdisciplinary perspective, critical thinking, creativity, innovation and problem-solving skills, while preparing learners to contribute meaningfully to the achievement of the Sustainable Development Goals.

Purpose of the Study

The purpose of this conceptual study is to examine how the integration of sustainability principles can strengthen universal Science, Technology, Engineering and Mathematics (STEM) education. Specifically, the study seeks to conceptualize a framework that connects STEM knowledge,



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sustainability challenges and real-world problem-solving in order to make STEM education more relevant, interdisciplinary, inclusive and responsive to contemporary global and local challenges.

Significance of the Study

This paper aims to provide a framework for policymakers to develop/strengthen policies that connect STEM education with sustainability and real-world societal challenges. The paper will be significant for curriculum development by proposing an integration of sustainability in STEM education. Similarly, this paper will be relevant in actualizing Sustainable Development Goals 4 (Quality Education), which seeks to ensure that learners develop the knowledge and skills required to promote sustainable development and Sustainable Development Goals 13 (climate Action) that calls for improving education, awareness and capacity building for addressing climate change.

Scope of the Study

This conceptual paper recognizes that sustainability challenges such as climate change, energy and waste management are not limited to particular countries or regions but are global issues. This paper draws from a global perspective with examples from developing contexts.

Conceptual Clarifications.

Concepts of universal STEM education, sustainability and Education for Sustainable Development (ESD), and the Interconnection are hereby clarified.

Universal STEM education: Universal STEM education is one that is accessible, equitable, relevant and inclusive irrespective of geography, gender, race or physical ability. STEM education is universally relevant because it develops in learners the scientific, technological, engineering and mathematical knowledge necessary to address global challenges, promote innovation and contribute to sustainable development. In line with SGD 4, universal STEM education ensures that technical and critical-thinking skills are treated as a basic right for all learners, and not just a select few. It is in light of this that Kelley and Knowles (2016) links Universal STEM education to the environmental, social and economic challenges of the 21st century.

Defining Sustainability and Education for Sustainable Development:

Sustainability simply means meeting our present needs without harming the ability of future generations to meet their own needs. Sustainability relies on three main parts, often called people, planet, and profit. Harvey et al., (2022) found that contemporary definitions of sustainability commonly emphasize three dimensions; environmental, social, and economic as well as inter-generational responsibility and ethical considerations. Accordingly, Drury et al. (2023) provide a broader definition, viewing sustainability as an ethical responsibility to minimize present and future negative impacts on people, other living organisms, and the planet while maximizing positive impacts. Education for Sustainable Development (ESD) is an educational approach that imparts in the learners, the knowledge, skills, values, and attitudes needed to make responsible choices for the environment, the economy, and society. It is a vital part of quality education and a key driver for achieving the UN Sustainable Development Goals (SDGs). ESD focuses on three main pillars of learning: cognitive, socio-emotional and behavioural. The cognitive dimension improves how we think, understand complex systems, and build knowledge about global challenges. Socio-emotional involves building empathy, solidarity, social skills, and emotional intelligence. Behavioural, Encourages actions, personal responsibility, and positive practical changes in daily life. In this regard, Ayua et al. (2026a) emphasized the importance of developing learners' creative minds and practical abilities through solution-based STEM education as a means of preparing them to address real-world challenges and contribute to sustainable development.



The interconnection:

Universal STEM education is central to addressing sustainability challenges because science provides the knowledge required to understand natural and human systems, technology provides tools for developing solutions, engineering supports the design and implementation of practical solutions, while mathematics provides the basis for measurement, modelling, data analysis and evidence-based decision-making. In the Nigerian context, STEM education has been identified as important for addressing societal challenges, including environmental problems and climate change (Abiodun et al., 2025). Furthermore, Olayeye et al. (2023) found that inclusive STEM education in Nigerian schools has implications for students' awareness of sustainable development, while also highlighting the importance of ensuring that learners from different backgrounds have equal opportunities to participate in STEM education. This suggests that strengthening STEM for sustainability should not focus only on scientific and technological knowledge but should also promote equitable access and participation.

Literature Review/Theoretical Framework

Global Status of STEM education and gaps in sustainability integration, Sustainability challenges requiring STEM solutions Models of Integrating sustainability into STEM, and theoretical Bases are reviewed.

Global Status of STEM education and gaps in sustainability integration:

Globally, STEM education is recognized as a cornerstone of progress and competitiveness. Developed nations like the United States, Germany, and Japan have long invested in STEM programs to maintain their technological edge. These countries are implementing comprehensive STEM curricula, promoting STEM careers, and investing in research and development to ensure sustainable growth. In Africa UNESCO recognizes STEM as an important driver of innovation and sustainable development and emphasizes the need to strengthen STEM capacity. In the Nigerian context, Aina (2022) notes that STEM education has contributed to development in sectors such as health, agriculture and telecommunications, although its effectiveness is constrained by several systemic challenges. Despite the increasing recognition of STEM education, its implementation remains uneven, particularly in developing countries. Nigerian evidence indicates that inadequate funding, poor-quality teaching, limited research capacity, inadequate infrastructure and shortages of qualified teachers continue to affect STEM education. According to Ayua et al. (2026b) inadequate infrastructure, outdated curricula and shortages of qualified educators as major barriers to achieving high-quality education in Nigeria. Connecting STEM disciplines with sustainability can make learning more meaningful while preparing learners to address environmental and developmental challenges. However, a significant gap remains in the integration of sustainability into STEM education. Although environmental and sustainability issues are increasingly recognized within education, they are not always systematically connected to STEM concepts, teaching methods and learning activities. Tarlochan et al. (2025) emphasize the need to incorporate sustainability issues into educational curricula, strengthen teacher training and use technology to improve educational outcomes in Nigeria. Their argument reinforces the need for an educational system in which sustainability is not treated as an isolated topic but is incorporated into the curriculum and teaching process. The sustainability gap can therefore be understood at several levels: curriculum, pedagogy, teacher preparation, infrastructure and inclusion. Strengthening STEM education through sustainability provides an opportunity to address both educational and societal challenges. Rather than teaching science, technology, engineering and mathematics as isolated areas of knowledge, STEM can be organized around authentic sustainability problems.



Sustainability challenges requiring STEM solutions:

Sustainability challenges are problems that threaten the ability of present and future generations to meet their needs while maintaining environmental, economic, and social well-being. Examples of sustainability challenges include: climate change, environmental pollution, biodiversity loss, deforestation, waste management among others. Sustainability challenges require STEM solutions because the environment depend heavily on scientific knowledge, technological innovation, engineering design and Mathematical analysis. Climate change requires scientific understanding, technological innovation and engineering approaches to reduce greenhouse-gas emissions and strengthen adaptation and resilience. Similarly, the transition to clean energy depends on advances in renewable-energy technologies, energy efficiency and energy-storage systems. Water-related challenges, including pollution, scarcity and flooding, require scientific knowledge and engineering solutions for water treatment, conservation and effective management. The circular economy also depends on STEM innovations in sustainable materials, recycling, waste management and resource efficiency. In Nigeria, STEM education has been identified as having the potential to address societal challenges, including climate change and natural-resource depletion (Federal Ministry of Education [FME], 2019).

Models of integrating sustainability into STEM:

The models for integrating sustainability into Science, Technology, Engineering and Mathematics (STEM) are stated as follows.

1. **Green STEM:** Green STEM refers to the integration of environmental sustainability principles into Science, Technology, Engineering and Mathematics education. It encourages learners to use STEM knowledge to understand environmental problems and develop practical solutions to challenges such as climate change, renewable energy, pollution, waste management and water scarcity. This approach shifts STEM learning from merely acquiring disciplinary knowledge toward using that knowledge to address real-world sustainability problems. Ogundare and Ibrahim (2026), argued that strengthening STEM education from a sustainability perspective can contribute to preparing learners to respond to contemporary societal and developmental challenges
2. **Eco-pedagogy:** Eco-pedagogy is an educational approach that develops learners' awareness of the relationship between humans, society and the natural environment. Rather than teaching environmental issues as an isolated topic, it encourages students to critically examine how human activities affect ecosystems and how communities can adopt more sustainable practices. Eco=pedagogy as a dimension of the SUSTAIN-STEM model seeks to leverage on the scientific attitudes, to develop in learners' environmental consciousness and an ethical responsibility towards ensuring sustainable use of the environment (Ayua & Kwagh, 2026)
3. **Project-Based Learning:** Project-Based Learning provides a practical mechanism for integrating sustainability into STEM. In PBL, learners work on authentic problems over a period of time and apply knowledge from different STEM disciplines to develop a solution or product. Bolstad et al. (2021) and Bolstad et al. (2023) note that project-based learning provides a suitable arena for integrating sustainability. Similarly project-based learning has been linked to learners' development of problem-solving and critical thinking skills (Bahar & Aksut, 2020; Nwosu et al., 2023)

Theoretical Basis: The theoretical footing of this study on strengthening universal STEM education via sustainability is fastened on three complementary frameworks. First, the UNESCO Education for



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Sustainable Development (ESD) for 2030 framework (UNESCO, 2020), advocated by UNESCO as an evolution of the UN Decade of ESD (2005-2014), postulates that education must advance knowledge, skills, values, attitudes and behaviours for sustainable development. It assumes that learning should be transformative and action-oriented to allow learners to address present-day sustainability challenges. Its implication is that it provides the philosophical validation for reorienting STEM education from sheer disciplinary knowledge transmission to a vehicle for sustainable advancement and the achievement of the SDGs. Second, Systems Thinking Theory, founded on Bertalanffy (1968) and popularized by Senge (1990), holds that multifaceted problems must be understood through the interactions and mutuality among system components rather than in isolation. It is a holistic approach for examining complex difficulties and systems that focus on the interactions among system components and the patterns that emerge from those interactions (York et al., 2019). It assumes that sustainability problems such as climate change, energy insecurity and water scarcity are interrelated systems. Its implication is that it offers the conceptual lens for strengthening STEM education, needing that STEM be taught as an interdisciplinary enterprise where scientific, technological, environmental, social and economic systems relate. Third, Constructivist Learning Theory propounded by Piaget (1936) and Vygotsky (1978) asserts that learners actively construct knowledge from experience. It assumes that meaningful learning occurs through active engagement with real-world problems. Its implication is that it provides the pedagogical basis for strengthening STEM education, suggesting that sustainability-based problem-solving enables learners to meaningfully construct STEM knowledge and competencies essential for sustainable development.

The SUSTAIN-STEM Model

The rationale of the model, model dimensions, and the model's implication on universal STEM education are discussed.

Rationale: STEM Education traditionally emphasis on the acquisition of disciplinary knowledge, concepts, principles and procedural skills in science, technology, engineering and mathematics. Although these foundational competencies remain essential, an exclusive emphasis on content acquisition may limit opportunities for learners to apply STEM knowledge to complex problems beyond the classroom. Moving STEM from content to impact involves creating learning experiences in which learners apply scientific and mathematical knowledge, technological tools and engineering processes to authentic problems. Rather than merely learning about concepts such as energy, water, climate or waste, Impact-driven STEM education encourages students to investigate these issues, analyse evidence, develop possible solutions, test their ideas and evaluate their environmental and social implications. Such an approach transforms learners from passive recipients of STEM knowledge into active problem-solvers, designers and innovators.

Dimensions of the SUSTAIN-STEM Model

The seven dimensions of the model are represented by "SUSTAIN", which includes: S (Systems thinking), U (Use of local context), S (Sustainable innovation), T (Teacher capacity), A (Assessment for impact), I (Inclusivity), and N (Networking). These are stated as follows.

S - Systems thinking: Sees sustainability challenges are being complex and interconnected rather than isolated problems. Issues such as climate change, water, energy and waste involve interactions among environmental, social, technological and economic systems. With the SUSTAIN-STEM Model, systems thinking involves presenting learners with authentic sustainability problems and encouraging them to identify the different components of the problem, examine the relationships among these components, and consider the possible solutions.



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U – Use of local context: Stresses the need to connect STEM education with learners' immediate environment, community experiences, local resources, and indigenous knowledge. Rather than presenting STEM concepts as abstract ideas that exist only in textbooks, learners can be encouraged to investigate sustainability challenges within their own communities and apply STEM knowledge to develop practical solutions. Research has linked indigenous science teaching to development of learners' cognitive reasoning, innovative thinking and critical thinking skills (Ayua et al., 2023c; Adam et al., 2024; Ayua et al., 2025).

S – Sustainable innovation: Encourages the use of STEM knowledge, creativity, design thinking, and engineering processes to develop innovative solutions to sustainability challenges. Rather than presenting STEM as a body of theoretical knowledge, this dimension encourages learners to apply what they learn to identify problems, generate ideas, design solutions, test prototypes, evaluate outcomes, and improve their designs. sustainable innovation positions learners not only as consumers of scientific and technological knowledge but also as potential innovators and problem-solvers. Design thinking provides an appropriate approach for promoting sustainable innovation because it encourages learners to understand the needs of people and communities before developing solutions. Incorporating green technology and engineering challenges into STEM education, students can develop the capacity to design solutions with less negative impacts on the environment. Innovative STEM teaching fosters and innovative skills in learners (Ayua et al., 2023b)

T – Teacher capacity: Recognizes that the successful integration of sustainability into STEM education depends largely on teachers' knowledge, skills, attitudes, and confidence. Teachers require adequate preparation to connect STEM concepts with Education for Sustainable Development (ESD), facilitate interdisciplinary learning, and engage students in solving authentic sustainability problems. Teacher capacity development should equip educators with practical skills for designing learner-centred and inquiry-based activities. Well-prepared teachers are better positioned to transform STEM classrooms into spaces where learners acquire knowledge, develop practical skills, and apply STEM to address real-world sustainability challenges.

A – Assessment for impact: Highlights the need to assess not only students' acquisition of STEM knowledge but also their ability to apply that knowledge to address real-world sustainability challenges. Traditional examinations often focus on students' ability to recall concepts, procedures, and facts, whereas sustainability-oriented STEM education requires learners to demonstrate how they can use knowledge to investigate problems, develop solutions, and evaluate their impacts. Assessment within the SUSTAIN-STEM Model should therefore include approaches such as project assessment, practical tasks, design challenges, presentations, problem-solving activities, and community-based projects. These approaches can provide evidence of learners' creativity, critical thinking, collaboration, innovation, systems thinking, and ability to apply STEM concepts to sustainability problems.

I – Inclusivity: Heartens equitable access to quality STEM and sustainability education for all learners irrespective of gender, location, socioeconomic background, or disabilities. Integrating inclusivity into sustainability-oriented STEM education requires deliberate efforts to remove barriers that limit learners' participation and achievement. Gender stereotypes, inadequate learning facilities, limited access to technology, poverty and geographical location can influence learners' opportunities to engage meaningfully in STEM. Inclusivity in SUSTAIN-STEM Model therefore promotes learning environments in which every learner is encouraged to participate, experiment, innovate, and contribute ideas to sustainability challenges.

N – Networking: Networking dimension emphasizes building partnerships and collaborative relationships among schools, universities, governments, industries, research institutions,



Qualitative Study on Strengthening Universal Science, Technology, Engineering and Mathematics Education: An... Aqua, G. A., Et. al. (2026) communities, NGOs, and international organizations to strengthen STEM education for sustainability. Global networking provides opportunities for sharing knowledge, technologies, teaching resources, research findings, and innovative practices across different contexts.

Thus, the SUSTAIN-STEM Model strengthens universal STEM education by promoting an approach to STEM teaching and learning that is inclusive, relevant, interdisciplinary, and connected to real-world sustainability challenges. Rather than treating Science, Technology, Engineering, and Mathematics as isolated subjects, the model connects STEM knowledge with issues such as climate change, energy, water, waste etc. This makes STEM education meaningful and encourages learners to apply their knowledge to problems within their communities and the wider world.

Implications for Curriculum, Policy and Practice

Redesigning STEM curricula, green labs, policy support, and the role of Colleges of Education are hereby discussed.

Redesigning STEM curriculum to embed SDGs and sustainability competencies: A sustainability-oriented STEM curriculum should move beyond content acquisition to emphasize the application of knowledge to problems. Curriculum redesign should explicitly connect STEM learning outcomes with the Sustainable Development Goals (SDGs).

Green laboratory, makerspaces, and low-cost sustainable experiments: Green laboratory practices should be embedded into science curricula to promote efficient use of resources, Government and relevant education agencies should develop guidelines and funding mechanisms for establishing green laboratories and school makerspaces. STEM policies should recognize that effective practical learning does not always require expensive equipment and should encourage the development and use of locally produced and low-cost teaching resources.

Policy support: Government and educational stakeholders should provide adequate and sustainable funding for STEM facilities, green laboratories, makerspaces, teaching materials, digital resources, and community-based STEM projects. Policies should support continuous professional development that equips teachers with knowledge and skills in Education for Sustainable Development (ESD). Assessment policies should move beyond an exclusive emphasis on examinations and recall of STEM content into assessment approaches that capture learners' ability to apply knowledge and solve problems.

Teacher training institutions' role: To produce sustainability-literate STEM teachers, the institutions should mainstream Education for Sustainable Development (ESD), climate education, and the Sustainable Development Goals (SDGs) into their STEM teacher education curricula. This entails equipping potential teachers with capabilities in systems thinking, inquiry-based learning, project-based learning, problem-solving, design thinking, and interdisciplinary pedagogies needed for sustainability-oriented STEM teaching. Also, teacher training institutions should create green laboratories, makerspaces, and sustainability-focused hands-on projects where teacher trainees can design and improvise low-cost, environmentally welcoming STEM teaching-learning solutions utilizing locally obtainable materials, and thus consolidating universal STEM education via sustainability.

Challenges and Strategies for Implementation

The following implementation challenges and strategies are advanced.

Resource Constraints, Lack of Awareness, and Exam-Focused Culture: Inadequate funding, poorly equipped laboratories, limited access to digital technologies, unreliable electricity, and shortages of instructional materials can hinder the implementation of practical STEM and sustainability activities. Limited understanding of the connection between STEM education and



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sustainability among teachers, school leaders, and other stakeholders may affect effective implementation. An examination-driven culture may also encourage memorization rather than creativity, critical thinking, innovation, and problem-solving.

Strategies for Implementation:

Partnerships, Open Educational Resources, Community Projects and International Collaboration.

1. Partnerships among governments, schools (at all levels), industries, non-governmental organizations (NGOs), and local communities can provide the resources and expertise needed to strengthen sustainability-oriented STEM education.
2. The use of Open Educational Resources can reduce the cost of accessing quality STEM and sustainability learning materials. Teachers and learners can access freely available textbooks, simulations, videos, and practical activities through digital platforms.
3. Connecting STEM education with community sustainability challenges can make learning more meaningful and encourage students to apply knowledge beyond the classroom.
4. Schools can organize projects around locally relevant issues such as waste disposal, water conservation, energy use, food and environmental pollution. Students may collect data, identify problems, design possible solutions, test their ideas, and evaluate their impact.
5. Community-based projects promote problem-solving, creativity, critical thinking, collaboration, and systems thinking while allowing learners to see STEM as a tool for addressing real-life challenges.
6. International collaboration can strengthen the exchange of knowledge, innovations, teaching resources. Schools, researchers, and educational organizations can collaborate across countries through joint research, virtual learning programmes, teacher networks, student projects, and professional development initiatives. Such collaboration exposes educators and learners to diverse approaches to sustainability while still allowing them to adapt these approaches to local needs.

Conclusion

Summary, Call to Action, and Future research directions are discussed.

Summary: STEM education cannot be considered truly universal if it remains disconnected from the social, economic, and environmental challenges that affect learners and their communities. Universal STEM education should therefore move beyond the transmission of scientific and technical knowledge to emphasize the application of STEM in addressing real-world.

Call to Action: There is a need to move from STEM education to STEM for Sustainable Development by integrating sustainability into STEM teaching and learning. Schools, educators, policymakers, communities and international partners must work together to ensure that STEM knowledge is applied to real-world challenges. This action will help develop learners who are not only knowledgeable in STEM but are also innovative, responsible, and capable of creating solutions that contribute to the Sustainable Development Goals (SDGs).

Future Research Directions: Future research should test the effectiveness of the SUSTAIN-STEM Model in improving students' STEM competencies and ability to develop solutions to real-world sustainability challenges.

Recommendations

1. Governments should strengthen policy and funding for STEM education by supporting sustainability-focused programmes.
2. Teacher training institutions should produce sustainability-literate STEM teachers through integrating ESD and SDGs into curricula, building capabilities in systems and design thinking, and founding green laboratories and makerspaces for low-cost home-grown solutions.



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3. Non-teacher training schools should fortify universal STEM education by means of integrating sustainability and the SDGs into STEM curricula by real-world, and problem-based learning.
4. Assessment systems should be reformed to measure not only students' content knowledge but also their creativity, critical thinking, collaboration, innovation, and ability to apply STEM knowledge to sustainability problems

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