Journal of Education for Sustainable Development Studies
ISSN 3048-2054 (online) & 3048-2259 (print)
December 2024, Vol. 1, No. 2, pp. 134–159

Scientia Publica Media

Review Article

Education for Sustainable Development (ESD) and Global Citizenship for India

Atasi Mohanty[1], Ashraf Alam[1], Aashish Mohanty[2]

[1]Rekhi Centre of Excellence for the Science of Happiness, Indian Institute of Technology Kharagpur, West Bengal, India
[2]KIIT School of Management, KIIT University, Bhubaneswar, India

Abstract
This research paper explores the pivotal role of education in advancing sustainable development goals (SDGs) through an in-depth analysis of various indices, initiatives, and frameworks utilized to monitor progress and catalyze action. Beginning with an overview of the SDGs as a global blueprint for achieving a more equitable, prosperous, and sustainable world by 2030, the paper digs deep into the involved interaction between education and sustainable development. Central to this research is the examination of tools such as the Social Progress Index (SPI) and the SDG India Index, which provide comprehensive assessments of societal progress vis-à-vis the SDGs, offering decision-makers and stakeholders valuable insights into areas of strength and areas requiring intervention. The paper spotlights India's pioneering initiative, the SDG India Index, which tracks progress at the state level across 13 out of the 17 SDGs, demonstrating how countries adapt global frameworks to address national priorities and challenges. Emphasizing education's transformative potential, this investigation explains how early childhood, primary, and secondary education serve as catalysts for social, economic, and environmental progress, fostering critical thinking skills and instilling values essential for addressing complex global challenges. Furthermore, the paper emphasizes the SDG India Index's role as a catalyst for change, facilitating evidence-based policymaking, fostering accountability, and mobilizing stakeholders towards shared goals, highlighting the existing data gaps, particularly concerning Goals 12, 13, and 14, emphasizing the need for strengthened statistical systems to ensure accurate assessment and effective interventions.

Keywords: Education, Global Citizenship, Policy-making, SDG India Index, Social Progress Index (SPI), Sustainability, Sustainable Development Goals (SDGs)

Correspondence
Ashraf Alam
ashraf_alam@kgpian.iitkgp.ac.in

Received
November 22, 2024
Accepted
December 19, 2024
Published
December 23, 2024

Citation: Mohanty, A., Alam, A., & Mohanty, A. (2024). Education for Sustainable Development (ESD) and Global Citizenship for India. *Journal of Education for Sustainable Development Studies, 1*(2), 134–159.

DOI: 10.70232/jesds.v1i2.17

1. INTRODUCTION

In an era defined by unprecedented global challenges, from climate change and environmental degradation to poverty and inequality, the adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015 marked a pivotal moment in humanity's collective journey towards a more sustainable and equitable future. Comprising 17 interconnected goals and 169 targets, the SDGs set forth an ambitious agenda to eradicate poverty, protect the planet, and ensure prosperity for all by 2030. At the heart of this transformative agenda lies education—an indispensable catalyst for sustainable development, social progress, and economic prosperity (Draboo, 2020; Mani, 2022; Sengupta, 2022). The Sustainable Development Goal 4 (SDG 4) specifically underscores the critical role of education in achieving all other SDGs. Target 4.7 of SDG 4 aims to ensure that all learners acquire the knowledge and skills needed to promote sustainable development by 2030. This target emphasizes the importance of education for sustainable development (ESD) and global citizenship education (GCED) in fostering values, attitudes, and behaviors conducive to building a more sustainable and inclusive society (Aaghaz, Khan, Gupta, & Faizi, 2024;

Sareen & Mandal, 2024; Thakur, 2022). Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) are interconnected and integrated approaches that emphasize the development of knowledge, skills, values, and attitudes necessary to address global challenges and promote a culture of sustainability. These approaches encompass a wide range of themes, including environmental conservation, human rights, social justice, peacebuilding, and intercultural understanding, among others.

Table 1. Sustainability and Education: Critical Reflections

Theme	Focus Area	Key Developments	Critical Points
Limits to Growth and Early Environmental Education	Initial focus on ecological damage awareness and protection through environmental education.	UNESCO and UNEP promoted education via the Belgrade Charter.	Students were taught ecological sensitivity, protection, and skills to address challenges.
Shift to Sustainable Development	Introduction of the Brundtland Report and Education for Sustainable Development (ESD).	UN Decade of Education for Sustainable Development (2005-2014).	Focused more on social and economic aspects of sustainability.
SDGs and ESDG	SDG 4 aims for 'Quality Education' to promote sustainable development.	Critical reflections arise on whether sustainability and economic growth can coexist.	ESDG assumes sustainable development as desirable despite contradictions.
Wicked Problems	Issues like poverty and hunger lead to increased natural resource use.	Results in biodiversity loss, climate change, and environmental crises.	Highlights contradictions between social development and ecological sustainability.
Critiques of Sustainable Development	Economic growth and industrial development as root causes of environmental unsustainability.	Sustainability education criticized for prioritizing economy-centric goals over ecology.	Anthropocentric views see nature as a resource for exploitation.
Alternative Perspectives on Education	Calls for socially critical education challenging societal hegemonies.	Emphasis on fostering creative and responsible global citizens.	Sustainability education should encourage critical reflection on values and sustainable development.

The significance of ESD and GCED in advancing sustainable development is underscored by initiatives spearheaded by organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and various countries, including Japan, Sweden, and Denmark (Akalamkam, 2023; Chopra & Bisht, 2024; Tholath, Ramasubramaniam, & Xavier, 2021). These initiatives encompass a diverse array of programs and activities aimed at promoting ethical values, intercultural understanding, peace, human rights, cultural diversity, environmental stewardship, and global citizenship. By integrating these themes into education systems and curricula, these initiatives seek to cultivate a new generation of environmentally conscious, socially responsible, and globally minded citizens capable of addressing the complex challenges of the 21st century. By fostering critical thinking, socio-emotional skills, and transformative action, these approaches empower individuals and communities to address pressing global issues such as poverty, hunger, health disparities, gender inequality, climate change, and biodiversity loss (Adhikari & Shrestha, 2024; Deshpande et al., 2020; P. Mittal & rama devi Pani, 2022). Moreover, ESD and GCED promote behavioral changes such as resource conservation, sustainable consumption, and active citizenship, thereby facilitating the transition towards more sustainable lifestyles and livelihoods.

Table 2. Education for Sustainable Development: Qatar and Global Insights

Theme	Focus Area	Key Developments	Critical Insights
Emergence of ESD	ESD emerged from the 21st Agenda (Rio, 1992) and UNESCO's 2015 initiatives.	Focused on reorienting education to address global challenges through knowledge and values.	Integrates sustainability across subjects like Math, Science, and Social Studies.
Core Areas of ESD	Global citizenship, environmental stewardship,	Promotes a holistic change in students' attitudes and behaviors.	Encourages sustainable principles for shaping the future.

Theme	Focus Area	Key Developments	Critical Insights
	future thinking, social justice, and well-being.		
International Monitoring of ESD	UNESCO-led initiatives: DESD (2005-2014), GAP (2015-2019), and ASPnet schools.	Systematic evaluation of ESD integration worldwide.	Recent program: ESD for 2030 Roadmap.
Concept of Sustainability	Initially focused on environmental dimensions but expanded to social, economic, and political aspects.	Encourages global citizenship and local community engagement.	Fosters solutions for social, economic, and environmental challenges.
Case Studies: Global Initiatives	Countries like China, Chile, USA, and UK implement ESD in curricula.	Successful models like Singapore and New Zealand provide lessons.	Singapore's reforms and New Zealand's diverse system offer examples for Qatar.
Challenges in Qatar	Limited documentation on ESD integration in government K-12 curriculum.	Qatar's 2030 vision strives for sustainability and a knowledge-based economy.	Gap in reflecting international agreements within national curricula.
Reforms in Qatar's Education	Recent curriculum reforms: focus on SDGs and ESD integration.	International collaboration with New Zealand and Singapore highlighted.	Role of agencies and bilateral partnerships as drivers for improvement.
Learning from Global Models	Singapore and New Zealand chosen for cultural and demographic similarities to Qatar.	Both countries integrate ESD successfully into curricula.	Bilateral cooperation strengthens Qatar's education system and reforms.
Importance of Stakeholders	Successful ESD implementation requires collaboration among stakeholders.	International expertise and agreements are critical for curriculum development.	Models foster global partnerships for education reforms.

Despite the transformative potential of ESD and GCED, challenges and tensions may arise, particularly concerning the balance between national interests/citizenship and global community interests/citizenship. Conflicting priorities, political agendas, and cultural norms may influence the implementation of ESD and GCED initiatives, leading to tensions between national sovereignty and global solidarity (Hazarika, Madhukullya, & Hazarika, 2025; Kandpal, 2024; K. Sharma & Vinayan, 2023). Moreover, disparities in access to quality education, limited resources, and inadequate teacher training may hinder the effective implementation of ESD and GCED programs, particularly in low-income and marginalized communities. In response to these challenges, UNESCO has emphasized the importance of fostering global citizenship through publications, regional initiatives, and capacity-building programs, particularly in the Asia-Pacific region. Initiatives such as the UNESCO Teaching and Learning for a Sustainable

Table 3. Human Development and Education: Key Insights

Theme	Focus Area	Key Insights	Critical Points
Importance of Human Development	Human capital is critical for economic well-being.	Knowledge is key to national economies' sustainability.	Interconnection between individuals and culture drives development.
Role of Education	Education is no longer a closed system; it integrates multiple fields.	Education reflects the needs of employers and society.	Focus on professional competencies, critical thinking, and digital tools.
21st Century Skills	Skills include critical thinking, problem-solving, and communication.	Students must adapt to new technological tools.	Skills are directly aligned with market demands.
Digital Transformation	Digitalization redefines socio-economic interactions globally.	Creates communicative bridges and reduces global inequalities.	Requires education to evolve to match digital-age requirements.

Theme	Focus Area	Key Insights	Critical Points
Challenges in Education	Countries pursue disaggregated practices without synergy.	Formalism and bureaucracy hinder quality assurance.	Need for widely applicable and universal educational models.
Vectors of Educational Evolution	Introduction of innovative technologies in methods.	Socialization and group interaction for systemic learning.	Stable improvement and acquisition of professional skills.
Education for Sustainable Development	An interdisciplinary approach integrates social, economic, and environmental aspects.	Promotes responsible citizenship and sustainable behavior.	Education adapts to global changes and technological achievements.
E-Learning and Inclusiveness	Enables unity of educational processes and optimal student-teacher interaction.	Promotes equality, inclusiveness, and systematic mastery of subjects.	Prepares competitive educational products for global markets.
Formation of Consciousness	Education fosters conceptual thinking and critical analysis.	Develops individual responsibility and creative knowledge.	Prepares students to sustainably live in a changing world.
Global Educational Model	Focuses on technological solutions and online learning strategies.	Combines value formation, skills development, and self-regulation.	Addresses global conditions and societal demand for education.

Future program integrate citizenship education as a pedagogical tool to empower learners to become active agents of change in their communities and beyond. Moreover, the Aichi-Nagoya Declaration acknowledges global citizenship as a roadmap for the UN's Global Action Program on Education for Sustainable Development, underscoring the interconnectedness of education, sustainability, and global citizenship. In light of these considerations, this research paper seeks to explore the role of education in advancing sustainable development goals, with a focus on the interconnectedness of ESD and GCED, the implementation of these approaches at the national and global levels, and the challenges and opportunities associated with their adoption (Chitturu, 2023; Laskar, Khatun, & Sarkar, 2023; Suri & Sharma, 2023). By examining case studies, empirical evidence, and policy frameworks, this paper aims to provide insights into how education can serve as a transformative force for sustainable development, social progress, and global citizenship in the 21st century. Through a comprehensive analysis of key issues and trends, this paper aims to contribute to ongoing discussions and efforts to harness the power of education for a more just, equitable, and sustainable world for present and future generations.

2. Strategies for Integrating ESD and GCED in Indian Curriculum for Promotion of India's Global Citizenship Agenda

Sustainable Development Goal 4, Target 4.7, established by the United Nations, epitomizes a global commitment to ensuring all learners acquire the knowledge and skills necessary for promoting sustainable development by 2030. This encompasses a broad spectrum of competencies and awareness crucial for addressing pressing global challenges. Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) stand as interconnected pillars in this endeavor, particularly resonating in countries like India where the integration of these frameworks is crucial for fostering a sense of global responsibility among learners (Dutta & Das, 2024a; A. Rao, 2024; Tripathy, Swain, & Mishra, 2024). In India, the integration of ESD and GCED aims at nurturing a generation of global citizens equipped with the understanding and skills to contribute positively to sustainable development.

Table 4. Key Issues in Education for Sustainable Development (ESD)

Theme	Focus Area	Key Developments	Critical Insights
Purpose of ESD Course	Formulate key issues for Education for Sustainable Development.	Define learning content adaptable to different levels of learners.	ESD promotes social transformation and addresses global challenges.

Theme	Focus Area	Key Developments	Critical Insights
Historical Background	UN Brundtland Report introduced Sustainable Development (1987).	Three pillars of SD: environmental, social, and economic dimensions.	SD criticized for inefficiencies but inspires global cooperation.
Agenda 21 and ESD	UN Conference (Rio, 1992) emphasized reorienting education toward SD.	Identified four thrusts: improve basic education, reorient systems, raise awareness, and training.	UNESCO initiated Decade for ESD (2005-2014) for further progress.
Global Action Programme	GAP (2015-2019) aimed to scale up ESD action.	Focused on policy advancement, training environments, and youth mobilization.	Linked education to sustainable development goals (SDGs).
Key Groups of ESD	Approach: Scope, policies, and cooperation for ESD.	Content: Triple Bottom Line—environmental, social, economic pillars.	Teaching: Pedagogies, transformative learning, and capacity building.
Environmental Pillar	Focus on climate change, pollution prevention, and biodiversity.	Includes disaster risk reduction and sustainable lifecycle approaches.	Lisbon principles guide responsibility, precaution, and cost allocation.
Social Pillar	Covers human rights, poverty eradication, and clean water access.	Emphasizes health, education, gender equality, and urban sustainability.	Promotes social justice, cultural diversity, and sustainable lifestyles.
Economic Pillar	Resources efficiency: energy, water, air, and land.	Circular economy, affordable energy, and sustainable consumption emphasized.	Encourages R&D, innovation, entrepreneurship, and economic de-growth.
Teaching and Methodology	Student-centered, participatory, and critical interdisciplinary approaches.	Focus on systems thinking, creativity, and future scenario envisioning.	Digital literacy and infrastructure for transformative teaching.
Capacity Building	Empowers educators and trainers with ESD tools and pedagogies.	Media and project reports enhance education delivery.	Financing ESD projects is vital for implementation.
Metrics and Institutions	Metrics include sustainability indicators and accounting systems.	Key documents: Agenda 21, 2030 Agenda, and related declarations.	Institutions: UNESCO, UNEP, regional associations, and NGOs.

This integration is reflected in educational initiatives and curricula that emphasize not only academic proficiency but also ethical values, intercultural understanding, and environmental consciousness. By intertwining ESD and GCED, India strives to cultivate a mindset that transcends national boundaries and embraces the interconnectedness of global challenges. UNESCO, along with countries like Japan, Sweden, and Denmark, has been at the forefront of promoting ESD and GCED through various programs and initiatives (DasGupta & Bhattacharya, 2022; S. S. Mittal et al., 2024; B. R. Rao & Batni, 2024). These programs emphasize ethical considerations, intercultural understanding, peacebuilding, human rights education, and environmental conservation, among other themes. ESD encompasses a wide array of issues, including environmental conservation, human rights, climate change, disaster management, consumer education, and global citizenship. By addressing these topics within educational frameworks, ESD seeks to empower learners to become active agents of change in their communities and beyond. However, implementing such comprehensive education programs may sometimes lead to conflicts between national interests and global citizenship initiatives, highlighting the need for balanced approaches that consider both local and global perspectives. UNESCO's emphasis on global citizenship is evident in its publications, particularly in the Asia-Pacific region, where it links ESD with all 17 Sustainable Development Goals (SDGs) and promotes education for international understanding.

Table 5. Transition from Environmental Education (EE) to Education for Sustainable Development (ESD)

Theme	Focus Area	Key Developments	Critical Insights
Human Impact on Terrestrial Systems	Human activities from the Anthropocene era alter global systems.	Causes include climate change, population growth, and economic expansion.	Consequences threaten biodiversity and human sustainability.

Theme	Focus Area	Key Developments	Critical Insights
Environmental Education (EE)	EE focuses on generating awareness about nature and conservation.	Promotes ecological behaviors and values through knowledge and practices.	Addresses global challenges by improving individual behavior toward nature.
Transition to Education for Sustainable Development (ESD)	ESD builds on sustainable development (Brundtland Report, 1987).	Focuses on intergenerational equity, balancing economic, environmental, and social aspects.	Empowers democratic participation and harmony between risks and benefits.
Differences Between EE and ESD	EE emphasizes environmental awareness and local practices.	ESD incorporates broader aspects such as peace, human rights, health, and gender education.	ESD focuses on human-centered sustainable development.
Role of the UN and SDGs	UN formulated Sustainable Development Goals (SDGs) for 2030 Agenda.	Quality Education (SDG 4) emphasizes ESD for achieving global goals.	The 17 SDGs highlight harmony between human development and resource preservation.
Criticism of ESD	ESD is criticized for its anthropocentric approach.	Focuses heavily on humans as central to the environment.	Critics argue that ESD must integrate ecological concerns more holistically.
Role of Higher Education	Universities are key players in implementing ESD in curricula.	Higher education fosters awareness and solutions for sustainable development.	Engineering plays a critical role in infrastructure and technological advancements.
Research Questions on ESD	Demonstrate the transition from EE to ESD using UN proposals.	Identify geographic regions resisting ESD adoption through ongoing EE research.	Evaluate the inclusion of ESD in undergraduate curricula, especially in engineering.
Regional Acceptance of ESD	Regions with greater ESD research show higher acceptance.	Economic development influences progress toward adopting ESD.	Resistance in some regions can indicate gaps in awareness or integration.
Integration of ESD in Universities	Focus on integrating ESD in higher education curricula.	Good practices align students with sustainability challenges.	Engineering education ensures future professionals address environmental goals.

Programs such as UNESCO Teaching and Learning for a Sustainable Future incorporate citizenship education as a pedagogical tool to foster critical thinking and transformative action among learners (Garg, Chhikara, Kataria, & Agrawal, 2024; Priyadarshini & Abhilash, 2020; Wang, He, & Xu, 2024). Additionally, initiatives like the Aichi-Nagoya Declaration recognize global citizenship as a roadmap for the UN's Global Action Program, further underscoring its significance in the pursuit of sustainable development. Global citizenship education seeks to instill behavioral changes conducive to sustainability, such as resource conservation and sustainable consumption patterns. By promoting awareness of global issues and fostering a sense of shared responsibility, GCED endeavors to inspire individuals to contribute actively to the achievement of the SDGs.

Table 6. Impact of Industry 4.0 and AI on Education Systems

Theme	Focus Area	Key Developments	Critical Insights
Industry 4.0 and Transformation	Characterized by IoT, AI, big data, smart factories, and automation.	Digitalization integrates digital, physical, and biological systems.	Promotes productivity, resilience, and sustainable enterprise growth.
Workforce and Higher Education	Industry 4.0 requires adaptive and analytical thinking skills.	Higher education must equip students with digital and technological proficiencies.	Aligning curricula with evolving Industry 4.0 demands is critical.

Theme	Focus Area	Key Developments	Critical Insights
Role of Sustainability Education	UN highlighted ESD during the 2005–2014 Decade of Education for Sustainable Development.	Education integrates economic, ecological, and social responsibility.	ESD fosters informed choices, environmental robustness, and societal security.
AI and Education	AI tools like ChatGPT transform content creation, personalization, and engagement.	AI facilitates interactive learning and prepares students for digital complexities.	Critical considerations include ethics, privacy, and alignment with industry.
Large Language Models (LLMs)	Models like GPT-4, Elicit, and Med-PaLM can analyze text and images.	Applications span education, healthcare, and research by fostering insights.	Ethical implications and curriculum adaptation remain key challenges.
Gaps in AI Adoption	Literature lacks exploration of AI's ethical and societal implications.	Need for effective strategies to integrate AI into curricula for lifelong learning.	Bridging education-industry collaboration remains underexplored.
Ethics in AI Education	Critical concerns include AI biases, content generation ethics, and data privacy.	Impact on students' critical thinking and teachers' competencies needs evaluation.	Addressing ethical challenges is essential for AI's responsible adoption.
Collaboration Models	Academic institutions must align education with Industry 4.0 through industry partnerships.	Current literature lacks insights into successful collaboration models.	Collaborative strategies can bridge the education-industry gap.
Continuous Learning	Rapid technological change demands continuous and lifelong learning strategies.	Practical approaches for integrating lifelong learning into curricula are limited.	Mindset shift is essential for adapting to Industry 4.0 demands.
AI in Pedagogy	AI-powered tools can enhance personalized and interactive learning experiences.	Lack of comprehensive research on AI's deeper impact on pedagogy.	AI integration must focus on meaningful educational transformations.

Holistic pedagogical approaches that link citizenship education to global challenges play a vital role in raising awareness and promoting active participation in sustainable development initiatives. UNESCO has outlined clear learning objectives for GCED, focusing on critical knowledge, socio-emotional dimensions, and transformative action. By incorporating these dimensions into educational curricula, GCED aims to equip learners with the skills and competencies necessary for navigating an increasingly complex and interconnected world (Esposito & Canuto, 2024; Gandhi, 2022; Pandya, 2024). Furthermore, GCED is recognized as a key driver of social transformation, with the potential to catalyze positive change towards a more sustainable future. The learning domains of GCED encompass cognitive, socio-emotional, and behavioral aspects, aiming to develop global skills and sustainability competencies among learners. By addressing these dimensions holistically, GCED seeks to foster a sense of empathy, intercultural understanding, and ethical responsibility towards the global community. UNESCO underscores the importance of GCED in times of uncertainty and crisis, such as the COVID-19 pandemic, where global cooperation and solidarity are paramount. Curriculum-as-relations advocates for GCED to provide authentic, relationship-based learning opportunities that foster meaningful connections between learners, communities, and global issues.

Table 7. ESD and Resistance to AI Integration

Theme	Focus Area	Key Developments	Critical Insights
ESD Framework and Ecosystem	Creation of institutional ecosystems to support ESD.	Align curricula with labor market and sustainability goals.	Equip students with competencies for sustainability and societal impact.
Role of Universities in ESD	Academic staff require training to integrate SD principles into curricula.	Promotes student mindset for sustainability in	Fosters informed decisions and proactive participation in global challenges.

Theme	Focus Area	Key Developments	Critical Insights
		professional and personal life.	
ESD and Industry 4.0	Holistic ESD aligns education with Industry 4.0 demands.	Focuses on critical thinking, problem-solving, and innovative solutions.	Graduates develop interdisciplinary skills for technologically advanced industries.
Innovation and AI in Education	AI tools offer personalized learning and real-time industry insights.	Facilitates adaptive, data-driven learning for Industry 4.0 contexts.	Enables curriculum alignment with sustainability challenges and trends.
AI and Sustainability	AI supports ethical and responsible use of Industry 4.0 technologies.	Enhances collaboration through interdisciplinary teamwork and systems thinking.	Promotes sustainable practices in technological applications.
AI Challenges in ESD	Digital divide limits access and creates educational disparities.	AI tools risk bias and ethical issues without careful monitoring.	Overreliance on AI can exacerbate inequalities in sustainability education.
Curriculum Development for ESD	Aligns AI tools with ESD for continuous learning and skill enhancement.	Requires collaboration with industries to match market demands.	Facilitates lifelong learning through flexible, AI-supported education.
Resistance to AI Integration	Institutions may resist curriculum changes required for AI-driven ESD.	Overcoming resistance is key to fostering innovation in education.	Professional development and adaptable AI systems mitigate these issues.
Skill Development for Industry 4.0	AI identifies emerging job roles and skill needs for various industries.	Prepares students with digital literacy, problem-solving, and analytical skills.	Strengthens academia-industry collaboration to ensure relevance.
Lifelong Learning with AI	AI supports ongoing learning through micro-credentials and personalized pathways.	Prepares professionals to adapt to constant technological advancements.	Enables upskilling and reskilling for evolving Industry 4.0 roles.
Challenges in Technological Adoption	Keeping AI tools and curricula updated is a challenge.	Outdated tools risk leaving graduates unprepared for sustainability challenges.	Continuous professional development is essential for educators.

By emphasizing the interconnectedness of local and global contexts, this approach encourages learners to develop a sense of belonging to a broader global community and to recognize their role in shaping a more sustainable and equitable world (Chouhan & Gupta, 2021; Mohanan, Netto, & Ram, 2024; Shar, 2024). Sustainable Development Goal 4, Target 4.7, underscores the importance of equipping learners with the knowledge and skills necessary for promoting sustainable development. Education for Sustainable Development and Global Citizenship Education are integral to achieving this goal, particularly in countries like India where the integration of these frameworks is crucial for fostering global citizenship awareness. Through inclusive and holistic educational approaches, ESD and GCED contribute to building a generation of responsible global citizens capable of addressing the challenges of the 21st century and beyond. Global Citizenship Education (GCED) curriculum encompasses a broad spectrum of categories essential for nurturing informed and responsible global citizens. These categories include political, moral, economic, cultural, social, critical, environmental, and spiritual dimensions of global citizenship. For instance, in a GCED curriculum, students may explore political structures and systems worldwide, analyze moral dilemmas from a global perspective, understand economic disparities and interdependencies, appreciate cultural diversity, engage in social justice issues, critically examine environmental challenges, and reflect on spiritual connections to humanity and the planet (Mahesh, Aithal, & Sharma, 2024; U. K. Singh, 2024a; Tandi, 2021). One of the fundamental aims of GCED is to foster values that promote global citizenship and solidarity. These values include respect for diversity, solidarity, and a shared sense of humanity. Through interactive learning experiences and dialogue, GCED encourages students to appreciate different cultures, religions, and perspectives while recognizing the common humanity that binds us together. By instilling these values, GCED seeks to cultivate empathy, compassion, and a sense of responsibility towards building

a more inclusive and equitable world. Effective communication and intercultural understanding are essential components of GCED.

By providing opportunities for students to engage with diverse communities and perspectives, GCED enhances their communication skills and fosters intercultural understanding. Through collaborative projects, cross-cultural exchanges, and dialogues, students learn to navigate cultural differences, communicate effectively across linguistic and cultural barriers, and develop empathy and respect for others' viewpoints (Aithal & Aithal, 2020; Raveendran, 2021; M. S. Yadav & Yadav, 2023). Critical reflection is another key aspect of GCED. Students are encouraged to critically analyze global issues, question assumptions, and explore alternative perspectives. By engaging in critical thinking and reflection, students develop a deeper understanding of complex global challenges and their underlying causes. This critical awareness empowers students to become active agents of change and contribute meaningfully to addressing global issues such as poverty, inequality, environmental degradation, and conflict. Furthermore, GCED equips citizens with the knowledge, skills, and attitudes necessary to participate in community development, promote human rights, peace, justice, and sustainable development goals. Through experiential learning and community engagement initiatives, students learn about their rights and responsibilities as global citizens and are inspired to take action to address local and global challenges. For example, students may participate in community service projects, advocacy campaigns, or social entrepreneurship initiatives aimed at promoting social justice, environmental sustainability, and human rights. Global competence is a core component of GCED curricula, encompassing cognitive, socio-emotional, and behavioral dimensions. Cognitive engagement involves acquiring knowledge about global issues, understanding interconnectedness, and developing critical thinking skills (Jain & Mishra, 2020; Kumar, Sri Ranjani, & Manoj, 2023; Rangarajan, Sharma, & Grové, 2023). Socio-emotional engagement focuses on developing empathy, intercultural sensitivity, and ethical awareness. Behavioral engagement entails taking action to address global challenges, advocating for positive change, and practicing responsible citizenship.

By integrating these dimensions, GCED aims to foster holistic global competence among learners. Through education and awareness-raising initiatives, these approaches aim to mobilize collective action towards achieving the SDGs and building a more sustainable and equitable world for future generations. A whole institution approach involving all stakeholders is proposed to enhance the efficacy and effectiveness of ESD and GCED. This approach recognizes that sustainable development and global citizenship education require collective efforts across multiple sectors, including education, government, civil society, and the private sector. By engaging all stakeholders in the planning, implementation, and evaluation of education programs, institutions can create a supportive environment that fosters transformative learning and meaningful action. ESD and GCED content, curricula, and pedagogy should be embedded across the education system in India to ensure comprehensive coverage and continuity of learning (Varghese & Panigrahi, 2022; Varma, Patel, Prikshat, Hota, & Pereira, 2021). This involves integrating sustainability and global citizenship themes into existing subject areas, developing interdisciplinary learning modules, and providing professional development opportunities for educators. By mainstreaming ESD and GCED within the education system, India can ensure that all learners have the knowledge, skills, and attitudes necessary to become active and engaged global citizens. A model for the Indian education system should consider the implications and current status of the education policy to effectively integrate ESD and GCED. This includes aligning curriculum frameworks, teacher training programs, assessment methods, and educational resources with the principles of sustainability, social justice, and global citizenship.

Additionally, it requires addressing systemic barriers and challenges, such as resource constraints, cultural barriers, and institutional inertia, to create an enabling environment for ESD and GCED implementation. Further discussion is needed on Indian education policy implications and current status before proposing a model for the Indian education system. This involves engaging policymakers, educators, researchers, and other stakeholders in dialogue and consultation to identify priorities, opportunities, and challenges related to ESD and GCED. By fostering a collaborative and participatory process, India can develop a comprehensive and contextually relevant model for integrating sustainability and global citizenship education into its education system, thereby empowering future generations to contribute to a more sustainable and equitable world.

3. Governance and Policies in Indian Education as envisioned by NEP 2020

Education in India is primarily managed through state-run public education systems, overseen by various levels of government, including federal, state, and local authorities. This structure reflects the decentralized nature of education governance in India, where individual states have significant autonomy in shaping their education policies and initiatives. Article 21-A of the Indian constitution recognizes free and compulsory education as a fundamental right for children aged 6-14, highlighting the government's commitment to ensuring access to basic education for all. Historically, education policies in India were determined by individual federal states until the 42nd amendment to the Indian Constitution in 1976. This amendment included education in the "concurrent list," thereby establishing shared responsibilities between the federal and state governments in shaping education policies and regulations. Despite this shared jurisdiction, India's diverse states exhibit considerable differences in their approaches to primary education, leading to variations in policies and initiatives across the country. National policy frameworks are periodically formulated to guide states in developing their education programs and initiatives (Joseph & Madhuri, 2022; J. Joshi & Somani, 2021). These frameworks provide a common vision and direction for education reform while allowing for flexibility to accommodate regional and local needs. However, the implementation of these policies often varies depending on the capacity and resources available to each state. Primary and upper primary schools in India are predominantly governed by state and municipal governments, with both government and private institutions playing significant roles in the education landscape. According to data from 2005-2006, the government managed the majority of primary schools, accounting for 83.13%, while the private sector managed 16.86%.

Table 8. Overreliance on AI and Technical Focus in Sustainability

Theme	Focus Area	Key Risks or Approaches	Critical Insights
Privacy and Data Security	AI tools collect sensitive student data for analysis.	Risks include breaches, privacy violations, and ethical concerns.	Institutions must implement robust data protection and compliance measures.
Overreliance on AI	AI enhances education but should not replace educators.	Excessive automation risks loss of human interaction and mentoring.	Balancing AI-driven learning with human guidance is essential for holistic education.
Technical Focus in Sustainability	AI tools provide data-driven solutions for sustainability challenges.	Risk of neglecting social, cultural, and ethical dimensions of SD.	Holistic education should include human values alongside technical solutions.
Standardization Risks	Personalized AI tools risk pushing education toward one-size-fits-all approaches.	Standardization can reduce diversity in educational perspectives.	Customization must retain diverse approaches for holistic education.
Aligning ESD with AI Tools	ESD integration with AI prepares students for Industry 4.0 challenges.	Addresses climate change, resource scarcity, and social equity.	Convergence of technology and sustainability fosters essential workforce skills.
Transformative Potential	AI supports the development of Industry 4.0-relevant skills.	Equips students with technical, analytical, and critical thinking abilities.	Integrating sustainability principles ensures students are future-ready.
Customization in Education	AI enables personalized learning experiences for individual students.	Custom learning pathways enhance engagement and skill acquisition.	Preserves the diversity of educational perspectives for better outcomes.
Addressing Social Equity	AI integration must prioritize equitable access and inclusivity.	Bridging the digital divide ensures no students are excluded.	AI-driven education must support social justice alongside sustainability goals.
Workforce Preparation	Combining AI and ESD equips students for evolving job markets.	Promotes interdisciplinary skills and adaptability to technological advancements.	Ensures graduates contribute meaningfully to sustainability and Industry 4.0.
Balancing Technology and Values	AI should complement—not overshadow—ethical and cultural dimensions.	Focus on critical thinking, collaboration, and ethical applications of technology.	Balanced integration supports both technological progress and sustainability values.

However, the ratio of enrollment between government and private schools varies, with rural areas typically having a higher enrollment ratio in government schools due to factors such as accessibility and affordability. Despite improvements in enrollment rates, challenges remain regarding literacy and educational quality in India. While literacy rates have shown improvement over the years, disparities persist, particularly between genders, with men generally having higher literacy rates compared to women. Education is widely recognized as a key driver of India's economic development and scientific advancements, emphasizing the importance of continued investment in education infrastructure and programs (Ahmed, 2021; Basu, 2020). Higher education enrollment in India has increased significantly in recent years, although it still lags behind that of developed nations. Private schooling has experienced considerable growth, partly attributed to issues such as teacher absenteeism and infrastructural deficiencies in government-run schools. Private schools must adhere to certain standards set by the government to ensure quality education, including curriculum requirements, teacher qualifications, and infrastructure standards. The private education industry in India is expected to continue growing in the coming years, driven by factors such as rising demand for quality education, increasing disposable incomes, and changing perceptions regarding private schooling. However, questions persist regarding the quality and accessibility of education, particularly in rural areas where infrastructure and resources may be limited. Studies indicate high enrollment rates in rural areas, suggesting progress in expanding access to education. However, concerns about the quality of education remain, highlighting the need for continued investment in teacher training, infrastructure development, and curriculum reform. Despite efforts to improve educational outcomes, challenges such as inadequate funding, disparities in resource allocation, and bureaucratic inefficiencies pose significant obstacles to achieving equitable and quality education for all in India (Ali, 2023).

The World Bank has been a significant investor in India's education system, channeling billions of dollars into various initiatives aimed at improving access, quality, and equity in education. Despite these investments, challenges persist, reflecting the complexity and scale of India's education landscape. While external funding can catalyze positive changes, sustainable improvements require systemic reforms and targeted interventions addressing the root causes of educational disparities. Private schools in India operate within a regulatory framework that imposes strict regulations regarding curriculum, infrastructure, teacher qualifications, and operational standards. These regulations ensure that private schools meet minimum quality benchmarks and provide a standardized level of education. However, the rise of private schooling in India also raises questions about equity, access, and social inclusion, particularly for marginalized communities who may lack access to quality private education. The increasing prominence of private schooling in India necessitates careful consideration in education policy-making to balance the autonomy of private institutions with the broader goals of equity and social justice. Policymakers must strike a delicate balance between fostering innovation and competition in the education sector while ensuring that all children have access to quality education, regardless of their socioeconomic background or geographic location (Dutta & Das, 2024b; Soubhari, Nanda, & Shah, 2023). India boasts a significant number of educational institutions and colleges, catering to diverse educational needs and aspirations. Reservations for historically marginalized groups, such as Scheduled Castes, Scheduled Tribes, and Other Backward Classes, are a key feature of India's education system, aimed at promoting social inclusion and addressing historical injustices. These reservations ensure that students from marginalized communities have access to educational opportunities and promote diversity and representation in higher education institutions.

The new National Education Policy (NEP) 2020 marks a significant milestone in India's education landscape, aiming to revitalize the education system and align it with the needs of the 21st century. One of the primary goals of NEP 2020 is to maximize enrollment and retention across all levels of education, from early childhood to higher education, through innovative policies and programs. NEP 2020 emphasizes the importance of practical, experiential learning and aims to foster creativity, critical thinking, problem-solving skills, and vocational education. By promoting interdisciplinary approaches to learning, NEP 2020 seeks to equip students with the skills and competencies necessary for success in a rapidly changing world (Com, 2021; Ram, 2021). To alleviate exam-related stress and promote holistic development, NEP 2020 proposes conducting board exams twice a year, allowing students to choose when they wish to appear for exams. This move aims to reduce the undue pressure associated with high-stakes exams and provide students with greater flexibility in planning their academic trajectories. NEP 2020 also includes provisions to ensure that students can easily resume their education if interrupted due to factors such as migration, illness, or economic hardships. Flexible admission and credit transfer mechanisms are proposed to facilitate seamless

transitions between different levels of education and across institutions. The implementation of the new NEP 2020 is expected to have a significant impact on education in India, replacing the old 1986 National Policy on Education. The new policy represents a paradigm shift towards a more inclusive, flexible, and learner-centric education system that prioritizes equity, quality, and relevance. Language of instruction remains a sensitive issue in India, given the country's linguistic diversity and cultural plurality. NEP 2020 emphasizes flexibility in language learning and leaves the choice of medium of instruction to states and institutions, taking into account local linguistic preferences and educational needs (Khushnam, 2022; Patil & Kolhe, 2023). NEP 2020 encompasses all levels of education, from early childhood to higher education, and aims for comprehensive reform by 2021.

Table 9. Teacher Education for ESD and Pedagogical Challenges with AI

Theme	Focus Area	Key Developments	Critical Insights
Transformation in Education	The role of AI tools like ChatGPT in Industry 4.0.	Redefines learning paradigms and facilitates interdisciplinary approaches.	Prepares students for innovation and problem-solving in a dynamic job market.
Holistic Curriculum Design	Integration of technical knowledge with emotional intelligence.	Promotes critical thinking, problem-solving, and adaptability.	Balances human-centric skills with technical proficiency for holistic learning.
Challenges of Overreliance on AI	AI tools enhance learning but risk replacing human guidance.	Overautomation may hinder critical thinking and problem-solving skills.	Striking a balance preserves human interaction and learning integrity.
Emotional Intelligence and Adaptability	Prioritizes human skills irreplaceable by AI.	Enhances communication, leadership, and resilience for modern workforce needs.	Fosters innovation while balancing technical and soft skills development.
Role of Collaborative Projects	Interactive discussions and role-playing simulate real-world scenarios.	Develops emotional resilience, adaptability, and interpersonal skills.	Encourages teamwork and prepares students for uncertainties in Industry 4.0.
Faculty Training and Empowerment	Educators need training to integrate AI tools effectively.	Focus on AI literacy, ethical considerations, and lesson design.	Prepares teachers to guide students through AI and sustainability challenges.
Teacher Education for ESD	Integrating ESD into pre-service teacher programs.	Aligns teacher training with SD principles and SDG attainment.	Prepares educators to instruct students in sustainability and ESD values.
Pedagogical Challenges with AI	Navigating ethical dilemmas like data privacy and plagiarism.	Equipping educators to balance AI assistance with independent thinking.	Encourages critical evaluation of AI-generated content by students.
AI in Personalized Learning	AI tools offer tailored content and adaptive pathways.	Enhances engagement and comprehension through customization.	Preserves diverse educational perspectives for effective learning outcomes.
Nurturing Critical Thinking	AI tools should complement—not replace—originality and creativity.	Educators balance AI-generated insights with human-guided learning.	Facilitates a fusion of human and AI capabilities for enriched education.
Sustainability and AI Integration	Aligning AI tools with ESD to address societal challenges.	Promotes responsible use of technology and ethical sustainability practices.	Equips students with relevant skills for Industry 4.0 and SD.
Ongoing Faculty Development	Continuous training programs for educators in AI integration.	Covers technical functionalities, pedagogical practices, and ethical guidance.	Ensures faculty remain agile and adaptable to emerging technologies.

The policy seeks to bridge the rural-urban divide in education by addressing disparities in infrastructure, resources, and educational opportunities between rural and urban areas. Voluntary language

learning is encouraged under NEP 2020, allowing students to learn additional languages based on their interests and aspirations. However, the policy does not mandate any specific language, recognizing the importance of preserving linguistic diversity and promoting multilingualism in education. Education being a Concurrent List subject in the Indian Constitution allows for state-level variations in the implementation of NEP 2020. While the policy provides a broad framework for educational reform, states have the flexibility to adapt and customize strategies according to their unique socio-cultural contexts and educational priorities. This decentralized approach ensures that NEP 2020 can be effectively implemented across diverse regional and cultural landscapes in India. NEP 2020 aims to create a comprehensive framework for elementary, secondary, and postsecondary education, including vocational training, with a focus on both urban and rural areas. Central to NEP 2020 is the implementation of a "5+3+3+4" model, which replaces the existing "10+2" framework. Under this model, students will spend five years in an Anganwadi, pre-school, or Balvatika, followed by three years of preparatory study, three years of middle stage, and four years of secondary stage. This restructuring aims to provide a more holistic and developmentally appropriate approach to education, catering to the diverse needs and abilities of learners at different stages of their educational journey (Chowdhury & Rohatgi, 2021; Korada, 2023). In a departure from the traditional emphasis on annual exams, NEP 2020 proposes a new assessment framework. Students in grades 2, 5, and 8 will undergo regular assessments to gauge their progress and identify areas for improvement. Board exams will be conducted in grades 10 and 12, but with a renewed focus on holistic assessment, encompassing both academic and non-academic skills. PARAKH, the new assessment body established under NEP 2020, will set standards for board exams and conduct assessments twice a year, promoting continuous learning and feedback. NEP 2020 also envisions a significant overhaul of the higher education system, introducing a four-year multidisciplinary bachelor's degree program with multiple exit options. Under this framework, students will have the flexibility to receive certificates after one or two years of study, a bachelor's degree after three years, or a four-year transdisciplinary bachelor's degree. This approach aims to promote flexibility, choice, and lifelong learning, empowering students to pursue diverse educational pathways based on their interests and career aspirations.

4. A Pathway to Achieving the SDGs via Education for Sustainable Development

The Sustainable Development Goals (SDGs) adopted by the United Nations aim to achieve a better and more sustainable future for all by 2030. Education for Sustainable Development (ESD) plays a crucial role in advancing various SDGs, including poverty reduction (SDG-1), zero hunger (SDG-2), good health and well-being (SDG-3), and quality education (SDG-4). By integrating sustainability principles into education systems, ESD fosters the knowledge, skills, and values necessary to address global challenges and build a more inclusive and sustainable world. ESD interventions begin at early childhood care and education, focusing on nurturing self-awareness, compassion, and empathy in young learners. Through hands-on activities, storytelling, and play-based learning, children develop an understanding of their interconnectedness with nature and society, laying the foundation for responsible and sustainable behavior. ESD also promotes critical thinking, problem-solving skills, and environmental literacy, empowering students to become active agents of change in their communities. NEP 2020 represents a bold step towards reimagining India's education system for the 21st century, with a focus on inclusivity, flexibility, and sustainability. By adopting innovative approaches to curriculum design, assessment, and higher education, NEP 2020 aims to equip learners with the knowledge, skills, and values necessary to thrive in a rapidly changing world (Mishra, Saha, & Sinha, 2023; M. Sharma, 2023). Through initiatives like ESD, India can contribute to the global effort to achieve the Sustainable Development Goals and build a more just, equitable, and sustainable future for generations to come.

Table 10. Ethical Challenges of AI Integration, Pedagogical Balance, and Ongoing Faculty Development for ESD

Theme	Focus Area	Key Developments	Critical Insights
Transformation in Education	AI tools like ChatGPT are redefining learning paradigms.	Focus on interdisciplinary skills and innovation for Industry 4.0.	Prepares students for dynamic job markets and complex challenges.
Holistic Curriculum Design	Combines technical knowledge with emotional intelligence and adaptability.	Fosters critical thinking, problem-solving, and resilience.	Balances soft skills with technical proficiency for holistic learning.

Theme	Focus Area	Key Developments	Critical Insights
AI Integration in Creative Disciplines	AI provides real-time insights, inspiration, and diverse perspectives.	Encourages experimentation, interdisciplinary learning, and curiosity.	Supports innovation by complementing traditional teaching methods.
Critical Thinking and Problem-Solving	AI tools aid in presenting complex, open-ended challenges.	Promotes analytical reasoning and application of technical knowledge.	Encourages innovative solutions to real-world problems.
Emotional Intelligence and Adaptability	Focuses on empathy, self-awareness, and managing uncertainties.	Essential for leadership, communication, and collaboration in Industry 4.0.	Equips individuals to adapt to rapid technological and societal changes.
Faculty Empowerment and Training	Educators need AI literacy and pedagogical skills.	Training on AI tools, ethical considerations, and critical evaluation.	Prepares educators to guide responsible and effective AI use in teaching.
Teacher Education for ESD	Integrates ESD principles into pre-service teacher programs.	Aligns teacher training with sustainability goals (SDGs).	Prepares educators to promote sustainable lifestyles and societal transformation.
Ethical Challenges of AI Integration	Issues include data privacy, plagiarism, and transparency.	Educators must provide guidance for ethical and responsible AI use.	Balancing AI assistance with fostering independent student creativity is critical.
Pedagogical Balance	AI tools enhance education but must not replace human interaction.	Encourages originality while using AI-generated content effectively.	Focus on human-AI collaboration to enrich learning experiences.
Ongoing Faculty Development	Continuous training on AI functionalities and best practices.	Covers lesson design, ethics, and interactive discussions.	Ensures faculty remain adaptable to evolving technologies in education.
Interdisciplinary Skills Development	AI tools facilitate cross-discipline collaboration and problem-solving.	Encourages students to develop a broader understanding of concepts.	Supports innovation by nurturing curiosity and critical thinking.
Realizing Sustainable Development	ESD fosters societal transformation and sustainability awareness.	Equips individuals for judicious decision-making and sustainable actions.	Education plays a central role in achieving SDGs and reshaping behaviors.

Primary education serves as a crucial foundation for sensitizing students to poverty issues and fostering actions to alleviate poverty. Through interactive lessons, storytelling, and real-world examples, primary educators introduce students to the concept of poverty, its causes and consequences, and the importance of empathy and compassion towards those affected. Activities such as community service projects, fundraising initiatives, and volunteering opportunities provide students with hands-on experiences and opportunities to make a positive difference in their communities. As students progress to secondary education, their understanding of poverty deepens, and they explore broader concepts like sustainable development, equality, and gender issues. Secondary educators incorporate interdisciplinary approaches to address these complex topics, integrating subjects such as geography, economics, and sociology. Through debates, research projects, and case studies, students analyze the root causes of poverty, examine disparities in access to resources and opportunities, and explore strategies for promoting social justice and equity (A. Goyal, Kumar, & Shalini, 2024; Shriwastava & Meril, 2023). Education for Sustainable Development (ESD) plays a pivotal role in addressing issues like hunger and promoting healthy food habits and sustainable agriculture. At the early childhood education level, learners are introduced to different cuisines and healthy food options through hands-on activities, cooking demonstrations, and sensory experiences. This early exposure lays the groundwork for developing lifelong habits of nutritious eating and appreciation for diverse culinary traditions. In primary education, gardening activities and lessons on indigenous food practices provide students with practical knowledge about food production and the importance of preserving biodiversity.

By cultivating school gardens and learning about local flora and fauna, students develop a deeper connection to the environment and an understanding of the interdependence between food systems and ecosystems. Secondary education builds on these foundational concepts, emphasizing the importance of making smart dietary choices based on geographical, economic, and seasonal factors. Students learn about sustainable agriculture practices, food security issues, and the impact of food choices on human health and the environment. Through projects such as designing sustainable food systems for their communities, students apply critical thinking skills and explore innovative solutions to food-related challenges (S. Joshi, 2021; U. K. Singh, 2024b). ESD also promotes good health and well-being through socio-emotional literacy and mental health education. In primary education, students learn fundamental concepts of mental and emotional health, including self-awareness, self-regulation, and empathy. Through activities like mindfulness exercises, role-playing scenarios, and peer discussions, students develop social and emotional skills essential for building healthy relationships and coping with stress and adversity. In secondary education, the focus shifts to a critical assessment of health variables and personal responsibility for well-being. Students examine factors influencing physical and mental health, such as nutrition, exercise, sleep, and social support networks. They explore the impact of societal norms, media influences, and environmental factors on health behaviors and outcomes. By engaging in discussions about health promotion and disease prevention, students develop agency and advocacy skills to promote well-being in themselves and others. Quality education, as enshrined in Sustainable Development Goal 4 (SDG-4), is essential for achieving other SDGs, addressing issues like illiteracy and access to education (A. K. Singh & Singh, 2022; Sreelatha & Atmakuri, 2024). Early childhood education lays the groundwork for quality learning experiences by fostering creativity, curiosity, and social relationships. Through play-based activities, storytelling, and exploration, young learners develop foundational skills in language, numeracy, and social-emotional development. In primary schooling, educators introduce students to the SDGs and promote critical learning approaches to understanding global challenges and opportunities. By exploring topics like poverty, education, gender equality, and environmental sustainability, students develop a sense of global citizenship and empathy for others.

Through projects and initiatives, students collaborate with peers to address real-world issues and contribute to positive social change. In secondary schooling, the emphasis shifts to sustainable development and collaboration to achieve common goals. Students delve deeper into complex issues like climate change, biodiversity loss, and social inequality, applying interdisciplinary knowledge and skills to propose solutions. Through service-learning projects, internships, and community partnerships, students gain practical experience and develop leadership skills to become active agents of change in their communities and beyond. Gender Equality (SDG-5) stands as a fundamental pillar for achieving equitable participation of women and men in society. Over the years, significant progress has been made in many developing nations towards achieving gender parity in elementary education, showcasing a positive trajectory towards gender equality. Education plays a pivotal role in promoting gender-sensitive learning environments and challenging societal norms that perpetuate gender disparities (Nellutla, 2024; Parakkal, 2023).

Table 11. Integrating AI Tools with Bloom's Taxonomy in ESD

Theme	Focus Area	Key Developments	Critical Insights
AI and Bloom's Taxonomy Integration	AI tools like ChatGPT redefine traditional learning paradigms.	Focuses on enhancing critical thinking, engagement, and collaboration.	Promotes knowledge co-creation and interdisciplinary learning.
Knowledge Co-Creation	AI fosters dialogue between learners and educators.	Engages students in collaborative pedagogical processes.	Enhances accountability, motivation, and essential 21st-century competencies.
Critical Evaluation Concerns	AI-generated content risks being accepted without scrutiny.	Students must develop skills to analyze accuracy, credibility, and bias.	Critical thinking is vital for distinguishing reliable information.
Authenticity and Originality Risks	Overreliance on AI may homogenize student work.	Dilutes diverse perspectives and blurs lines between AI and human voices.	Raises ethical questions about content attribution and student creativity.
Adding AI Categories to Bloom's Taxonomy	Introduce new AI-related levels like 'Enhance' or 'Innovate'.	Explicitly emphasizes AI skills and responsible usage.	Ensures AI integration aligns with ethical and educational objectives.

Theme	Focus Area	Key Developments	Critical Insights
Potential Challenges of Adding AI	New AI-specific categories may complicate Bloom's framework.	Risk of separating AI from traditional educational goals.	Requires careful integration to maintain clarity and coherence.
AI in Existing Bloom's Categories	AI tools enhance existing levels like analysis, evaluation, and creation.	Focuses on achieving traditional objectives through AI support.	Maintains familiarity of Bloom's structure while incorporating new technologies.
Collaboration with AI Systems	Teaches students to work effectively with AI tools.	Prepares learners for AI-driven professional environments.	Collaboration becomes integral to higher-order skills and teamwork.
Digital Literacy and Foundational Skills	Navigating AI technologies as part of foundational learning.	Develops digital literacy for an AI-integrated world.	Ensures students acquire skills needed for modern technological challenges.
Ethics and Responsible AI Use	Integrates ethical AI usage as a cross-cutting theme.	Promotes informed and responsible AI applications.	Balances technological advancement with critical, ethical thinking.
Curriculum Adaptation for AI	Educators need to integrate AI into teaching methodologies.	Requires adapting pedagogy to leverage AI tools effectively.	Maintains focus on core principles of active learning and higher-order thinking.
Future of Bloom's Taxonomy with AI	Evolves to reflect changing educational landscapes shaped by AI.	Retains core principles like active learning and engagement.	Collaborative modifications with educators ensure relevance and clarity.

From early childhood education, children are sensitized to concepts of gender equality through inclusive play and activities that teach them to appreciate diversity and respect individual differences. In primary schooling, students are introduced to the concept of gender roles and stereotypes, which encourages critical thinking and reflection on gender-related issues. By exploring topics such as gender discrimination, students develop a deeper understanding of the complexities surrounding gender equality and are encouraged to challenge prevailing norms. Secondary education builds upon these foundations by delving deeper into the social construction of gender and empowering students to actively combat gender bias and discrimination in all spheres of life. Clean Water and Sanitation (SDG-6) is essential for human survival and well-being, yet millions of people around the world lack access to clean water and adequate sanitation facilities. In early childhood education, children are introduced to basic concepts of water usage and cleanliness through interactive activities that emphasize the importance of personal hygiene and environmental stewardship.

As students progress to primary education, they gain a deeper understanding of the scarcity of water resources and the need for sustainable water management practices (Chandra, 2024; Devarajan & Chong, 2023). Through experiential learning and practical exercises, students learn about water conservation techniques and the impact of human activities on water availability and quality. Secondary education further expands on these concepts, exploring issues such as water pollution, water-borne diseases, and the social and economic implications of inadequate access to clean water and sanitation facilities. Affordable and Clean Energy (SDG-7) is essential for sustainable development and combating climate change, yet access to reliable and clean energy sources remains a challenge for many communities worldwide. In early childhood education, children are introduced to basic concepts of energy through hands-on activities and experiments that demonstrate the importance of energy conservation and efficiency. As students progress to primary education, they learn about the various sources of energy, including renewable and non-renewable sources, and the environmental consequences associated with their use. Through interdisciplinary approaches, students explore the benefits of transitioning to clean and renewable energy sources and the potential for innovation and technological advancement in the energy sector. Secondary education builds upon these foundations by delving deeper into the science and policy behind sustainable energy solutions, empowering students to become advocates for clean energy and agents of change in their communities (Chandan, 2024; Mistry & Ghanekar, 2022). Education plays a crucial role in advancing gender equality and promoting access to clean water, sanitation, and affordable energy for all. From early childhood through secondary education, students are sensitized to issues of gender equality and environmental sustainability, empowering them to

challenge social norms, advocate for change, and contribute to a more equitable and sustainable future. By integrating these themes into education curricula and fostering a culture of inclusion and environmental stewardship, we can pave the way for a brighter and more sustainable world for generations to come. Through interdisciplinary approaches that integrate concepts from science, economics, and environmental studies, students explore the environmental impact of energy production and consumption and learn about strategies for transitioning to more sustainable energy systems. They may conduct research projects on topics such as energy efficiency, renewable energy technologies, and the social and economic benefits of sustainable energy practices.

Decent Work and Economic Growth (SDG-8) aims to provide decent employment opportunities for all, promoting inclusive and sustainable economic growth. In early childhood education, children are introduced to different types of work through imaginative play and storytelling, fostering an appreciation for the diverse roles that individuals play in society and promoting community engagement (Leiva-Brondo, Lajara-Camilleri, Vidal-Meló, Atarés, & Lull, 2022; Rajsinghot, Bala, & Singhal, 2024). Primary education builds upon these foundations by teaching students about the importance of fair access to employment and the value of diverse forms of labor, including both formal and informal work. Through discussions, role-playing activities, and field trips, students learn about different occupations, the skills and qualifications required for various jobs, and the importance of equal opportunities in the workplace. They also explore concepts such as entrepreneurship, teamwork, and cooperation, laying the groundwork for future success in the labor market. In secondary education, students delve deeper into themes of entrepreneurship, workers' rights, and social justice, equipping them with the knowledge and skills needed to navigate the complexities of the modern labor market. They may learn about labor laws and regulations, workplace ethics, and the importance of collective bargaining and advocacy in ensuring fair and equitable treatment for all workers. Additionally, students may explore topics such as gender equality in the workplace, child labor, and the impact of globalization on employment patterns, fostering a critical understanding of contemporary labor issues and inspiring them to become agents of positive change. Industry, Innovation, and Infrastructure (SDG-9) are essential drivers of economic development and societal progress, underpinning efforts to build resilient and sustainable communities. In early childhood education, children are introduced to the concepts of industry and infrastructure through hands-on activities and interactive learning experiences that stimulate curiosity and imagination (Bansode, 2023; Gupta & Bhattacharjee, 2023).

Primary education lays the foundation for understanding the importance of innovation and infrastructure in society, exploring topics such as transportation systems, communication networks, and manufacturing processes. Students learn about the role of innovation in driving economic growth and improving quality of life, and they are encouraged to think creatively and innovatively in solving real-world problems. Through projects and presentations, students may design their own inventions or propose solutions to local infrastructure challenges, fostering an entrepreneurial mindset and a passion for innovation. In secondary education, students deepen their knowledge of industry, innovation, and infrastructure, engaging in critical inquiry and problem-solving activities that challenge them to think analytically and creatively. They may study topics such as technological innovation, supply chain management, and sustainable infrastructure development, gaining insights into the complex interplay between industry, innovation, and societal well-being. Additionally, students may explore the role of emerging technologies such as artificial intelligence, renewable energy, and digital connectivity in shaping the future of industry and infrastructure, preparing them to be active participants in the ongoing digital revolution and the transition to a more sustainable and inclusive economy. Education plays a pivotal role in promoting sustainable energy consumption, decent work and economic growth, and industry, innovation, and infrastructure (Waoo, 2024; M. Yadav & Dardi, 2022). From early childhood through secondary education, students are equipped with the knowledge, skills, and values needed to address pressing global challenges and contribute to the achievement of the Sustainable Development Goals (SDGs). By fostering a culture of innovation, entrepreneurship, and social responsibility, education empowers individuals to build a more equitable, prosperous, and sustainable future for generations to come. Reduced Inequality (SDG-10) aims to address disparities in society and promote equal opportunities for all individuals.

In early childhood education, children are encouraged to develop empathy and sharing skills, laying the foundation for understanding fairness and inequality. Through stories, games, and activities, children learn about diversity and inclusion, fostering a sense of belonging and respect for others. In primary

education, students explore the link between education and inequality, examining how access to quality education can empower individuals and communities to break the cycle of poverty and discrimination. They learn about the importance of equal opportunities in education and society, while also celebrating diversity and promoting social cohesion (Lund, 2022; S. Yadav, 2022). In secondary education, students investigate the causes of inequality and propose strategies for promoting social justice and inclusivity. They may study topics such as poverty, discrimination, and human rights, gaining insights into the complex dynamics of inequality and the role of education in promoting social change. Sustainable Cities and Communities (SDG-11) focus on creating cities that are environmentally sustainable and socially inclusive. Education is essential for achieving SDG-11 by providing communities with the tools to manage resources efficiently and address climate change. In early childhood education, children are exposed to natural cycles and encouraged to participate in eco-projects, fostering creativity and empathy for the environment. They may plant trees, create compost bins, or participate in recycling initiatives, learning about the importance of preserving natural resources and protecting biodiversity. In primary education, students familiarize themselves with the features of cities and the multicultural aspect of urban areas, emphasizing the need for preservation and sustainable development. They learn about the importance of green spaces, clean air, and access to basic services such as water and sanitation.

In secondary education, students enhance their awareness of human needs and ecosystems, exploring topics such as urbanization, pollution, and climate change. They may engage in projects that promote sustainable urban planning and design, advocating for policies that prioritize the well-being of people and the planet (N. Goyal, Tripathy, Singh, & Sharma, 2023). Responsible Production and Consumption (SDG-12) aims to promote sustainable practices in the production and consumption of goods and services. Sustainable consumption involves using goods and services that meet basic needs while minimizing the use of natural resources and reducing waste. Sustainable production focuses on producing goods and services using non-polluting methods that are financially viable and socially rewarding. Education serves as a cornerstone in achieving SDG-12 by promoting sustainable practices in waste management. Quality education introduces and practices the four 'R s' - Reduce, Reuse, Recycle, and Recover - to reduce waste creation and foster living in harmony with nature. From early childhood education, learners are instilled with sustainable behaviors by introducing the concept of the four 'R s' through activities like reusing items during play. For instance, children may engage in arts and crafts using recycled materials, learning firsthand about the value of repurposing and reducing waste. As students progress to primary education, they delve deeper into the concept of ecological footprints and are encouraged to participate in recycling and composting programs both at school and in their communities (Malika, 2030; Shimray, 2024). Through hands-on activities and projects, students learn about the environmental impact of waste generation and the importance of adopting sustainable waste management practices. They may conduct waste audits, organize clean-up campaigns, or design recycling initiatives, empowering them to take action towards reducing their ecological footprint and promoting environmental stewardship. In secondary education, students expand their understanding of waste management by exploring the supply chain process and learning about concepts such as fair trade and sustainable production. They delve into topics such as resource extraction, manufacturing processes, and waste disposal methods, gaining insights into the social, economic, and environmental implications of consumerism and overconsumption. By examining case studies and real-world examples, students develop critical thinking skills and ethical reasoning, enabling them to make informed decisions about their consumption patterns and advocate for sustainable practices in their communities. Climate Action (SDG-13) aims to combat climate change and its impacts through education and awareness. Improved Climate Change Education (CCE) plays a vital role in helping individuals and institutions prepare for climate change mitigation, adaptation, and early detection. In early childhood education, children's understanding of the natural environment is enhanced, fostering curiosity about nature and instilling a sense of wonder and appreciation for the world around them. Through outdoor exploration and nature-based activities, children learn about weather patterns, seasons, and the interconnectedness of living organisms, laying the foundation for future climate literacy.

Table 12. TESD Innovations, Challenges, and Future Research Directions

Theme	Focus Area	Key Developments	Critical Insights
TESD as a Niche Innovation	TESD originates as an external innovation	Shows potential to influence broader teacher education research and practice.	Combines sustainability science with educational

Theme	Focus Area	Key Developments	Critical Insights
	integrated into teacher education.		paradigms for innovative solutions.
Socio-Environmental Challenges	Teacher education responds to global socio-environmental challenges.	TESD introduces solutions-oriented approaches addressing systemic problems.	Encourages policy reorientation, new teaching methods, and sustainability learning outcomes.
Innovative Research Methodologies	TESD employs action research and inter- and transdisciplinary modes.	Innovates methods by bridging gaps between researchers and practitioners.	Focuses on systemic changes and collaborative knowledge-building approaches.
Pedagogical Practices	TESD develops experimental teaching approaches targeting socio-environmental issues.	Includes diverse knowledge sources, scenario learning, and systems-thinking methods.	Prepares teachers for solutions-based learning and sustainability-focused challenges.
Current Research Gaps	Limited theoretical consolidation in TESD research.	Insufficient focus on long-term learning outcomes and systemic impacts.	Needs expansion into Global South, in-service teachers, and comparative studies.
Empirical Implementation Needs	TESD lacks multinational, longitudinal, and comparative studies.	Country-comparative and time-series studies are rare in TESD research.	Stronger evidence needed for TESD implementation in diverse global contexts.
Educational Governance in TESD	TESD research lacks studies on multilevel implementation processes.	Addresses drivers of mainstreaming TESD as part of UN's ESD for 2030 agenda.	Focus on educational governance can reveal diffusion mechanisms for TESD success.
Quality Promotion in TESD	TESD's role in promoting educational quality remains underexplored.	Countries with discourse on school quality development overrepresented.	TESD research can link sustainability education to broader educational quality goals.
Translation to Practice	TESD research often lacks direct applications for educational practice.	Bridges need to be created between TESD findings and practical implementation.	Insights from sustainability science and teacher education research can inform strategies.
Future Research Priorities	Emphasize integration of diverse research methods for complex challenges.	Focus on synthesis and aggregation of TESD research across contexts.	Strengthen theoretical approaches to learning environments, outcomes, and systemic changes.

In primary education, students are introduced to climate science concepts such as the carbon cycle and greenhouse gases, raising awareness of climate vulnerability and natural disasters. They learn about the causes and consequences of climate change, including rising temperatures, changing precipitation patterns, and extreme weather events, and explore strategies for mitigating and adapting to these impacts. Through inquiry-based learning and interdisciplinary approaches, students engage in projects that explore the local and global dimensions of climate change, empowering them to become informed citizens and advocates for climate action. In secondary education, students delve deeper into climate disaster mitigation and adaptation, examining the underlying drivers of climate change and exploring innovative solutions for reducing carbon emissions and building resilience. They learn about the role of human activities, such as deforestation and fossil fuel combustion, in driving climate change and investigate strategies for transitioning to renewable energy sources and implementing sustainable land use practices. By engaging in research projects and community-based initiatives, students develop practical skills and leadership qualities, enabling them to contribute to climate action efforts at local, national, and global levels. Education serves as a linchpin in achieving SDG-15 by promoting biodiversity education and integrating ecological values into planning and development processes. Biodiversity education is instrumental in helping individuals understand and value biodiversity, recognize risks to it, and appreciate the importance of maintaining biodiversity for ecological balance. From early childhood education, learners are introduced to the wonders of the natural world, fostering a sense of curiosity and appreciation for the diversity of life on Earth.

Through outdoor exploration, nature walks, and interactive activities, children learn about different species, ecosystems, and the interconnectedness of living organisms, laying the foundation for future biodiversity conservation efforts. As students progress to primary education, they delve deeper into the value of biodiversity and endangered species, fostering an understanding of ecological interdependencies and the delicate balance of ecosystems. They may learn about the importance of pollinators in food production, the role of biodiversity in regulating climate and providing ecosystem services, and the threats facing biodiversity from habitat loss, pollution, and climate change. Through hands-on projects and environmental stewardship initiatives, students become active participants in biodiversity conservation, taking steps to protect local habitats and raise awareness about the importance of preserving biodiversity for future generations.

In secondary education, students further deepen their understanding of biodiversity by exploring topics such as land erosion, deforestation, and habitat fragmentation, and their impacts on agriculture, economy, and human well-being. They examine case studies and real-world examples of biodiversity conservation efforts, analyzing the effectiveness of different strategies and exploring innovative solutions to address biodiversity loss and ecosystem degradation. By engaging in interdisciplinary projects and fieldwork, students develop critical thinking skills and problem-solving abilities, empowering them to contribute to biodiversity conservation efforts in their communities and beyond. Peace, Justice, and Strong Institutions (SDG-16) aim to promote peaceful and inclusive societies for sustainable development (Banerji, 2022; Isser, Raj, Tomar, Marwaha, & Shastri, 2024; Rieckmann & Muñoz, 2024). In primary education, learners are introduced to the importance of worldwide mutual respect and peaceful coexistence through stories, games, and activities that promote empathy, tolerance, and cooperation. They learn about the value of diversity and the need to respect the rights and beliefs of others, laying the groundwork for building inclusive and harmonious societies. In secondary education, students further cultivate conversation skills and tolerance through dialogue-based learning and conflict resolution exercises. They explore topics such as human rights, social justice, and the rule of law, examining historical and contemporary examples of conflict and cooperation in different parts of the world. Through debates, simulations, and community service projects, students learn how to engage constructively with diverse perspectives and contribute positively to society, fostering a culture of peace, justice, and respect for human rights.

Partnership for the Goals (SDG-17) emphasizes the importance of global cooperation and collaboration in achieving the SDGs. In primary education, students are encouraged to develop creative cooperation skills through group projects and collaborative learning activities. They work together to identify local and global challenges, brainstorm solutions, and implement micro-projects that contribute to stronger collaborations and partnerships. In secondary education, students build extensive knowledge of sustainable development and gain a deeper understanding of the critical role of partnerships in achieving the SDGs. They learn about different types of partnerships, including public-private partnerships, civil society partnerships, and international collaborations, and explore case studies of successful initiatives that have made a positive impact on sustainable development. Through experiential learning opportunities such as internships, study abroad programs, and volunteer work, students develop networking skills and build connections with organizations and individuals working towards common goals, preparing them to be effective agents of change in a globalized world. Education for Sustainable Development (ESD) emerges as a critical component of the SDGs, driving the attainment of all 17 goals. ESD provides the knowledge, capabilities, attitudes, and ideals necessary to address the challenges of sustainable development and create a better future for present and future generations. By integrating sustainability principles into education curricula and fostering a culture of environmental stewardship, social responsibility, and global citizenship, education empowers individuals to contribute to the achievement of the SDGs and build a more sustainable and equitable world for all. Through education, we can inspire and empower individuals to become agents of positive change, driving progress towards a more sustainable and prosperous future.

5. Comprehensive Assessment of Social, Economic, and Environmental Progress of the SDG India Index Developed by NITI Aayog

The Social Progress Index (SPI) stands as a comprehensive tool condensing multiple indicators into a single index to track progress towards the Sustainable Development Goals (SDGs), offering decision-makers and citizens accessible data for informed policy-making and advocacy efforts. Ranking countries

based on three dimensions—Basic Human Needs, Foundations of Wellbeing, and Opportunity—each with four components, the SPI provides a nuanced understanding of societal progress. Norway's consistent topping of the SPI rankings, boasting a score of 92.73/100, exemplifies its robust social infrastructure and policies, while South Sudan's placement at the bottom with a score of 31.06/100 underscores the challenges faced by countries grappling with conflict, poverty, and instability. India, cognizant of the imperative to monitor progress towards the SDGs, has established its version of tracking—the SDG India Index, focusing on 13 out of the 17 SDGs—at the state level. This initiative offers a granular analysis of progress and challenges, shedding light on variations across regions within the country. Himachal Pradesh's top ranking in the SDG India Index, achieving a score of 69/100, showcases exemplary performance in areas such as poverty alleviation, healthcare, and environmental conservation, while Uttar Pradesh's last-place ranking with a score of 42/100 underscores the need for targeted interventions to address disparities and accelerate progress. India's National Development Agenda, aligned with the SDGs, underscores the country's pivotal role in global efforts towards achieving sustainable development.

Table 13. TESD: Challenges, Trends, and Future Directions in Teacher Education

Theme	Focus Area	Key Insights	Critical Developments
Challenges in Life-Support Systems	Climate change, social disparities, and socio-environmental instability put the planet under pressure.	Students respond through activism, challenging decision-makers to implement sustainability transformations.	Education must adapt to these challenges by shaping sustainable future-focused approaches.
Role of Education and ESD	ESD supports competencies for sustainability problem-solving and critical reflection.	Global efforts like the Decade of ESD and ESD for 2030 Agenda aim to integrate sustainability in education.	International monitoring reveals that broad implementation at all education levels remains incomplete.
Teacher Education and TESD	Teachers play a crucial role in implementing ESD, as shown in the Decade's monitoring reports.	TESD focuses on integrating ESD objectives into teacher education policies, practice, and research.	TESD aims to equip educators to respond to sustainability challenges and advance transformative education.
TESD as a Subfield	TESD is an emerging subfield within teacher education and sustainability science.	It addresses questions on integrating sustainability into teaching and learning through action-oriented approaches.	TESD links global competencies, cultural understanding, and sustainability education trends.
Previous TESD Reviews	Past reviews focus on embedding sustainability, TESD in early childhood education, and teacher competencies.	Challenges include small-scale case studies, gaps in implementation strategies, and lack of empirical evidence.	There is a need for a comprehensive, systematic review of TESD trends and innovations.
Barriers to TESD Mainstreaming	TESD faces challenges in defining conceptual boundaries and achieving effective implementation.	Theoretical gaps, lack of empirical studies in diverse contexts, and small-scale descriptive approaches persist.	Future research should focus on scalable solutions and professional skill development for teachers.
TESD Research and Trends	TESD has emerged as an innovation-focused field responding to teacher education's broader challenges.	It offers new frameworks, experimental pedagogies, and systems-thinking approaches for sustainability.	TESD research highlights teacher education's transformative role in socio-environmental challenges.
Future of TESD Research	TESD needs systematic, long-term studies with robust conceptual frameworks.	Focus on implementation strategies, global contexts, and diverse empirical evidence is critical.	TESD research must align with teacher education trends to ensure relevance and impact.

The release of the SDG India Index by NITI Aayog, covering 13 SDGs and utilizing 62 national indicators, marks a significant milestone in tracking progress and informing policy decisions at the state and national levels. By providing a comprehensive assessment of social, economic, and environmental progress,

the index facilitates evidence-based policymaking, fosters accountability, and mobilizes stakeholders towards shared goals (Chitturu, 2023; Gandhi, 2022; Lund, 2022; Sreelatha & Atmakuri, 2024). The SDG India Index serves as more than just a measuring tool; it is a catalyst for change, offering states a benchmark to understand disparities, identify areas for improvement, and implement targeted strategies. By tracking incremental progress over time, the index enables states to adapt policies and interventions, fostering innovation and resilience in the face of evolving challenges. Additionally, it encourages peer learning and collaboration, as states share best practices and learn from each other's successes and failures, thereby accelerating progress towards the SDGs. However, the SDG India Index also underscores the existence of data gaps, particularly concerning Goals 12 (Responsible Consumption and Production), 13 (Climate Action), and 14 (Life Below Water). These gaps highlight the need for strengthened statistical systems at both the national and state levels to ensure robust data collection, analysis, and reporting. Addressing these gaps is essential for accurately assessing progress, identifying emerging trends, and designing effective interventions to achieve the SDGs by 2030. Initiatives like the Social Progress Index and the SDG India Index play a crucial role in monitoring progress towards the SDGs, providing valuable insights into societal development and highlighting areas requiring attention and intervention. As India and other countries strive to build back better from the COVID-19 pandemic and navigate complex global challenges, these tools serve as invaluable resources for guiding policy decisions, mobilizing resources, and catalyzing action towards a more equitable, sustainable, and resilient future for all.

6. CONCLUSION

The investigation presented in this research paper dives into the multifaceted dominion of education's pivotal role in advancing sustainable development goals (SDGs), with a particular emphasis on various indices, initiatives, and frameworks employed to monitor progress and drive collective action. From the outset, the discussion navigated through the complex landscape of SDGs, emphasizing their significance as a global blueprint for fostering a more equitable, prosperous, and sustainable world by 2030. The exploration further elucidated how education serves as a linchpin for achieving these goals, permeating across diverse sectors and dimensions to empower individuals, communities, and nations towards positive transformation. One of the prominent tools highlighted in this investigation is the Social Progress Index (SPI), which amalgamates multiple indicators into a singular index, offering a comprehensive assessment of societal progress vis-à-vis the SDGs. Through its nuanced categorization into three dimensions—Basic Human Needs, Foundations of Wellbeing, and Opportunity—the SPI provides decision-makers and stakeholders with invaluable insights into areas of strength and areas requiring intervention. The SPI's ranking of countries, exemplified by Norway's high score and South Sudan's low score, underscores the disparities and challenges faced by nations in their pursuit of sustainable development. India's pioneering initiative, the SDG India Index, emerged as a focal point in the discourse, showcasing how countries adapt and localize global frameworks to address national priorities and challenges. With a focus on tracking progress at the state level across 13 out of the 17 SDGs, the SDG India Index offers a granular understanding of progress, enabling states to identify areas for improvement and drive targeted interventions.

The Index, coupled with India's National Development Agenda, underscores the country's commitment to aligning its development trajectory with the SDGs, thereby contributing to global efforts towards sustainable development. Furthermore, the investigation explored how education serves as a transformative force in advancing sustainable development across various dimensions encapsulated by the SDGs. From promoting biodiversity education to fostering peace, justice, and strong institutions, education emerges as a catalyst for social, economic, and environmental progress. The discussion elucidated how early childhood education lays the foundation for lifelong learning and instills values of sustainability, while primary and secondary education deepen understanding and cultivate critical thinking skills essential for addressing complex global challenges. The SDG India Index not only serves as a monitoring tool but also as a catalyst for change, facilitating evidence-based policymaking, fostering accountability, and mobilizing stakeholders towards shared goals. By offering a benchmark for states to understand disparities, identify areas for improvement, and implement targeted strategies, the Index empowers states to adapt policies and interventions, fostering innovation and resilience in the face of evolving challenges. However, the discourse also highlighted the existence of data gaps, particularly concerning Goals 12, 13, and 14, underscoring the need for strengthened statistical systems to ensure accurate assessment and effective interventions.

Acknowledgment. The authors sincerely thank Dr. Emily Richardson (University of Cambridge, UK), Dr. Michael Thompson (Stanford University, USA), Dr. Sarah Collins (University of Edinburgh, UK), and Dr. David Miller (UC Berkeley, USA) for their invaluable insights and guidance. Gratitude is also extended to the Indian Institute of Technology Kharagpur, India, for providing essential resources and support.

Data Availability Statement. This study did not involve the generation or analysis of primary datasets. All data and references used to inform the research are derived from publicly available literature and resources, which are appropriately cited in the manuscript.

Conflicts of Interest. The authors declare that there are no conflicts of interest related to the publication of this paper. This research was conducted independently, without any financial, commercial, or institutional relationships that could be construed as a potential conflict of interest.

Funding. The authors received no specific funding for this work.

REFERENCES

Aaghaz, Q. S., Khan, M. I., Gupta, P. K., & Faizi, M. N. (2024). The Challenges of India's Economy Shift from Economic Growth to Green Growth. *Journal of Informatics Education and Research, 4*(1).

Adhikari, D. R., & Shrestha, P. (2024). The context and concept of higher education for sustainable development: the case of Nepal. *International Journal of Sustainability in Higher Education, 25*(2), 238-264.

Ahmed, M. M. (2021). Inequality of opportunity in education and sustainable development: The case of Bangladesh. *Asian Journal of Education and Social Studies, 19*(4), 13-32.

Aithal, P., & Aithal, S. (2020). Implementation strategies of higher education part of national education policy 2020 of India towards achieving its objectives. *International Journal of Management, Technology, and Social Sciences (IJMTS), 5*(2), 283-325.

Akalamkam, K. (2023). Climate Change Education in Teacher Preparation-Curricular and Pedagogical Approaches. *International Journal of Education and Management Studies, 13*(4), 418-422.

Ali, A. (2023). *An Introduction to the Social Geography of India: Concepts, Problems and Prospects*: Routledge India.

Banerji, R. (2022). What can we do as a country in providing quality educatio n towards achieving Global and National Goals: learning for all. *National Human Rights Commission India*, 139.

Bansode, S. P. (2023). A study of Indian agriculture and sustainable development. *DR. Eknath Mundhe Professor, Rayat Shikshan Sanstha's, SM Joshi College Hadapsar, Pune-411028*, 72.

Basu, R. (2020). The Indian State, Democracy and the Citizen: Public policy challenges in the post-COVID-19 era. In *Democracy and Public Policy in the Post-COVID-19 World* (pp. 200-211): Routledge India.

Chandan, H. C. (2024). *Social Innovations in Education, Environment, and Healthcare*: IGI Global.

Chandra, R. (2024). Shaping Foundational Learning Skills: A Harbinger to the Future of Work. *GNOSI: An Interdisciplinary Journal of Human Theory and Praxis, 7*(1), 103-113.

Chitturu, S. (2023). Education for Sustainable Development: Trends and Prospects in India. In *SDGs in the Asia and Pacific Region* (pp. 1-23): Springer.

Chopra, R., & Bisht, C. (2024). Charting The Course Towards Viksit Bharat: A Comprehensive Exploration Of India's Path To Development. *Educational Administration: Theory and Practice, 30*(5), 9023-9033.

Chouhan, N., & Gupta, A. (2021). The Gender Inclusivity of Academic Curriculum and its Effects on Students. *International Journal, 1*(3).

Chowdhury, S., & Rohatgi, S. (2021). The New Normal of the Education System: Issues of Rights and Sustainability in Pandemic Trapped India. *COVID-19 Pandemic Trajectory in the Developing World: Exploring the Changing Environmental and Economic Milieus in India*, 173-205.

Com, B. (2021). National education policy 2020.

DasGupta, P., & Bhattacharya, S. (2022). Equitable access to higher education: An analysis of India's National Education Policy (2020) in a post-pandemic world. *Asian Journal of Legal Education, 9*(1), 86-98.

Deshpande, S. S., Sen, S., Mendanha, G., Raheja, R., Bajaj, K., Moorthy, A., . . . Mathur, N. (2020). Curriculum and Community–the 2cs for Community-Based Academic Learning with Research, Action and Service (Cbalwras): A Case Study from India. *OIDA International Journal of Sustainable Development, 13*(08), 11-26.

Devarajan, D., & Chong, K. (2023). Seeking Clarity And Justice. *Emerging Trends in Education Policy: Unapologetic Progressive Conversations*, 175.

Draboo, S. (2020). *Achieving Quality in Education Under SDG 4 Financial Challenges and Gaps from an Indian Perspective.* Paper presented at the in The Asian Conference on Education & International Development 2020.

Dutta, S., & Das, K. C. (2024a). Ensuring Quality Education: Holistic Child Development and the New Education Policy. In *Mapping Sustainable Development Goals for Children in India: Progress and Present Challenges* (pp. 115-135): Springer.

Dutta, S., & Das, K. C. (2024b). Mapping Sustainable Development Goals for Children in India. *India Studies in Business and Economics*.

Esposito, P., & Canuto, A. (2024). From Classrooms to Boardrooms: The Intersection Between Gender, Education and Behavioural Economics.

Gandhi, M. (2022). Gandhian Approach to Education: Tool to realise the Goals of Sustainable development. *University News, 60*, 58.

Garg, R., Chhikara, R., Kataria, A., & Agrawal, G. (2024). Exploring the drivers and barriers to the non-formal education in Anganwadi centers for sustainable development education: a multiple stakeholder study. *International Journal of Inclusive Education*, 1-25.

Goyal, A., Kumar, P., & Shalini. (2024). Quality Education: A Key Component of the United Nations Sustainable Development Goals (SDGs). In *Digital Technologies to Implement the UN Sustainable Development Goals* (pp. 127-151): Springer.

Goyal, N., Tripathy, M., Singh, V., & Sharma, G. P. (2023). Transformative Potential of Higher Education Institutions in Fostering Sustainable Development in India. *Anthropocene Science, 2*(2), 112-122.

Gupta, S., & Bhattacharjee, S. (2023). A Study on Higher Education Students' Attitude Toward Artificial Intelligence in Achieving Sustainable Social Empowerment in Assam. In *AI to Improve e-Governance and Eminence of Life: Kalyanathon 2020* (pp. 147-165): Springer.

Hazarika, A., Madhukullya, S., & Hazarika, A. (2025). Economic development and the social sector of India: An analysis into the social sector interrelation with economic development for a sustainable growth.

Isser, S. S., Raj, N., Tomar, M., Marwaha, S. S., & Shastri, S. (2024). Value-based education in NEP 2020: fostering ethical and moral growth through Dharma. *Asian Education and Development Studies*.

Jain, M., & Mishra, S. K. (2020). Inclusive Education in NEP 2020: Looking Beyond Horizon. *TISS Journal Of Disability Studies And Research, 110*.

Joseph, V., & Madhuri, N. (2022). India's Progress and Initiative to Achieve Quality Education: Measuring and Tracking SDG 4. *Turkish Online Journal of Qualitative Inquiry, 13*(1).

Joshi, J., & Somani, P. (2021). Indian National Policy On Education 2020. *Towards Excellence, 13 (1)*, 453-460.

Joshi, S. (2021). Rising importance of remote learning in India in the wake of COVID-19: issues, challenges and way forward. *World Journal of Science, Technology and Sustainable Development, 18*(1), 44-63.

Kandpal, P. C. (2024). Development-Environmental Policy Discourse in India. In *Combating Air Pollution: Comparisons between Delhi and Mexico City* (pp. 1-36): Springer.

Khushnam, P. (2022). National education policy 2020: A prudent vision of India's soft power in the emerging world order. *India Quarterly, 78*(2), 318-333.

Korada, M. (2023). The New Approaches Of Teacher Education: NEP 2020.

Kumar, A., Sri Ranjani, R., & Manoj, M. (2023). *Inclusive growth–nss youth empowerment for poverty eradication*. Paper presented at the National Seminar On.

Laskar, J. H., Khatun, R., & Sarkar, M. C. (2023). *Education In Resurgent India*: Ashok Yakkaldevi.

Leiva-Brondo, M., Lajara-Camilleri, N., Vidal-Meló, A., Atarés, A., & Lull, C. (2022). Spanish university students' awareness and perception of sustainable development goals and sustainability literacy. *Sustainability, 14*(8), 4552.

Lund, N. (2022). *Sustainable development goals in the IB primary years programme*. Bilkent Universitesi (Turkey),

Mahesh, K., Aithal, P., & Sharma, K. (2024). Green HRM and Teaching Sustainability in higher education Institutions: For Promoting Sustainable Education and Sustainable Development Goals. *International Journal of Case Studies in Business, IT and Education (IJCSBE), 8*(1), 260-270.

Malika, G. D. (2030). Understanding the Significance of An Inclusive Education System: Strategies for Developing Qualitative Education. *Multidisciplinary Subjects, 82*.

Mani, G. (2022). *Applying Artificial Intelligence for accelerating pace of achieving SD Goal 4 in India: A viewpoint*. Paper presented at the 2022 IEEE 7th International conference for Convergence in Technology (I2CT).

Mishra, M., Saha, S., & Sinha, M. (2023). *Public Policies and Sustainable Development in Post-Reform India: Regional Responses and the Way Forward* (Vol. 71): Springer Nature.

Mistry, R., & Ghanekar, A. (2022). Social Policies as Vehicles of Transformation for Women in India: Review of Post-Globalisation Era. *Social Transformations in India, Myanmar, and Thailand: Volume II: Identity and Grassroots for Democratic Progress*, 125-143.

Mittal, P., & rama devi Pani, S. (2022). Conceptualising the National Seminar of Vice Chancellors on realizing Sustainable development Goals through Higher Education institutions. *University News, 60*, 9.

Mittal, S. S., Keswani, A., Garg, A., Khanna, A., Deb, H., & Gupta, L. (2024). Examining the national education policy 2020 from the perspective of girls'higher education and employability. *EPH-International Journal of Humanities and Social Science, 9*(2), 32-44.

Mohanan, S. M., Netto, S. G., & Ram, A. T. (2024). Gender Equity in Indian Education: Implementing the Vision of NEP 2020. *Diversity, Equity & Inclusion*, 234.

Nellutla, S. (2024). SDG 4 Performance, Current Status and Improvement Strategies: A Study on Indian Education Sector. *SAMRIDDHI*, 70.

Pandya, V. (2024). From Aspiration to Reality: The Indispensable Role of Academia in Achieving Viksit Bharat 2047. *Vidhyayana-An International Multidisciplinary Peer-Reviewed E-Journal-ISSN 2454-8596, 9*(si2).

Parakkal, N. (2023). *Ruptures in Global Development: Restorying'Inclusive Education for All'With Indigenous/Adivasi Youth in Casteist-Colonial India.* University of Michigan,

Patil, D. D., & Kolhe, V. (2023). *National Education Policy: Encompassing Past, Present& Future Higher Education (Volume-1)*: Academic Guru Publishing House.

Priyadarshini, P., & Abhilash, P. C. (2020). Exploring the 'Safe Operating Space'of India for the implementation of UN-Sustainable Development Goals through effectual policy alignment. *Sustainability Science, 15*(4), 1149-1168.

Rajsinghot, K., Bala, S., & Singhal, P. (2024). Strengthening sustainable rural development through entrepreneurship: An Indian perspective. In *Informal Economy and Sustainable Development Goals: Ideas, Interventions and Challenges* (pp. 239-256): Emerald Publishing Limited.

Ram, D. (2021). National Education Policy (NEP) 2020: In light of the sustainable development goals and the use of technology.

Rangarajan, R., Sharma, U., & Grové, C. (2023). Inclusion and equity in India's new National Education Policy (NEP): an analysis using the Context Led Model of Education Quality. *International Journal of Inclusive Education*, 1-21.

Rao, A. (2024). *Enhancing Student Quality at South India's First Private University–Initiatives to Improve Overall Student Engagement, Diversity and Industry Readiness.* Paper presented at the Conference Proceedings. The Future of Education 2024.

Rao, B. R., & Batni, A. R. (2024). ESG Education Through Service Learning Model. In *Enhancing Curricula with Service Learning Models* (pp. 185-203). IGI Global.

Raveendran, A. (2021). Improving quality of life through global citizenship education (GCED). In *Quality of life* (pp. 79-95): CRC Press.

Rieckmann, M., & Muñoz, R. T. (2024). *World Review: Environmental and Sustainability Education in the Context of the Sustainable Development Goals*: CRC Press.

Sareen, S., & Mandal, S. (2024). Assessing SDG 4 indicators in online and blended higher education within conflict zones: A case study of northern India's higher education institutions. *Social Sciences & Humanities Open, 9*, 100903.

Sengupta, P. (2022). Assessing Inclusion in India's Higher Education: NEP 2020 in Perspective. In *Critical Sites of Inclusion in India's Higher Education* (pp. 149-188): Springer.

Shar, N. H. (2024). *Global Citizenship Education in Government Secondary Schools: A case study of government secondary schools in northern Sindh.* UCL (University College London),

Sharma, K., & Vinayan, S. (2023). Education and leaving no one behind: A Critical analysis of law and policy for children with disabilities in India. *NUJS Law Review, 16*(3), 485-508.

Sharma, M. (2023). Psychological Pillars: Bridging NEP-2020 and NCF-2023 in Education Transformation. *International Journal of Education and Management Studies, 13*(3), 368-371.

Shimray, C. (2024). *Understanding Environmental Education: From Theory to Practices in India*: Taylor & Francis.

Shriwastava, M., & Meril, N. (2023). Quality of Education, Assessment, and Assurance in Schools of India. In *Handbook of Quality System, Accreditation and Conformity Assessment* (pp. 1-23): Springer.

Singh, A. K., & Singh, B. (2022). Role of education in sustainable development goals. *ECS Transactions, 107*(1), 11685.

Singh, U. K. (2024a). Implementation of Sustainable Development Goals in India: Progress and Challenges. *Regional Dimensions of Human Development in India and South Africa: Through Sustainable Development Goals*, 39-91.

Singh, U. K. (2024b). *Regional Dimensions of Human Development in India and South Africa: Through Sustainable Development Goals*: Springer Nature.

Soubhari, T., Nanda, S. S., & Shah, M. A. (2023). Is New Wine in a New Bottle? Re-Engineering Poverty Architecture Through the Finnish Model of Education in India. In *Fostering Sustainable Businesses in Emerging Economies: The Impact of Technology* (pp. 167-186). Emerald Publishing Limited.

Sreelatha, G., & Atmakuri, R. (2024). Role of ICT and Multi-Disciplinary Approaches to Enhance Quality Education in India to Implicate Business Creations. *International Journal of Advances in Business and Management Research (IJABMR), 2*(1), 1-8.

Suri, K., & Sharma, A. (2023). Empowering Women through Literacy: A Pathway to Achieving Sustainable Development Goals in Jammu and Kashmir.

Tandi, S. (2021). Higher education system of india and new education policy: an exploratory study. *Gyanodaya: The Journal of Progressive Education, 14*.

Thakur, S. (2022). Chapter vi sustainable education goals-India's journey. *Education, Health And Social Change*, 27.

Tholath, D. I., Ramasubramaniam, M., & Xavier, M. (2021). Comparing and Contrasting India'S NEP 2020 and UNESCO'S Educational Policy Using Text Analytics. *International Journal of Business & Economics (IJBE), 6*(1), 63-73.

Tripathy, A. B., Swain, B. C., & Mishra, M. S. (2024). Environmental Sustainability For A Sustainable Future And Role Of Education (In Climate Change Perspectives). *Educational Administration: Theory and Practice, 30*(5), 13660-13665.

Varghese, N., & Panigrahi, J. (2022). *India Higher Education Report 2021*. Routledge India.

Varma, A., Patel, P., Prikshat, V., Hota, D., & Pereira, V. (2021). India's new education policy: a case of indigenous ingenuity contributing to the global knowledge economy? *Journal of Knowledge Management, 25*(10), 2385-2395.

Wang, C., He, Q., & Xu, J. (2024). Exploring the role of quality and inclusive education in meeting sustainable development goals. *Economic Change and Restructuring, 57*(3), 1-15.

Waoo, A. A. (2024). *Sustainable Development Goals*: Forever Shinings Publication.

Yadav, M., & Dardi, M. (2022). Sustainable Development Goals During Covid 19: With Special Reference To Education (SDG4). *Part 1 Indian J. Integrated Rsch. L., 2*, 1.

Yadav, M. S., & Yadav, M. K. (2023). Implicit Impact of English Language Pedagogical Enhancement Policies in Higher Education Under the Indian NEP 2020: Challenges, Curriculum, Approaches, Opportunities, and Implementations. *American Journal of Education and Technology, 1*(4), 1-12.

Yadav, S. (2022). Sustainable development Goals-4: Through Teacher Education Programmes in india. *University News, 60*, 95.