



Tech-Driven Sustainability: Exploring the Convergence of Edtech and Sustainable Development

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ABSTRACT

In the pursuit of sustainable development, education is essential for influencing attitudes, actions, and behaviours. In this endeavour, educational technology (EdTech) has become a potent instrument, providing creative teaching and learning methods that are consistent with sustainable development ideals. In light of the 2030 goals, this paper examines the relationship between educational technology and education for sustainable development (ESD), drawing on information from credible sources such as academic research, UNESCO, and the Commonwealth of Learning. Education for sustainable development (ESD) aims to prepare the next generation of citizens to deal with sustainable development concerns. The learning environments that teachers design in a classroom have a significant impact on the learning of the students. This paper seeks to clarify how EdTech might be used to further ESD goals in the next ten years by a review of trends, obstacles, and opportunities. In addition to highlighting the implementation of the new Education for Sustainable Development framework in the Indian context, the ESD for 2030 roadmap outlines the urgent issues facing the planet (UNESCO, 2020). The Education for Sustainable Development roadmap in India has been laid in the New Education Policy (NEP) (MHRD, India, 2020).

Keywords: educational technology, education for sustainable development, national education policy 2020, digital initiatives

Introduction

Education may mould attitudes, develop skills, and spur change, making it a vital component of society advancement. The need of education to support sustainable development is more than ever in light of global issues including socioeconomic injustice, biodiversity loss, and climate change. A human being is socialised through education, which prepares him or her to sustain in society (Kanvaria, 2020). The idea of Education for Sustainable Development (ESD) was first put forth by Japan at the World Summit on Sustainable Development in 2002, and since then, United Nations Educational, Scientific and Cultural Organization (UNESCO), the leading United Nations (UN) agency for ESD, has been leading international efforts based on the global framework, the "UN Decade of Education for Sustainable Development (2005-2014)", which was adopted at the 57th Session of the General Assembly of the United Nations in 2002, and the "Global Action Programme on Education for Sustainable Development (GAP-ESD) (UNESCO, 2002). In this endeavour, educational technology, or EdTech, shows itself to be a potent friend, providing creative ways to improve learning outcomes and encourage long-term habits. With the ambitious Sustainable Development Goals (SDGs) set for 2030, it is critical to comprehend how educational technology and education for sustainable development (ESD) interact. Teachers need to be well-equipped with the changes happening in the world around in this ever-changing environment (Kanvaria & Dubey, 2020).

Education is acknowledged by UNESCO as a basic human right and as a major force behind sustainable development (UNESCO, 2015). According to UNESCO, education for sustainable development (ESD) attempts to provide students the information, abilities, attitudes, and values they need to contribute to a more sustainable future (UNESCO, 2017). ESD is positioned as Goal 4's Target 4.7, "Ensure inclusive and equitable quality education opportunities for all learners," which states that by 2030, "all learners shall acquire the knowledge and skills necessary to promote sustainable development, including, among others, through

education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development" (UNESCO, 2015).

In the meantime, a vast range of digital tools and platforms that support teaching, learning, and the sharing of knowledge are included in educational technology. Through the use of EdTech, educators may reach students in a variety of settings and provide them the tools they need to take on sustainability-related concerns by overcoming the limitations of traditional time and location. In India, the Education Vertical for National Institution for Transforming India (NITI) Aayog aims to create an atmosphere that is conducive to learning so that individuals can reach their full potential and contribute to the socioeconomic advancement of the nation. The Education Vertical aims to support children's grade-level competency, socio-emotional development, preparedness for school, and critical and higher-order thinking. Through a high-quality, accessible, equitable, responsible, and inexpensive educational system, it aims to equip kids with employable skills, a research temperament, and subject-matter competence.

Current Trends and Innovations in EdTech for ESD

Digital platforms and tools provide a multitude of ways to advance Education for Sustainable Development (ESD), including new ways to study, easier access to information, collaboration, and the potential for people to take an active role in sustainability issues. The research examples, case studies and interventions that follow demonstrate how different digital tools and platforms support ESD.

1. SATH-E Programme

The Sustainable Action for Transforming Human Capital–Education (SATH-E) - A report by Education Vertical enlists interventions for systematic transformations of school education along with examples and success stories across states. The five essential pillars of systematic transformation are listed with the interventions that have been undertaken in schools across various states (NITI Aayog, 2019).

1) Focus on academic reforms

- Learning outcomes to be based on achievement of competencies rather than completion of syllabus.
- Holistic and multi-disciplinary education including art, sports, life skills and competencies required in 21st-century workplaces (Sinakou et al., 2019)
- Designing assessments and testing of proficiency in competencies, critical thinking, and conceptual clarity through better-designed examinations. National Education Policy (NEP, 2020) emphasizes the importance of formative assessments that continuously test students through creative activity- and project-based methods, and recurrently assess student learning levels in written and non-written formats.
- Learning enhancement programs based on the basic level of learners and remediation may be carried out over a period, continuously, or a combination of the two. The enhancement program should be continued during the full academic year to enable the ongoing bridging of gaps in learning.
- Digital learning in classrooms as well as in remote mode

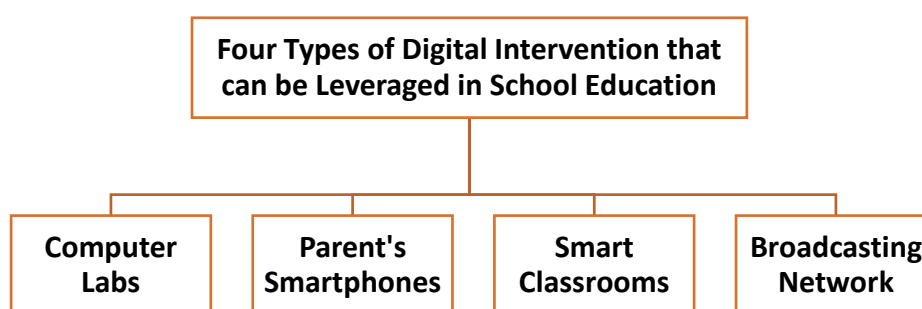


Figure 1: Types of digital intervention for school education (Source: NITI Aayog, 2019)

Online learning at home can be enabled on any internet-capable device, such as a smartphone, laptop, or tablet. It can greatly boost the entire learning cycle in learning, assessment and tracking of results.

2) Strengthening administrative and implementation systems

The purpose of the educational system is to consolidate small schools into fewer, better-resourced institutions to make each school conducive to delivering high-quality education. This can be done by reorganizing schools, resulting in more resources, greater administrative support, and upgraded governance.

For example, National Digital Education Architecture (NDEAR) was launched in 2021 to create a unifying national digital infrastructure to energise and catalyse the education ecosystem. There is an Education Ecosystem Registry (EER) monitored through Vidya Samiksha Kendra (VSK) at Central Institute of Educational Technology (CIET). The registries are designed to be easily accessible by other building blocks and usable through “registry-as-a-service with open APIs” beyond the traditional portals for end users to view and access. School, teacher, and student are core registries envisaged in NDEAR (across federated levels and not as a central database). It is essential that data about schools, teachers, students, administrative officials, subjects, textbooks, etc. are maintained through a set of federated 4th generation registries. (MoE, 2023)



Figure 2. Interface of Vidya Samiksha Kendra (Source: <https://vsk.ndear.gov.in/#/summary-statistics>)

3) Strengthening human capacity

A meaningful increase in learning outcomes will be extremely challenging when there are numerous underqualified contract teachers or numerous teacher shortages. States that have implemented mechanisms for more accountability of staff have successfully seen benefits such as improved teacher satisfaction over time, as well as a significant jump in learning outcomes. Teachers have multiple entry and exit points in the education system and shall require the teacher registry to be maintained at the Central level or at the State level with national access (MoE, 2023). Again, EER is of great help to maintain more accountable and quality teachers.

4) Develop mechanisms that enforce more accountability

Performance can be increased by motivating stakeholders to compete within the system. This intervention builds momentum at the block level by encouraging healthy competition among blocks to enhance a variety of inputs (such as high-quality execution) and outputs (e.g., of Learning Enhancement Programs).

We hope that the framework for systemic transformation presented, as well as the codification of best practices from States, would be beneficial to other States that may wish to transform their educational system into a high performing one (Kanvaria & Yadav, 2023).

5) Create a Shared Vision and Motivation for Change

Delivering high-quality education becomes a priority for the rest of the administrative structure if the leadership makes that evident in its communications and actions. This assures that department officials at the district and block levels become increasingly active in enhancing educational outcomes.

2. Massive Open Online Courses (MOOCs) and Online Courses

These platforms are increasingly used to disseminate ESD information to a worldwide audience. According to Leal Filho et al. (2019), these platforms provide courses on a variety of subjects, from social justice to environmental conservation, allowing students to interact with a range of viewpoints and gain information about sustainability challenges. For example, the University of Helsinki's MOOC "Sustainability in Everyday Life" gives participants useful tools and techniques for applying sustainability concepts to their day-to-day activities (Mäkelä et al., 2020). And SWAYAM platform run courses like "Strategies and Models for Sustainability" and "Sustainability Science" that mainly focuses on the concept and evolution of sustainable development, sustainability indicators and the genesis of integrated holistic sustainable development indices by giving Indian Examples (MoE, 2024).

3. Simulations of Virtual Reality (VR) and Augmented Reality (AR)

VR and AR simulations offer learners immersive educational experiences that let them investigate real-world sustainability issues in a safe setting. By allowing users to visualise difficult ideas like ecosystem dynamics or the effects of climate change, these technologies improve users' comprehension and empathy for environmental challenges (Chen et al., 2021). For instance, users can directly witness the effects of deforestation on

biodiversity and ecosystem services with the VR programme "EcoSim," created by academics at Stanford University (Chen et al., 2021).

4. Gamified Learning Platforms

By incorporating gaming elements into instructional activities, gamification is being utilised more and more in ESD to increase motivation and engagement. According to Götz, Stieglitz, and Spiekermann (2020), gamified learning platforms use rewards like points, badges, and leader boards to promote sustainable behaviours and active engagement. For example, the "Cool School Challenge" platform encourages students to compete in lowering their ecological footprint through trash reduction and energy saving activities, hence gamifying sustainability teaching (Götz et al., 2020).

These examples demonstrate how digital tools and platforms can effectively support ESD by providing accessible, engaging, and interactive learning experiences that empower individuals to contribute to sustainability goals.

Challenges and Barriers

Despite the potential benefits of integrating educational technology (EdTech) for Education for Sustainable Development (ESD), several challenges and barriers must be addressed:

- **Digital Divide and Access Inequities**

In low-income and rural regions in particular, the digital divide continues to be a major obstacle to obtaining EdTech tools and resources (UNESCO, 2019). Inequalities in educational possibilities are made worse by unequal access to technology, which also restricts the effectiveness of ESD programmes.

- **Limitations of Technological Infrastructure**

The successful use of EdTech solutions is impeded by a lack of hardware resources and dependable internet access, particularly in poor nations (UNESCO, 2019). It could be difficult for teachers and students to use digital tools for ESD without a suitable infrastructure. In order to design and construct sustainable structures, it asks for a responsive strategy that includes the missing dimensions of educating surroundings (Geitz & de Geus, 2019).

- **Content Relevance and Quality**

Ensuring the relevance and quality of digital content for ESD is difficult because the abundance of online resources can cause information overload or the spread of false or biased information (Mogaji & Maringe, 2017). To make sure that digital resources support ESD principles and learning objectives, educators must critically assess them.

Opportunities to Leverage Educational Technology for ESD Goals

Despite these challenges, several opportunities exist for leveraging EdTech to advance ESD goals:

- **International Cooperation and Knowledge Exchange**

Educators and students can work together globally and exchange knowledge thanks to EdTech platforms, which promote intercultural understanding and group efforts towards sustainability (UNESCO, 2019). Diverse viewpoints can be brought into ESD activities through virtual exchange programmes and online forums.

- **Creative Pedagogical Strategies**

According to Jones et al. (2019), digital tools and platforms present chances for creative pedagogical strategies that encourage critical thinking and active learning about sustainability challenges. Learners are able to explore intricate sustainability ideas through interactive multimedia resources, virtual field trips, and gamified simulations.

From the views of "proactive learning, interactive learning, and in-depth learning," it is crucial to continuously improve learning and pedagogies. This entails not just emphasizing the exploratory learning process, such as correctly positioning problem-solving learning, enriching opportunities for proactive, learner-centred learning, and adding in experiences and activities, but also thoroughly examining which aspect of the learning process would be most effective and how they should be positioned. Effective ESD promotion requires that the implementation of ESD be positioned in the school management strategy, the internal school organisation is streamlined, the school as a whole handle ESD systematically, the ESD be appropriately positioned in the teaching plans, the perspective of collaboration with the local community, universities, and businesses be incorporated, and the communication and reflection on learning outcomes by students be appropriately positioned.

To maximize the potential of EdTech for ESD, the following recommendations are proposed:

- **Infrastructure and Connectivity Investment**

To guarantee that all students have fair access to EdTech resources, governments and educational institutions should place a high priority on infrastructure and broadband connectivity (UNESCO, 2019).

- **Teacher Training and Capacity Building**

In order to provide educators with the knowledge and abilities required to successfully incorporate EdTech into ESD curricula, comprehensive teacher training programmes should be put in place (UNESCO, 2019). Digital

literacy, critical assessment of online materials, and best practices in education should be the main areas of concentration for professional development opportunities.

Conclusion

In summary, as we work to meet sustainability targets by 2030, the incorporation of educational technology (EdTech) into Education for Sustainable Development (ESD) offers both opportunities and problems. While digital platforms and tools provide creative ways to involve students, encourage collaboration, and make information easier to access, there are still important obstacles that need to be addressed to ensure equitable and successful implementation, including the digital divide, restrictions on technological infrastructure, and worries about the quality of the content.

Notwithstanding these obstacles, EdTech has enormous potential to further ESD goals and provide people the tools they need to make a positive impact on a more sustainable future. To optimise the effectiveness of EdTech in ESD efforts, critical tactics include global collaboration and knowledge exchange, novel pedagogical techniques, and investment in teacher training and capacity building.

Governments, academic institutions, legislators, educators, and EdTech developers must work together in the future to overcome obstacles, seize opportunities, and fulfil the transformative potential of digital innovation for sustainability. In order to leverage the power of EdTech to educate, inspire, and empower future generations to create a more sustainable society, stakeholders can prioritise infrastructure investment, support digital literacy and critical thinking abilities, and curate high-quality digital content. Essentially, the nexus between educational technology and education for sustainable development promises to shape a more promising future in which students will possess the attitudes, knowledge, and abilities needed to confront the complex issues confronting our world and create a society that is more resilient, equitable, and sustainable.

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