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ROLE OF ICT RESOURCES IN FOSTERING ENVIRONMENTAL AWARENESS AMONG PREPARATORY-STAGE STUDENTS

Shilpi Rani [1*]
[1] Research Scholar, Department of Education (CIE), University of Delhi, New Delhi, India

ABSTRACT

Environmental awareness is a compulsory aspect of education since it helps the children to realize their connection with the natural world and to form responsible attitudes to its preservation. The school education preparatory stage (Classes III-V) is a significant step in instilling in young learners the environmental sensitivity, knowledge and sustainability. In modern learning setting, Information and Communication Technology (ICT) has proved to be a powerful learning tool that can empower environmental education using digital videos, animations, interactive presentations, educational applications, virtual experiences and online learning platforms. The current paper looks into the contributions of the ICT resources to the development of environmental awareness among students in the preparatory-stage. It discusses how teaching-learning experiences based on technology could render more meaningful the concepts of the environment and how they could be interactive and related to the daily life of children. Specific focus has been made on the role played by ICT in creating awareness on biodiversity, pollution, climate change, natural resources, waste management and environmental sustainability. The pedagogical importance of multimedia learning, visualisation, digital storytelling and locally relevant digital content in facilitating environmental knowledge in young learners is also addressed in the article. Moreover, it discusses the teacher role in choosing and incorporating suitable ICT resources into environmental education, especially within the framework of the National Education Policy (NEP) 2020, as well as the National Curriculum Framework of School Education (NCF-SE) 2023. The article identifies issues like poor digital infrastructure, technology disparities, limited digital skills and over-screen time by teachers, and alongside its educational potential. It claims that ICT should be an addition to, not a substitute of direct observation, experiential learning and nature. The article concludes that meaningful incorporation of ICT in environment education can help in the formation of environmentally aware, knowledgeable and responsible youths.

Keywords: Information and Communication Technology (ICT), Environmental Awareness, Preparatory Stage, Digital Pedagogy, Environmental Education

INTRODUCTION

One of the main issues facing the modern society is environmental degradation. Climate change, air and water pollution, deforestation, the loss of biodiversity, overuse of natural resources and inappropriate disposal of waste have become some of the problems that have disrupted the ecological balance of the planet. These are not confined to a specific geographical area but they have become issues of global concern and need to be addressed with the concerted awareness, responsible behaviour and sustainable practices. Education plays a significant role in solving these environmental challenges as it generates knowledge,

*Corresponding Author:
Email address: Shilpi Rani (s.shilpir@gmail.com)

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attitudes, values and skills which help individuals to get familiar with environmental issues and engage them in solutions. Here, environmental education does not just focus on information about nature but also the sense of responsibility towards the protection and conservation of the environment Palmer (1998), Tilbury (1995).

Environmental awareness is especially relevant due to its development in childhood since the perception of the environment in the early years of learning predetermines the children in the perception of nature, attitude to it, and daily behavioural patterns. Class III-V: The preparatory stage is a significant phase during which children start to acquire a more systematic knowledge of their physical, biological and social worlds under the National Education Policy (NEP) 2020. At this level, students are more and more able to see the interdependence between human beings and nature, the nature of environmental problems and the impact of human activities. Children can thus be made aware of the significance of trees, plants, animals, water, air, soil and other natural resources through environmental education. It is also able to promote uncomplicated yet significant habits like water conservation, plastic recycling, neatness, plant protection and animal care.

The National Education Policy 2020 lays stress on the cultivation of environmental consciousness, scientific temper, digital literacy and critical thinking in school children. It understands that environmental awareness, such as water and resource conservation, sanitation and hygiene, is a crucial educational capacity Ministry of Education (2020). In a similar manner, the National Curriculum Framework School Education 2023 emphasizes the need to relate knowledge in the curriculum with the experiences of the children, local environment and real-life experiences. These policy guidelines offer avenues on how Information and Communication Technology (ICT) can be incorporated in environmental education by offering meaningful age-relevant teaching-learning experiences NCRT (2023).

ICT has changed the way education is conducted by providing a wide range of resources and possibilities in accessing, presenting and communication of knowledge. ICT in school education encompasses computers and laptops, tablets, projectors, smart boards, educational television, digital video, animations, interactive applications, web-based resources and online learning systems. These materials can assist the teachers in illustrating environmental concepts which might be otherwise hard to explain to young learners using only verbal explanations or reading in a textbook. As an illustration, the water cycle can be demonstrated by the use of animated videos, digital presentations can be used to explain the various types of pollution and documentary styles can be used to expose students to forests, wildlife, oceans and endangered species. These materials can be used to offer visual and auditory experiences to make classroom learning more significant and interesting.

The principles of multimedia learning can also be applied to explain the significance of ICT in the field of environmental education. According to Mayer (2009), words combined with pictures may be used to facilitate meaningful learning in the event the instructional materials are constructed in the cognitive needs of the learners. During the preparation stage, visual representations, narrations, illustrations, demonstrations and interactive activities are likely to be beneficial to the children. The digital resources can thus assist the teachers in describing abstract environmental processes with concrete visual examples. As an example, a student can better learn about the effects of deforestation by watching an animation of how the process of cutting trees, as well as soil erosion, loss of animal habitats and alterations in rain patterns are connected.

The other valuable input of ICT is its capability to relate classroom learning to the environmental scenarios that exceed the immediate environment of children. Students will be able to visit mountains, rivers, forests, deserts, wetlands and wildlife habitats they might never visit physically through digital maps, photographs, educational videos and virtual field experiences. Educational materials can be also used to assist teachers to present on local environmental issues, such as air pollution, water shortage, garbage collection and degradation of green areas. Relation of such concerns to the daily experiences of children may promote observation, discussion and environmental awareness. Nevertheless, online experiences ought to complement face-to-face interactions with nature instead of substituting outdoor education and hands-on learning about the environment Ardoin and Bowers (2020).

ICT opens the possibilities of the formation of active involvement in environmental learning as well. Students do not just have to sit inactive receivers of information but can engage in digital quizzes, interactive presentation, storytelling, simple research tasks and classroom projects. They can take pictures in the school environment of plants, create digital posters on the conservation of water, draw up presentations on waste sorting or make notes on local environmental factors. These activities may stimulate curiosity, communication, teamwork and problem solving skills. Hungerford and Volk (1990) emphasise that environmental education should aim beyond the acquisition of knowledge and contribute towards responsible environmental behaviour.

Although these are possible, there should be a serious consideration of integrating ICT in environmental education. Access to digital gadgets, power, internet access, access to suitable educational resources and the technological skills of teachers might vary significantly between schools. Moreover, overuse of screens, passive use of digital media as well as inappropriate use of online materials can decrease the educational value of technology. Hence, the efficiency of ICT is not merely based on the presence of devices but their relevant incorporation into instruction.

It is against this backdrop that this current article will analyze how ICT resources can play out in the development of environmental awareness among the students in the preparatory stage. It covers the educational value of digital materials, their role in environmental awareness and sensitivity, the educational role of the teacher and the difficulties of technology adoption. It also

reflects on the role of ICT-based environmental education in serving the overarching goals of NEP 2020 and NCF-SE 2023 by promoting environmentally friendly practices and sustainable mindsets in young learners.

OBJECTIVES

- To investigate the educational value of the ICT resources in the environmental education at the preparatory level.
- To examine how digital materials can be used to enhance environmental awareness and sensitivity among young learners.
- To investigate the role of multimedia, animations, digital storytelling and interactive learning in dispensing environmental concepts.
- To investigate the contribution of teachers in the incorporation of ICT in environmental education.
- To pinpoint the issues involved in the effective use of ICT resources in school-based environmental education.
- To propose effective measures to enhance ICT-based environmental learning in line with NEP 2020 and NCF-SE 2023.

RESEARCH METHODOLOGY

The article adopts a descriptive and analytical approach based on a review of secondary sources. Peer-reviewed research articles, relevant academic books, international educational publications, policy documents and curriculum frameworks have been reviewed to comprehend the interaction between ICT and environmental education. Special consideration is paid to the National Education Policy 2020, National Curriculum Framework of School Education 2023, UNESCO publications and proven literature on multimedia learning and environmental education.The discussion is structured around the pedagogical uses of ICT, the environmental awareness building, the position of teachers, educational opportunities and challenges of implementation. The article is theoretical and literature-founded; it does not profess to give primary field information or experimentally determined results.

MAKING ENVIRONMENTAL CONCEPTS MORE CONCRETE THROUGH DIGITAL RESOURCES

Among the significant contributions made by ICT to environmental education, one can distinguish the possibility of visual and multimedia representation of the most complicated environmental concepts and their understanding. At the preparative level, students are training their skills in comprehending connections amid various elements of the environment. Other concepts like climate change, ecological balance, food chains, biodiversity, soil erosion and water conservation will be hard to be taught using verbal teaching only. Digital animations, educational videos, illustrations and interactive presentations can help teachers present these concepts in a more concrete and understandable manner. To illustrate, an animated presentation of the water cycle can be used to make students learn about evaporation, condensation and precipitation. On the same note, a computerized animation that illustrates deforestation can be used to show how the destruction of trees will impact on soil, animals and rainfall distribution. The theory of multimedia learning by Mayer (2009) forms a theoretical basis to utilize the visual and verbal materials that are designed properly to aid in understanding. Thus, ICT can enhance environmental learning in case digital content is chosen based on the age, interests and learning needs of the students.

DEVELOPING AWARENESS OF ENVIRONMENTAL PROBLEMS

ICT resources have the ability to introduce students to environmental issues that are in both local, national and international levels. Using educational documentaries, photos, digital presentations and news based learning materials, teachers can expose a problem like air pollution, water pollution, and plastic waste, climate change and natural habitat destruction. As an example, children can be made to see the implications of dumping household and industrial wastes in water bodies through photographs and videos of polluted rivers. Likewise, information about the decreasing forest cover provided through digital resources could be used to foster the debate on the significance of trees and biodiversity. The fact that local relevant examples are used is also important since children will be able to relate digital information to the environment they are in. To initiate the discussions of cleanliness, pollution and environmental responsibility, teachers can show photos of local roads, markets, drains, parks and water bodies. These strategies align with the focus of environmental education on perception of environmental issues and coming up with responsible action Palmer (1998), Rickinson (2001).

PROMOTING ENVIRONMENTAL SENSITIVITY THROUGH MULTIMEDIA LEARNING

Environmental awareness is not only a knowledge of environmental facts but also a sense of emotional sensitivity, concern and responsibility to the environment. Digital narratives, nature films, videos and photos of wildlife can offer students a chance to become emotionally attached to nature. Jasani (2025) As an illustration, a short video depicting the life of an endangered animal can make children realize the necessity of protecting wildlife. In the same manner, a digital narrative of a contaminated neighbourhood can be used to start discussions in the classroom on the roles of individuals and communities. Chawla (1998) underlines the importance of

meaningful life experiences in environmental sensitivity development. Here, ICT has the potential to offer more learning experiences that can evoke curiosity and concern, especially with the observed, discussed and acted-upon digital activities. However, emotional sensitivity cannot be viewed as a natural consequence of video watching, and it needs a significant teacher guidance and time to reflect on it.

CONNECTING CLASSROOM LEARNING WITH THE LOCAL ENVIRONMENT

One of the main aspects of good environmental education is its connection to the immediate environment of learners. Children are to be taught to know about environmental conditions within their neighbourhoods, schools and communities. ICT can enhance this relationship using digital photographs, maps, presentations, audio recordings and basic documentation tasks. The teachers can also request students to see trees within the school area, name various plants, take photographs of trash drop-offs or write about water conservation at their households. The observations may then be discussed by way of classroom presentation or online displays. As an example, students can make a basic digital presentation about the sources of air pollution in their localities, the state of local water bodies or the need to preserve the local parks. These activities relate technological learning to the real environmental experiences and encourage the inquiry-based learning. Environmental education research also highlights the significance of meaningful experience and local relevance of learning with the formation of environmental concern Ardoin and Bowers (2020).

PROMOTING ACTIVE INVOLVEMENT AND GREEN CONSCIOUSNESS

ICT can facilitate the shift in the nature of environmental education, which is information-based, to participatory learning. Learners will be able to develop digital posters, make presentations, go through environmental quizzes and write simple online tales concerning environmental protection. The teachers can arrange classroom lessons where the groups will create presentations on saving electricity, plastic use, protecting biodiversity and keeping the environment clean. Online quizzes are capable of assisting students in updating environmental concepts, and online storytelling may stimulate them to convey environmental messages in their language. According to UNESCO (2017) education in support of sustainable development must prepare the knowledge, skills, values and attitudes needed to take responsible action. Thus, ICT-based activities must not only motivate the children to develop awareness about environmental challenges, but also to adopt simple conservation skills in their everyday activities. The final educational goal must be to instil responsible behavior, and not just make students more familiar with online information.

TEACHER ROLE IN THE INTRODUCTION OF ICT IN ENVIRONMENTAL EDUCATION

Success of ICT in environmental education is heavily reliant on whether the teacher can select suitable digital material and how the teacher can merge it with the curricular goals. Teachers are facilitators who help students to process environmental information, process visual materials and relate digital knowledge with real life experiences. They are to choose the age-specific videos, animations, educational applications and digital presentations that are correct, meaningful, and relevant to the learning goals. As an example, during the lesson about biodiversity, a teacher can show a wildlife film and discuss this issue in the classroom and provide a school-based project when students need to identify plants and birds in their vicinity. The ICT Competency Framework of Teachers created by UNESCO (2018) puts an accent on the significance of digital competencies of teachers, pedagogic knowledge and professional growth to the effective utilization of educational technology. Therefore, educators must have technology expertise as well as knowledge in the subject of the environment so that ICT can play a significant role in environmental education. Jasani (2024)

ISSUES AND CONSTRAINTS OF ICT INTEGRATION

Although ICT has potential to be incorporated effectively in environmental education, it has a number of challenges. Access to computers, projectors, tablets, electricity and internet connectivity is not evenly distributed in the educational institutions. State schools, especially those in economically disadvantaged regions, can be constrained by the digital infrastructure and access to suitable educational tools. Digital competency of teachers is another important issue. There are teachers who might get access to technological gadgets but without the required training on the use of the gadgets in classroom instruction. Access to quality and age-based environmental content in local languages is also significant. Moreover, overreliance on online sources can also decrease the possibility of outdoor engagements, first-hand observation and communication with nature. Ardoin and Bowers (2020) emphasize the significance of nature-based experiences in environmental education to young children. Consequently, ICT must be regarded as an additional pedagogical tool as opposed to experiential and activity-based learning.

IMPLICATIONS AND RECOMMENDATIONS EDUCATIONAL

- **Integration with curriculum:** The relevant digital resources should be promoted to environmental issues in the current school curriculum.

- **Teacher training:** Teachers should have ICT competencies and capability to utilize digital resources to teach about the environment through regular professional development programmes.
- **Locally pertinent content:** Digital educational resources need to contain some examples of local environmental issues which may include air pollution, water shortage, waste management and biodiversity degradation.
- **Use of multimedia resources:** Educators are supposed to make use of educational videos, animations, interactive presentation and digital storytelling to teach the concepts of the environment.
- **Experiential learning:** Digital activities ought to be interlinked with nature walks, gardening, school cleanliness programmes, tree plantation and observation of nature.
- **Inclusive access:** Schools are supposed to see that students who belong to diverse socioeconomic groups have equal access to ICT-based learning.
- **Creation of digital learning content:** Higher institutions of learning need to promote creation of age-related environmental material in various Indian languages.
- **Student participation:** The students are to be invited to create digital posters, presentations, environmental reports and short stories connected with the environmental conservation.
- **Conscientious use of technology:** Teachers and parents ought to make sure that there is an appropriate screen time, safe internet use and meaningful use of digital devices.
- **Ongoing evaluation:** Teachers are to evaluate environmental knowledge using classroom discussions, projects, observations and the involvement of their students in conservation activities as an alternative to digital quizzes.

MAJOR EDUCATIONAL OUTCOMES EXPECTED FROM ICT INTEGRATION

The following table presents the potential contributions of ICT resources to environmental awareness among preparatory-stage students. These are conceptual educational outcomes, not findings from a separate empirical investigation.

ICT resource	Environmental learning opportunity	Expected educational outcome
Educational videos	Understanding pollution and climate change	Environmental knowledge
Animations	Learning the water cycle and food chains	Conceptual understanding
Digital maps	Exploring forests, rivers and natural habitats	Geographical awareness
Nature documentaries	Observing wildlife and biodiversity	Environmental sensitivity
Interactive quizzes	Revising environmental concepts	Knowledge reinforcement
Digital storytelling	Understanding conservation issues	Environmental values
Digital photography	Observing local environmental problems	Observation and inquiry
Digital presentations	Communicating conservation messages	Participation and responsibility

Source: Conceptual framework developed from the literature reviewed in this article

CONCLUSION

Environmental awareness is a mandatory learning need in equipping young learners to appreciate ecological relations and act responsibly to environmental issues. The preparation phase helps give a valuable chance to enhance environmental knowledge, sensitivity, values and responsible habits among children. In this regard, Information and Communication Technology can be used to provide promising opportunities to enhance environmental education using digital videos, animations, multimedia presentation, educational applications, virtual experiences and interactive learning exercises.

The discourse presented in this article suggests that ICT would render environmental concepts more reachable, engaging and comprehensible to the students in the preparatory stage. It is capable of making children interested in such problems like pollution, loss of biodiversity, deforestation, climate change and conservation of natural resources. Digital resources might also help bridge classroom learning to the issues of the local environment and motivate students to engage in environmental protection related activities. Nevertheless, the learning quality of ICT is based on the quality of online materials, the teaching skills of educators and the purposeful combination of technology with learning goals.

It is also vital to note that digital learning alone cannot be used to build environmental awareness. Direct observation, nature walks, gardening and personal involvement with nature and animals, community involvement and practical conservation activities are still important elements of environmental education. Over-reliance on technology can result in children missing out on the chance to have first-hand experience with nature. Hence, ICT must be used to supplement experiential and activity-based learning and not displace it.

The aims of NEP 2020 and NCF-SE 2023 offer a valuable starting point of incorporating digital pedagogy in environmental education. Schools need to work on the digital abilities of teachers and give them equal access to ICT facilities and prepare the education content that are locally relevant. Students are also advised to be creative and responsible in using technology to communicate their environmental issues and take part in conservation efforts.

Finally, incorporating ICT in environmental education must not only be aimed at enhancing classroom activities or enabling delivery of information. Its more general education purpose must be to raise ecologically aware, sensitive and responsible citizens who value the significance of ecological balance and sustainable living. A moderate mix of online material, significant pedagogical activities, and immediate nature experiences can help achieve this learning objective.

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