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NEP 2020 and the Dual Mandate: Enhancing School Academic Environment through Green Infrastructure and Sustainable Pedagogy

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Abstract
The National Education Policy (NEP) 2020 envisions an education system that is learner-centered, experiential, multidisciplinary, and aligned with the principles of sustainable development. In response to growing environmental concerns and the need for quality education, the policy promotes a dual mandate of strengthening academic environments while fostering environmental sustainability. This study explores how green infrastructure and sustainable pedagogy can work together to transform school education and create meaningful learning experiences for students. The research examines the role of eco-friendly school facilities, including green buildings, energy-efficient systems, rainwater harvesting structures, waste management practices, biodiversity parks, and school gardens, in creating healthy and resource-efficient learning environments.
Simultaneously, the study investigates sustainable pedagogical approaches such as project-based learning, experiential learning, outdoor education, environmental action projects, and interdisciplinary teaching strategies that encourage active student participation and real-world problem-solving. Through an analysis of policy provisions and existing educational practices, the research highlights the complementary relationship between environmentally sustainable infrastructure and innovative teaching-learning processes. The findings suggest that schools equipped with green infrastructure and supported by sustainability-oriented pedagogy demonstrate higher levels of student engagement, motivation, creativity, critical thinking, and academic achievement. Furthermore, these approaches contribute significantly to the development of environmental literacy, ecological responsibility, responsible citizenship, and lifelong learning competencies among students.
The study underscores that the successful implementation of NEP 2020 requires schools to integrate physical sustainability measures with pedagogical innovations. Such integration not only improves educational quality but also nurtures environmentally conscious individuals capable of contributing to sustainable development. The paper concludes that green infrastructure and sustainable pedagogy together provide a powerful framework for holistic school transformation and for achieving both national educational objectives and global sustainability goals.
Keywords: *National Education Policy 2020, Green Infrastructure, Sustainable Pedagogy, Academic Environment, Environmental Literacy, Experiential Learning, School Transformation, Sustainable Education, Holistic Development, Sustainable Development Goals (SDGs).*

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Introduction

Education plays a fundamental role in shaping individuals who are capable of responding to contemporary social, economic, and environmental challenges. In the twenty-first century, educational systems are expected not only to promote academic excellence but also to foster environmental awareness, critical thinking, creativity, and responsible citizenship. As global concerns regarding climate change, environmental degradation, biodiversity loss, and resource depletion continue to intensify, schools are increasingly recognized as important institutions for promoting sustainable development through education (**UNESCO, 2021**).

The **National Education Policy (NEP) 2020** represents a transformative vision for Indian education that emphasizes holistic development, experiential learning, multidisciplinary approaches, critical thinking, and environmental consciousness (**Government of India, 2020**). The policy advocates an educational framework that prepares learners to become informed, responsible, and productive citizens capable of addressing emerging global challenges. In this context, sustainability has emerged as a key educational priority that must be integrated into both school infrastructure and teaching-learning processes.

Green infrastructure refers to environmentally sustainable physical facilities and practices designed to minimize ecological impact while creating healthy and resource-efficient educational environments. Such infrastructure includes green buildings, renewable energy systems, rainwater harvesting, waste management mechanisms, biodiversity parks, school gardens, and energy-efficient technologies (**United Nations Environment Programme [UNEP], 2020**). These initiatives not only support environmental conservation but also provide students with opportunities to engage in meaningful and practical learning experiences.

Alongside sustainable infrastructure, contemporary educational discourse emphasizes the importance of sustainable pedagogy. Sustainable pedagogy encompasses learner-centered teaching approaches that encourage inquiry, participation, collaboration, experiential learning, and problem-solving in real-life contexts (**Sterling, 2010**). Approaches such as project-based learning, outdoor education, environmental action projects, and interdisciplinary instruction help students develop critical competencies required for sustainable living and lifelong learning (**Tilbury, 2011**).

Research has demonstrated that environmentally supportive learning environments positively influence students' academic achievement, motivation, creativity, emotional well-being, and engagement in learning activities (**Kuo, Barnes, & Jordan, 2019**). Similarly, experiential and sustainability-oriented pedagogical practices have been found to enhance higher-order thinking skills, environmental literacy, and responsible decision-making (**Hopkins & McKeown, 2005**). The integration of green infrastructure and sustainable pedagogy therefore offers significant potential for transforming schools into dynamic learning communities.

The concept of a dual mandate—enhancing educational quality while promoting environmental sustainability—has gained increasing attention in educational policy and practice. NEP 2020 recognizes that academic excellence and sustainability are not separate goals but interconnected dimensions of holistic education (**Government of India, 2020**). Schools that

combine eco-friendly infrastructure with innovative pedagogical practices are better positioned to create enriching educational experiences while contributing to sustainable development.

Against this backdrop, the present study explores the role of green infrastructure and sustainable pedagogy in enhancing school academic environments under NEP 2020. The study seeks to understand how these complementary approaches contribute to educational quality, environmental literacy, and holistic student development while supporting the broader objectives of sustainable education.

Background of the Study

The relationship between educational environments and student learning has been a subject of extensive research across the world. Traditional educational models primarily focused on classroom instruction and academic achievement, often overlooking the influence of environmental conditions and sustainability practices on learning outcomes (**Bransford, Brown, & Cocking, 2000**). However, growing awareness of environmental challenges and the need for sustainable development has prompted educators and policymakers to reconsider the role of schools in promoting ecological responsibility.

The concept of sustainable education emerged from international efforts to address environmental concerns through educational reforms. The **United Nations Conference on Environment and Development (UNCED, 1992)** and subsequent global initiatives emphasized the importance of integrating sustainability into educational systems. Education for Sustainable Development (ESD) advocates that learners should acquire the knowledge, values, attitudes, and skills necessary to contribute to a sustainable future (**UNESCO, 2021**).

Green infrastructure in educational institutions has gained prominence as a practical strategy for promoting sustainability. Schools around the world have adopted initiatives such as green buildings, renewable energy technologies, rainwater harvesting systems, school gardens, biodiversity conservation projects, and waste management programs to reduce environmental impacts and enhance educational experiences (**UNEP, 2020**). These initiatives create healthier learning environments while serving as living laboratories for environmental education.

Research findings suggest that exposure to natural environments positively influences students' cognitive functioning, concentration, academic performance, and psychological well-being (**Matsuoka, 2010**). Similarly, nature-based educational settings have been associated with improved motivation, creativity, collaboration, and engagement among learners (**Kuo et al., 2019**). Such evidence highlights the educational benefits of integrating sustainability into school infrastructure.

At the same time, educational scholars have emphasized the importance of sustainable pedagogy in preparing learners for complex societal challenges. Sustainable pedagogy promotes active learning, inquiry, critical reflection, collaboration, and problem-solving rather than passive knowledge transmission (**Sterling, 2010**). Experiential learning approaches enable students to connect classroom knowledge with real-world issues, thereby enhancing understanding and practical application (**Kolb, 1984**).

In India, the launch of **National Education Policy 2020** marked a significant shift toward learner-centered and competency-based education. The policy advocates experiential learning, multidisciplinary education, environmental awareness, and critical thinking as essential components of school education (**Government of India, 2020**). It encourages schools to adopt innovative pedagogical practices and environmentally sustainable approaches that contribute to holistic development.

The convergence of green infrastructure and sustainable pedagogy has therefore emerged as an important area of educational transformation. Understanding how these elements interact to improve academic environments and promote sustainability is essential for achieving the objectives of NEP 2020. This study seeks to contribute to this understanding by examining the dual mandate of educational excellence and environmental responsibility within contemporary school education.

Rationale of the Study

The rationale for the present study arises from the increasing recognition that educational quality and environmental sustainability must be addressed simultaneously to meet the challenges of the twenty-first century (**UNESCO, 2021**). Educational institutions are no longer expected merely to impart academic knowledge; they are also responsible for developing environmentally conscious citizens capable of contributing to sustainable development.

Despite significant improvements in educational access and infrastructure, many schools continue to face challenges related to environmental degradation, resource inefficiency, limited experiential learning opportunities, and insufficient integration of sustainability into educational practices (**UNEP, 2020**). These challenges highlight the need for innovative approaches that combine environmental responsibility with academic excellence.

The **National Education Policy 2020** provides a unique opportunity to address these concerns through its emphasis on experiential learning, multidisciplinary education, environmental awareness, and holistic development (**Government of India, 2020**). However, the successful implementation of these objectives requires a deeper understanding of how green infrastructure and sustainable pedagogy can be integrated effectively within school systems.

Green infrastructure alone may improve the physical environment of schools, but its educational impact can be maximized only when combined with sustainability-oriented pedagogical practices (**Tilbury, 2011**). Similarly, innovative teaching methods become more meaningful when supported by learning environments that reflect sustainable values and practices. Therefore, examining the interaction between infrastructure and pedagogy is essential for understanding comprehensive school transformation.

Furthermore, there is a growing need for empirical and conceptual studies that explore the relationship between sustainable educational environments and academic outcomes. While existing literature highlights the individual benefits of green infrastructure and experiential learning, fewer studies have examined their combined contribution to educational quality and sustainability within the context of NEP 2020 (**Kuo et al., 2019**).

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The study is also significant because it aligns with the **United Nations Sustainable Development Goals (SDGs)**, particularly Goal 4 (Quality Education), Goal 11 (Sustainable Communities), Goal 12 (Responsible Consumption and Production), and Goal 13 (Climate Action) (**United Nations, 2015**). Educational institutions play a critical role in advancing these goals through sustainable infrastructure and transformative learning practices.

Therefore, the present study seeks to examine how green infrastructure and sustainable pedagogy can jointly contribute to improving academic environments, promoting environmental literacy, and achieving the transformative vision of NEP 2020. The findings are expected to provide valuable insights for educators, school leaders, policymakers, and researchers committed to building sustainable and future-ready educational institutions.

Objectives of the Study

1. To examine the role of green infrastructure in enhancing the academic environment and educational quality of schools under the framework of National Education Policy (NEP) 2020.
2. To identify the major components of green infrastructure, such as green buildings, renewable energy systems, rainwater harvesting, waste management practices, biodiversity parks, and school gardens, adopted in schools.
3. To analyze the contribution of sustainable pedagogical practices, including experiential learning, project-based learning, outdoor education, and interdisciplinary teaching, to students' academic achievement and holistic development.
4. To explore the relationship between green infrastructure and sustainable pedagogy in promoting environmental literacy, responsible citizenship, and sustainable development among students.
5. To suggest strategies for integrating green infrastructure and sustainable pedagogy to achieve holistic school transformation and the educational objectives of NEP 2020.

Research Questions

1. How does green infrastructure contribute to the enhancement of the academic environment and educational quality in schools under NEP 2020?
2. What are the major green infrastructure practices adopted by schools to promote sustainability and environmental responsibility?
3. How do sustainable pedagogical approaches influence students' academic achievement, engagement, critical thinking, and holistic development?
4. In what ways do green infrastructure and sustainable pedagogy collectively promote environmental literacy, ecological responsibility, and responsible citizenship among students?
5. What strategies can be adopted to effectively integrate green infrastructure and sustainable pedagogy for achieving school transformation and the goals of NEP 2020?

Review of Related Literature

The concept of green schools and sustainable education has gained considerable importance in recent decades due to increasing environmental challenges and the global emphasis on

sustainable development. Researchers have highlighted the role of environmentally friendly infrastructure and innovative pedagogical approaches in creating effective learning environments.

Green Infrastructure and Educational Environment

Orr (2004) emphasized that educational institutions should function as living laboratories where environmental sustainability is embedded in everyday practices. Green infrastructure such as energy-efficient buildings, school gardens, rainwater harvesting systems, and waste management facilities not only reduce environmental impacts but also enhance students' learning experiences.

Henderson and Tilbury (2004) found that schools adopting whole-school sustainability approaches demonstrated improvements in student engagement, environmental awareness, and institutional effectiveness. Their study suggested that physical environmental improvements contribute significantly to creating positive educational climates.

Kumar and Singh (2021) reported that green campuses promote healthier learning environments by improving air quality, reducing energy consumption, and encouraging active student participation in environmental activities. Such initiatives support both ecological sustainability and academic excellence.

Sustainable Pedagogy and Academic Achievement

Sterling (2010) argued that sustainability education should move beyond traditional teaching methods and focus on transformative learning experiences. Sustainable pedagogy encourages critical thinking, problem-solving, collaboration, and real-world engagement.

Hopkins and McKeown (2015) observed that experiential and project-based learning approaches improve students' academic achievement while fostering environmental responsibility. They emphasized that sustainability-oriented teaching helps learners connect classroom knowledge with real-life challenges.

UNESCO (2017) highlighted that Education for Sustainable Development (ESD) equips learners with knowledge, skills, values, and attitudes necessary for sustainable living. Sustainable pedagogy promotes interdisciplinary learning and supports holistic student development.

Green Schools and NEP 2020

The National Education Policy (2020) advocates experiential learning, multidisciplinary education, environmental awareness, and sustainable development. The policy encourages schools to adopt learner-centered pedagogies and environmentally responsible practices.

Aithal and Aithal (2020) noted that NEP 2020 provides opportunities for integrating sustainability into educational planning through innovative teaching methods, community engagement, and environmental education initiatives.

UNESCO (2020) further emphasized that sustainable educational institutions contribute to achieving Sustainable Development Goal 4 (Quality Education) and other global sustainability targets.

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Research Gap

Although several studies have examined green infrastructure and sustainable pedagogy independently, limited research has explored their combined influence on school transformation and academic excellence within the framework of NEP 2020. Particularly in the Indian school context, empirical evidence regarding the integration of green campuses and sustainable teaching-learning practices remains insufficient. Therefore, the present study seeks to address this gap by examining how green infrastructure and sustainable pedagogy together contribute to school environment transformation under NEP 2020.

Research Methodology

Research Approach

The study adopted a **quantitative descriptive survey approach** to examine the role of green infrastructure and sustainable pedagogy in transforming school education under the framework of NEP 2020.

Research Design

A **descriptive survey design** was employed to collect data regarding perceptions of teachers, school administrators, and students about green infrastructure practices and sustainable pedagogical approaches.

Population of the Study

The population comprised teachers, school administrators, and senior secondary students from selected schools implementing environmental sustainability initiatives.

Sample

A sample of **100 respondents** was selected using **stratified random sampling** from different stakeholder groups.

Category	Number
Teachers	40
School Administrators	20
Students	40
Total	100

Sampling Technique

Stratified Random Sampling was used to ensure representation from different categories of stakeholders.

Tool Used for Data Collection

A **self-constructed questionnaire** based on green infrastructure, sustainable pedagogy, and NEP 2020 indicators was developed.

Structure of the Questionnaire

Dimension	Number of Items
Green Infrastructure	10
Sustainable Pedagogy	10
Academic Environment	5

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School Transformation Strategies	5
Total	30

Responses were collected using a **five-point Likert Scale**:

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

Validity and Reliability

- **Content Validity:** Established through expert review by specialists in Education and Environmental Studies.
- **Reliability:** Cronbach's Alpha coefficient = **0.87**, indicating high internal consistency.

Data Collection Procedure

1. Permission was obtained from the selected schools.
2. Respondents were informed about the purpose of the study.
3. Questionnaires were administered personally and through online forms.
4. Responses were collected and tabulated systematically.

Statistical Techniques Used

The collected data were analyzed using:

- Frequency
- Percentage
- Mean Score
- Standard Deviation
- Descriptive Analysis

Delimitations of the Study

1. The study was limited to selected schools.
2. Only 100 respondents were included.
3. The investigation focused on green infrastructure and sustainable pedagogy within the framework of NEP 2020.
4. Findings are based on respondents' perceptions and self-reported data.

Analysis and Interpretation

Objective-wise Analysis and Interpretation

Objective	Indicators Examined	Positive Responses (n=100)	Percentage (%)	Interpretation
To examine the role of green infrastructure in	Improved learning environment, student comfort,	88	88%	Green infrastructure significantly

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enhancing the academic environment	classroom effectiveness			improves the quality of the academic environment.
To identify major green infrastructure practices adopted in schools	Tree plantation, rainwater harvesting, school gardens, waste management, solar energy	84	84%	Most schools have adopted multiple sustainable infrastructure practices.
To analyze the contribution of sustainable pedagogy to academic achievement and holistic development	Experiential learning, project work, outdoor learning, interdisciplinary activities	86	86%	Sustainable pedagogy enhances academic learning and overall student development.
To explore the relationship between green infrastructure and sustainable pedagogy	Integration of environmental practices with classroom teaching	82	82%	Infrastructure and pedagogy complement each other in promoting sustainability education.
To suggest strategies for school transformation under NEP 2020	Teacher training, eco-clubs, community participation, project-based learning	90	90%	Integrated sustainability strategies support effective implementation of NEP 2020.

Analysis

The data indicate that the highest response (90%) was observed regarding strategies for school transformation, followed by the enhancement of the academic environment (88%). Sustainable pedagogy (86%) and green infrastructure practices (84%) were also reported as significant contributors to educational improvement.

Interpretation

The findings suggest that green infrastructure and sustainable pedagogy together create supportive learning environments that align with the vision of NEP 2020. Schools implementing these practices are more likely to achieve academic excellence and sustainability goals.

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Research Question 1

How does green infrastructure contribute to the enhancement of the academic environment and educational quality in schools under NEP 2020?

Response Category	Frequency	Percentage (%)
Highly Effective	48	48%
Effective	35	35%
Moderately Effective	12	12%
Less Effective	5	5%
Total	100	100%

Analysis

A total of 83% of respondents perceived green infrastructure as either highly effective or effective in improving educational quality.

Interpretation

Green infrastructure positively influences academic environments by providing healthier, safer, and more engaging learning spaces. Such environments support NEP 2020's emphasis on holistic and experiential education.

Research Question 2

What are the major green infrastructure practices adopted by schools?

Green Infrastructure Practice	Frequency	Percentage (%)
Tree Plantation	92	92%
Waste Management	88	88%
School Gardens	85	85%
Rainwater Harvesting	78	78%
Renewable Energy Systems	65	65%

Analysis

Tree plantation (92%) emerged as the most common green initiative, followed by waste management (88%) and school gardens (85%).

Interpretation

Schools prioritize low-cost and high-impact sustainability practices. These initiatives contribute to environmental awareness and resource conservation while enriching educational experiences.

Research Question 3

How do sustainable pedagogical approaches influence students' academic achievement, engagement, critical thinking, and holistic development?

Learning Outcome	Frequency	Percentage (%)
Increased Student Engagement	91	91%
Improved Academic Achievement	85	85%
Enhanced Critical Thinking	89	89%
Better Problem-Solving Skills	87	87%

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Holistic Development	90	90%

Analysis

Student engagement (91%) and holistic development (90%) received the highest responses, indicating strong educational benefits.

Interpretation

Experiential and project-based pedagogies improve learner participation, critical thinking, and academic performance, thereby supporting the competency-based educational goals of NEP 2020.

Research Question 4

In what ways do green infrastructure and sustainable pedagogy collectively promote environmental literacy, ecological responsibility, and responsible citizenship?

Outcome	Frequency	Percentage (%)
Environmental Awareness	93	93%
Ecological Responsibility	88	88%
Sustainable Behaviour	86	86%
Responsible Citizenship	84	84%
Community Participation	81	81%

Analysis

Environmental awareness (93%) emerged as the most significant outcome, followed by ecological responsibility (88%).

Interpretation

The integration of sustainability-focused infrastructure and pedagogy effectively develops environmentally responsible citizens and promotes long-term sustainable behaviors among students.

Research Question 5

What strategies can be adopted to effectively integrate green infrastructure and sustainable pedagogy for achieving school transformation and the goals of NEP 2020?

Strategy	Frequency	Percentage (%)
Experiential Learning Projects	94	94%
Teacher Capacity Building	90	90%
Eco-Club Activities	88	88%
Community Participation	84	84%
Digital Sustainability Education	80	80%

Analysis

Experiential learning projects (94%) and teacher capacity building (90%) were identified as the most effective strategies.

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Interpretation

Successful implementation of NEP 2020 requires integrating sustainability into both infrastructure and pedagogy through experiential learning, teacher development, and community engagement.

Major Theme	Percentage (%)	Interpretation
Green Infrastructure Development	84%	Creates environmentally sustainable learning environments.
Sustainable Pedagogy	88%	Enhances engagement, creativity, and academic achievement.
Academic Excellence	85%	Improves learning outcomes and student performance.
Environmental Literacy	93%	Strengthens ecological awareness and sustainability values.
School Transformation under NEP 2020	90%	Supports holistic and learner-centered educational reforms.

The analysis demonstrates that **green infrastructure and sustainable pedagogy operate synergistically to improve educational quality, environmental literacy, and holistic student development**. Schools that integrate eco-friendly infrastructure with experiential and project-based learning create stronger academic environments, promote responsible citizenship, and advance the objectives of **NEP 2020** and sustainable development. The findings reinforce the dual mandate of achieving academic excellence while fostering environmental responsibility through sustainable school transformation.

Findings of the Study

Based on the analysis of the responses collected from 100 participants, the following major findings emerged:

Sl. No.	Findings
1	A large majority of respondents (88%) agreed that green infrastructure positively enhances the academic environment by improving student comfort, concentration, and classroom effectiveness.
2	Most schools (84%) have adopted various green infrastructure initiatives such as tree plantation, school gardens, rainwater harvesting, waste management systems, and solar energy utilization.
3	Sustainable pedagogical practices including experiential learning, project-based learning, outdoor education, and interdisciplinary activities were perceived as highly effective in improving academic achievement and holistic development (86%).

4	A strong relationship (82%) was observed between green infrastructure and sustainable pedagogy, indicating that physical environmental initiatives support classroom-based sustainability learning.
5	The highest level of agreement (90%) was recorded for strategies supporting school transformation under NEP 2020, including teacher training, eco-clubs, community participation, and project-based learning.
6	The findings demonstrate that environmentally sustainable schools contribute not only to ecological awareness but also to academic excellence and student well-being.
7	Green campuses provide opportunities for experiential learning, thereby strengthening the practical implementation of NEP 2020 principles.
8	Integration of environmental sustainability into school infrastructure and pedagogy creates a holistic educational ecosystem that supports long-term educational development.

Conclusion

The present study highlights the significant role of green infrastructure and sustainable pedagogy in transforming school education in accordance with the vision of the National Education Policy (NEP) 2020. The findings reveal that environmentally sustainable school environments positively influence teaching-learning processes, student engagement, academic performance, and holistic development. Green infrastructure initiatives such as school gardens, rainwater harvesting systems, solar energy installations, and waste management practices create healthy and resource-efficient learning spaces.

Simultaneously, sustainable pedagogical approaches including experiential learning, project-based learning, environmental education, and interdisciplinary teaching strengthen students' critical thinking, problem-solving abilities, and environmental consciousness. The study further establishes that green infrastructure and sustainable pedagogy are mutually reinforcing components that contribute to educational quality and sustainability.

Therefore, schools should adopt integrated sustainability strategies involving teacher capacity building, eco-club activities, community engagement, and institutional environmental planning. Such initiatives will support the successful implementation of NEP 2020 while fostering environmentally responsible citizens capable of contributing to sustainable development. The transformation of schools into green and academically vibrant learning spaces is essential for achieving the goals of quality education and sustainability in the twenty-first century.

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