

Environmental Sustainability In Architecture Education: Integrating Green Thinking Through NEP 2020 For Future Employability

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Abstract

The escalating environmental crises, including climate change, resource depletion, and urban pollution, have placed sustainability at the forefront of architectural education worldwide. This paper explores the integration of green thinking within architecture education in India, focusing on the implications of the National Education Policy (NEP) 2020—a transformative framework aimed at making education holistic, interdisciplinary, and skill-oriented. The study critically examines how sustainability principles are embedded in architecture curricula in alignment with NEP directives, emphasizing the development of green skills that enhance future employability. Employing a mixed-methods approach involving curriculum analysis, stakeholder interviews, and industry surveys, this research identifies the current gaps between academic offerings and industry expectations. The findings highlight uneven adoption of sustainability modules and a pressing need for enhanced collaboration between educational institutions and the architectural industry. Based on these insights, the paper proposes strategic recommendations for standardizing sustainability education, fostering faculty training, and promoting experiential learning. Ultimately, this study underscores the pivotal role of NEP 2020 in bridging education-employment gaps and shaping environmentally responsible architects equipped to meet the demands of a rapidly evolving green economy.

Keywords: Sustainability, Architecture Education, NEP 2020, Green Skills, Employability, Curriculum Integration, Interdisciplinary Learning, Sustainable Design, Industry Collaboration, Skill Development

INTRODUCTION

Sustainability has emerged as an essential paradigm in contemporary architecture, driven by the urgent need to mitigate environmental degradation and promote resource-efficient built environments. Buildings and infrastructure contribute significantly to global carbon emissions and energy consumption, making the role of architects crucial in designing solutions that harmonize with natural ecosystems (Kibert, 2016). As a result, architecture education must evolve to instill a deep understanding of sustainable practices, encouraging future professionals to prioritize environmental stewardship alongside aesthetic and functional considerations.

In India, the National Education Policy (NEP) 2020 represents a landmark reform designed to revolutionize the education system by fostering multidisciplinary learning, critical thinking, and skill development aligned with national and global sustainability goals(Nep_achievement (1), n.d.) The NEP explicitly emphasizes the integration of environmental education and sustainability principles across disciplines, including professional courses like architecture. This policy encourages educational institutions to adopt flexible curricula, promote research and innovation, and strengthen industry linkages, thus preparing students to navigate complex environmental challenges and meet the growing market demand for green skills.

This research paper seeks to explore the extent to which architecture education in India has embraced the NEP 2020 framework to integrate sustainability effectively. It investigates how curricula have adapted to include green thinking, the readiness of institutions in implementing these changes, and the alignment of educational outcomes with the evolving expectations of the architecture industry. By analyzing these dimensions, the study aims to identify existing gaps and propose actionable recommendations that support the development of future architects who are not only employable but also champions of sustainable development (Chansomsak, n.d.)

3.4 Employability and Green Skills

The contemporary architecture industry increasingly prioritizes sustainability, requiring professionals who possess specialized green skills that extend beyond traditional design expertise. These green skills include knowledge of sustainable design principles, energy-efficient building techniques, renewable energy integration, environmental impact assessments, and familiarity with green building certification standards such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and GRIHA (Green Rating for Integrated Habitat Assessment).

Employers in the construction and architectural sectors emphasize competencies in digital tools that facilitate sustainable design and analysis, particularly Building Information Modeling (BIM) with sustainability plugins, energy simulation software (e.g., EnergyPlus, Ecotect), and Life Cycle Assessment (LCA) tools. ("Advancing Employability and Green Skills Development," 2013) emphasizes that architecture, like other fields, requires generic green skills to meet the demands of a green economy, including understanding green growth, interpreting environmental legislation, and enhancing energy efficiency, which are essential for employability in this sector.

In addition to technical skills, green architecture promotes environmental awareness and sustainability culture, which are essential skills for employability in architecture. Understanding sustainable practices and local traditions enhances architects' competencies in creating eco-friendly designs, aligning with contemporary industry demands.(Sern et al., 2018)

Recent studies and market analyses reveal a growing demand for 'green architects' who can contribute to sustainable urban development and circular economy models. Green skills enhance employability by equipping individuals with the knowledge and abilities needed for jobs that support environmental sustainability. Upskilling the current workforce and improving awareness of green career paths are essential for meeting the demand in growing sectors.(POST-PN-0711, n.d.)

Green skills are recognized as transferable skills essential for long-term employability. Training in these skills enhances organizational performance, motivates employees to adopt environmentally friendly practices, and aligns with India's National Skill Qualification Framework for sustainable workforce development.(978-981-19-2072-1, n.d.) (Fuchs, 2024) highlights that Green Skills are essential for sustainability transitions, yet there is a research gap regarding their implementation in vocational education and training, which directly impacts employability by equipping individuals with necessary competencies for sustainable practices.

Green skills enhance employability by equipping individuals with the necessary competencies for a low-carbon economy. The integration of these skills into technical and vocational education and training (TVET) programs is essential for fostering a sustainable workforce in the Fourth Industrial Revolution.(Ramli et al., 2018)

3.1 Sustainability in Architecture

Sustainability in architecture is a critical approach aimed at minimizing the environmental impact of buildings while enhancing the quality of life for occupants. This concept encompasses various strategies, materials, and technologies that promote energy efficiency, resource conservation, and ecological balance. Sustainability in architecture, or green architecture, aims to minimize environmental impact through efficient use of materials, energy, and space. It emphasizes ecological conservation and integrates environmentally friendly principles in the design and construction of buildings.(Harindra Syam et al., 2023)

Educational programs worldwide have recognized the need to embed sustainability into architectural curricula to prepare future architects for the challenges of climate change and urbanization. Many institutions incorporate certifications such as LEED (Leadership in Energy and Environmental Design), BREEAM, and WELL Building Standard to familiarize students with recognized green building frameworks and evaluation methods). Additionally Environmental Impact Assessment (EIA) is a process that evaluates the potential environmental effects of proposed projects, ensuring sustainable development by minimizing negative impacts. It is legally recognized in India under the Environment (Protection) Act, 1986, and involves public consultation.(Antil, 2023)

3.2 NEP 2020 Vision Regarding Sustainability

The NEP 2020 envisions integrating sustainable development into education by emphasizing environmental sustainability, economic growth, and social change, aiming to equip students with knowledge and skills for responsible citizenship and addressing global challenges by 2030(Varghese, n.d.). NEP 2020 emphasizes sustainability education, including environmental awareness and ecological responsibility. It aims to integrate sustainable practices into curricula, promoting responsible global citizenship and preparing students to address 21st-century challenges related to sustainable development and social responsibility.(Radha & Arumugam, 2023)

The National Education Policy - 2020 emphasizes sustainability by promoting multidisciplinary academic research, which is essential for quality education. This approach aims to create a robust human resource, fostering economic growth and societal development while inspiring national progress.(Debnath, 2023) NEP 2020 envisions sustainability by aligning education with Sustainable Development Goals, emphasizing quality education as foundational for sustainable development, promoting early childhood education, and integrating technology and multilingual education to enhance accessibility and inclusivity in India's educational system.(B. & N., 2022). NEP 2020 envisions sustainability by aligning educational frameworks with the UN's Sustainable Development Goals, promoting inclusivity, equitable opportunities, and empowering learners to contribute actively to sustainable development, thereby fostering a holistic educational environment conducive to lifelong learning and societal progress.(Tushar Dhar Shukla et al., 2023)



Figure:1 Sustainable Development Goals

Source: (B. & N., 2022)

(Sunita, 2022) In her investigations, she identified the National Education Policy (NEP) 2020, which offers a variety of measures to ensure that educators receive high-quality training and that their workplaces satisfy basic criteria, as well as NEP 2020 thinks that the quality of teacher education, recruiting, deployment, service conditions, and teacher empowerment are critical for educators in order to attract the smartest and brightest pupils, particularly those from neglected rural areas.

3.3 NEP Provisions Relevant to Architecture Education

The National Education Policy (NEP) 2020 includes important provisions for architectural education in India, with the goal of improving quality, flexibility, and employability. The strategy promotes a multidisciplinary approach that incorporates technology and innovative teaching methods to transform architecture education to meet current demands. (Naazea, 2023) discusses the division within the architecture fraternity regarding NEP 2020's inclusion of architectural education, highlighting the Council of Architecture's role and the belief that professional education should remain under the purview of experienced professionals.

The policy also promotes experiential learning, including project-based and community-based learning methods, which are essential for understanding real-world sustainability challenges. Such hands-on approaches help architecture students develop practical skills in using sustainable materials, designing climate-responsive buildings, and engaging with stakeholders in sustainable urban development.

Furthermore, (Kohale et al., 2024) discusses the integration of Competency Based Education (CBE) in architectural education, emphasizing the need for alignment with NEP 2020 provisions, which advocate for holistic learning, skill development, and lifelong learning, essential for modern architectural practices in India.

4. RESEARCH METHODOLOGY

This study employs a **mixed-methods research approach**, combining qualitative and quantitative techniques to comprehensively analyze the integration of sustainability in architecture education within the context of NEP 2020. The methodology is designed to capture both the structural changes in curriculum and the perspectives of key stakeholders—students, educators, and industry professionals—thereby providing a holistic understanding of the current status and future directions.

4.1 Curriculum Analysis

The first phase involves a systematic review and comparative analysis of architecture syllabi from a representative sample of Indian universities and institutions. The analysis covers courses offered both **before and after the introduction of NEP 2020** to identify curricular modifications related to sustainability and green skills. Key parameters analyzed include:

- Inclusion of sustainability topics (e.g., green materials, energy efficiency, climate-responsive design)
- Integration of vocational and skill-based modules (e.g., LEED certification, BIM for sustainability)
- Presence of interdisciplinary or elective courses aligned with environmental goals

4.2 Surveys and Interviews

The second phase engages three groups of stakeholders through structured surveys and semi-structured interviews to gauge perceptions of sustainability integration and the relevance of green skills to employability:

- **Students:** Their awareness, interest, and perceived preparedness in sustainability topics.
- **Faculty Members:** Insights on curriculum development, teaching challenges, and NEP implementation.
- **Industry Professionals:** Expectations for graduate competencies, demand for green skills, and gaps observed in new hires.

Survey data is quantitatively analyzed using descriptive statistics, while qualitative interview responses are coded to identify emerging themes.

4.3 Comparative Study

The third phase involves a detailed comparison of NEP 2020 provisions against actual educational practices and industry requirements. This includes:

- Mapping NEP recommendations (curricular flexibility, interdisciplinary learning, and vocational training) to current curriculum structures.
- Identifying gaps where institutional adoption of NEP guidelines is incomplete or inconsistent.

4.4 Data Visualization

| Skill Area | Confidence Pre-NEP (%) | Confidence Post-NEP (%) |
|---------------------------|------------------------|-------------------------|
| Passive Solar Design | 40 | 70 |
| Green Materials Knowledge | 35 | 65 |
| Energy Modeling | 25 | 60 |
| Environmental Regulations | 30 | 55 |

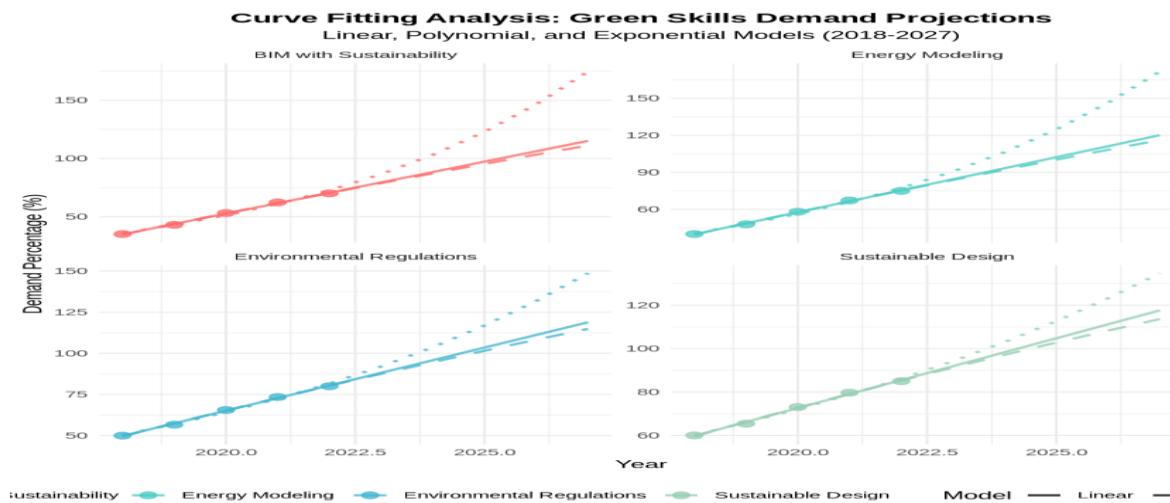
Table 1: Student Confidence in Sustainability Skills (Pre- vs. Post-NEP)

Table 2: Gap Analysis of NEP Provisions vs Current Practice

| NEP Provision | Curriculum Adoption | Industry Alignment | Comments |
|--------------------------------|---------------------|--------------------|--------------------------------|
| Multidisciplinary Learning | Moderate | High | More electives needed |
| Experiential Learning | Low | High | Hands-on projects scarce |
| Vocational Skill-based Courses | Moderate | Moderate | Emerging trend, needs scale-up |

| NEP Provision | Curriculum Adoption | Industry Alignment | Comments |
|------------------------|---------------------|--------------------|-----------------------------------|
| Industry Collaboration | Low | High | Few formal partnerships currently |

Graph 1: Industry Demand for Green Skills Over Last 5 Years



Statistical Significance:

The polynomial curves indicate that green skills demand is not just growing linearly but is actually accelerating over time. This suggests that as sustainability becomes more critical in industry, the rate of demand increase is itself increasing.

The curve analysis provides more nuanced projections than simple linear regression, showing that the growth trajectory may be steeper in future years than historical linear trends would suggest.

Table 3: Employer-Prioritized Green Skills

| Rank | Green Skill | % Employers Prioritizing |
|------|-------------------------------------|--------------------------|
| 1 | Sustainable Building Design | 90% |
| 2 | Energy Efficiency Modeling | 80% |
| 3 | Knowledge of Environmental Policies | 75% |
| 4 | Use of BIM & Digital Tools | 70% |
| 5 | Waste Management Practices | 65% |

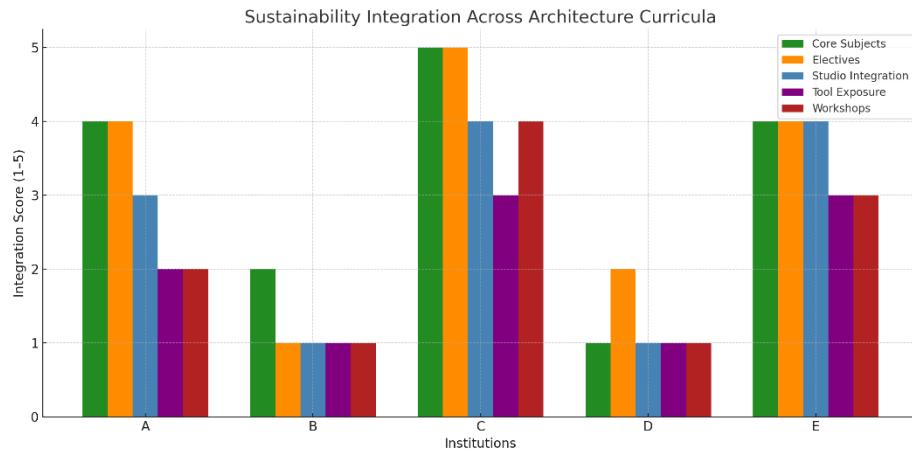
The chart shows that green building and sustainability skills are becoming increasingly important in the job market, with technical skills like BIM tools and policy knowledge also being highly valued.

5. FINDINGS AND DISCUSSION

5.1 Curriculum Comparison

The comparative analysis of architectural curricula across various Indian universities reveals a heterogeneous approach toward embedding sustainability within the academic framework. While post-NEP 2020 syllabi exhibit a noticeable increase in the inclusion of sustainability-related topics such as green technologies, energy-efficient building systems, and environmental ethics, the extent and depth of coverage remain inconsistent. Some institutions have developed comprehensive modules emphasizing climate-responsive design and life-cycle assessment, while others continue to offer limited theoretical exposure with minimal hands-on or project-based learning components.

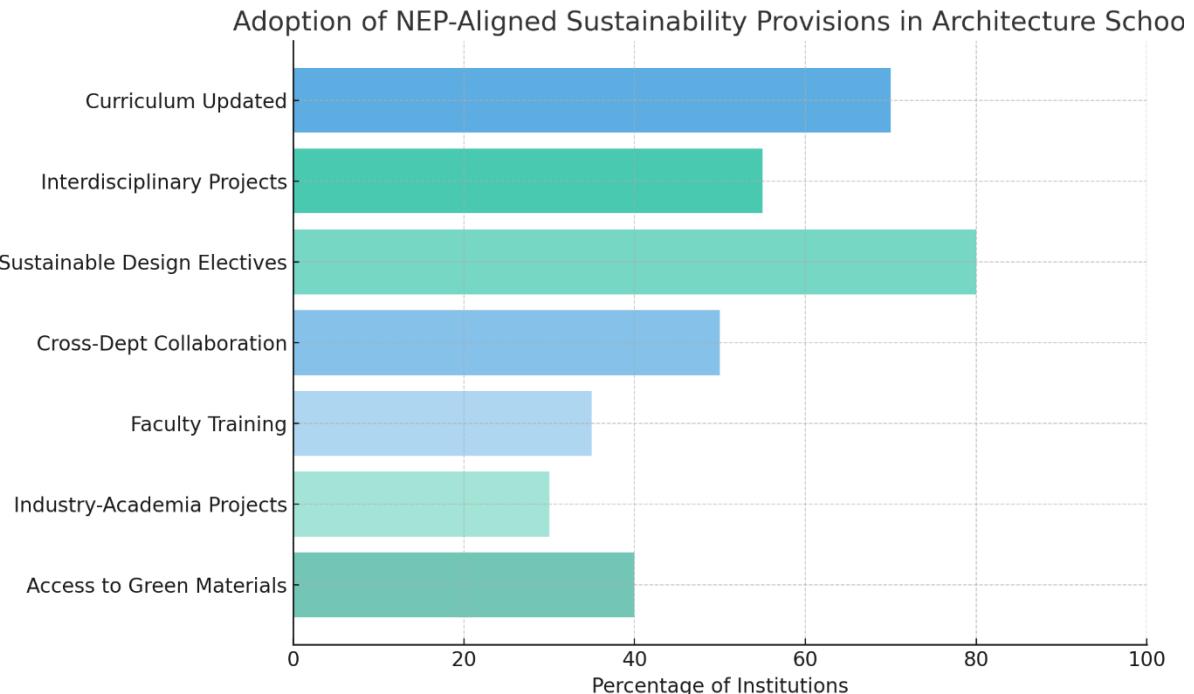
Graph 2: Sustainability Integration across Architecture Curricula for Institutions



The variability in curriculum integration points to the absence of a standardized approach or guideline for sustainability education in architecture, despite NEP's broad directives. Many universities have introduced elective courses focusing on sustainable architecture, green building certifications (e.g., LEED), and smart materials. However, practical exposure through workshops, internships, and real-world case studies is often insufficient, hindering students' ability to apply theoretical knowledge effectively in professional settings.

5.2 NEP Adoption Status

An examination of institutional adoption of NEP provisions reveals a progressive but gradual shift toward the envisioned sustainability framework. Most architecture schools have responded positively by updating curricula, introducing interdisciplinary projects, and encouraging flexible course choices aligned with NEP's emphasis on holistic and experiential learning.



Graph 3: Adoption of NEP-aligned sustainability provisions in Architecture schools

Elective courses on sustainable design principles, green material use, and climate-sensitive architecture are now more common. Additionally, some institutions have started fostering collaboration across departments—linking architecture with environmental science, urban planning, and civil engineering—to promote multidisciplinary learning.

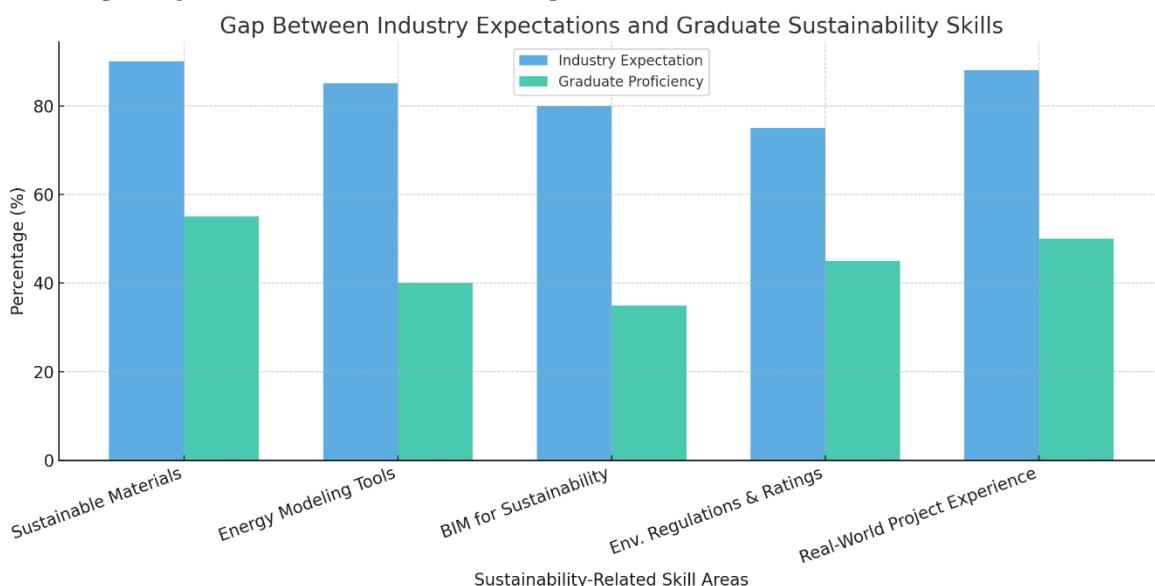
Nonetheless, full integration faces challenges. Resource constraints such as limited access to sustainable materials for practical training, insufficient faculty expertise in emerging green technologies, and the lack

of structured industry-academia partnerships slow the process. Faculty development programs on sustainability education are often lacking, which affects the quality and consistency of delivery.

5.3 Industry Expectations

Feedback from industry professionals underscores the critical gap between academic preparation and practical requirements in the architecture sector, particularly regarding sustainability competencies. Employers emphasize the necessity of graduates being proficient not only in theoretical knowledge but also in hands-on skills, including:

- Practical experience with sustainable and locally sourced building materials.
- Competence in using energy-efficient design and analysis software, such as energy modeling tools and Building Information Modeling (BIM) with sustainability features.
- Awareness of environmental regulations, green certification standards, and policies impacting construction and urban development.



Graph 4: Gap between industry expectations and graduate sustainability skills:

Industry reports and interviews reveal that while new hires often demonstrate solid foundational knowledge, their readiness to engage in complex, real-world sustainable projects is limited due to insufficient exposure during their education. Employers advocate for increased internship opportunities, project-based learning, and stronger collaborations with architectural firms to bridge this gap.

Summary

Overall, the findings reveal promising progress toward integrating sustainability in architecture education post-NEP 2020, yet highlight significant inconsistencies and challenges that need to be addressed. The policy's vision is being gradually translated into curriculum updates and pedagogy reforms, but gaps persist in practical skill development and faculty readiness. Aligning academic output more closely with industry expectations requires focused efforts in experiential learning, resource allocation, and fostering stronger academic-industry partnerships.

6. Role of NEP in Bridging Gaps

The National Education Policy (NEP) 2020 serves as a transformative framework that addresses several longstanding gaps in architecture education, particularly concerning the integration of sustainability and green thinking. By advocating for **interdisciplinary education**, NEP enables architecture students to draw knowledge from related fields such as environmental science, urban planning, and engineering. This multidisciplinary approach is crucial in preparing graduates to tackle complex sustainability challenges, which require holistic and systems-level thinking.

NEP's emphasis on **curricular flexibility** allows institutions to customize their programs to incorporate emerging green technologies, sustainability principles, and skill-based learning modules. This flexibility empowers academic institutions to stay relevant in an evolving professional landscape while embedding sustainability as a core educational value rather than a peripheral topic.

The policy also promotes **experiential and vocational learning**, encouraging hands-on training, real-world projects, and internships in collaboration with industry stakeholders. Such experiential learning is vital for architecture students to develop practical competencies in sustainable design, materials selection, and energy modeling—skills highly sought after by employers.

Moreover, NEP's focus on **research and innovation** supports the continuous advancement of sustainable architectural practices. By incentivizing research aligned with Sustainable Development Goals (SDGs), the policy cultivates a culture of inquiry and innovation that can lead to novel green building techniques, climate-responsive designs, and environmentally friendly urban solutions.

Importantly, NEP fosters stronger **academia-industry partnerships**, which are essential for keeping curricula up-to-date with industry trends and enhancing graduate employability in the green sector. These partnerships enable the co-creation of knowledge, provide platforms for skill exchange, and facilitate the transition from theoretical learning to professional practice.

7. Recommendations

Based on the findings and NEP's vision, several strategic recommendations emerge to accelerate and deepen the integration of sustainability in architecture education:

1. **Standardize Sustainability Modules:** Develop a standardized framework for sustainability education across architecture programs nationwide, making core green design components mandatory. This would ensure consistent coverage of essential topics such as passive design strategies, renewable materials, energy conservation, and environmental ethics.
2. **Faculty Development and Capacity Building:** pedagogical innovations. Building faculty expertise is critical to delivering quality education and mentoring students effectively in emerging sustainability practices.
3. **Strengthen Industry-Academia Collaborations:** Establish formal partnerships with architectural firms, green certification bodies, and construction companies to offer students internships, live projects, site visits, and guest lectures. This collaboration bridges the gap between classroom learning and real-world applications, enhancing employability and practical skill acquisition.
4. **Certification and Skill Training Integration:** Integrate recognized green building certification training programs such as LEED (Leadership in Energy and Environmental Design), GRIHA (Green Rating for Integrated Habitat Assessment), and WELL Building Standards into the curriculum. These certifications add value to student credentials and align academic learning with industry expectations.
5. **Promote Research in Sustainable Architecture:** Encourage student and faculty research initiatives focused on sustainability challenges in the built environment. Linking research with the United Nations' SDGs can drive innovation and generate context-specific solutions to India's environmental and urbanization issues.
6. **Enhance Digital Literacy in Sustainability Tools:** Incorporate training on digital design and analysis tools essential for sustainable architecture, such as Building Information Modeling (BIM) with sustainability plugins, energy simulation software (e.g., EnergyPlus, Ecotect), and life-cycle assessment tools. Proficiency in these tools is increasingly critical for green design and project execution.
7. **Expand Experiential Learning Opportunities:** Embed hands-on workshops, design studios focused on sustainability, and community-based projects that allow students to engage with real environmental challenges. This practical exposure nurtures critical thinking and problem-solving skills necessary for sustainable architectural practice.

8. CONCLUSION

The integration of sustainability into architecture education is no longer optional but imperative for addressing the urgent environmental challenges of the 21st century, including climate change, resource depletion, and urban pollution. The National Education Policy 2020 offers a visionary and strategic framework to embed sustainability comprehensively through multidisciplinary learning, curricular flexibility, and skill-based approaches.

This research demonstrates that while significant strides have been made in incorporating sustainability topics post-NEP, there remains considerable variability in the depth and effectiveness of implementation

across institutions. Practical exposure and faculty preparedness are identified as critical gaps that impede the full realization of NEP's sustainability goals in architectural education.

To prepare future architects capable of designing eco-friendly, resilient, and socially responsible built environments, continuous efforts must be made to standardize curricula, enhance faculty expertise, and foster strong linkages with industry. Embracing digital tools, certification programs, and research aligned with sustainable development will further equip graduates with the green skills essential for employability in a rapidly evolving global marketplace.

In essence, NEP 2020 is a catalyst that can transform architecture education into a driver of sustainable development, ensuring that future professionals not only respond to environmental challenges but actively lead the transition toward greener, healthier, and more sustainable built environments.

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