



Credit Mobility and Pedagogical Barriers of Engineering Institutions in NEP 2020 Implementation

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Abstract

The National Education Policy (NEP) 2020 envisions a paradigm shift in Indian higher education, promoting flexibility, interdisciplinarity, and learner-centric approaches. Despite its progressive framework, engineering education faces several barriers that hinder effective implementation. This paper critically examines systemic and pedagogical challenges impeding the realization of NEP 2020 within technical institutions. Central to these issues are rigidity in course delivery and semester-based time constraints, which restrict innovation and limit opportunities for holistic learning. Credit mobility remains constrained by incompatible frameworks across universities, while the rigidity of disciplinary structures undermines interdisciplinarity. Furthermore, the operationalization of the Academic Credit Bank faces practical challenges, including misalignment in evaluation standards and lack of institutional readiness. Resistance from faculty, rooted in entrenched pedagogical practices and apprehension toward change, further complicates reforms. The demand for a pedagogical shift toward outcome-based and technology-enabled teaching underscores the urgency of sustained faculty development initiatives. Without adequate training and support systems, educators remain unequipped to align with NEP's vision. The study argues that addressing these barriers requires systemic reform, capacity building, and the development of robust frameworks for credit mobility and interdisciplinarity. Strengthening faculty development and pedagogical innovation is critical to ensuring the transformative potential of NEP 2020 in engineering education.

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Introduction:

The National Education Policy (NEP) 2020, which was endorsed by the Government of India following over three decades of policy inaction, is a paradigm shift in the country's vision and operationalization of education. The policy seeks to make Indian education more multidisciplinary, holistic, skill-based, and globally competitive. Focused on flexibility, creativity, and output-based learning, the policy places special focus on restructuring higher education as a whole, including professional programs such as engineering (Murali, 2023). As noted by The Times of India (2020), NEP 2020 aims to democratize access to high-quality education and make India a knowledge superpower during the 21st century. This implies a shift from memorization to idea-based understanding, from disciplinary isolation to unified systems of knowledge, and from fixed program structures to flexible, student-focused models. The policy suggests the launch of a four-year multidisciplinary undergraduate course, flexible curricular designs, many exit-entry points, Academic Bank of Credits (ABC), and expanded use of online and digital platforms like SWAYAM and DIKSHA. These reforms have particular significance for engineering education that occupies the interface of science, technology, and economic growth.

Engineering Education in the National Development Agenda:

Engineering education in India is not just a subset of technical training; it is a force for national innovation, industrial growth, and economic resilience. India has over 3,500 engineering institutions graduating more than 15 lakh students each year, as estimated by the All-India Council for Technical Education (AICTE). Yet the employability of such graduates is still a major concern. National Employability Report studies by Aspiring Minds (2019) indicate that merely 20% of the engineering graduates are employable in the knowledge economy, particularly in fields demanding high-level cognitive and problem-solving skills.

NEP 2020 itself is a response to this relevance crisis in engineering education. It promotes outcome-based education, incorporation of 21st-century skills (critical thinking, communication, creativity), and increased industry-academia linkages (Murali, 2024). It also stresses the incorporation of new technologies like Artificial Intelligence, Robotics, and Internet of Things into the curriculum. These changes, if implemented efficaciously, can bring engineering education back on track with the changing needs of Industry 4.0 and the world knowledge economy. In addition, future engineering graduates must be prepared to drive India's socio-economic solutions for challenges ranging from climate resilience and sustainable infrastructure to digital government and rural development. Therefore, reinventing engineering education according to NEP is not merely an educational requirement—it is a nation's call to action.

Purpose and Structure of the Paper While the NEP has potential for revolutionary change, its successful applicability in engineering education is beset by a multitude of complex issues. Most of the engineering colleges, particularly in rural and semi-urban locations, have been teaching under outdated pedagogical paradigms and infrastructural limitations. Untrained staff is often found at the faculty level with respect to contemporary pedagogy; interdisciplinarity continues to be more of an aspiration than a reality; and computing infrastructure required for blended learning is heterogeneously deployed. In addition, institutional resistance and inertia, especially among senior administrators and faculty members, further hinder reform.

This paper seeks to critically analyze the various obstacles faced by engineering institutions in the process of implementing NEP 2020. It shall discuss major areas of concern such as curriculum redesigning, faculty development, infrastructure upgradation, and the challenge of promoting interdisciplinarity and digitalization.

Concurrently, the paper will also elucidate the possibility offered by NEP's adaptive framework. This consists of pedagogic innovations, increased access to education, and improved industry-relevance. Based on both policy reports and institutional practices, it will outline real-world strategies for executing reforms in engineering education.

Major Barriers

The paper focuses on major barriers, which list and examine structural, pedagogical and institutional issues. Through discussion of these dimensions, the paper adds to the emerging literature and policy debate around the NEP and seeks to function as a resource for educators, administrators, and policymakers engaged in reimagining engineering education in India.

Curriculum and Credit Mobility

A foundation of the National Education Policy (NEP) 2020 is its focus on flexibility, interdisciplinary, and student-oriented learning. The policy seeks to leave behind inflexible, isolated structures that have long characterized Indian higher education, especially in engineering. It suggests a transition towards multidisciplinary courses, varied exit-entry routes, and establishing an Academic Bank of Credits (ABC) to facilitate academic mobility. Although this vision is bold and revolutionary, its application in engineering education is confronted by huge structural and institutional resistance.

Rigidity of Disciplinary Structures

Indian engineering education has traditionally been tied to tightly specialized, discipline specific curricula, fuelled by rigorous regulatory environments and inheritance models focusing on technical depth and not on overall education. Undergraduate engineering programs have been locked into rigid credit loads, generic courses, and minimal electives out of the core field for decades. This stiffness is in clear opposition to NEP 2020's thrust for multidisciplinary and modular pedagogy. As per Tuscola (2022), the NEP aims at a flexible credit system that will enable students to pick courses from any discipline and institution, promoting integrated learning and wider intellectual exposure. A mechanical

engineering student, for instance, should, through NEP's structure, be able to pursue electives in environmental ethics, public policy, or digital humanities. This is likely to encourage imagination, ethical thought, communication skills, and socio-technical literacy, all of which 21st-century engineers need. Yet, the conventional engineering course of study in India remains largely credit-locked and disciplinary. Most institutions are not organized to provide cross-listed courses or facilitate inter-departmental work. Most engineering colleges, particularly outside of elite institutions such as the IITs or NITs, do not possess faculty trained across disciplines or facilities to implement liberal arts or management modules. Further, program structures standardized by organizations such as the AICTE have traditionally stressed technical specialization that has reinforced academic silos and limited curriculum reform. The rigidity in course delivery, semester-based time constraints, and sequential prerequisite courses makes it challenging to initiate new-generation programs that cross departmental lines (e.g., Artificial Intelligence courses for Civil Engineering students or Sustainable Design for Computer Science students). The rigidity eventually limits students' capacity to create their own learning path and hampers the cultivation of multi-disciplinary thinking, which NEP 2020 aims to consolidate.

Academic Credit Bank and Mobility

One of the greatest innovations brought about by NEP 2020 is the Academic Bank of Credits (ABC), a centralized digital vault to house academic credits acquired by students from various institutions and subject areas. The ABC is aimed to enable horizontal and vertical mobility, enabling learners to accrue and transfer credits smoothly between institutions and programs. Students can leave and rejoin academic programs with acquired credits retained, enabling lifelong learning and greater access to education. Although the policy framework for ABC is in place—supported by digital platforms such as Digi Locker and led by the University Grants Commission (UGC) and National e-Governance Division (Negad)—the ground-level implementation is extremely fragmented. According to Tuscola (2022), an overwhelming majority of Indian engineering colleges do not have the requisite Enterprise Resource Planning (ERP) infrastructure or credit management systems to properly integrate with the ABC framework. In addition, the majority of colleges and universities continue to utilize non-standardized assessment methodologies, incompatible credit infrastructures, and hand-grading entry systems. Such variation renders interoperability challenging and vitiates the credit transfer system integrity. Small-scale institutions, especially those found in semi-urban or rural regions, are hindered by logistical and cost constraints to replace their systems. Even when ERP suites are implemented, administrative personnel and faculty members go untrained on leveraging them for credit mobility initiatives.

In addition, the freedom to innovate or quickly move to address new regulatory requirements is hindered in many affiliated colleges due to the absence of autonomy. State universities and their affiliated colleges are bound by stiff, centralized mandates that restrict their move to implement credit

mobility measures. This creates a system-wide delay to adopt ABC, thus impeding NEP's vision of developing a learner-focused, dynamic educational environment.

Faculty and Regulatory Body Resistance

Outside of technical and infrastructural limitations, among the more abstract but deeply entrenched obstacles to curriculum and mobility reform is resistance on the part of faculty members and institutional overseers. Faculty see these reforms as disruptive or threatening to established teaching, research, and faculty autonomy status. Traditional syllabi and lectures provide a measure of comfort, structure, and predictability, which many educators are hesitant to relinquish. In addition to this, there lies a serious concern with professors, working specifically in the classical engineering institutions. They are concerned about their ability to teach interdisciplinary or liberal education courses. Most have not been adequately trained and exposed to new teaching methodologies, are not trained in new disciplines such as data science or engineering ethics, and worry that interdisciplinary teaching can weaken their field knowledge or assessment credibility. While suggesting a practical solution to this problem, Kashinath (2025) mentioned that teachers are to be trained in the aspects of language, culture, society to cultivate aptitude to understand, learn and appreciate inter and multi-disciplinary courses. In addition, academic administrators and the regulatory agencies have traditionally worked in bureaucratic silos where changes to the curriculum involve several layers of approval from university boards, affiliating bodies, and accrediting agencies. Such a bureaucratic inertia hinders innovation and a culture of risk aversion where institutions are hesitant to test novel experiments on new credit design, course integration, or inter-institutional collaboration. While referring to challenges and pitfalls of the NEP-2020 document, Govinda (2020) mentioned that it is an idealized and ambitious document aiming at transform the system which has been built so far and start afresh. Further, such decisions and policies create fear and discomfort among the institutional leaders who are fear of change due to compliance, resource, and faculty resistance concerns. Lack of implementation guidelines, a lack of adequate change management training, and the absence of faculty incentives to adopt reform make the challenge even more complex.

Also, accrediting agencies such as NAAC or NBA, though in accordance with NEP in spirit, tend to evaluate institutions on conventional measures of quality—staff-to-student ratios, publication output, infrastructure, etc.—and not on flexibility of curriculum, interdisciplinary learning, or credit mobility. This incongruence dissuades institutions from adopting nonconventional approaches, even when NEP promotes it.

Faculty Development and Pedagogical Shift At the heart of NEP 2020's vision is a paradigmatic move away from rote-based, lecture-focused teaching to experiential, student-focused, and interdisciplinary learning. This move is necessary to prepare students to develop the creative, analytical, and socio-emotional skills needed for the 21st century through effective strategies to ensure active participation of the students (Chaitanya & Reddy, 2022). In the context of engineering education in India, though,

this move is met with strong structural and cultural barriers. One of the most enduring obstacles are the deep-seated legacy of rote learning, insufficient training infrastructure, and lack of academic leadership able to deal with change.

Referring to the similar context, Chaitanya (2024) emphasized on the essence of imparting training in the latest technological aids to contribute to teachers' professional development, academic leadership and positive transformation in their professions. While speaking about the pedagogical shift, Sharma (2020) mentioned that NEP-2020 brings substantial and notable changes in the pedagogical structure of the curriculum without any rigid separation between various streams and courses.

Conclusion

The successful implementation of NEP 2020 in engineering education depends on overcoming systemic and pedagogical barriers that constrain its transformative potential. Rigid disciplinary structures, semester-bound delivery, and incompatible credit frameworks restrict the envisioned flexibility and interdisciplinarity. Similarly, the challenges surrounding the Academic Credit Bank, along with limited faculty preparedness and resistance to pedagogical change, slow the pace of reform. Addressing these obstacles requires coordinated institutional support, robust faculty development programs, and policy alignment across accreditation and governance structures. Only through such systemic reform can engineering education fully realize NEP 2020's vision of a flexible, inclusive, and future-ready ecosystem.

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