An International Multidisciplinary Journal
अनन्यशास्त्रम्
(A Unique Treatise of Knowledge)
ISSN:3049-3927 (Online)
Volume: 01 | Issue: 03 | December: 2025
Research Article

ANANYAŚĀSTRAM:
An International Multidisciplinary Journal
(A Unique Treatise of Knowledge)
Peer-Reviewed | Refereed | Open Access Journal
DOI: https://doi.org/10.64328/aimjv01i030017

From Policy to Practice: Interdisciplinary and Industry Barriers in NEP 2020

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Abstract

The National Education Policy (NEP) 2020 envisions a transformative approach to higher education in India, emphasizing interdisciplinarity, outcome-based learning, and stronger industry-academia collaboration. In engineering education, however, multiple barriers impede its effective implementation. This paper critically examines the challenges associated with interdisciplinary integration and professional competency development. Departmental silos restrict collaborative teaching and research, limiting students' exposure to interdisciplinary perspectives and real-world problem-solving. Weak linkages between industry and academia further undermine opportunities for experiential learning, internships, and skill-aligned curriculum design. Assessment practices and accreditation frameworks, traditionally oriented toward theoretical knowledge, remain misaligned with the competency-based, outcome-focused paradigm promoted by NEP 2020. Conventional evaluation methods often fail to capture students' professional competencies, critical thinking, and practical application skills. Integrating industry-relevant competencies into curriculum and assessment processes requires structural reform, robust faculty development, and institutional commitment. By highlighting these barriers, the study emphasizes the need for policy-driven initiatives to foster interdisciplinary collaboration, strengthen industry partnerships, and realign assessment and accreditation mechanisms with professional and outcome-based learning goals. Addressing these challenges is crucial for developing a skilled, adaptable, and industry-ready engineering workforce, thereby enabling NEP 2020's vision of flexible, holistic, and future-oriented technical education.

Keywords: NEP 2020, Engineering Education, Industry–Academia Linkages, Interdisciplinary Learning, Outcome-Based Education.

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Introduction

The National Education Policy (NEP) 2020 envisions a transformative framework for Indian higher education, promoting interdisciplinary learning, outcome-based education (OBE), and stronger linkages with industry. In engineering education, these reforms aim to develop adaptable, skilled, and industry-ready graduates capable of addressing complex, real-world problems. However, effective implementation faces significant barriers. Departmental silos hinder interdisciplinary collaboration, restricting opportunities for cross-functional teaching, research, and problem-solving. Weak industry–academia linkages limit students' exposure to professional practices, internships, and competency-driven experiences. Conventional assessment methods and accreditation frameworks often emphasize theoretical knowledge over practical and professional competencies, creating misalignment with OBE and competency-based education principles. Integrating industry-relevant skills into curriculum, pedagogy, and assessment requires structural, administrative, and faculty capacity enhancements. Additionally, institutional inertia and resistance to curricular reforms further slow the adoption of interdisciplinary approaches. This paper critically examines these systemic challenges, highlighting the urgent need for policy alignment, strengthened industry partnerships, and innovative pedagogical practices. Addressing these barriers is essential to realizing NEP 2020's vision of flexible, holistic, and future-ready engineering education that bridges academic learning with professional competence.

Review of Literature

Interdisciplinary and Industry Collaboration Challenges:

The NEP 2020 sees higher education institutions as interdisciplinary knowledge sites that bust conventional academic silos and have rigorous partnership with industry. For the case of engineering institutions, it means developing flexible, cross-cutting curricula that enable students to blend core engineering with disciplines like humanities, design, economics, AI, sustainability, and entrepreneurship. At the same time, it requires intense integration with industry via collaborative curriculum development, internships, apprenticeships, and live projects.

But making this vision a reality is hindered by ingrained problems of institutional culture, governance, and ecosystem interconnections. Non-metro engineering colleges continue to work under inefficient academic paradigms that value disciplinary purity, faintly collaborate with industry, and provide insufficient space for students to adapt learning to new employment markets.

Breaking Departmental Silos:

One of the biggest hurdles in the way of interdisciplinary education in engineering schools is the persistence of narrow departmental identities. While NEP 2020 motivates flexible major- minor combinations that incorporate combinations such as Mechanical Engineering with Design Thinking or Computer Science with

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Philosophy of Ethics, most colleges do not have the curriculum planning, academic organization, and institutional freedom necessary to institutionalize such combinations.

As noted by TruScholar and India Education Forum, Indian engineering departments tend to exist as independent silos with little coordination or co-development of the curriculum across departments. The faculty are hardly cross-trained to teach or mentor beyond their core areas, and most timetables and credit systems are Linear, discipline-bound progression oriented.

Furthermore, institutional regulations involving course approvals, credit transfer, and faculty deployment tend to be unfavourable towards interdisciplinary flexibility. Even when a student shows interest in pursuing a design course from the Architecture department or a policy module from Humanities, institutional logistics such as overlap of timetables, non- recognition of credits, or administrative hurdles tend to nip the effort at the bud.

Resistances also exist among department chairs and senior faculty who view multidisciplinary courses as a threat to disciplinary depth or academic territory. This results in curriculum innovation being isolated and NEP's multidisciplinary intention on paper in most institutions.

In addition, university affiliations that have command over the syllabus of scores of engineering colleges in India are usually reluctant to implement cross-disciplinary paradigms.

Mandatory scholastic reforms like flexible electives, open credit systems, and institutional credit banks do not exist or are dispersedly prevalent.

Research Methodology

This study employs qualitative method and the secondary data is collected from NEP 2020 related documents such as research articles, educational reports , policy review and literature review to study reforms for engineering education. This collected data is analysed by identifying main themes such as Weak Industry-Academia Linkages, Skill Alignment Disconnects with Emerging Sectors, Assessment, Accreditation & Outcome-Based Education, Competency-based vs Traditional Assessment Accreditation Realignment and Professional Competency Integration and etc. It critically analyses the various obstacles faced by engineering institutions in the process of implementing NEP 2020.

Results / Findings

Weak Industry-Academia Linkages:

The gap between industry and engineering colleges has haunted Indian technical education for a long time. Regardless of frequent policy initiatives, the majority of engineering colleges are unable to develop sustained, formal relationships with the private sector. NEP 2020 focuses on collective curriculum design, co-

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programmed courses, live industrial projects, and mandatory internships. Yet, the conversion of these objectives into institutional practices is inconsistent and incomplete.

Fewer than 25% of India's engineering colleges have functional MoUs with industry that lead to significant academic or research involvement, as per IJABS and The Times of India. Most existing collaborations are symbolic and are used for fulfilling accreditation requirements such as NAAC or NBA, and not embedded in pedagogy or curriculum.

The Multi-fold Reasons:

Curricula are seldom co-developed with industry and thus become stodgy, irrelevant syllabi that ignore contemporary technological developments or the needs of employers. Models of internships are inadequately coordinated, frequently being boiled down to clerical or observer roles that have limited pedagogical content.

Faculty-industry interactions are minimal, and institutions do not have full-time industry liaison officers or placement officers who can keep dialogue channels open with industrial collaborators. Regulatory inflexibilities, including procurement regulations, do not enable colleges to invite guest industry experts, co-operate on joint labs, or exchange IP resulting from projects.

Even where industry is keen to collaborate, the absence of mutual comprehension and shared vocabulary among business and academia usually holds back the process. Universities cannot describe their research capacities or innovation potential in a manner that resonates with industry, while firms realize university schedules and reward mechanisms ill-suited to business interests. Thus, engineering graduates tend to be short of exposure to actual problems of the world, and the institutional pipeline to startups, patents, or translational R&D is underutilized.

Skill Alignment Disconnects with Emerging Sectors:

NEP 2020 focuses on education relevant to employment, especially through incorporation of emerging fields such as Artificial Intelligence, Semiconductor Technology, Green Energy, Industry 4.0,

Smart Cities, and Sustainable Infrastructure. But the majority of engineering courses and faculty skills continue to be out of sync with the needs of these fast-changing industries.

In a report by The Times of India, there is a serious gap between industry demand and graduate competence. For instance: Semiconductor fabrication, a high-priority sector for India's Atmanirbhar Bharat vision, needs people with expertise in nanofabrication, VLSI design, and cleanroom procedure— capacities rarely imparted in most ECE departments.

AI and Data Science demand knowledge of Python, machine learning frameworks, and data analytics—all of which are often introduced late or superficially in traditional CS syllabi. Sustainability and climate engineering

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involve interdisciplinary themes (policy, design, systems thinking) that are largely missing from conventional engineering pedagogy.

Additionally, soft skills like communication, teamwork, creative problem-solving, and adaptability—which employers consistently highlight—are rarely cultivated in engineering classrooms focused on exams and textbook content.

Another facet of the issue is in assessment practices. The vast majority of engineering colleges still focus on mechanical, rote-based assessments even in final year projects or industry-related courses. There is limited scope for design-thinking pedagogy, open-ended problem-solving, or cross-functional teamwork, which are key to the 21st-century work environment. Consequently, employers usually complain that new graduates in engineering are "not job- ready" and need to be retrained for 6–12 months before they can contribute. Not only does this decrease employability, but it also expands the trust difference between industry and academia.

Assessment, Accreditation & Outcome-Based Education:

The foundational direction of reform under the National Education Policy (NEP) 2020 includes the paradigm change from input-oriented to outcome-based education (OBE) with an inherent focus on holistic, formative, and competency-based evaluation practices. In this way, education is aligned to the needs of the world through quantification of not only retention of content but also application, problem-solving skills, communication, ethical thinking, and collaboration. For the engineering education system of India, this transition means profound changes in the approach to assessment, quality assurance systems, and curriculum development.

Although policy papers and national regulative agencies support these reforms, institutional ecosystems tasked with delivering them—particularly tier-2 and tier-3 engineering colleges— face capacity, cultural resistance, and regulatory ambiguity. Three essential issues that engineering institutions must resolve in accepting the NEP-directed reforms in assessment, accreditation, and professional skill development are the subject matter of this section.

Competency-based vs Traditional Assessment:

Most urgent among these challenges is the culture of high-stakes, summative assessments that pervasively dominate evaluation models in the majority of India's engineering colleges. Students are generally evaluated through final examinations that place disproportionate emphasis on memorization, mechanical solution-finding, and formulaic responses. These tests tend to be rigid, syllabus-driven, and detached from industry or societal applications.

Competency-based assessment, advocated by NEP 2020, on the other hand, emphasizes continuous and multi-modal assessment through:

Formative evaluations (quizzes, class discussions, reflective writing),

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Project-based evaluations (live problem-solving, design tasks), Peer and self-evaluation (collaborative reviews),

Portfolio submissions (cumulative evidence of learning), Capstone and interdisciplinary projects

Scaling these is a knotty challenge. According to TruScholar and other education technology think tanks, the majority of institutions do not have:

Faculty who have been trained to construct alternative assessments,

Rubrics or grading tools for soft or experiential learning,

Digital platforms for managing portfolios or continuous assessment,

Institutional openness to moving away from exam-based cultures

Additionally, uniformity, objectivity, and accreditation concerns prompt most colleges to hold on to traditional tests despite the addition of projects or internships into syllabi. This creates hybrid models which compromise both methods—projects are there, but are graded loosely and without prescribed rubrics; exams remain to dictate the final grade.

Finally, given India's scale of engineering education—with lakhs of students and thousands of faculty—standardizing and scaling competency-based assessment across institutions poses serious logistical and quality assurance challenges.

Discussion / Analysis

Accreditation Realignment:

Accreditation within India's higher education sector is presently witnessing a giant transition. Conventional organizations such as NAAC (National Assessment and Accreditation Council) and NBA (National Board of Accreditation) are being reorganized in line with the new NEP directives, through the suggested establishment of HECI (Higher Education Commission of India) and its verticals as NHERC (National Higher Education Regulatory Council) and NAC (National Accreditation Council).

Within the NEP 2020 vision, the new regulatory environment is anticipated to:

- Encourage autonomy for high-performing institutions,
- Be based on transparent, outcomes-based standards,
- Reward diversity, interdisciplinarity, and innovation,
- Promote digitally enabled quality assurance.

While these objectives are forward-looking, the transition period has brought uncertainty and insecurity to engineering colleges. As Wikipedia and scholarly commentaries observe, most colleges remain unsure of:

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- What specific new quality standards will be mandated,
- How old accreditations (NAAC, NBA) will find a place in the future system,
- What the contribution of external benchmarking agencies (e.g., QS, NIRF) will be,
- How institutional governance, documentation, and outcome reporting will be assessed.

Smaller colleges usually function with restricted administrative and documentation capability, and it becomes challenging to get ready for such changing accreditation forms. Most faculties are still unaware of Program Outcomes (POs), Course Outcomes (COs), and Graduate Attributes, which are principal measures employed in outcome-based accreditation. Internal Quality Assurance Cells (IQACs), although mandated, are under-resourced or procedural in most institutions.

In consequence, compliance is then superficial—colleges tend to 'complete forms' without genuine reform in teaching, learning, or institutional vision. This lack of congruence between policy expectation and ground implementation can undermine the credibility of the entire OBE-accreditation nexus.

Professional Competency Integration:

Another imperative charge of NEP 2020 is the embedding of transversal skills like leadership, communication, teamwork, ethics, global awareness, and lifelong learning both in curriculum and in assessment. Engineering education that has long been technical-depth oriented is being redirected toward building graduates who are better prepared for complex, multi-faceted roles in society and industry.

Yet, integrating such capabilities into core engineering education is currently in an embryonic phase, according to The Times of India and IJABS. Some of the challenges are:

No separate courses or modules: Colleges fail to provide systematic learning of communication, entrepreneurship, or design thinking. When taught, they are usually extracurricular or nominal.

Faculty unease or incompetence: Faculty in engineering, normally educated in technical areas, may be poorly trained or not confident in teaching leadership, ethics, or socio-cultural sensitivity.

Ambiguity of assessment: It is hard to measure soft skills through traditional tests. It is challenging for institutions to build sound rubrics to assess emotional intelligence, teamwork, or reflective ability.

Lack of institutional focus: Even if incorporated into vision statements or graduate attribute sets, the soft skills are seldom accorded a sense of urgency in faculty workload plans, time tables, or reward schemes.

In addition, such competencies are rarely aligned with actual learning outcomes or accreditation standards, leading to disjointed application. Although a few top-tier institutions and independent colleges have begun incorporating Design Your Life modules, communications labs, or ethics case discussions, these are hardly commonplace.

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Without embedding soft skill development into the core teaching-learning process—with dedicated time, qualified mentors, peer evaluation, and real-world exposure—the goals of NEP will remain aspirational. Engineering graduates may continue to struggle with professional contexts where emotional intelligence, cross-cultural negotiation, or ethical dilemmas are central.

Conclusion:

Effective implementation of NEP 2020 in engineering education requires overcoming departmental silos, weak industry linkages, and misaligned assessment systems. Strengthening interdisciplinary collaboration, integrating professional competencies, and aligning accreditation with outcome-based education are critical. Institutional commitment, faculty capacity building, and robust industry partnerships are essential to develop skilled, adaptable, and industry-ready engineers. Addressing these barriers will enable the realization of NEP 2020's vision of flexible, holistic, and future-oriented engineering education.

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