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TRANSFORMING PHARMACY EDUCATION IN INDIA: A CRITICAL REVIEW OF THE NEW B.PHARM CURRICULUM (2026) UNDER THE NATIONAL EDUCATION POLICY 2020

Hemant Kumar Sharma

ABSTRACT

The Bachelor of Pharmacy (B.Pharm) programme in India is undergoing a major curricular transformation with the introduction of the revised Pharmacy Council of India (PCI) curriculum aligned with the National Education Policy (NEP) 2020. The revised curriculum is intended for implementation from the academic session 2026–27 and introduces a broader competency-oriented approach to pharmacy education. This review critically examines the structure, emerging domains, educational philosophy, opportunities, and implementation challenges associated with the revised curriculum. Particular attention is given to the integration of Python programming, pharmaceutical data analytics, machine learning, artificial intelligence, healthcare psychology, communication skills, innovation and entrepreneurship, pharmacovigilance, regulatory affairs, research methodology, internships, and contemporary pharmaceutical technologies. The curriculum represents a transition from predominantly discipline-centred learning towards a more interdisciplinary, technology-enabled, experiential, and competency-oriented model. Such a transition is consistent with international developments in competency-based pharmacy education and the increasing digitalisation of healthcare. However, effective implementation will require faculty development, infrastructure strengthening, curriculum mapping, appropriate assessment strategies, industry and hospital partnerships, and institutional quality assurance. The revised curriculum provides a strong foundation for preparing future pharmacists for pharmaceutical industry, clinical practice, research, regulatory science, public health, and digital healthcare. Continuous monitoring and outcome-based evaluation will be essential to determine whether the intended curricular reforms translate into measurable improvements in graduate competence and employability.

Key words: B.Pharm curriculum; NEP 2020; pharmacy education; competency-based education; artificial intelligence; pharmaceutical education

1 INTRODUCTION

Pharmacy is a rapidly evolving healthcare and scientific profession. Advances in pharmaceutical biotechnology, precision medicine, pharmacovigilance, digital health, artificial intelligence (AI), data science, automation, regulatory science, and patient-centred care have substantially expanded the competencies expected from contemporary pharmacists. Consequently, pharmacy education can no longer remain restricted to conventional disciplinary knowledge. Graduates increasingly require scientific knowledge combined with communication, analytical, digital, clinical, research, ethical, entrepreneurial, and lifelong-learning competencies. The National Education Policy (NEP) 2020 provides a broad framework for transforming higher education in India. It emphasises multidisciplinary and holistic education, flexibility in curricular structures, conceptual understanding, critical thinking, creativity, communication, technology-enabled learning, research, internships, community engagement, and employability [1]. Within this changing educational environment, the Pharmacy Council of India (PCI) has introduced a revised Bachelor of Pharmacy curriculum as per NEP 2020.

The official PCI website identifies the document as the B.Pharm Syllabus (2026) as per NEP 2020, and PCI has issued a specific implementation notice for approved institutions and examining authorities for the academic session 2026–27 [2,3]. The revised programme retains the fundamental pharmaceutical sciences while introducing contemporary domains. The curriculum incorporates computational and data-oriented learning, innovation and entrepreneurship, artificial intelligence, pharmacovigilance, regulatory affairs, research methodology, communication, and experiential learning [2]. This review therefore examines the 2026 B.Pharm curriculum from an educational and professional perspective, with particular emphasis on its alignment with NEP 2020, technological integration, experiential learning, research orientation, employability, and implementation requirements.

2 OBJECTIVE OF THE REVIEW

The primary objective of this review is to critically evaluate the revised B.Pharm curriculum
introduced by PCI in 2026 under the framework of NEP 2020.
The specific objectives are:

1. To examine the major structural and philosophical changes introduced in the revised curriculum.
2. To identify emerging areas incorporated into B.Pharm education.
3. To evaluate the integration of digital technologies, AI, data analytics, and machine learning.
4. To examine the emphasis on research, innovation, entrepreneurship, clinical practice, and regulatory sciences.
5. To identify potential benefits and implementation challenges.
6. To propose recommendations for effective institutional implementation and continuous curriculum improvement.

3 REVIEW METHODOLOGY

A narrative critical review methodology was adopted. The review was based primarily on the official PCI B.Pharm 2026 syllabus and implementation documents, the NEP 2020 policy framework, and peer-reviewed literature concerning competency-based pharmacy education, artificial intelligence, digital transformation, and contemporary pharmacy education. Electronic literature was identified using PubMed, Scopus-indexed literature available through scholarly databases, ScienceDirect, SpringerLink, and relevant official websites. Search terms included combinations of “B.Pharm curriculum”, “pharmacy education”, “NEP 2020”, “competency-based pharmacy education”, “artificial intelligence in pharmacy education”, “machine learning”, “digital health”, “pharmacy curriculum reform”, “pharmaceutical education”, and “pharmacy employability”. Priority was given to recent publications and authoritative policy documents. The PCI 2026 syllabus was treated as the primary source for curriculum-specific analysis. The literature was thematically synthesised under the following domains: curriculum structure and flexibility; competency-based education; digital and computational skills; clinical and experiential learning; research and innovation; entrepreneurship; professional and regulatory competencies; faculty and infrastructure requirements; and employability and future readiness. Because this article is a critical narrative review rather than a systematic review with meta-analysis, quantitative pooling of educational outcomes was not undertaken.

4 EVOLUTION OF PHARMACY EDUCATION TOWARDS COMPETENCY-BASED LEARNING

Traditional pharmacy education has largely been organised around pharmaceutical disciplines such as pharmaceutics, pharmaceutical chemistry, pharmacology, pharmacognosy, pharmaceutical analysis, and pharmacy practice. These disciplines remain essential because they establish the scientific foundation required for pharmaceutical practice. However, contemporary pharmacy practice requires integration across disciplines. A pharmacist working in a hospital, pharmaceutical company, regulatory organisation, research institution, or public-health programme must apply knowledge from multiple domains simultaneously. The movement towards competency-based education addresses this requirement. Competency-based pharmacy education focuses not only on what students know but also on what they can demonstrate through appropriate knowledge, skills, attitudes, and professional behaviours. International literature supports the movement towards competency-based pharmacy education. McMullen et al. described curriculum design, teaching and learning, assessment and feedback, faculty, resources, and contextual factors as important components of contemporary competency-based pharmacy education [4]. The International Pharmaceutical Federation (FIP) has also developed global competency frameworks to support the knowledge, skills, attitudes, and behaviours required for the pharmacy workforce [5]. The revised Indian B.Pharm curriculum can therefore be viewed as part of a broader international movement towards competency-oriented pharmacy education.

5 MAJOR FEATURES OF THE B.PHARM CURRICULUM 2026

The revised programme is structured across eight semesters and represents a substantial curricular revision aligned with NEP 2020. It retains the core pharmaceutical sciences while adding contemporary areas intended to address changing professional requirements [2]. The most notable directions include computational and data literacy, machine learning and AI, communication and healthcare psychology, innovation and startup orientation, research methodology, pharmacovigilance, regulatory affairs, and experiential learning.

6 INTEGRATION OF PYTHON AND DATA ANALYTICS

One of the distinctive features of the revised curriculum is the formal introduction of computational education. The syllabus introduces Python programming and data-oriented learning within pharmaceutical education [2]. The inclusion of computational skills is significant because pharmaceutical research increasingly involves large datasets, statistical modelling, pharmacovigilance databases, clinical data, formulation optimisation, molecular datasets, and real-world healthcare information. Python can support pharmaceutical students in data cleaning, organisation, visualisation, basic modelling, reproducible analysis, and research data management. The educational objective should not be to transform pharmacy graduates into software developers. Instead, students should develop pharmaceutical data literacy and be able to understand, interpret, critically evaluate, and appropriately use computational tools.

7 MACHINE LEARNING IN PHARMACEUTICAL EDUCATION

The revised curriculum introduces machine-learning concepts within pharmaceutical sciences [2]. Machine learning has potential applications across drug discovery, prediction of molecular properties, formulation development, pharmacokinetic modelling, adverse-event detection, medical-data analysis, and personalized medicine. Teaching should remain application-oriented. Students should understand data quality, training and testing datasets, supervised and unsupervised learning, model validation, overfitting, performance metrics, bias, uncertainty, and ethical considerations. The emphasis should be on interpretation and responsible application rather than algorithmic complexity.

8 ARTIFICIAL INTELLIGENCE IN CLINICAL APPLICATIONS

The inclusion of AI in clinical applications reflects the rapid digitalisation of healthcare. AI can support medication-related information retrieval, clinical decision support, pharmacovigilance, drug discovery, and healthcare analytics, but its use requires critical appraisal. A recent study among Indian B.Pharm students reported substantial interest in AI alongside knowledge gaps and concerns regarding accuracy, confidentiality, ethical issues, over-reliance, and academic use [6]. Therefore, AI education should include verification of AI-generated information, data privacy, bias, hallucination and misinformation, academic integrity, human oversight, and clinical limitations. The future pharmacist should therefore be AI-literate rather than AI-dependent.

9 HEALTHCARE PSYCHOLOGY AND COMMUNICATION SKILLS

The revised curriculum gives greater curricular visibility to communication and healthcare psychology [2]. This is consistent with patient-centred care, in which pharmacists must counsel patients, communicate medication information, support adherence, collaborate with healthcare professionals, and respond to patient concerns. Communication training should use role play, counselling simulations, case discussions, interprofessional exercises, standardised patient encounters, and reflective learning. Assessment should measure actual communication performance rather than only theoretical recall.

10 INNOVATION AND STARTUP ECOSYSTEM

The curriculum introduces innovation and startup-oriented learning. This aligns with NEP 2020 priorities concerning creativity, innovation, multidisciplinary education, and employability. Pharmacy graduates may pursue entrepreneurship in pharmaceutical manufacturing, nutraceuticals, cosmetics, clinical research, pharmacovigilance, digital health, medical devices, regulatory services, community pharmacy, and pharmaceutical technology services. Entrepreneurship education should include intellectual property, regulatory requirements, market assessment, business-model development, financial planning, quality systems, incubation, and startup mentoring.

11 RESEARCH ORIENTATION

Research competence is essential for evidence-based pharmacy practice and innovation. The revised curriculum strengthens the visibility of research through biostatistics, data analytics, research methodology, internships, and project-based learning [2]. Students should learn to formulate research questions, search and critically appraise literature, design studies, analyse data, maintain research integrity, and communicate findings. Research education should also address publication ethics, plagiarism, responsible AI use, data integrity, clinical research ethics, and intellectual property.

12 PHARMACOVIGILANCE AND REGULATORY AFFAIRS

Pharmacovigilance and regulatory affairs are important professional domains in the pharmaceutical sector. Graduates should understand adverse drug reaction reporting, signal detection, benefit-risk assessment, medication safety, post-marketing surveillance, regulatory submissions, and pharmaceutical quality systems. Exposure to these domains can improve employability in pharmaceutical companies, contract research organisations, regulatory consultancies, and pharmacovigilance organisations.

13 INTERNSHIP AND EXPERIENTIAL LEARNING

NEP 2020 places emphasis on experiential learning and internships [1]. The revised B.Pharm framework provides opportunities for students to connect classroom learning with professional environments [2]. An effective internship should include defined learning outcomes, pre-internship orientation, relevant placement, faculty and workplace mentors, logbooks or competency portfolios, periodic assessment, reflection, and final competency evaluation. Completion of hours alone should not be treated as sufficient evidence of competence.

14 STRENGTHS OF THE REVISED CURRICULUM

The major strengths include alignment with NEP 2020, incorporation of digital and computational skills, stronger research orientation, industry-relevant domains, professional communication, and entrepreneurship.The curriculum has the potential to broaden graduate career pathways while preserving the scientific foundation of pharmacy education. Its major strength is the movement towards integration rather than replacement of traditional pharmaceutical disciplines.

15 IMPLEMENTATION CHALLENGES

Effective implementation may face several challenges. Faculty members trained primarily in conventional pharmaceutical disciplines may require professional development in Python, data analytics, AI, machine learning, digital health, entrepreneurship, and modern assessment. Institutions will also require adequate computing infrastructure, reliable internet, appropriate software, updated laboratories, digital learning resources, and simulation facilities. Competency-based curricula additionally require assessment reform; simply adding new subjects without changing assessment practices may limit the intended educational impact. Meaningful industry and hospital collaboration will be essential for

experiential learning. Institutional differences in financial and technological capacity may also produce unequal implementation outcomes.

16 SWOT ANALYSIS

The revised curriculum has strong potential but also presents implementation risks. Its strengths include technological integration, research orientation, entrepreneurship, and broader employability. Weaknesses include faculty-development requirements, infrastructure costs, institutional variation, and the possibility of curriculum overload. Opportunities include digital-health careers, AI-enabled pharmaceutical research, startups, interdisciplinary collaboration, and global employability. Threats include rapid technology obsolescence, unequal resources, misuse of generative AI, and resistance to pedagogical change.

17 DISCUSSION

The revised B.Pharm curriculum represents an important transition in Indian pharmacy education. Its significance extends beyond the addition of new subjects. The broader transformation lies in redefining the pharmacist as a professional capable of combining pharmaceutical science with digital literacy, research competence, communication, innovation, and healthcare-oriented decision-making. The inclusion of computational subjects is timely because pharmaceutical research and healthcare increasingly depends on data. Pharmacists will encounter AI-enabled systems across drug discovery, clinical decision support, pharmacovigilance, regulatory science, and healthcare analytics.

However, curriculum innovation alone does not guarantee educational transformation. Competency-based pharmacy education requires alignment among curriculum design, teaching methods, assessment, faculty capability, resources, and professional practice [4,5]. Curriculum balance is also important. Emerging technologies should complement rather than displace foundational pharmaceutical sciences. Pharmaceutics, pharmaceutical chemistry, pharmacology, pharmacognosy, pharmaceutical analysis, pharmacy practice, and related disciplines remain essential. The appropriate model is therefore integration rather than replacement.

18 RECOMMENDATIONS

1. Establish institutional curriculum-implementation committees for continuous monitoring.
2. Conduct annual faculty-development programmes covering emerging curriculum areas.
3. Map courses to measurable competencies and graduate attributes.
4. Introduce authentic assessment methods, including case-based assessment, portfolios, simulations, practical competency assessment, and project evaluation.
5. Strengthen industry and hospital collaborations for structured experiential learning.
6. Develop institutional AI-use policies covering academic integrity, privacy, verification, and ethical use.
7. Create digital learning spaces for data analytics and computational pharmacy.
8. Promote undergraduate research through structured mentorship.
9. Strengthen entrepreneurship and incubation linkages.
10. Establish graduate-tracking systems to evaluate employability and professional outcomes.
11. Use feedback from students, alumni, employers, faculty, and practitioners for continuous improvement.
12. Conduct longitudinal educational research to determine whether curricular reforms improve graduate competency and employment outcomes.

19 FUTURE DIRECTIONS

Future research should evaluate student learning outcomes, graduate employability, faculty readiness, AI literacy, effectiveness of computational education, internship outcomes, industry satisfaction, entrepreneurial outcomes, clinical competency development, and undergraduate research productivity Longitudinal studies following students from admission to employment would provide valuable evidence for subsequent curriculum revisions. AI integration should also be continuously evaluated because current evidence suggests both interest and concerns regarding accuracy, privacy, ethics, and over-reliance [6].

20 CONCLUSIONS

The revised B.Pharm curriculum introduced by the Pharmacy Council of India in 2026 under NEP 2020 represents a substantial shift in the direction of pharmacy education in India. It preserves the scientific foundation of pharmaceutical education while incorporating computational literacy, data analytics, machine learning, artificial intelligence, communication, innovation, entrepreneurship, research methodology, pharmacovigilance, regulatory affairs, and experiential learning. The principal opportunity is to move from a predominantly content-oriented model towards broader competency development. If appropriately implemented, the curriculum can prepare graduates for pharmaceutical industry, clinical and community pharmacy, research, regulatory sciences, pharmacovigilance, digital healthcare, and entrepreneurship. The long-term success of the reform will depend on implementation quality. Faculty preparedness, infrastructure, assessment reform, industry and hospital partnerships, ethical technology use, and continuous outcome evaluation are essential. The NEP 2026 B.Pharm curriculum should therefore be viewed not simply as a revised list of subjects, but as an opportunity to redesign the educational ecosystem around the future pharmacist.

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