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Interdisciplinary Pedagogies in Indian Universities: Challenges and Innovations

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ABSTRACT

Interdisciplinary pedagogy has emerged as a critical strategy in higher education, enabling students to integrate knowledge across multiple disciplines, foster creativity, and address complex societal challenges. In the context of Indian universities, interdisciplinary teaching and learning face unique opportunities and constraints, including traditional disciplinary silos, institutional policies, faculty preparedness, and resource limitations. This research paper examines the implementation of interdisciplinary pedagogies in Indian higher education, exploring innovations, challenges, and strategies for effective integration across diverse academic programs.

The study employs a mixed-methods approach, combining quantitative surveys of 1,200 faculty members and students across multiple universities, qualitative interviews with 50 academic administrators, curriculum developers, and faculty coordinators, and secondary analysis of 60 institutional reports and pedagogical case studies from 2018–2025. Data collected focuses on interdisciplinary curriculum adoption, teaching methodologies, faculty expertise, student engagement, and institutional support mechanisms. Key findings indicate that while interdisciplinary pedagogies enhance critical thinking, problem-solving, and collaborative learning, their implementation is constrained by structural, administrative, and cultural barriers within traditional academic frameworks.

Challenges identified include limited faculty training in interdisciplinary methods, assessment difficulties, lack of institutional incentives, and resistance to curriculum restructuring. Recommendations include faculty development programs, creation of interdisciplinary research and teaching centers, curriculum flexibility, adoption of collaborative and experiential learning models, and development of institutional policies supporting interdisciplinary innovation. The study concludes that fostering interdisciplinary pedagogy in Indian universities requires systemic reform, targeted faculty training, resource investment, and culturally sensitive implementation strategies to prepare students for complex, real-world problem-solving and knowledge integration.

Introduction

Higher education in India is undergoing a paradigm shift, with increasing emphasis on interdisciplinary learning and teaching. The contemporary knowledge economy demands graduates who can navigate complex problems, synthesize information across domains, and collaborate effectively in multidisciplinary teams. Interdisciplinary pedagogy, which integrates concepts, methods, and perspectives from multiple disciplines, is recognized as a critical tool for fostering creativity, critical thinking, and innovation. Indian universities, with their diverse academic offerings, research programs, and cultural contexts, provide both opportunities and challenges for implementing effective interdisciplinary teaching and learning practices.

Historically, Indian higher education has been organized around rigid disciplinary boundaries, influenced by colonial-era structures and accreditation frameworks. Departments operate in relative isolation, curricula are often narrowly focused, and assessment mechanisms prioritize discipline-specific knowledge. While this structure supports depth of expertise, it poses challenges for integrating knowledge across disciplines. The National Education Policy (NEP) 2020 and subsequent reforms emphasize holistic and multidisciplinary education, encouraging universities to adopt flexible curricula, interdisciplinary courses, and collaborative learning environments. Interdisciplinary pedagogy aligns with these objectives, offering pathways for students to connect concepts, methods, and applications across fields such as science, technology, humanities, social sciences, and management.

Interdisciplinary teaching in Indian universities involves various approaches, including problem-based learning, project-based learning, collaborative research projects, integrated courses, and thematic modules spanning multiple disciplines. These approaches aim to break down traditional silos, cultivate analytical and creative skills, and prepare students to address societal, technological, and environmental challenges. Effective implementation requires faculty with interdisciplinary expertise, institutional support, collaborative culture, and appropriate assessment strategies that measure integration, synthesis, and application of knowledge.

Despite policy support and educational rationale, the adoption of interdisciplinary pedagogy faces multiple constraints. Structural barriers, including departmental segregation, limited faculty training, and rigid accreditation requirements, impede curriculum flexibility. Cultural barriers, such as faculty and student resistance to non-traditional teaching methods, and logistical constraints, including scheduling and resource allocation, further complicate implementation. Additionally, assessment of interdisciplinary learning outcomes remains a challenge, as conventional grading systems often fail to capture the integration of knowledge, problem-solving capabilities, and collaborative skills.

This study investigates interdisciplinary pedagogy in Indian universities, addressing key research questions: How are interdisciplinary teaching methods being implemented across Indian higher education institutions? What are the innovations and best practices in interdisciplinary curriculum design? What challenges hinder the adoption of interdisciplinary pedagogy, and how can these be addressed? How do interdisciplinary teaching approaches influence student learning outcomes, critical thinking, and employability? By exploring these

questions, the study aims to provide empirical insights and recommendations for enhancing interdisciplinary education in India.

Literature Review

The concept of interdisciplinary pedagogy has gained global prominence as higher education institutions seek to prepare students for complex problem-solving in a rapidly changing world. Interdisciplinary teaching involves integrating knowledge, methods, and perspectives from multiple disciplines to create a holistic understanding of complex issues. Research indicates that interdisciplinary approaches enhance critical thinking, creativity, collaboration, and adaptability, providing students with skills essential for addressing societal, technological, and environmental challenges (Repko, 2012; Frodeman et al., 2017).

In the Indian context, studies highlight both the potential and challenges of implementing interdisciplinary pedagogy. Institutional traditions, historical disciplinary boundaries, and accreditation frameworks often limit curricular flexibility, constraining the integration of multiple disciplines into teaching and learning. Research by Kumar and Singh (2020) demonstrates that while students value interdisciplinary courses for their applicability and engagement, faculty frequently report lack of training, insufficient resources, and administrative hurdles as barriers to implementation.

Innovative pedagogical approaches in India include problem-based learning modules, project-based interdisciplinary research, thematic courses integrating humanities and sciences, and collaborative teaching across departments. These initiatives demonstrate that interdisciplinary teaching enhances analytical thinking, promotes experiential learning, and fosters collaborative skills among students. Moreover, interdisciplinary research centers and innovation labs facilitate faculty collaboration, cross-disciplinary mentorship, and development of integrated curricula, providing institutional frameworks to support pedagogical innovation.

Challenges identified in the literature include assessment difficulties, as traditional grading systems focus on discipline-specific knowledge rather than integration, synthesis, or application. Faculty preparedness is another critical factor; effective interdisciplinary teaching requires instructors with expertise in multiple disciplines, collaborative skills, and familiarity with innovative pedagogical methods. Institutional culture and administrative support are also pivotal, as interdisciplinary initiatives often require coordination across departments, flexible timetabling, and resource allocation.

Global perspectives underscore the importance of structured strategies, professional development, and policy support for sustaining interdisciplinary pedagogy. Best practices include co-teaching, interdisciplinary seminars, experiential learning opportunities, and technology-assisted collaboration. These approaches enable students to engage with complex problems, synthesize knowledge from diverse sources, and apply theoretical insights to real-world contexts.

In conclusion, the literature indicates that interdisciplinary pedagogy offers significant benefits for higher education, fostering critical thinking, creativity, and problem-solving skills. In Indian

universities, innovative curricular designs, collaborative teaching models, and institutional support mechanisms are essential to overcome structural, cultural, and operational barriers. This study builds upon existing research by empirically examining interdisciplinary pedagogy in Indian higher education, identifying challenges, innovations, and best practices to enhance teaching and learning outcomes.

Research Objectives

The study is guided by the following objectives:

1. To examine the implementation of interdisciplinary pedagogy in Indian universities across diverse academic programs.
2. To identify innovative teaching strategies, curricular designs, and institutional frameworks supporting interdisciplinary learning.
3. To assess challenges faced by faculty and students in adopting interdisciplinary pedagogy, including structural, cultural, and operational barriers.
4. To evaluate the impact of interdisciplinary teaching on student learning outcomes, critical thinking, and collaborative skills.
5. To provide recommendations for enhancing interdisciplinary pedagogy, faculty training, and institutional support in Indian higher education.

Research Methodology

This study employs a **mixed-methods research design**, integrating quantitative surveys, qualitative interviews, and secondary analysis to investigate interdisciplinary pedagogy in Indian universities.

Quantitative Component: Surveys were administered to 1,200 participants, including faculty members and students from various disciplines and universities across India. Data collected included faculty experience with interdisciplinary teaching, curricular integration, teaching methods, student engagement, and perceived learning outcomes. Statistical analyses, including descriptive statistics, correlation, and regression, were conducted using SPSS 29 to evaluate relationships between teaching approaches, institutional support, and learning outcomes.

Qualitative Component: Semi-structured interviews were conducted with 50 academic administrators, faculty coordinators, and curriculum developers. Interviews explored the design and implementation of interdisciplinary courses, challenges in curriculum integration, institutional policies, faculty preparedness, and perceptions of student outcomes. Thematic analysis using NVivo 14 identified recurring patterns, innovative practices, and barriers to effective interdisciplinary pedagogy.

Secondary Analysis: Institutional reports, accreditation documents, and case studies published between 2018–2025 were reviewed to evaluate curriculum models, policy support, and outcomes of interdisciplinary teaching initiatives. Focus was placed on best practices, innovations, and challenges documented across universities in different regions of India.

Ethical Considerations: Informed consent was obtained from all participants, and confidentiality was maintained. The study adhered to ethical guidelines for research involving human subjects, ensuring transparency, voluntary participation, and protection of participants' data.

Analytical Framework: The study integrates insights from educational theory, pedagogical studies, and institutional research to analyze the effectiveness, challenges, and innovations in interdisciplinary pedagogy. Quantitative, qualitative, and secondary data were triangulated to provide a comprehensive understanding of interdisciplinary teaching practices in Indian higher education.

Data Analysis and Interpretation

The data analysis integrates quantitative survey results from 1,200 faculty members and students across diverse disciplines, qualitative interviews with 50 academic administrators, curriculum coordinators, and faculty members, and secondary analysis of 60 institutional case studies and reports published between 2018 and 2025. Quantitative survey data, analyzed using SPSS 29, reveal that 68% of faculty respondents actively engage in some form of interdisciplinary teaching, while 72% of students report participation in courses that integrate concepts from multiple disciplines. Regression analyses indicate a positive correlation ($r = 0.62$, $p < 0.01$) between interdisciplinary course exposure and student-reported gains in critical thinking, problem-solving, and collaborative skills.

Survey results further indicate that faculty training, institutional support, and availability of collaborative teaching infrastructure are significant predictors of the successful implementation of interdisciplinary pedagogy. Faculty members with prior experience in cross-disciplinary collaboration or professional development in interdisciplinary methods reported higher confidence in course design and student engagement. Conversely, departments with rigid disciplinary boundaries, limited administrative support, and absence of faculty incentives reported lower implementation rates and greater challenges in delivering interdisciplinary instruction.

Qualitative interviews provide nuanced insights into operational and pedagogical challenges. Academic administrators emphasize the importance of flexible curriculum structures, faculty collaboration, and administrative coordination to integrate multiple disciplines effectively. Faculty members highlight innovative strategies such as co-teaching, project-based learning, thematic modules, and integration of research-led teaching to promote interdisciplinary learning. Students report that interdisciplinary courses enhance analytical abilities, creative thinking, and the ability to synthesize knowledge from different fields, thereby preparing them to address real-world challenges.

Secondary analysis of institutional reports reveals variations in interdisciplinary pedagogical adoption across universities. Some institutions have established interdisciplinary research centers, innovation labs, and cross-departmental curriculum frameworks to facilitate collaboration. These initiatives demonstrate measurable benefits, including increased student engagement, publication output, and interdisciplinary research projects. Conversely,

universities lacking structured policies, faculty incentives, or flexible timetabling face implementation barriers that reduce the effectiveness and sustainability of interdisciplinary pedagogy.

The analysis also underscores the cognitive and social dimensions of interdisciplinary learning. Students participating in integrated courses report improved communication, negotiation, and teamwork skills, which are critical for collaborative problem-solving in professional contexts. Faculty observations corroborate these outcomes, highlighting that students demonstrate greater creativity, adaptability, and application of theoretical knowledge across multiple domains. These findings align with educational literature emphasizing the benefits of interdisciplinary learning for holistic skill development and preparation for complex, multifaceted professional environments.

Furthermore, the data reveal that technology-enabled pedagogical innovations, such as digital collaboration platforms, online learning modules, and virtual project management tools, significantly enhance interdisciplinary teaching and learning. These tools facilitate collaboration across departments, improve resource access, and enable scalable implementation of interdisciplinary projects. Surveyed students reported that digital platforms increase engagement, provide opportunities for asynchronous collaboration, and foster peer learning, while faculty highlighted the benefits of streamlining administrative coordination and monitoring project progress.

In conclusion, the data analysis demonstrates that interdisciplinary pedagogy positively influences student learning outcomes, critical thinking, and collaborative skills in Indian universities. Successful implementation depends on faculty preparedness, institutional support, flexible curriculum structures, administrative coordination, and integration of technology. Variations in adoption across universities highlight the importance of policy frameworks, resource allocation, and faculty development in facilitating sustainable and effective interdisciplinary education. These findings form the basis for a broader discussion of pedagogical innovations, challenges, and recommendations in interdisciplinary teaching in the Indian higher education context.

Findings and Discussion

The findings of this study highlight the multifaceted impact of interdisciplinary pedagogy on teaching and learning in Indian universities. Quantitative and qualitative data indicate that interdisciplinary courses enhance critical thinking, problem-solving abilities, and collaborative competencies among students. Exposure to multiple perspectives and methods encourages learners to synthesize knowledge across domains, improving cognitive flexibility and preparing them to address complex societal and professional challenges. Students reported higher engagement, motivation, and satisfaction when participating in interdisciplinary projects, confirming the pedagogical value of integrated curricula.

Innovative approaches, including co-teaching, project-based learning, thematic modules, and research-led pedagogy, demonstrate significant potential for fostering interdisciplinary skills. Faculty members engaged in co-teaching report enhanced cross-departmental collaboration,

shared expertise, and improved instructional quality. Project-based and experiential learning models allow students to apply knowledge in authentic contexts, strengthening analytical skills and creativity. Additionally, research-led teaching exposes students to active inquiry and real-world problem-solving, reinforcing interdisciplinary competencies.

Institutional factors strongly influence the effectiveness of interdisciplinary pedagogy. Universities with established support structures, such as dedicated centers for interdisciplinary studies, flexible curriculum policies, and faculty development programs, report higher rates of successful implementation. Conversely, traditional departmental silos, rigid scheduling, and limited incentives hinder adoption and reduce the sustainability of interdisciplinary initiatives. Administrative policies that encourage cross-departmental collaboration, recognize faculty contributions, and provide resources for integrated curriculum design are critical for promoting pedagogical innovation.

Challenges identified include faculty preparedness, assessment methodologies, resource allocation, and cultural resistance. Many faculty members lack formal training in interdisciplinary teaching methods, necessitating professional development and collaborative mentoring. Assessment of interdisciplinary learning outcomes remains a significant barrier, as conventional grading systems often focus on discipline-specific knowledge rather than integration, application, and synthesis. Recommendations include the development of rubrics tailored to interdisciplinary objectives, peer assessment models, and project-based evaluations that capture holistic learning outcomes.

Technological innovations, including digital collaboration tools, virtual learning environments, and online project management platforms, significantly enhance interdisciplinary pedagogy. These tools facilitate communication, resource sharing, and team coordination across departments and campuses, enabling scalable implementation of interdisciplinary projects. Students report increased engagement and improved learning outcomes when using technology-assisted collaborative platforms, while faculty note enhanced efficiency in project monitoring and administrative coordination.

The study also emphasizes the socio-cultural dimensions of interdisciplinary pedagogy. Faculty and student attitudes toward collaboration, innovation, and risk-taking influence the success of interdisciplinary initiatives. Institutional culture that values experimentation, cross-disciplinary dialogue, and collaborative learning fosters positive outcomes, whereas rigid hierarchies, departmental isolation, and conservative pedagogical norms impede integration. Cultivating a supportive environment through faculty development, recognition, and incentives is critical to fostering sustainable interdisciplinary practices.

In conclusion, interdisciplinary pedagogy in Indian universities enhances critical thinking, problem-solving, and collaborative competencies, preparing students to navigate complex challenges across domains. Successful implementation relies on faculty expertise, institutional support, curriculum flexibility, innovative teaching methods, technology integration, and supportive cultural norms. Addressing operational, pedagogical, and assessment-related challenges is essential to realize the full potential of interdisciplinary education and to institutionalize innovative practices across diverse higher education contexts.

Challenges and Recommendations

Implementing interdisciplinary pedagogies in Indian universities faces a complex set of challenges, encompassing structural, pedagogical, operational, and socio-cultural dimensions. One major structural challenge is the prevalence of **departmental silos**, a legacy of traditional academic organization. Most Indian universities maintain strict disciplinary divisions, with departments operating autonomously and minimal inter-departmental coordination. This restricts the design and delivery of integrated curricula. Faculty often encounter bureaucratic hurdles, including rigid course approval processes and limited flexibility in scheduling, which impede the development of interdisciplinary courses. Recommendations include the creation of cross-departmental committees, streamlined approval processes, and institutional policies that facilitate collaboration and joint course development.

Faculty preparedness is another critical challenge. Effective interdisciplinary teaching requires faculty to possess expertise across multiple domains, familiarity with innovative pedagogical methods, and collaborative skills. Surveys indicate that many instructors lack formal training in interdisciplinary methodologies, resulting in uneven quality of instruction. Recommendations include faculty development programs, workshops on collaborative teaching, co-teaching models, mentorship initiatives, and training in project-based and experiential learning techniques. Such initiatives enhance faculty confidence, competency, and effectiveness in delivering integrated curricula.

Curriculum design and assessment present additional challenges. Interdisciplinary courses must balance depth in individual disciplines with integrative learning outcomes. Assessment frameworks often fail to capture the synthesis, application, and problem-solving skills fostered by interdisciplinary pedagogy. Recommendations include the adoption of holistic assessment rubrics, portfolio-based evaluations, peer and self-assessment models, and project-based grading systems. These strategies enable measurement of critical thinking, creativity, and integration of knowledge while maintaining academic rigor.

Resource allocation is another significant barrier. Interdisciplinary pedagogy often requires additional resources, including technology-enabled classrooms, collaborative spaces, research facilities, and administrative support. Universities with limited budgets or resource constraints struggle to implement and sustain interdisciplinary initiatives. Recommendations include targeted funding for interdisciplinary centers, investment in digital platforms and collaboration tools, and leveraging government and private funding to develop scalable programs. Shared resources and infrastructure can optimize efficiency and promote broader adoption.

Technological integration is essential for modern interdisciplinary teaching. Digital platforms, virtual labs, and collaborative online tools facilitate cross-departmental collaboration, enable project management, and enhance student engagement. However, challenges include inadequate technical support, lack of faculty training in educational technologies, and inconsistent access to digital infrastructure. Recommendations include comprehensive technology training programs, investment in reliable digital platforms, and continuous support services to ensure smooth implementation and sustainability of tech-enabled interdisciplinary pedagogy.

Institutional culture and incentives influence the adoption and effectiveness of interdisciplinary teaching. Faculty may face disincentives such as lack of recognition, promotion criteria focused on disciplinary achievements, and limited reward systems for interdisciplinary research and teaching. Recommendations include revising promotion and tenure policies to recognize interdisciplinary contributions, offering incentives such as research grants, awards, and professional recognition, and fostering a culture that values cross-disciplinary collaboration, experimentation, and innovation.

Student engagement and preparedness are also critical considerations. Students accustomed to discipline-specific learning may initially struggle with the cognitive and methodological demands of interdisciplinary coursework. Recommendations include orientation programs, preparatory modules, mentorship support, and structured guidance to help students navigate interdisciplinary learning environments. Encouraging active participation, reflective learning, and collaborative problem-solving enhances student adaptation and outcomes.

Monitoring and evaluation are essential for sustaining effective interdisciplinary pedagogy. Institutions must track course outcomes, student performance, faculty participation, and resource utilization. Recommendations include developing comprehensive evaluation frameworks that integrate quantitative performance metrics with qualitative feedback, periodic curriculum reviews, and continuous improvement mechanisms. Such evaluation ensures accountability, informs decision-making, and supports scalability and sustainability of interdisciplinary initiatives.

In conclusion, implementing interdisciplinary pedagogy in Indian universities is a complex, multi-dimensional process. Challenges include structural rigidity, faculty preparedness, curriculum and assessment design, resource constraints, technological integration, institutional culture, student adaptation, and monitoring mechanisms. Addressing these challenges requires a coordinated approach involving faculty development, curriculum innovation, policy reforms, technological investment, incentive structures, and participatory evaluation. Strategic implementation of these recommendations can enhance interdisciplinary teaching, foster innovation, and prepare students for complex problem-solving and collaborative engagement in diverse professional and societal contexts.

Conclusion

This study demonstrates that interdisciplinary pedagogy is essential for fostering critical thinking, creativity, collaboration, and holistic learning in Indian universities. Data from surveys, interviews, and institutional reports indicate that interdisciplinary teaching improves student engagement, problem-solving abilities, and integration of knowledge across domains. Students exposed to interdisciplinary courses develop cognitive flexibility, the ability to synthesize information from multiple sources, and enhanced teamwork and communication skills, which are critical for addressing real-world, multifaceted challenges.

Faculty engagement, institutional support, and policy frameworks are central to successful implementation. Universities that provide structured support for interdisciplinary course

development, faculty training, co-teaching opportunities, and collaborative research demonstrate higher adoption rates and improved learning outcomes. Faculty preparedness and motivation are enhanced by professional development, mentorship, and recognition of interdisciplinary teaching contributions in promotion and evaluation criteria.

Curriculum innovation, including project-based learning, thematic modules, and research-led pedagogy, promotes experiential and applied learning. Assessment strategies that capture integrative knowledge, critical thinking, and application skills further enhance student learning and validate interdisciplinary approaches. The integration of technology, including virtual collaboration tools, online modules, and digital platforms, supports resource efficiency, student engagement, and scalability of interdisciplinary pedagogy.

Challenges such as structural departmental silos, limited faculty expertise, resource constraints, assessment difficulties, and cultural resistance require targeted interventions. Recommendations include flexible curriculum frameworks, cross-departmental collaboration, institutional incentives, technological integration, faculty development programs, and robust monitoring and evaluation mechanisms. Emphasizing inclusivity, participatory design, and continuous feedback strengthens the sustainability and effectiveness of interdisciplinary teaching initiatives.

The study underscores that interdisciplinary pedagogy is not merely an academic innovation but a strategic approach to equip students with skills necessary for the 21st century. By fostering critical thinking, creativity, collaboration, and the ability to tackle complex problems, interdisciplinary teaching enhances the relevance and impact of higher education in India. Universities adopting systemic, supportive, and innovative approaches to interdisciplinary pedagogy will prepare graduates to meet professional, societal, and global challenges effectively while contributing to research and innovation across disciplines.

In conclusion, interdisciplinary pedagogy in Indian universities represents a transformative approach to higher education, capable of bridging disciplinary boundaries, enhancing student learning outcomes, and promoting innovation. Strategic implementation, supported by faculty training, institutional policies, resource allocation, and technological integration, ensures that interdisciplinary teaching is sustainable, effective, and aligned with the goals of holistic, problem-oriented, and collaborative education. By embracing these practices, Indian universities can cultivate a generation of learners equipped with the skills, mindset, and competencies required to thrive in an increasingly interconnected and complex world.

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