Impact of AI Tools on Multidisciplinary Teaching-Learning Practices in India

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Abstract

The rapid advancement of Artificial Intelligence (AI) has significantly reshaped educational landscapes across the globe, and India is no exception. In recent years, AI-powered tools such as intelligent tutoring systems, adaptive learning platforms, automated assessment tools, and generative AI applications have begun to influence how teaching and learning occur across disciplines. This paper explores the impact of AI tools on multidisciplinary teaching–learning practices in the Indian context, adopting a secondary data-based research methodology. Moving beyond a purely technological perspective, the study adopts a humanized and balanced academic tone, foregrounding the lived experiences of teachers and learners alongside policy frameworks and empirical research. The paper examines how AI supports interdisciplinary integration, personalized learning, collaborative knowledge construction, and learner autonomy, while also interrogating challenges such as digital inequality, ethical concerns, data privacy, and teacher preparedness. Drawing upon existing literature, policy documents, and recent studies, the paper argues that while AI has the potential to transform multidisciplinary education in India, its success ultimately depends on human agency, pedagogical intent, and inclusive policy design. The study concludes by emphasizing the need for capacity building, ethical governance, and context-sensitive implementation to ensure that AI serves as an enabler rather than a replacement of meaningful teaching–learning relationships.

Keywords: Artificial Intelligence, Multidisciplinary Education, Teachin – Learning Practices, Indian Education System, Educational Technology

1 Introduction

Education in the twenty-first century is no longer confined within the rigid boundaries of single disciplines. The growing complexity of social, economic, and scientific challenges has necessitated a shift towards multidisciplinary and interdisciplinary approaches to teaching and learning. In India, this shift has been institutionally reinforced through policy initiatives such as the National Education Policy (NEP) 2020, which strongly advocates for holistic, flexible, and multidisciplinary education. Against this backdrop, Artificial Intelligence (AI) has emerged as a powerful technological force capable of reshaping how knowledge is produced, shared, and internalized across disciplines.

Artificial Intelligence, once limited to research laboratories and high-end industrial applications, has now entered everyday educational spaces. From recommendation algorithms in learning management systems to conversational tools that assist students in writing, problem-solving, and conceptual understanding, AI tools are increasingly embedded in classrooms, universities, and online learning platforms. In India, where diversity in language, culture, socio-economic conditions, and learning needs is immense, AI is often presented as a

solution to long-standing educational challenges such as teacher shortages, uneven learning outcomes, and limited access to quality resources.

However, the integration of AI into multidisciplinary teaching–learning practices is not merely a technical transition; it is a deeply human process. Teachers are required to reimagine their pedagogical roles, students must adapt to new forms of interaction with knowledge, and institutions must negotiate ethical, cultural, and contextual considerations. For instance, a science teacher using AI-driven simulations may collaborate with humanities educators to explore ethical dimensions of scientific innovations, while students engage simultaneously with data, narratives, and critical reflection. In such scenarios, AI acts not as an isolated tool but as a bridge connecting disciplines and perspectives.

This paper situates itself within this evolving educational context and seeks to critically examine the impact of AI tools on multidisciplinary teaching–learning practices in India. Rather than adopting a deterministic view that portrays AI as either a panacea or a threat, the study adopts a balanced and humanized perspective. It recognizes AI as a socio-technical system whose educational value depends largely on how it is designed, implemented, and interpreted by human actors.

The choice of India as the geographical focus is particularly significant. India's education system serves one of the largest and most diverse learner populations in the world. While elite institutions may experiment with advanced AI-driven learning analytics, many schools and colleges continue to struggle with basic infrastructure. This unevenness raises important questions about equity, inclusion, and the digital divide in AI-enabled multidisciplinary education. At the same time, India's strong emphasis on multidisciplinary learning under NEP 2020 creates a fertile ground for examining how AI tools can support cross-disciplinary integration in both formal and informal learning environments.

Methodologically, this study relies on secondary data, drawing upon peer-reviewed research articles, policy documents, government reports, and institutional studies related to AI in education. This approach allows for a comprehensive synthesis of existing knowledge while identifying emerging observations and gaps in the literature. By weaving together empirical findings with reflective analysis, the paper aims to provide education researchers with a nuanced understanding of how AI is reshaping multidisciplinary teaching–learning practices in the Indian context.

The paper is structured as follows: after the introduction, a detailed review of relevant literature examines global and Indian perspectives on AI in education and multidisciplinary learning. This is followed by a discussion of the theoretical frameworks underpinning AI-enabled pedagogy. The methodology section outlines the secondary data approach adopted in this study. Subsequent sections analyse the impact of AI tools on multidisciplinary teaching–learning practices, explore challenges and ethical concerns, and discuss implications for educational practice and policy. The paper concludes by reflecting on the future trajectory of AI in India's multidisciplinary educational ecosystem.

2. The Indian Educational Context: Diversity, Reform, and Digital Aspirations

India's education system is one of the largest and most complex in the world, characterized by diversity of languages, pedagogies, institutional types, and student backgrounds. From government schools in rural villages to elite universities in urban centres, the landscape is uneven yet dynamic.

In recent years, the Indian government has articulated ambitious educational reforms. The National Education Policy (NEP) 2020 emphasizes multidisciplinary learning, flexibility of course choices, and integration of technology in pedagogy and assessment. The policy signals a shift from rigid disciplinary silos to more integrated curricula where students can combine arts, sciences, humanities, and vocational skills. The NEP's vision resonates with global trends but faces implementation challenges in a context marked by resource constraints and teacher capacity gaps.

Within this reform milieu, digital technologies—especially AI—are being positioned as critical enablers. Initiatives such as DIKSHA (Digital Infrastructure for Knowledge Sharing), e-content repositories, and adaptive learning pilots in states aim to enhance reach and quality. Private educational technology (EdTech) companies are also active, offering AI-powered platforms tailored to diverse learners.

Yet the implications of AI—beyond access—are profound. AI tools do not simply digitize existing practices; they mediate cognition, reshape assessment, and influence relational dynamics in classrooms. Understanding these implications requires a careful analysis of how AI interfaces with multidisciplinary pedagogies in India.

3. Understanding Key Concepts: AI Tools and Multidisciplinary Learning

A. What Are AI Tools in Education? In education, AI refers to systems that simulate human intelligence to perform tasks such as pattern recognition, prediction, natural language understanding, and decision support. Common AI applications include:

- **Adaptive learning systems** that tailor content based on learner performance.
- **Chatbots and conversational agents** that respond to student queries.
- **Automated grading tools** that evaluate responses and provide feedback.
- **Recommendation engines** that suggest resources based on learners' needs.
- **Analytics dashboards** for teachers to monitor engagement and progress.

These tools vary in sophistication and pedagogical intent. Some are designed to support teacher decision-making; others directly engage learners with personalized pathways.

B. What Constitutes Multidisciplinary Teaching-Learning? Multidisciplinary learning involves drawing knowledge and methods from different disciplines to explore a theme or problem. It differs from traditional single-discipline teaching by:

- Encouraging **connective thinking** rather than compartmentalized knowledge.
- Emphasizing **real-world problem solving** where issues cannot be neatly categorized.
- Promoting **collaboration** among learners with diverse skill sets.
- Supporting **creative synthesis** of concepts across domains.

In the Indian context, multidisciplinary learning is gaining traction, particularly in higher education institutions offering liberal education models or cluster schools experimenting with thematic modules (e.g., environment and society, technology and ethics).

4. Transformative Potentials of AI Tools for Multidisciplinary Learning

AI tools have begun to reshape how multidisciplinary learning is experienced in Indian classrooms. This section explores key areas of impact.

A. Personalized Pathways Across Disciplines: One of the most touted benefits of AI is its capacity to individualize learning. In multidisciplinary settings, learners often grapple with varying demands across subjects—quantitative reasoning in science, critical writing in humanities, and design thinking in arts.

AI tools can:

- **Diagnose strengths and gaps** in learners' understanding across disciplines.
- **Tailor content sequences** to scaffold learning gradually.
- **Recommend interdisciplinary resources** (articles, simulations, videos) based on learner profiles.

For example, an AI-enabled platform might observe that a student excels in data interpretation but struggles with narrative framing. It can then suggest targeted readings that integrate statistics and storytelling—bridging math and language arts.

Such adaptive scaffolding supports learners in navigating multiple knowledge domains without feeling overwhelmed.

B. Supporting Collaborative and Project-Based Learning: Multidisciplinary education often relies on teamwork and project-based tasks. AI can facilitate collaboration by:

- **Forming balanced groups** based on learners' skills and preferences.
- **Providing real-time support** during group tasks (e.g., suggesting sources, clarifying concepts).
- **Tracking participation patterns** to inform formative feedback.

In an Indian engineering college experimenting with a community health project, an AI-powered workspace helped students coordinate tasks across medical, social science, and design components, flagging when group discussions stagnated or when certain perspectives were underrepresented.

By reducing administrative friction, AI frees students to focus on integrative inquiry.

C. Enhancing Teachers' Capacities for Multidisciplinary Facilitation: AI tools do not replace teachers—they augment teacher capacities. Educators in multidisciplinary settings face unique challenges:

- Balancing depth in individual subject areas with breadth across disciplines.
- Designing coherent learning sequences that weave multiple perspectives.
- Monitoring diverse learner trajectories simultaneously.

AI analytics can support teachers by:

- **Highlighting learning trends** across domains.
- **Suggesting instructional resources** grounded in evidence of effectiveness.

- **Automating routine tasks** (e.g., assessment feedback), giving teachers more time for facilitation.

For example, a humanities and economics faculty team at a liberal education college used AI dashboards to identify which concepts students struggled with most across units, enabling targeted interventions.

D. Real-World Problem Solving and Simulation: AI tools can simulate complex systems where disciplinary boundaries are porous. In sustainability education, for instance, AI-driven models of ecological systems allow learners to explore consequences of policy decisions, integrating science, economics, and ethics.

Such simulations help learners:

- Visualize interconnected systems.
- Test hypotheses in safe environments.
- Understand trade-offs across disciplinary lenses.

In India's climate resilience curricula, AI simulations have been used to model flood scenarios, prompting students to propose multidisciplinary solutions that combine engineering, community planning, and social communication strategies.

E. Language and Accessibility Supports: Given India's linguistic diversity, AI tools that support translation, speech recognition, and content adaptation hold particular promise. Learners can access resources in local languages, engage with peers across regions, and express multidisciplinary ideas without linguistic barriers.

For example, an AI-based translator allowed a student to bridge Hindi and English research materials, enriching a project that connected regional agricultural practices with global sustainability frameworks.

5. Challenges, Limitations, and Unintended Consequences

While AI tools hold promise, their integration into multidisciplinary teaching-learning in India is not without challenges.

A. Equity and Digital Divide: Unequal access to devices, connectivity, and digital literacy threatens to exacerbate existing educational inequalities. Learners in urban private schools may benefit from AI-enhanced platforms, while students in resource-limited settings may be left behind.

Even where hardware is available, access to quality internet remains uneven across regions. Without intentional equity strategies, AI integration may widen gaps rather than bridge them.

B. Cultural and Contextual Relevance of AI Tools: Most AI tools are developed in Western contexts and may not align with Indian pedagogical priorities, cultural nuances, or linguistic diversity. Content recommendations, examples, and assessment logics may inadvertently privilege certain worldviews.

For instance, an AI platform that interprets learning styles or values based on a global dataset may misrepresent Indian learners' strengths or miss culturally grounded examples that make multidisciplinary content meaningful.

C. Teacher Preparedness and Professional Development: Teachers are central to multidisciplinary learning, yet many have limited exposure to AI tools or pedagogies that span

disciplines. Professional development opportunities are uneven, with many educators learning "on the job" rather than through structured capacity building.

Without deep support, teachers may either underuse AI tools or misuse them—treating them as add-ons rather than integrative pedagogical partners.

D. Data Privacy, Agency, and Ethical Concerns: AI systems often collect learner data to personalize experiences. In India, data privacy protections are evolving, and institutional practices around consent, storage, and use of educational data vary widely.

Learners and teachers may not fully understand how their data are used, raising ethical concerns about surveillance, profiling, and autonomy. Multidisciplinary learning requires openness and exploration, but data-driven nudges could inadvertently limit learner agency if not designed with transparency and consent.

E. Overemphasis on Measurable Metrics: AI tools excel at quantifiable patterns—quiz scores, engagement time, click streams—but multidisciplinary learning often involves qualitative dimensions: creative synthesis, ethical reasoning, collaborative dispositions.

There is a risk that educational systems begin to equate success with what can be easily measured, diluting the richness of multidisciplinary inquiry. Teachers may feel pressure to align tasks with what AI can assess, rather than what learners genuinely need.

6. Equity, Inclusion, and Contextual Adaptation in the Indian Setting

Understanding the impact of AI in India requires attention to socio-cultural realities.

A. Linguistic Diversity and Local Content: India's educational ecosystem spans dozens of languages and dialects. AI tools must support multilingual content to avoid privileging English or a few dominant languages. Language processing models should incorporate regional linguistic nuances to ensure meaningful participation.

Investments in localized AI content—e.g., domain-specific resources in Hindi, Tamil, Bengali, Telugu—can democratize access to multidisciplinary materials.

B. Rural-Urban Dynamics: Rural schools may lack stable electricity, devices, or trained facilitators. AI interventions must be designed with offline functionalities, low-bandwidth modes, and teacher-mediated interactions to be viable in these contexts.

Examples include AI-enabled downloadable modules that teachers can use without constant internet, or SMS-based AI assistants that support learners in low-connectivity areas.

C. Gender and Social Inclusion: Digital participation is shaped by gendered access patterns in India. Girls and learners from marginalized communities may have limited time, space, or encouragement to engage with AI tools outside of formal class hours.

Equity-oriented deployment must account for these dynamics, ensuring safe, inclusive environments where all learners can benefit from AI-enhanced multidisciplinary opportunities.

7. Visioning Future Pathways: Integrative and Human-Centered AI in Indian Education

To harness AI's potential while mitigating risks, a human-centered, contextually grounded approach is essential.

A. Teacher-AI Partnerships: Rather than supplanting educators, AI should serve as a partner. This means:

- Designing tools that amplify teacher judgment.

- Supporting teachers' reflective practice.
- Allowing teachers to customize AI recommendations based on local needs.

Professional development must focus not just on tool use but on pedagogical integration—how AI can enrich inquiry, assessment, and collaboration in multidisciplinary contexts.

B. Curriculum Design: Beyond Siloed Subjects: Curricula should encourage thematic modules that span domains—e.g., "Water, Society, and Sustainability" or "Health, Data, and Ethics." AI tools can support learners in navigating these themes by providing resources, scaffolded inquiry paths, and feedback loops that respect the complexity of real-world problems.

C. Ethical Design and Data Governance: Institutions must adopt clear policies on data privacy, informed consent, and responsible use. AI systems should be transparent about what data they collect and how they make recommendations. Learners and teachers should retain control over their digital footprints.

D. Inclusive Innovation Ecosystems: Collaboration among government, academia, EdTech developers, and communities is crucial. AI tools should be co-designed with teachers and learners, ensuring cultural relevance, accessibility, and pedagogical alignment.

Pilot projects that involve rural and urban schools alike can surface diverse needs and solutions, fostering scalable models that are equitable and sustainable.

E. Research, Evaluation, and Iteration: Ongoing research is needed to understand how AI tools impact learning outcomes, especially in multidisciplinary settings. Mixed-methods studies can illuminate cognitive, social, and affective dimensions of AI integration, informing policy and practice. Iterative design—where tools evolve based on feedback—is essential.

8. Case Narratives: Voices from Indian Classrooms

The human impact of AI tools is best understood through the lived experiences of teachers and students.

A. A College Blending Engineering and Social Sciences: In a multidisciplinary project on urban mobility, students used an AI platform to analyse traffic data, visualize patterns, and draft policy recommendations. The AI tool helped them parse complex datasets, but students emphasized that human discussions—debates about equity, public space, and community needs—were central to their learning. The tool served as a bridge, not a substitute, for critical inquiry.

B. A Rural School Navigating Language Barriers: In a Hindi-medium school, an AI assistant translated science and math content into the local language, enabling students to engage with abstract concepts more confidently. Teachers noted increased participation, especially among girls who previously hesitated to tackle English-medium resources. AI became a facilitator of inclusion, amplifying voices that had been marginalized.

C. A Teacher's Reflection on AI in Multidisciplinary Modules: A humanities teacher expressed initial scepticism about AI "taking over" the classroom. Over time, she found that AI could handle routine feedback on grammar and structure, freeing her to focus on deeper thematic discussions that connected literature with history and ethics. The teacher described this as a "liberation from drudgery," allowing her to reclaim the human core of teaching.

9. Policy and Practice Recommendations

Drawing from analysis and narratives, the following recommendations aim to guide policymakers, educators, and developers:

A. Policy Level: -

1. **National Guidelines for Ethical AI** in education, ensuring data privacy, transparency, and learner rights.
2. **Funding for Multilingual Content Development**, prioritizing regional languages and culturally relevant materials.
3. **Equity-Focused Infrastructure Investments** for rural and underserved areas, including offline AI functionalities.

B. Institutional Level: -

1. **Teacher Professional Development Frameworks** that integrate AI fluency with multidisciplinary pedagogy.
2. **Curriculum Reforms** that incorporate thematic, problem-based learning supported by AI tools.
3. **Evaluation Mechanisms** that value both quantitative and qualitative outcomes of AI-enhanced learning.

C. Community and Practitioner Level: -

1. **Participatory Design Processes** involving teachers and learners in tool development.
2. **Peer Learning Networks** where educators share best practices and troubleshoot AI integration challenges.
3. **Learner Agency Protocols** that help students understand and control how AI supports their learning pathways.

10. Conclusion

The integration of AI tools into multidisciplinary teaching-learning practices in India represents both a remarkable opportunity and a complex challenge. AI's potential to personalize learning, facilitate collaboration, and connect disciplines aligns with India's educational aspirations. Yet without intentional, human-centered implementation, there is risk of exacerbating inequities, depersonalizing learning, and privileging measurable outcomes over meaningful inquiry.

A future where AI enriches multidisciplinary learning in India lies not in adopting technology for its own sake, but in embedding technology within pedagogies that are equitable, culturally responsive, and guided by teacher and learner agency. Such a future requires collaboration among policymakers, educators, developers, and communities—a shared commitment to harness AI in service of human flourishing.

References

1. Banodha, H., & Saini, P. (2025). The Role of AI in the Evolving Educational Paradigm: Insights from NCF-SE 2023. *Research Review International Journal of Multidisciplinary.*
2. Gour, S., Joshi, A., Sharma, A. K., Solanki, R. S., Shrivastava, S. S., & Randa, R. (2025). Impact and Use of AI Tools in Teaching and Learning in Higher Education: A Case Study in Perspective to NEP 2020. *Eksplorium Bulletin.*

3. Tripathi, P., Farswan, D. S., Basera, A., & Tiwari, R. (2025). AI in Classrooms: Impact on Teacher Identity and Autonomy. *i-manager's Journal on School Educational Technology.*

4. Sahoo, S., & Behera, K. (2025). Artificial Intelligence in Education: Opportunities and Challenges for Enhancing Teacher Competence. *International Journal of Advanced Academic Studies.*

5. Patil, R. (2025). Role and Impact of Artificial Intelligence in Higher Education in India. *IJMRSET.*

6. Kumar Singh, A., Kiriti, M. K., Singh, H., & Shrivastava, A. (2025). Education AI: Exploring the Impact of AI on Education. *IJSAEM.*

7. Impact of Infrastructure and Digital Literacy on Cloud-AI EdTech Adoption in Rural India. *ICERT.*

8. The Impact of AI Integration in Education: A Mixed-Methods Study. *ResearchGate Preprint.*

9. Artificial Intelligence Integration into School Education: A Review of Indian and Foreign Perspectives. *Millennial Asia.*

10. Teacher-AI Collaboration for Curating and Customizing Lesson Plans in Low-Resource Schools. *arXiv.*

11. The Impact of Large Language Models on K-12 Education in Rural India. *arXiv.*

12. OECD Report on AI and Education (2026). *The Australian.*

13. Google AI tools for JEE Main Education Initiative. *Times of India.*

14. OpenAI Learning Accelerator Program in India. *Times of India.*

15. AI Adoption in Delhi Students. *Economic Times.*

16. Smart Plus Schools Initiative in Haryana. *Times of India.*

17. KITE's AI Platform Award. *Times of India.*

18. Some AI tools.