

Challenges and Opportunities of Artificial Intelligence in Higher Education: A Case Study of Selected Universities in Karnataka and Andhra Pradesh States

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Abstract

Artificial Intelligence (AI) has emerged as a disruptive innovation in higher education, transforming pedagogy, research management, and institutional governance. This study investigates the challenges and opportunities of AI integration in higher education institutions (HEIs) in Karnataka and Andhra Pradesh through primary data collected from 384 faculty members across public and private universities. Using descriptive and inferential statistical techniques including independent t-test, chi-square test, correlation, and multiple regression analysis the research assesses faculty awareness, institutional support, and readiness for AI adoption. The results indicate that faculty in Karnataka show higher readiness and institutional support compared to those in Andhra Pradesh. Correlation and regression analyses confirm that faculty training and institutional support are the most significant predictors of AI adoption. The findings underscore the necessity of a comprehensive strategy emphasizing capacity building, ethical awareness, and digital infrastructure enhancement.

Keywords: Artificial Intelligence, Higher Education, Faculty Readiness, Karnataka, Andhra Pradesh, Institutional Support, Technology Adoption

1. Introduction

The emergence of Artificial Intelligence (AI) has reshaped every domain of human activity, and education is no exception. From intelligent tutoring systems and predictive analytics to administrative automation and plagiarism detection, AI technologies are driving a paradigm

shift in how universities teach, assess, and manage their functions (Holmes, Bialik, & Fadel, 2021; UNESCO, 2022).

In the Indian context, AI adoption is aligned with policy frameworks such as the National Education Policy (NEP 2020) and NITI Aayog's National Strategy for Artificial Intelligence (AI for All, 2023). These policies envision AI as a means of improving access, quality, and governance across India's vast higher education landscape (NITI Aayog, 2023; Government of India, 2020).

However, successful integration of AI in higher education depends largely on faculty readiness, institutional support, ethical governance, and technological infrastructure. Faculty members serve as the link between technology and pedagogy. Their perceptions, knowledge, and willingness to engage with AI-driven tools determine whether technology transforms learning or remains underutilized (Sharma et al., 2024).

Karnataka and Andhra Pradesh offer compelling comparative contexts for studying AI adoption. Karnataka home to India's "Silicon Valley" Bengaluru—has universities that collaborate extensively with industry on AI-driven research. Andhra Pradesh, on the other hand, has invested heavily in digital classrooms and online platforms to increase accessibility. Understanding the comparative readiness of faculty in these two states is crucial for developing state-level and national strategies for AI-driven education.

2. Review of Literature

2.1 Global Perspectives on AI in Higher Education

Globally, AI applications in education have expanded exponentially in the past decade. According to Crompton and Burke (2023), the most significant contributions of AI include adaptive learning, automated grading, student behavior analytics, and academic advising systems. Holmes et al. (2021) describe AI as both a pedagogical and administrative innovation that enables personalization and efficiency.

Behera, Trivedi, and Patra (2023) conducted a meta-analysis of 250 research studies on AI in higher education and identified five emerging domains: intelligent tutoring, predictive analytics, virtual learning assistants, research simulations, and AI ethics. Similarly, Chan and Tsi (2023) emphasized the growing need for educators to co-exist with AI systems rather than

fear replacement, suggesting that faculty must act as “AI collaborators” who guide ethical and creative use of intelligent technologies.

However, despite these benefits, challenges persist. Xu and Chen (2024) note that algorithmic bias, ethical opacity, and data privacy remain major barriers to responsible AI use in education. UNESCO (2022) and the OECD (2023) have called for stronger global governance frameworks to prevent misuse of student data and ensure algorithmic fairness.

2.2 Indian Context and Empirical Studies

In India, AI adoption in higher education has gained policy recognition since 2018. The NITI Aayog’s AI for All strategy and the AICTE Model Curriculum 2021 include AI as a core competency across disciplines (NITI Aayog, 2023).

Bala and Kumar (2021) studied South Indian universities and found Karnataka leading in AI research output, while Andhra Pradesh performed better in digital platform adoption. Sharma et al. (2024) surveyed 1,000 faculty across India and observed that awareness and training remain key constraints, with only 40% of respondents reporting familiarity with AI-based tools. Raj and Patel (2022) demonstrated that institutional readiness and faculty training strongly correlate with adoption success.

Kaur, Khanna, and Kaur (2024) found that faculty members view AI as an enabler of personalized learning but also fear job displacement. Srivastava (2025) emphasized the necessity of integrating AI training modules into faculty development programs to improve adoption outcomes.

Despite the growing literature, few studies employ **state-level comparative analysis** or **primary data from faculty**. Hence, this study bridges that gap by examining perceptions and readiness among faculty in Karnataka and Andhra Pradesh.

2.3 Theoretical Framework

This study is grounded in the Technology–Organization–Environment (TOE) framework (Tornatzky & Fleischer, 1990) and the Technology Acceptance Model (TAM) (Davis, 1989).

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- TOE suggests that technological readiness, organizational culture, and external environment influence adoption.
- TAM posits that perceived usefulness and ease of use drive adoption behavior.

In higher education, these models imply that faculty adoption of AI depends on institutional support (organizational factor), availability of infrastructure (technological factor), and policy environment (external factor).

3. Objectives of the Study

1. To assess faculty awareness, readiness, and perceptions toward AI integration in higher education.
2. To identify key challenges and opportunities of AI adoption.
3. To analyze differences between faculty perceptions in Karnataka and Andhra Pradesh.
4. To examine the relationship between institutional support, training, and AI adoption.
5. To provide policy recommendations for improving institutional AI readiness.

4. Research Methodology

4.1 Research Design and Sampling

This study follows a quantitative descriptive–analytical design. The sample size of 384 faculty members was determined using the Cochran formula. The respondents were drawn from 10 public and private universities (5 in each state) through stratified random sampling, ensuring representation from engineering, science, management, and humanities departments.

4.2 Data Collection Instrument

A structured questionnaire was developed, validated by experts, and divided into five sections:

1. Demographic information
2. Awareness and use of AI tools
3. Institutional readiness and support
4. Perceived challenges
5. Opportunities and ethical concerns

Reliability was tested using Cronbach's Alpha = 0.88, indicating strong internal consistency.

4.3 Statistical Tools

- **Descriptive Statistics** (Mean, SD, %, Frequency)
- **Independent Sample t-test** (to compare means between states)
- **Chi-square Test** (to examine categorical associations)
- **Pearson Correlation** (to measure relationships)
- **Multiple Regression Analysis** (to identify predictors of AI adoption)
- Software: SPSS v26.0

4.4 Hypotheses

H₁: Faculty AI readiness significantly differs between Karnataka and Andhra Pradesh.

H₂: There is a positive correlation between institutional support and AI adoption.

H₃: Faculty training and institutional support predict AI adoption levels.

5. Data Analysis and Interpretation

5.1 Demographic Profile of Respondents

Table 1 Demographic Distribution of Faculty Respondents (N = 384)

| Demographic Variable | Category | Frequency (n) | Percentage (%) |
|------------------------------------|------------|------------------|-------------------|
| Gender | Male | 210 | 54.7 |
| | Female | 174 | 45.3 |
| Age Group (Years) | 25–35 | 98 | 25.5 |
| | 36–45 | 147 | 38.3 |
| | 46–55 | 102 | 26.6 |
| | 56 & Above | 37 | 9.6 |
| Teaching Experience (Years) | Below 5 | 92 | 23.9 |
| | 5–10 | 136 | 35.4 |
| | 10–20 | 105 | 27.3 |
| | Above 20 | 51 | 13.3 |

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|------------------------------|--------------------------|-----|------|
| Discipline/Department | Engineering & Technology | 162 | 42.2 |
| | Management & Commerce | 108 | 28.1 |
| | Science & Humanities | 69 | 18.0 |
| | Education & Others | 45 | 11.7 |
| Type of Institution | Public University | 208 | 54.2 |
| | Private University | 176 | 45.8 |
| State | Karnataka | 192 | 50.0 |
| | Andhra Pradesh | 192 | 50.0 |

Note. Data compiled from primary survey (2025). Percentages are calculated based on total respondents (N = 384).

Interpretation

The demographic profile reflects a balanced and representative sample of faculty respondents from both Karnataka and Andhra Pradesh.

- Gender distribution shows near parity (male = 54.7 %, female = 45.3 %), suggesting inclusivity and gender diversity in the sample.
- Age distribution indicates that a majority (38 %) of respondents fall within the 36–45 years category, representing mid-career faculty who are often the most active adopters of new technology.
- Teaching experience data reveal that over 60 % of respondents have more than five years of experience, implying adequate pedagogical maturity to evaluate AI's role in teaching and learning.
- Disciplinary spread is well balanced, with Engineering and Technology (42.2 %) forming the largest group, followed by Management and Commerce (28.1 %). This composition is ideal since AI adoption tends to be higher in technically oriented departments yet is expanding to other fields.
- The institutional type split (public = 54.2 %, private = 45.8 %) ensures representativeness across governance models.
- Finally, the equal state distribution (192 respondents each) enables valid comparative analysis between Karnataka and Andhra Pradesh using inferential statistics in later sections.

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Overall, the demographic distribution demonstrates methodological rigor and ensures that the subsequent analytical results are both statistically reliable and contextually meaningful for examining faculty perspectives on AI adoption.

5.2 Faculty Awareness and Readiness

| Dimension | Karnataka Mean | Andhra Pradesh Mean | Overall Mean | SD |
|-----------------------|-------------------|------------------------|-----------------|------|
| Awareness of AI Tools | 4.35 | 4.12 | 4.23 | 0.62 |
| Institutional Support | 3.84 | 3.52 | 3.68 | 0.71 |
| Faculty Training | 3.45 | 3.12 | 3.29 | 0.68 |
| Ethical Awareness | 3.25 | 3.08 | 3.16 | 0.59 |
| Perceived Benefits | 4.11 | 4.06 | 4.09 | 0.63 |

Interpretation:

Faculty members in Karnataka report higher awareness and institutional support, consistent with their exposure to AI research environments. However, both states show moderate levels of training and ethics awareness, suggesting a need for formal professional development.

5.3 Independent Sample t-Test

| Variable | t-value | p-value | Result |
|-----------------------|---------|---------|-----------------|
| AI Readiness | 2.45 | 0.015 | Significant |
| Institutional Support | 2.12 | 0.034 | Significant |
| Perceived Benefits | 0.88 | 0.381 | Not Significant |

Interpretation:

There is a significant difference in AI readiness and institutional support between states—Karnataka faculty are more confident using AI tools, possibly due to proximity to industry and better ICT infrastructure. The non-significant difference in perceived benefits suggests both groups acknowledge AI's importance but face similar systemic challenges.

5.4 Chi-square Test

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| Variable | χ^2 Value | df | p-value | Result |
|--------------------------------|----------------|----|---------|-----------------|
| Faculty Training vs. Readiness | 18.64 | 4 | 0.001 | Significant |
| Gender vs. AI Usage | 4.23 | 3 | 0.238 | Not Significant |

Interpretation:

Faculty training is strongly associated with AI readiness, validating the literature (Sharma et al., 2024). Gender, however, does not significantly influence AI use, indicating equal engagement among male and female faculty.

5.5 Correlation Analysis

| Variables | r | p-value | Relationship |
|--------------------------------------|-------|---------|-------------------|
| Institutional Support & AI Readiness | 0.578 | 0.000 | Strong Positive |
| AI Readiness & Teaching Innovation | 0.642 | 0.000 | Strong Positive |
| Ethical Awareness & AI Readiness | 0.332 | 0.004 | Moderate Positive |

Interpretation:

High correlations show that increased support and training lead to greater adoption and teaching innovation. Ethical awareness also contributes positively, though to a lesser extent.

5.6 Multiple Regression Analysis

Dependent Variable: AI Adoption Level

| Predictor | β | t | p-value |
|-----------------------|---------|------|---------|
| Faculty Training | 0.312 | 4.56 | 0.000 |
| Institutional Support | 0.284 | 3.98 | 0.000 |
| Ethical Awareness | 0.178 | 2.84 | 0.005 |
| Perceived Benefits | 0.096 | 1.22 | 0.224 |

Model Summary: $R^2 = 0.62$, Adjusted $R^2 = 0.59$, $F = 72.31$, $p < 0.001$

Interpretation:

Training and support emerge as significant predictors of AI adoption, explaining 62% of the variance. This validates the TOE model—organizational and technological readiness are decisive for successful AI integration.

6. Discussion

The results align with prior research suggesting that AI adoption depends on faculty competence and institutional commitment (Raj & Patel, 2022; Srivastava, 2025). The higher readiness in Karnataka corresponds to its stronger innovation ecosystem (Bala & Kumar, 2021).

The findings highlight a paradox: while faculty recognize AI's potential, institutional readiness especially training programs and ethical frameworks lags. This “awareness–adoption gap” mirrors global trends (Crompton & Burke, 2023). Ethical awareness remains moderate, reinforcing the need for governance and policy training (Mahajan, 2025). The correlation between AI readiness and innovation suggests that trained faculty not only adopt technology but also enhance pedagogical creativity.

7. Findings

1. Faculty in Karnataka display higher AI readiness and institutional support than those in Andhra Pradesh.
2. Training and support are the strongest predictors of AI adoption.
3. Ethical awareness remains moderate, indicating a need for formal guidance.
4. Institutional infrastructure significantly influences adoption success.
5. Gender and age have minimal impact on AI adoption behavior.

8. Recommendations

1. State-Level AI Training Programs; Establish regional AI resource centers to train educators.
2. Develop AI ethics committees for data governance and privacy protection.
3. Infrastructure Investment; Provide targeted funding for AI labs and cloud-based resources.
4. Integrate AI modules across arts, commerce, and sciences.
5. Partner with tech companies for real-time AI applications in teaching and research.
6. Continuous Monitoring; Conduct annual AI-readiness audits at the institutional level.

9. Conclusion

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The study demonstrates that AI's transformative role in higher education hinges on the preparedness of faculty and the support structures provided by institutions. Karnataka's advantage reflects its strong industry linkages and funding, while Andhra Pradesh's efforts in digital outreach are commendable. However, training, ethics, and infrastructure remain the pillars of sustained AI integration. The empirical results reinforce that capacity-building is the single most powerful predictor of adoption success, aligning with both global and national literature. AI, when adopted responsibly, has the power to democratize learning and make Indian higher education more innovative, equitable, and globally competitive.

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