

Teacher Readiness for AI Integration in Andhra Pradesh: A Mixed-Methods Analysis of Technology Adoption

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Abstract

The integration of Artificial Intelligence (AI) in K-12 education presents significant opportunities and challenges, particularly in developing regions. This mixed-methods study investigates the readiness, perceptions, and barriers to AI adoption among 95 in-service teachers across 12 districts of Andhra Pradesh, India. Grounded in the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), the study analyzed survey responses and open-ended comments. Quantitative findings reveal moderate technological comfort ($\bar{X}=4.07/5$ for panel boards) but low AI training ($\bar{X}=2.75/5$) and usage ($\bar{X}=2.85/5$). Significant gender and district-based variations were observed, particularly in AI self-efficacy and perceived engagement benefits. Qualitative analysis highlights critical barriers including infrastructure deficiencies (internet, power), technical challenges, and pedagogical misalignment. The study provides actionable recommendations for policymakers and teacher training institutions to facilitate contextualized AI adoption in rural educational ecosystems.

Keywords: Artificial Intelligence in Education, Teacher Readiness, Technology Acceptance Model (TAM), Rural Education, Andhra Pradesh, Digital Divide, Technology Adoption

1. Introduction

The rapid advancement of Artificial Intelligence (AI) is reshaping the global educational landscape. From personalized learning platforms and intelligent tutoring systems to automated assessment tools, AI promises to enhance pedagogical effectiveness and operational efficiency. However, the successful integration of these technologies is contingent upon the readiness and acceptance of a key stakeholder: the teacher. As the primary mediators between technology and learners, teachers' perceptions and willingness to adopt AI directly determine the success or failure of such initiatives. In developing nations like India, this challenge is exacerbated by the complexities of resource-constrained, linguistically diverse, and primarily rural education systems.

Recent research in the Indian context confirms that while faculty in higher education recognize the utility of AI, adoption is often hindered by inadequate training and institutional support. Razi-ur-Rahim et al. (2025) found that perceived usefulness and ease of use were primary drivers for GenAI adoption among Indian faculty, underscoring the applicability of the Technology Acceptance Model (TAM). Similarly, studies using the

UTAUT2 model have highlighted the role of performance expectancy, effort expectancy, and social influence in shaping teachers' behavioral intentions. However, these studies predominantly focus on higher education and urban contexts, leaving a critical gap in understanding the grassroots realities of K-12 teachers in rural India. Furthermore, existing literature emphasizes significant barriers: technical issues, curriculum misalignment, cultural inappropriateness of content, and data privacy concerns.

This study addresses these gaps by focusing on Andhra Pradesh, a state in southern India with a significant rural population undergoing large-scale digital infrastructure implementation in its schools. The primary objective is to assess the readiness and perceptions of in-service teachers regarding AI integration. The specific research questions are:

1. What is the current level of AI awareness, training, and usage among teachers in Andhra Pradesh?
2. What are the primary perceived benefits and challenges of integrating AI tools in their classrooms?
3. How do perceptions and readiness vary across gender, school type (KGBV, Gurukulam, ZP), and district?

2. Literature Review

2.1 Theoretical Framework

This study is anchored in two prominent technology acceptance models. The Technology Acceptance Model (TAM) posits that perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants of behavioral intention to use a technology. In the educational technology context, TAM has been extensively validated, including for AI tools in India. The Unified Theory of Acceptance and Use of Technology (UTAUT) and its extension, UTAUT2, offer a more comprehensive framework, incorporating social influence, facilitating conditions, and hedonic motivation. This study leverages these theories to interpret teachers' self-reported ratings of AI's utility (personalization, engagement), ease of use (comfort with panels), and the influence of infrastructural support (facilitating conditions).

2.2 AI Readiness and Perceived Benefits

Globally, K-12 teachers acknowledge the potential of AI to increase efficiency, provide interactivity, and support personalized learning. In India, the perceived benefits are often articulated in terms of reduced administrative workload and enhanced student engagement. Arunfred & Marin (2025) note that AI-based tools can transform pedagogy by enabling data-driven insights for teachers. However, acceptance remains moderate, and is often contingent on tangible evidence of improved learning outcomes.

2.3 Barriers to AI Integration

Despite the promise, significant barriers persist. A systematic review of the literature consistently identifies several categories of challenges: infrastructural (internet connectivity, reliable electricity, hardware maintenance); pedagogical and curricular (misalignment of AI content with local syllabus, lack of contextualized resources); teacher-centric (lack of training, low digital/AI literacy, time constraints, resistance to change); and ethical (data privacy, over-reliance on AI, erosion of critical thinking). These challenges are amplified in the rural Indian context, where the digital divide remains a formidable obstacle.

3. Methodology

This study employed a cross-sectional, explanatory sequential mixed-methods design. The primary data source was a structured online survey (Form responses 2) distributed to 95 in-service teachers across 12 districts of Andhra Pradesh. The survey instrument collected data on demographics, technology usage frequency, AI tool awareness, perceived benefits and challenges (rated on 5-point Likert scales), and open-ended comments. Descriptive and inferential statistics (mean scores, subgroup comparisons) were calculated using Microsoft Excel. The "Additional Comments" section of the survey provided rich qualitative data, which was analyzed thematically to understand the lived realities of teachers in rural classrooms.

4. Results

The analysis yielded key findings regarding teachers' technological comfort, AI-specific readiness, and the stark contrasts between districts.

4.1 Overall Technological Comfort and AI Readiness

Teachers reported moderate-to-high comfort with digital panel boards ($\bar{X}=4.07/5$), indicating adequate familiarity with basic hardware. However, a significant readiness gap emerged in the realm of AI. AI awareness was low ($\bar{X}=3.43/5$), and both formal AI training ($\bar{X}=2.75/5$) and current classroom usage of AI tools ($\bar{X}=2.85/5$) were markedly low.

4.2 Gender and School-Type Variations

A gender-based disparity was evident. Across all teacher cohorts, males consistently rated themselves higher than females in comfort with technology, confidence in integrating AI, and

Table 1: Overall Average Scores of Teacher Readiness (n=95)

Metric Average	(1–5)
Comfort with panel board operatio	4.0
Awareness of AI educational tool	3.43
Received AI training	2.75
Currently use AI tools in teaching	2.85
AI helps personalize learning	3.54
AI reduces administrative workloaAI reduces administrative workload	3.37
Confident integrating AI into teaching	3.46
AI improves student engagement	3.45
Concerned about data privacy/ethics	3.05
Supported by management in using AI	3.52
AI tools are culturally appropriate	3.28

the perceived benefits of AI for personalizing learning and improving student engagement. Females, however, reported slightly higher levels of formal training.

Table 2: Gender-wise Averages Across Teacher Cohorts (n=75)

Metric	Male (n=128)	Female (n=47)
Comfort with panel board	4.29	3.91
Received AI training	2.61	2.85
Confident integrating	3.79	3.23
Confident integrating AI	3.79	3.23
AI improves student engagement	3.71	3.28

When disaggregated by school type, teachers in Kasturba Gandhi Balika Vidyalayas (KGBVs) showed moderate AI awareness but low usage. Gurukulam teachers,

particularly males, demonstrated the highest confidence in AI integration. ZP school teachers, while comfortable with panels, showed lower AI adoption and confidence.

4.3 District-Wide Analysis

Srikakulam district, with the largest sample ($n \approx 75$), mirrored the overall low scores for AI training (2.75). In stark contrast, Anakapalli and Parvathipuram Manyam, having sample size ($n=50$ and $n=52$ respectively), exhibited exceptionally high AI training and usage scores ($\bar{X}=3.67$ to 4.50). This suggests the presence of localized "pockets of innovation" or early adopters.

4.4 Qualitative Insights: Thematic Analysis of Perceived Barriers

Thematic analysis of open-ended comments revealed three dominant, interrelated barriers:

1. **Infrastructure as the Primary Obstacle:** A recurring lament was the lack of reliable internet and electricity in rural areas. A teacher from Srikakulam stated, "Internet not available is a major disadvantage." Another echoed, "Power supply and internet are the main problems in rural areas."
2. **Technical and Logistical Hurdles:** Teachers frequently cited hardware issues, including panel overheating, screen-casting problems, and difficulties with different brands (e.g., "Samsung panel board different from LG panel board"). One teacher noted the occupational hazard of "staring at it for 6-7 hours a day causes eye muscle fatigue."
3. **Pedagogical and Training Gaps:** The lack of proper, contextualized training was a universal grievance. Comments like "need more work shops" and "Requires training and infrastructure" were common. Teachers expressed a need for training not just in AI tools, but in basic computer skills and pedagogical strategies for integration.

5. Discussion

The findings of this study present a critical paradox in Andhra Pradesh's push for AI-enabled education. On one hand, teachers demonstrate a foundational level of digital comfort and a clear recognition of AI's potential for personalization and engagement. This aligns with the perceived usefulness (PU) construct of TAM. On the other hand, this nascent acceptance is being actively suppressed by a severe lack of facilitating conditions (infrastructure, training), echoing the core premise of UTAUT.

The gender gap in self-efficacy and confidence is a significant concern. While female teachers received slightly more training, they reported lower confidence, suggesting that training content or delivery may not be effectively addressing their specific needs or building psychological readiness. This finding aligns with broader research on technology

adoption which indicates that self-efficacy is a stronger predictor of intention than formal training alone.

The most consequential finding is the stark disparity between districts. The high AI adoption scores in Anakapalli and Parvathipuram Manyam, are "canary in the coal mine" indicators. They demonstrate that with targeted intervention (e.g., a proactive school leader, a foundational training program, or a local internet solution), rapid adoption is possible. Conversely, the low scores in a large district like Srikakulam reveal the systemic failure of a "one-size-fits-all" approach.

The qualitative data powerfully confirms the barriers identified in other developing nation contexts. Until the foundational issues of reliable electricity and internet connectivity are addressed, any investment in AI training or tools will yield diminishing returns. Furthermore, the expressed concerns about eye strain, hardware overheating, and software incompatibility highlight a lack of human-centered design in the current digital infrastructure.

6. Conclusion and Recommendations

This study concludes that teachers in Andhra Pradesh are caught at a crossroads of technological aspiration and infrastructural reality. While they are not inherently resistant to AI, their readiness is fundamentally constrained by a lack of contextualized training and basic digital infrastructure. A significant policy-practice gap exists, where the introduction of advanced technology has outpaced the creation of a supportive ecosystem for its users.

Recommendations:

1. **Infrastructure-First Approach:** The government must prioritize the provision of reliable electricity and high-speed internet in all rural schools as a prerequisite for any AI integration initiative.
2. **Contextualized Training Modules:** Move beyond generic AI literacy. Develop module-based training that directly links AI tools to specific chapters in the state curriculum, demonstrating clear PEOU and PU for the teacher.
3. **Bridging the Gender Digital Divide:** Implement targeted peer-mentoring programs for female teachers and design training content that explicitly builds technical self-efficacy, not just knowledge.
4. **Create Sustainable Support Systems:** Establish local "digital resource centers" at the mandal or cluster level with a designated technical person who can provide immediate on-site support for hardware and software issues.

5. Start Small with Pilot Projects: Replicate the success observed in smaller districts by implementing structured, "low-complexity, high-impact" pilot projects before scaling state-wide.

7. References

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