Vol. 14, Sp. Issue: 1, December: 2025
ISSN: (P) 2347-5412 ISSN: (O) 2320-091X

Teachers' Readiness and Perceived Barriers to Artificial Intelligence Integration in School Education: A Case Study of Balasore District

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Introduction

Artificial Intelligence (AI) is rapidly entering the field of school education through adaptive learning tools, automated assessments, virtual assistants, predictive analytics, and personalized learning platforms. Its successful implementation, however, depends heavily on teachers' readiness to adopt AI and their perceptions of the barriers associated with its integration. In many Indian districts, including Balasore (Odisha), the integration of AI remains in its infancy. Teachers' digital competencies, attitudes toward innovation, infrastructural constraints, and institutional support play critical roles in shaping AI adoption. This study investigates the level of readiness among school teachers of Balasore district and identifies the challenges they perceive in integrating AI into their teaching-learning processes.

Theoretical Background of the Study

a) Technology Acceptance Model (TAM)- According to TAM, teachers' willingness to adopt AI depends on perceived usefulness, perceived ease of use, and behavioural intention toward technology adoption.

b) Unified Theory of Acceptance and Use of Technology (UTAUT)- UTAUT highlights performance expectancy, effort expectancy, social influence, and facilitating conditions as determinants of technology acceptance.

c) Diffusion of Innovations Theory (Rogers, 2003)- This theory explains how innovations spread in a social system. Teachers' readiness is influenced by their innovativeness, compatibility, observability, and trialability of AI tools.

d) Technological Pedagogical Content Knowledge (TPACK) Framework- TPACK guides understanding of how teachers integrate technological knowledge (AI-based tools) with pedagogy and content.

Significance of the Study

- Helps policymakers and administrators understand the ground reality of AI adoption in schools.
- Assists in designing targeted training programmes for teachers.
- Identifies institutional, infrastructural, and attitudinal barriers.
- Supports the development of AI-inclusive curriculum and resource allocation strategies.
- Contributes to the academic discussion on AI readiness at the school level in semi-urban districts.

Statement of the Problem

Despite growing interest in AI for school education, teachers in Balasore district display varying levels of preparedness. Lack of training, limited technological resources, uncertainty about AI's role in teaching autonomy, and fear of job displacement may influence teachers' perceptions. The absence of empirical evidence concerning teachers' readiness and perceived barriers necessitates a systematic investigation.

Operational Definitions of Key Terms

- **AI Integration:** Use of AI-enabled tools, platforms, and applications for teaching, learning, assessment, and classroom management.

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- **Teachers' Readiness:** Teachers' digital competence, confidence, attitudes, and willingness to adopt AI in the classroom.
- **Perceived Barriers:** Constraints perceived by teachers, such as infrastructural inadequacies, lack of knowledge, fear of technology, and institutional limitations.
- **School Education:** Classes I–XII in government and private schools of Balasore district.

Variables

Independent Variables

- Teachers' readiness dimensions (digital skills, AI awareness, attitudes, confidence).
- School context (infrastructure, training, administrative support).

Dependent Variable

- AI integration in teaching-learning processes.

Objectives of the Study

1. To assess teachers' readiness for AI integration in school education.
2. To identify perceived barriers faced by teachers while implementing AI tools.
3. To examine differences in readiness among teachers based on gender, experience, type of school, and qualification.
4. To suggest strategies for overcoming the barriers and strengthening AI adoption.

Research Questions

1. What is the level of readiness among school teachers of Balasore district toward AI integration?
2. What barriers do they perceive in adopting AI tools?
3. Are there significant differences in readiness across demographic variables?
4. What institutional factors support or hinder AI adoption?

Scope of the Problem

The study focuses on school teachers from government and private schools of Balasore district. It examines their readiness for AI adoption and the challenges they experience in real classroom contexts.

Delimitation and Area

- Study limited to Balasore district (Odisha).
- Focus only on teachers, not students or administrators.
- Concerns classroom-level integration, not administrative AI systems.

Review of Related Literature

1. Holmes et al. (2019)- Found that teachers' digital literacy significantly influences AI adoption in classrooms.
2. Luckin & Holmes (2017)- Emphasized that lack of conceptual understanding of AI among teachers creates resistance to adoption.
3. Sarwar & Muhammad (2019)- Reported that infrastructural inadequacies and absence of training programmes are major barriers in developing countries.
4. Elmahdi (2021)- Demonstrated that proper professional development enhances readiness for AI-based teaching.
5. Popenici & Kerr (2017)- Highlighted teachers' concerns related to autonomy, ethics, and job security when adopting AI systems.

Research Gap

Limited studies exist at the district level in India, especially in semi-urban regions like Balasore. Prior research mainly generalizes AI adoption; few studies examine the **combined dimensions of readiness and perceived barriers** among school teachers. This gap warrants the present case study.

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Research Methodology

a) Research Design- Descriptive survey design backed by comparative analysis.

b) Population- All government and private school teachers of Balasore district.

c) Sample- Approximately 200 teachers selected from secondary and higher secondary schools.

d) Sampling Method- Stratified random sampling ensuring representation from rural/urban, government/private schools.

e) Sources of Data- Primary data from questionnaires; secondary data from reports and academic literature.

Research Tools

- **Teachers' Readiness for AI Scale** (self-constructed with dimensions: awareness, attitudes, skills, confidence).
- **Perceived Barriers Scale** (covering infrastructure, knowledge, ethics, workload, training gaps).
- Reliability assessed through Cronbach's Alpha; validity ensured through expert review.

Data Collection

- Permission obtained from school authorities.
- Questionnaire administered personally and digitally.
- Assured confidentiality and voluntary participation.

Statistical Analysis

- Descriptive statistics: Mean, SD, percentage scores.
- Inferential statistics:
    - t-test (gender, school type differences)
    - ANOVA (experience or qualification-based differences)
    - Pearson correlation (readiness–barrier relationship)

Tabulation and Interpretation

Data is organized in tables showing readiness levels, perceived barriers, group comparisons, and correlations. Interpretation will follow research questions and hypotheses.

Findings of the Study

1. Teachers possess moderate readiness for AI integration.
2. Infrastructural limitations, lack of training, and low AI awareness are major barriers.
3. Private school teachers show higher readiness compared to government school teachers.
4. Positive attitude and confidence strongly predict willingness to adopt AI tools.
5. Teachers desire structured training and institutional support.

Summary

Teachers of Balasore district show interest in AI integration but face significant constraints. Readiness levels vary widely based on experience, exposure, and institutional resources.

Conclusions

AI integration is achievable but requires systematic intervention through training, infrastructure improvement, and policy support. Teachers' attitudes and confidence are key drivers.

Recommendations

- Organise district-level AI training workshops.
- Improve digital infrastructure in government schools.
- Introduce AI literacy modules in teacher education programmes.
- Provide ongoing technical support and collaborative learning networks.
- Ensure ethical guidelines for safe AI usage.

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