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Research Article

AI Tool Usage Among Education College Teachers: A Comparative Analysis Study

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Abstract

This study investigates the usage of Artificial Intelligence (AI) tools among education college teachers, focusing on differences across gender, location of students (rural vs. urban), type of school management (government vs. private), and teaching experience (below 5 years vs. above 5 years). A sample of 300 teachers (150 male, 150 female) was surveyed, with equal representation across rural (150) and urban (150) student locations, government (150) and private (150) schools, and teaching experience categories (150 below 5 years, 150 above 5 years). Using SPSS for analysis, descriptive statistics (mean, standard deviation), t-tests, ANOVA (F-value), and correlation analyses were conducted to explore AI tool adoption. Results indicate significant differences in AI tool usage based on gender and teaching experience, with non-significant differences for location and management type at the 0.05 significance level. The findings provide insights for policymakers and educators to enhance AI integration in teacher education.

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KEYWORDS: Artificial Intelligence, Role of AI in Education, Principles of AI in Education, Components of AI in Education, Correlation Analysis.

1. INTRODUCTION

Artificial Intelligence (AI) tools are transforming education by offering personalized learning, automating tasks, and enhancing teaching methodologies. However, their adoption among education college teachers varies due to factors like gender, location, school management type, and teaching experience. This study aims to explore these variations systematically, addressing the gap in understanding how demographic and professional factors influence AI tool usage in teacher education settings.

Meaning and Definition of Artificial Intelligence:

Artificial Intelligence (AI) refers to the development of computer systems that can perform tasks typically requiring human intelligence, such as learning, problem-solving, decision-making, and perception. In essence, AI enables machines to mimic cognitive functions like reasoning and adaptability. According to John McCarthy, a pioneer in AI, it is "the science and engineering of making intelligent machines, especially intelligent computer programs." In the context of education, AI involves tools and systems that enhance teaching, learning, and administrative processes by automating tasks, personalizing learning experiences, and providing data-driven insights.

Role of AI in Education

AI is transforming education by offering innovative solutions to improve teaching efficiency and student outcomes. For college teachers, AI tools play a significant role in:

Personalised Learning: AI-driven platforms analyze student performance and tailor content to individual needs, enabling teachers to address diverse learning styles.

Administrative Efficiency: AI automates tasks like grading, attendance tracking, and scheduling, allowing teachers to focus on instruction.

Enhanced Engagement: Tools like virtual tutors, chatbots, and interactive simulations create engaging learning environments.

Data-Driven Insights: AI analytics help teachers identify student strengths, weaknesses, and progress, informing instructional strategies.

Accessibility: AI tools, such as text-to-speech or real-time translation, make education inclusive for diverse learners.

Principles of AI in Education:

The Effective use of AI in Education is guided by Several Principles:

Equity and Inclusion: AI systems should ensure accessibility and fairness, avoiding biases in algorithms that could disadvantage certain groups.

Transparency: Teachers and students should understand how AI tools process data and make decisions.

Privacy and Security: Protecting sensitive student and teacher data is critical, adhering to regulations like GDPR or FERPA.

Human-Centric Design: AI should complement, not replace, human teachers, enhancing their ability to foster critical thinking and creativity.

Continuous Learning: AI systems must adapt to evolving educational needs through regular updates and feedback loops.

Components of AI in Education

AI systems in education typically consist of the following components:

Machine Learning (ML): Algorithms that learn from data to predict student performance or recommend resources.

Natural Language Processing (NLP): Enables tools like chatbots and voice assistants to interact with students and teachers.

Computer Vision: Used in tools like facial recognition for attendance or analyzing handwritten assignments.

Data Analytics: Processes large datasets to provide insights into student progress and teaching effectiveness.

Robotics and Automation: Includes virtual tutors or automated grading systems that streamline repetitive tasks.

Statement of the Problems:

The integration of artificial intelligence (AI) tools in higher education has sparked significant interest, yet their adoption among education college teachers remains uneven. While AI offers opportunities to enhance teaching efficiency, personalize learning, and streamline administrative tasks, several challenges hinder its widespread use. Key issues include:

- Limited AI Literacy and Training: Many education college teachers lack sufficient training in AI tools, leading to low confidence and underutilization. This is particularly evident among veteran educators, with only 17% of teachers with over 10 years of experience using AI tools compared to 21% of newer teachers.
- Disparities Across Disciplines: Preliminary evidence suggests STEM educators adopt AI tools more readily for efficiency, while humanities instructors prioritize rapport and creativity, creating a gap in tool application.
- Ethical and Privacy Concerns: The absence of clear institutional guidelines on AI use raises concerns about data privacy, algorithmic bias, and academic integrity, with 69% of students in related studies noting risks of AI misuse.
- Access and Equity Issues: Teachers in under-resourced colleges, particularly in high-poverty areas, report lower

AI adoption (18% vs. 25% in wealthier institutions), exacerbating educational inequities.
- Impact on Teacher-Student Dynamics: Over-reliance on AI tools risks diminishing critical thinking and human connection, with mean scores of 3.53–3.99 reflecting concerns about reduced rapport.

This study seeks to address these problems by comparing AI tool usage among education college teachers across disciplines, experience levels, and institutional contexts, identifying barriers and opportunities for effective integration.

2. REVIEW OF RELATED LITERATURE

The integration of AI tools in education has been widely studied, with recent literature highlighting both opportunities and challenges in higher education settings. Below is a synthesised review of key findings relevant to AI tool usage among college education teachers:

1. **AI Applications in Education**:
- AI tools, such as intelligent tutoring systems, adaptive learning platforms, and automated assessment systems, enhance teaching by personalizing learning and reducing administrative burdens. For instance, tools like Knewton Alta and PowerBuddy provide data-driven insights, improving student outcomes by 15–20% in some studies.
- Conversational AI (e.g., ChatGPT, Google Assistant) supports lesson planning and student engagement, with 25% of K-12 teachers using such tools weekly. However, adoption in higher education lags, particularly among non-STEM educators.

2. **Teacher Adoption and Barriers**:
- A systematic review (2015–2024) found that 65% of AI education research focuses on student-facing tools, while only 35% addresses teacher professional development, indicating a gap in supporting educators' AI integration.
- Teachers with less than one year of experience show higher AI adoption (21% vs. 17% for veterans), but lack of training and AI literacy remains a significant barrier, especially in under-resourced institutions.
- Cultural and ethical concerns, such as adapting AI-generated content to local contexts and addressing data privacy, further impede adoption, particularly in high-poverty settings where only 18% of teachers use AI tools.

3. **Discipline-Specific Trends**:
- STEM educators value AI for efficiency (e.g., automated grading, analytics), while humanities instructors prioritize rapport and creativity, leading to lower adoption rates. A study noted humanities teachers' concerns about AI diminishing student creativity and teacher-student bonds (mean scores 3.53–3.99).
- Discipline-specific applications, such as AI scaffolding for scientific writing in STEM, show promise but require tailored training to align with pedagogical goals.

4. **Ethical and Cognitive Impacts**:
- Ethical challenges, including algorithmic bias, plagiarism, and privacy breaches, are significant. For example, 48.2% of students in one study expressed concerns about AI-generated content accuracy, and 69% noted risks of academic fraud.
- Over-reliance on AI tools correlates with reduced critical thinking and cognitive offloading, particularly among younger users, highlighting the need for balanced integration.

Research Tools Used for the Study

To investigate AI tool usage comprehensively, the study employs a mixed-methods approach, utilizing the following research tools:

1. **Structured Questionnaires**:

A 30-item survey with Likert-scale questions to assess teachers' frequency of AI tool usage, perceived ease of use, and attitudes toward AI integration.

Includes demographic questions (e.g., years of experience, discipline) and open-ended questions to capture qualitative insights on barriers and benefits.

Distributed to 300 education college teachers across 15 institutions, selected via stratified random sampling to ensure diversity in institution type and location.

2. **In-Depth Interviews:**

Semi-structured interviews with 20 teachers (10 STEM, 10 humanities) to explore perceptions, experiences, and ethical concerns regarding AI tools.

Interview questions focus on specific tools used (e.g., ChatGPT, Turnitin), challenges faced, and impacts on teaching practices.

Conducted virtually or in person, recorded, and transcribed for thematic analysis.

3. **Focus Groups:**

Three focus groups (8–10 participants each) to discuss institutional support, training needs, and cultural barriers to AI adoption. Grouped by experience level (novice, mid-career, veteran) to identify trends across career stages.

4. **Observation of Classroom Practices**:

Classroom observations in 10 courses to document real-world AI tool usage (e.g., automated grading, virtual assistants).

Observations guided by a checklist to assess tool integration, teacher-student interaction, and student engagement.

5. **Data Analysis Tools**:

Quantitative data were analysed using SPSS for descriptive statistics, ANOVA to compare usage across disciplines, and regression analysis to identify predictors of AI adoption.

These tools ensure a comprehensive examination of AI usage, combining quantitative metrics with qualitative insights to address the research questions effectively.

Correlation Analysis: AI Tool Usage Among Education College Teachers:

To understand the relationship between AI tool usage and various factors among college teachers, a correlation analysis can explore how variables like teacher demographics, technological proficiency, institutional support, and teaching outcomes interact. Below is a structured approach to conducting such an analysis:

Variables for Analysis:

AI Tool Usage: Frequency and types of AI tools used (e.g., learning management systems, AI grading tools, virtual assistants).

Teacher Demographics: Age, gender, and years of teaching experience.

Technological Proficiency: Teachers' familiarity with technology, measured through self-reported skills or training hours.

Institutional Support: Access to AI tools, training programs, and infrastructure (e.g., high-speed internet, software licenses).

Teaching Outcomes: Metrics like student engagement, academic performance, or time saved on administrative tasks.

3. OBJECTIVES

1. To examine the extent of AI tool usage among education college teachers.
2. To compare AI tool usage across gender (male vs. female), location (rural vs. urban students), management type (government vs. private schools), and teaching experience (below 5 vs. above 5 years).
3. To identify correlations between demographic/professional factors and AI tool usage.
4. To assess the statistical significance of differences in AI tool usage at the 0.05 level.

Hypotheses

- **H1**: There is a significant difference in AI tool usage between male and female education college teachers.
- **H2**: AI tool usage differs significantly between teachers serving rural and urban students.
- **H3**: There is a significant difference in AI tool usage between teachers in government and private schools.
- **H4**: Teachers with less than 5 years of experience use AI tools significantly more than those with more than 5 years.
- **H5**: There is a significant correlation between demographic/professional factors and AI tool usage.

4. METHODOLOGY

Sample

The study included 300 education college teachers, equally distributed across:

- **Gender**: 150 male, 150 female
- **Location**: 150 teaching rural students, 150 teaching urban students
- **Management Type**: 150 in government schools, 150 in private schools
- **Teaching Experience**: 150 with below 5 years, 150 with above 5 years

A stratified random sampling method ensured balanced representation across these categories.

Data Collection

A structured questionnaire was developed to measure AI tool usage, focusing on frequency and types of tools used (e.g., virtual learning platforms, AI-powered educational games, and generative AI like ChatGPT). The questionnaire used a 5-point Likert scale (1 = Never, 5 = Very Frequently). The instrument was validated through a pilot study (Cronbach's alpha = 0.85).

Data Analysis

Data were analyzed using SPSS version 26. The following analyses were conducted:

- **Descriptive Statistics**: Mean and standard deviation (SD) of AI tool usage.
- **Independent Samples t-Test**: To compare AI tool usage across gender, location, management type, and teaching experience.
- **ANOVA (F-value)**: To assess overall differences across groups.
- **Correlation Analysis**: To examine relationships between demographic variables.
- **Significance Level**: Set at 0.05 for all statistical tests.

5. RESULTS

Descriptive Statistics

- The overall mean AI tool usage score was 3.45 (SD = 0.78), indicating moderate adoption. Table 1 presents the mean and SD for each group.

Table 1: Descriptive Statistics of AI Tool Usage

Variable	Group	N	Mean	SD
Gender	Male	150	3.62	0.75
	Female	150	3.28	0.79
Location	Rural Students	150	3.40	0.82
	Urban Students	150	3.50	0.74

t-Test Results

- Independent samples t-tests were conducted to test hypotheses H1–H4. Results are summarised in Table 2.

Table 2: t-Test Results for AI Tool Usage

Comparison	t-value	df	p-value	Significant (p < 0.05)
Male vs. Female	3.84	298	0.000	Significant
Rural vs. Urban	-1.12	298	0.264	Not Significant
Government vs. Private	-1.56	298	0.120	Not Significant
Below 5 vs. Above 5	5.42	298	0.000	Significant

- **H1**: Supported. Male teachers (M = 3.62) used AI tools significantly more than female teachers (M = 3.28, p < 0.05).
- **H2**: Not supported. No significant difference between rural (M = 3.40) and urban (M = 3.50) student locations (p = 0.264).
- **H3**: Not supported. No significant difference between government (M = 3.38) and private (M = 3.52) schools (p = 0.120).
- **H4**: Supported. Teachers with less than 5 years of experience (M = 3.70) used AI tools significantly more than those with more than 5 years (M = 3.20, p < 0.05).

ANOVA Results

A one-way ANOVA was conducted to assess overall group differences. Results are shown in Table 3.

Table 3: ANOVA Results for AI Tool Usage

Variable	F-value	df	p-value	Significant (p< 0.05)
Gender	14.75	1,298	0.000	Significant
Location	1.25	1,298	0.264	Not Significant
Management Type	2.43	1,298	0.120	Not Significant
Teaching Experience	29.38	1,298	0.000	Significant

- Significant differences were found for gender and teaching experience (p < 0.05), but not for location or management type.

- **Correlation Analysis**

Pearson's correlation was used to test H5, examining relationships between AI tool usage and demographic/professional factors. Table 4 presents the results.

Table 4: Correlation Analysis

Variable	Correlation Coefficient (r)	p-value	Significant (p < 0.05)
Gender (Male = 1, Female = 0)	0.22	0.000	Significant
Location (Rural = 1, Urban = 0)	0.06	0.264	Not Significant
ManagementType(Gov=1, Private= 0)	0.09	0.120	Not Significant
Teaching Experience (Below 5 = 1, Above 5 = 0)	0.31	0.000	Significant

- **H5**: Partially supported. Significant positive correlations were found between AI tool usage and gender (r = 0.22, p < 0.05) and teaching experience (r = 0.31, p < 0.05). No significant correlations were found for location or management type.

Interpretation of Results

- **Gender**: Male teachers showed higher AI tool usage, possibly due to greater familiarity with technology or access to training. This aligns with prior studies suggesting gender differences in technology adoption.
- **Location**: The lack of significant difference between rural and urban student locations suggests that AI tool access is relatively equitable, possibly due to widespread internet availability.
- **Management Type**: Non-significant differences between government and private schools indicate that institutional resources may not be the primary barrier to AI adoption.
- **Teaching Experience**: Teachers with less experience (below 5 years) were more likely to use AI tools, likely due to their recent exposure to technology during training.

6. DISCUSSION

The findings highlight that gender and teaching experience significantly influence AI tool usage among education college teachers. Male teachers and those with less than 5 years of experience are more likely to adopt AI tools, possibly due to greater technological familiarity or openness to innovation. The lack of significant differences in location and management type suggests that AI tools are becoming accessible across diverse educational settings. However, the moderate overall usage (M = 3.45) indicates a need for targeted training to enhance adoption, particularly for female teachers and those with more experience.

Implications

- **Policy**: Institutions should prioritize AI training programs, especially for female teachers and those with over 5 years of experience.
- **Practice**: Collaborative sessions on prompt engineering and AI literacy can enhance teacher confidence in using AI tools.
- **Research**: Future studies should explore longitudinal impacts of AI training on teacher efficacy and student outcomes.

Limitations

- The study relied on self-reported data, which may introduce bias.
- The sample was limited to education college teachers, limiting generalizability to other disciplines.
- Specific AI tools (e.g., ChatGPT vs. Google Classroom) were not differentiated in the analysis.

Recommendations

Based on a comparative analysis of AI tool usage among education college teachers, the following recommendations aim to enhance adoption, address challenges, and promote effective integration of AI in higher education settings. These recommendations draw from recent studies and aim to foster equitable, ethical, and practical use of AI tools.

- Enhance Teacher Training and Professional Development
- Develop Clear Institutional Policies on AI Use
- Promote Equity in AI Access and Implementation
- Foster AI Literacy Across Disciplines

Further Study

To deepen understanding of AI tool usage among education college teachers and address gaps in current research, the following areas warrant further investigation:

1. **Longitudinal Studies on AI Adoption Trends**—Use mixed-methods approaches, combining surveys with qualitative interviews to capture evolving perceptions and barriers across multiple academic years.
2. **Discipline-Specific AI Applications-Methodology**: Employ comparative case studies across departments, using surveys and focus groups to identify tool preferences and pedagogical impacts.
3. **Impact of AI on Teacher-Student Dynamics**—Methodology: Conduct randomized controlled experiments, similar to those on student agency, to assess how AI tools influence teacher-student rapport and classroom dynamics.
4. **Ethical and Bias-Related Challenges -Methodology**: Use qualitative methods like thematic analysis of teacher and student interviews to identify ethical challenges, complemented by quantitative surveys to measure prevalence.
5. **Comparative Effectiveness of Specific AI Tools**—Methodology: Design controlled studies to test tools in real classroom settings, measuring outcomes like student engagement, grades, and teacher workload reduction.

7. CONCLUSION

This study provides a comprehensive analysis of AI tool usage among education college teachers, revealing significant differences based on gender and teaching experience. While location and management type do not significantly influence usage, targeted interventions are needed to bridge gaps in adoption, particularly for female teachers and those with more experience. These findings contribute to the growing body of literature on AI in education and offer practical insights for enhancing its integration in teacher training programs.

AI tools hold immense potential to revolutionize education by supporting teachers in delivering personalized, efficient, and engaging instruction. A correlation analysis of AI tool usage among education college teachers can reveal critical insights into factors driving adoption and their impact on teaching outcomes. By understanding these relationships, institutions can design targeted interventions to promote AI integration, ensuring that teachers are equipped to leverage these technologies effectively while upholding ethical and inclusive practices.

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