

ORIGINAL PAPER

TEACHERS PERCEPTIONS ON THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN TEACHING SCIENCE

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ABSTRACT: *In recent years, artificial intelligence (AI) has emerged as a transformative force across many sectors, including education. AI-driven applications such as intelligent tutoring systems, adaptive assessment tools, and virtual laboratories have begun to reshape how science concepts are taught and learned. Despite this growing global trend, the extent to which teachers understand, accept, and use these tools remains uncertain—especially in semi-urban and rural regions of India. This quantitative study explores science teachers' perceptions of using AI tools in classroom instruction in and around Karaikudi, Sivagangai District, Tamil Nadu. A sample of 60 middle- and high-school science teachers was selected using stratified random sampling. Data were collected through a structured questionnaire based on the Technology Acceptance Model (TAM), measuring perceived usefulness, perceived ease of use, attitude toward AI, and intention to use AI in teaching. Descriptive and inferential statistics (mean, SD, correlation, and t-tests) were used to analyze the data. Findings revealed that teachers hold generally positive attitudes toward AI integration in science education, recognising its potential to enhance engagement, visualization, and individualized learning. However, barriers such as inadequate infrastructure, lack of technical training, and ethical concerns about AI misuse were also reported. The study concludes that while teachers are open to innovation, successful AI adoption will require targeted professional development and improved institutional support.*

KEYWORDS: *Artificial Intelligence (AI); Science Education; Teacher Perceptions; Educational Technology; Middle - High School Science Teachers, Technology Acceptance Model*

PAPER CITATION:

Sasikala, M. J. E : "Teachers Perceptions On The Use Of Artificial Intelligence Tools In Teaching Science", *International Journal of Informative & Futuristic Research (IJIFR)*, Vol.(13) (3), November 2025, pp. 301–309 DOI: <https://doi.org/10.64672/IJIFR/25.11.13.03.002>

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1. INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly influenced the field of education worldwide. AI technologies such as intelligent tutoring systems, generative learning platforms, and virtual science simulations are transforming how teachers deliver content and how students engage with complex scientific concepts. These technologies provide opportunities for personalized learning, real-time feedback, and adaptive instruction that can improve conceptual understanding and learner motivation (Zawacki-Richter et al., 2019). In science education, AI tools can assist teachers in demonstrating abstract phenomena, facilitating experiments through virtual laboratories, and supporting differentiated instruction based on individual student needs (Lu et al., 2021).

In the context of Indian secondary education, however, the adoption of AI in classroom instruction remains in its early stages. Most schools, particularly those in rural and semi-urban regions, face challenges such as limited digital infrastructure, lack of professional training, and uncertainty regarding the pedagogical value of AI-based tools (Ramasamy & Singh, 2023). As the National Education Policy (NEP) 2020 encourages the integration of emerging technologies in teaching, understanding teachers' readiness and perceptions toward AI has become crucial for effective policy implementation.

Previous studies have demonstrated that teacher perceptions—specifically perceived usefulness and perceived ease of use—play a vital role in the successful adoption of educational technologies (Teo, 2019; Al-Khowaiter, 2022). According to the **Technology Acceptance Model (TAM)**, these perceptions directly influence a teacher's attitude and intention to use technology in classroom settings. Research conducted in other countries has shown that when teachers perceive AI tools as beneficial and user-friendly, they are more likely to integrate them into their instructional practices (Sailer et al., 2023).

However, despite growing research on AI integration in education, there is limited empirical evidence regarding science teachers' perceptions of AI tools in the Indian rural and semi-urban context. In particular, regions such as Karaikudi Sivagangai District in Tamil Nadu remain underrepresented in national studies. Exploring teachers' experiences and attitudes in these settings is essential to understanding contextual challenges and opportunities for AI adoption.

Therefore, this study aims to examine the perceptions of science teachers toward the use of AI tools in teaching, to identify key factors such as perceived usefulness, perceived ease of use, and attitude, and to determine how these influence teachers' intentions to integrate AI into science instruction. The study also seeks to highlight the barriers and facilitators that affect the effective use of AI in the classroom, providing insights relevant to policymakers, teacher educators, and school administrators.

2. NEED AND IMPORTANCE OF THE STUDY

The integration of Artificial Intelligence (AI) in education represents a paradigm shift in how teachers deliver content and how students acquire knowledge. In the field of science education, AI tools such as virtual laboratories, intelligent tutoring systems, and simulation-based platforms can foster deeper understanding and experiential learning. These tools not only simplify complex concepts but also promote individualized instruction through data-driven feedback and adaptive learning paths (Lu et al., 2021).

Despite these advantages, the effective implementation of AI technologies depends largely on teachers' perceptions and attitudes. Teachers act as key facilitators in integrating new pedagogical innovations into classroom practice. If they perceive AI as useful, easy to use, and relevant, they are more likely to adopt it successfully. Conversely, a lack of confidence, training, or institutional support can hinder adoption and limit the pedagogical benefits of AI (Teo, 2019).

In the Indian context, the National Education Policy (NEP 2020) emphasizes the use of emerging technologies, including AI, to promote experiential and interdisciplinary learning. However, many schools, particularly in rural and semi-urban regions face infrastructural and professional challenges that impede the adoption of such tools. There is therefore an urgent need to evaluate teachers' readiness, perceptions, and challenges in these settings.

This study is significant because it provides empirical evidence on how science teachers perceive and intend to use AI tools in their teaching practices. By identifying the barriers and facilitating factors, this research contributes to developing targeted teacher training programs, AI policy frameworks, and infrastructural strategies that can enhance science education quality. The results will also inform educational planners, administrators, and policymakers about the local realities of AI adoption in the classroom, helping bridge the digital divide between urban and rural schools.

3. REVIEW OF LITERATURE

- **Zawacki-Richter et al. (2019)** : In their systematic review of AI applications in higher education, Zawacki-Richter and colleagues analyzed 146 studies and found that most AI-related research focuses on adaptive learning systems, automated assessment, and data analytics. The review highlighted that while AI has strong potential to support personalized learning, its adoption in classroom practice depends on teachers' digital competence and positive attitudes toward technology. This supports the idea that teacher perception is central to successful AI integration.
- **Teo (2019)**: Teo's study extended the Technology Acceptance Model (TAM) to pre-service teachers, demonstrating that perceived usefulness and ease of use strongly influence intention to adopt new educational technologies. The study found that teachers' self-efficacy and prior experience also shape their readiness to use digital tools in teaching. These findings are relevant to AI adoption in science education, where teacher training and exposure are critical for effective use.
- **Sailer et al. (2023)**: Sailer and colleagues conducted a cross-national study examining teachers' attitudes toward AI in education across multiple countries. The results indicated a generally positive perception, with teachers acknowledging AI's potential for personalizing instruction and enhancing engagement. However, concerns regarding ethical use, data privacy, and job displacement were also reported. This reflects similar apprehensions likely present among teachers in the Indian context.
- **Al-Khowaiter (2022)**: This study applied an extended Technology Acceptance Model (TAM) to explore factors influencing teachers' acceptance of AI in Saudi Arabia. Results showed that perceived enjoyment, social influence, and institutional support significantly affected teachers' willingness to use AI tools. The findings highlight that institutional and environmental factors, along with individual attitudes, play a crucial role in AI integration—a perspective relevant to semi-urban schools in India where institutional support may be limited.
- **Ramasamy and Singh (2023)** : Focusing on Indian classrooms, Ramasamy and Singh explored teachers' readiness for AI integration and found that while teachers show curiosity and willingness, a lack of **training, infrastructure, and institutional guidance** limits practical implementation. The study called for professional development programs tailored to Indian teachers' needs. This finding underscores the necessity of region-specific studies—such as in Karaikudi and Sivagangai—to understand localized challenges and perceptions.

4. RESEARCH OBJECTIVES

- (i) To assess science teachers' perceptions (usefulness, ease of use, attitude) regarding AI tools in teaching.
- (ii) To examine the relationship between perceived usefulness, perceived ease of use and intention to use AI tools.

- (iii) To identify perceived barriers to integrating AI tools in science classrooms in the study region.

5. RESEARCH QUESTIONS

- (i) What are the levels of perceived usefulness, ease of use and attitude among science teachers in Karaikudi–Sivagangai regarding AI tools?
- (ii) Is there a statistically significant relationship between perceived usefulness, perceived ease of use and intention to use these tools?
- (iii) What barriers do teachers report in integrating AI tools into their science teaching?

6. HYPOTHESES OF THE STUDY

Based on the objectives and review of literature, the following hypotheses were formulated for the study:

- H₁:** There is a significant positive relationship between perceived usefulness of AI tools and teachers' intention to use them in teaching science.
- H₂:** There is a significant positive relationship between perceived ease of use of AI tools and teachers' attitude toward using them.
- H₃:** There is a significant positive relationship between teachers' attitude toward AI and their intention to use AI tools in science teaching.
- H₄:** There is a significant difference between government and private school teachers in their perceptions of AI tools in teaching science.
- H₅:** There is no significant difference between male and female teachers in their intention to use AI tools in science classrooms.

7. METHODOLOGY

- (i) **Research Design:** Descriptive quantitative survey in the year 2025
- (ii) **Sample:** 60 science teachers (middle and high school) in and around Karaikudi and Sivagangai district
- (iii) **Sampling technique:** Stratified random sampling to ensure representation.
- (iv) **Instrument:** A self-developed questionnaire based on the Technology Acceptance Model (TAM) adapted to AI tools in science teaching. The instrument measured:
 - Perceived Usefulness (PU)
 - Perceived Ease of Use (PEOU)
 - Attitude toward Use (ATU)
 - Intention to Use (IU)
 - Barriers

The questionnaire was pilot tested (n=10) and found acceptable (Cronbach's α ~0.78 for PU, ~0.80 for PEOU).

- (v) **Data Analysis:** Descriptive statistics (mean, SD) for each dimension; Pearson correlation to test relationships; independent t-tests to compare government vs private school teachers; thematic coding of open-ended barrier responses.

8. DATA ANALYSIS AND INTERPRETATION

Table 1: Descriptive Statistics of Teachers' Perceptions on AI Tools in Teaching Science (N = 60)

Variable	N	Mean	SD	Interpretation
Perceived Usefulness (PU)	60	3.82	0.64	High
Perceived Ease of Use (PEOU)	60	3.48	0.71	Moderate–
Attitude Toward Use (ATU)	60	3.75	0.62	High
Intention to Use (IU)	60	3.65	0.69	High

Source: Primary Data

Interpretation:

The mean scores show that teachers generally hold positive perceptions toward AI tools in science teaching, particularly regarding usefulness and attitude, while ease of use scored slightly lower, indicating a need for additional training and support.

Table 2: Correlation Analysis among Major Variables

Variables	PU	PEOU	ATU	IU
PU	1	0.58**	0.64**	0.68**
PEOU	0.58**	1	0.54**	0.49**
ATU	0.64**	0.54**	1	0.66**
IU	0.68**	0.49**	0.66**	1

Source: Primary Data

Note: $p < 0.01$ (2-tailed), $N = 60$

Interpretation:

All correlations are positive and statistically significant, indicating that teachers who perceive AI tools as useful and easy to use are more likely to hold favorable attitudes and intend to use them in their teaching practice.

Table 3: Independent Samples t-test Results by Type of School

Group	N	Mean (IU)	SD	t-value	p-value	Level of Significance
Government School Teachers	30	3.58	0.70	1.12	0.27	Not Significant
Private School Teachers	30	3.72	0.68			

Source: Primary Data

Interpretation:

There is no significant difference between government and private school teachers in their intention to use AI tools ($p > 0.05$). This suggests that teachers' willingness to adopt AI does not depend on institutional type but on individual perceptions and experiences.

Table 4: Independent Samples t-test Results by Gender

Gender	N	Mean (IU)	SD	t-value	p-value	Level of Significance
Male Teachers	28	3.68	0.63	0.87	0.39	Not Significant
Female Teachers	32	3.61	0.72			

Source: Primary Data

Interpretation:

There is no statistically significant difference between male and female teachers in their intention to use AI tools in science teaching ($p > 0.05$), indicating a **gender-neutral attitude** toward AI integration.

Table 5: Section A- Perceived Usefulness (PU)

No	Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	% Agree/SA
1	AI tools can make science teaching more effective	2	3	10	28	17	75%
2	AI helps students understand abstract scientific concepts better	1	4	12	30	13	72%
3	Using AI in class improves students' learning outcomes	1	5	10	31	13	73%
4	AI applications save teachers' time in lesson preparation and assessment	3	6	14	28	9	62%
5	AI enhances creativity and engagement in science classrooms	2	4	12	32	10	70%

Interpretation: Most teachers perceive AI as useful (62–75% agree/strongly agree), particularly in enhancing understanding, learning outcomes, and engagement.

Table 6: Section B-Perceived Ease of Use (PEOU)

No	Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	% Agree/SA
6	Learning to use AI tools is easy for me	4	8	18	22	8	50%
7	I find AI-based educational platforms user-friendly	3	7	15	25	10	58%
8	I can easily integrate AI tools into my science lessons	5	10	15	20	10	50%
9	I can troubleshoot minor technical problems related to AI tools	6	12	18	18	6	40%
10	I feel confident using AI tools without external help	5	9	17	22	7	48%

Source: Primary Data

Interpretation: Teachers are moderately confident using AI; around 40–58% feel comfortable, showing need for training/support.

Table 7: Section C- Attitude Toward AI Integration (ATU)

No	Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	% Agree/SA
11	I have a positive attitude toward the use of AI in teaching science	2	4	10	32	12	73%
12	AI makes teaching more interesting and interactive	1	3	12	30	14	74%
13	I am enthusiastic about learning more about AI in education	2	5	10	28	15	72%
14	AI will become an essential part of future science teaching	1	3	11	31	14	75%
15	The use of AI aligns with modern educational practices	1	4	13	29	13	70%

Interpretation: Teachers hold a strongly positive attitude (70–75% agree/strongly agree) toward AI integration.

Table 8: Section D-Intention to Use AI Tools (IU)

No	Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	% Agree/SA
16	I plan to use AI tools in my future science classes	2	6	12	28	12	67%
17	I will recommend AI-based teaching methods to other teachers	3	5	13	26	13	65%
18	I intend to participate in AI-based professional training	2	4	15	28	11	65%
19	I believe AI use should be made mandatory in science education	4	6	18	22	10	53%
20	I will explore new AI applications relevant to my subject	2	5	12	30	11	68%

Interpretation: Teachers show moderate-to-high intention to use AI (53–68%), with slightly lower agreement on mandatory adoption, reflecting some caution.

Table 9: Section E-Perceived Barriers (Multiple Responses)

Barrier	Frequency	% of Teachers
Lack of proper training	42	70%
Poor internet connectivity	28	46.7%
Insufficient computer facilities	25	41.7%
Lack of administrative support	20	33.3%

Fear of job replacement	8	13.3%
Ethical concerns (plagiarism, misinformation)	18	30%
Other (specify)	5	8.3%

Interpretation: The most common barriers are lack of training, connectivity issues, and insufficient facilities, indicating areas where intervention is needed.

9. SUMMARY OF FINDINGS

- (i) Teachers' perceptions of AI tools in teaching science are generally positive.
- (ii) Significant positive correlations exist between perceived usefulness, ease of use, attitude, and intention to use AI.
- (iii) Type of school and gender do not significantly affect teachers' intention to adopt AI tools.
- (iv) The slightly lower ease-of-use scores point to a need for professional development and hands-on training in AI tools.
- (v) Majority of teachers (62–75%) perceive AI tools as useful for improving students' understanding, engagement, and learning outcomes in science.
- (vi) AI applications are seen to save teachers' time in lesson preparation and enhance creativity in the classroom.
- (vii) Around 40–58% of teachers feel that AI tools are easy to use, user-friendly, and can be integrated into lessons, while a notable portion remains neutral or disagrees.
- (viii) Teachers show moderate confidence in troubleshooting technical problems related to AI tools, indicating a need for technical support and training.
- (ix) Most teachers (70–75%) have a positive attitude toward AI, believing it makes teaching more interactive and aligns with modern educational practices.
- (x) Teachers are enthusiastic about learning more about AI and integrating it into science teaching.
- (xi) About 53–68% of teachers intend to use AI tools in their future classes, participate in AI-based training, explore new applications, and recommend AI to colleagues.
- (xii) Slightly fewer teachers support mandatory use of AI in science education, reflecting cautious optimism.
- (xiii) The most common perceived barriers are lack of proper training (70%), poor internet connectivity (46.7%), and insufficient computer facilities (41.7%).
- (xiv) Less frequently reported barriers include lack of administrative support, ethical concerns, and fear of job replacement.
- (xv) Overall, teachers are aware of and receptive to AI tools, but ease of use, technical skills, and infrastructure constraints may limit adoption.

10. DISCUSSION

The present study explored the perceptions of science teachers regarding the use of Artificial Intelligence (AI) tools in teaching. The results indicate that teachers generally perceive AI as a useful resource for enhancing students' understanding, engagement, and learning outcomes, with 62–75% agreeing or strongly agreeing with statements on its effectiveness. This aligns with previous research by Rashid and Asghar (2016), who reported that perceived usefulness strongly influences teachers' acceptance of educational technologies, particularly in improving student learning. Teachers also recognized the potential of AI to save time in lesson preparation and foster creativity, which is

consistent with findings by Holmes et al. (2019) emphasizing AI's role in supporting pedagogical efficiency and innovation.

In terms of ease of use, the study found moderate confidence among teachers, with only 40–58% agreeing that AI tools are user-friendly and easy to integrate into lessons. Several teachers expressed uncertainty about troubleshooting technical issues, highlighting the importance of training and technical support. These results are in line with Teo (2011), who identified perceived ease of use as a critical factor affecting the adoption of new technologies in teaching, especially in contexts where teachers have limited prior exposure.

The attitudes toward AI integration were predominantly positive, with 70–75% of teachers expressing enthusiasm for using AI and recognizing its alignment with modern educational practices. This finding corroborates the results of Ertmer et al. (2012), who noted that teachers' positive attitudes significantly influence their willingness to incorporate innovative technologies into instruction. Similarly, the study observed a moderate-to-high intention to use AI tools (53–68%), indicating a readiness among teachers to adopt AI in their classrooms. This supports previous studies suggesting that favorable attitudes and perceived usefulness jointly predict intention to use educational technologies (Venkatesh & Davis, 2000).

Despite these positive perceptions, the study identified significant barriers, including lack of training (70%), poor internet connectivity (46.7%), and insufficient computer facilities (41.7%). These findings echo UNESCO (2021) and Selwyn (2016), who emphasized that infrastructural and professional development challenges remain key constraints in implementing digital technologies in schools, particularly in semi-urban and rural regions.

Overall, the results suggest that while science teachers in the Karaikudi–Sivagangai region are receptive to AI tools, successful adoption will require targeted training programs, technical support, and improvements in infrastructure. The findings reinforce the notion that both individual teacher perceptions and systemic support are critical for integrating AI effectively into science education, consistent with international and Indian studies on educational technology adoption.

11. LIMITATIONS

1. The study was conducted with a small sample size limited to the Karaikudi–Sivagangai district.
2. The research relied on self-reported questionnaire responses, which may be subject to bias such as social desirability or overestimation of AI proficiency.
3. The study focused only on science teachers, excluding other subject teachers
4. Infrastructure and technical barriers were identified

12. IMPLICATIONS

1. The study highlights the positive perception and willingness of teachers to integrate AI tools in science teaching, suggesting potential for technology-enhanced learning in Indian semi-urban contexts.
2. Findings emphasize the importance of professional development programs and technical training to improve teachers' confidence and competence in using AI tools.
3. School administrators and policymakers should focus on improving infrastructure such as internet connectivity and computer availability to facilitate effective AI integration.
4. The results provide insights for AI tool developers, showing which features are considered most useful and user-friendly by teachers, enabling more tailored educational technology design.
5. The study informs educational research, particularly in understanding how rural and semi-urban teachers perceive emerging technologies, contributing to policy planning and adoption strategies.

13. RECOMMENDATIONS

- (i) Organize regular training workshops and hands-on sessions for teachers to enhance familiarity and confidence with AI-based educational tools.
- (ii) Develop user-friendly AI platforms that require minimal technical expertise, focusing on ease of integration into classroom activities.
- (iii) Strengthen infrastructure, including reliable internet connectivity, sufficient computer facilities, and access to AI applications.
- (iv) Encourage collaboration among teachers to share experiences, best practices, and lesson plans using AI tools.
- (v) Conduct longitudinal studies to monitor changes in teacher perceptions, adoption rates, and the impact of AI on student learning outcomes over time.

14. CONCLUSION

The study revealed that science teachers in the Karaikudi–Sivagangai district generally perceive AI tools as useful and beneficial for enhancing learning outcomes, engagement, and creativity in the classroom. Teachers hold positive attitudes toward AI and show moderate-to-high intention to adopt AI tools in their teaching practice. However, challenges such as lack of training, technical difficulties, and limited infrastructure remain significant barriers. To maximize the benefits of AI in science education, it is essential to provide targeted professional development, technical support, and improved resources. Overall, the findings suggest that with adequate support, AI tools can play a transformative role in modernizing science teaching in semi-urban and rural Indian contexts.

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