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Exploring AI's Impress on Education: Teacher Intuitions from Tamil Nadu

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A B S T R A C T

Artificial Intelligence (AI) is playing an increasingly important role in the education sector, enabling automation, personalized learning, and adaptive teaching methods. However, teachers' perceptions, attitudes, and self-efficacy are critical in determining whether AI is successfully integrated. A structured survey administered to 100 engineering college teachers measured their perceptions about AI, their perceived teaching effectiveness and their confidence in adopting AI were collected. Utilizing a serial mediation model, the study analyzes the data through SPSS and Hayes' PROCESS macro to evaluate direct and indirect effects of teacher effectiveness toward AI adoption. Findings show that teacher effectiveness has direct and indirect effect on AI adoption via teacher attitude and self efficacy. AI teaching experience teaches teachers develop greater self-efficacy and positive attitudes of teaching with AI tools. The results highlight the necessity for professional development programs that are designed to boost teachers' confidence and skills in utilizing AI-based educational resources. These insights will be crucial for educators, policymakers, and ed-tech developers, as they stress the need for specific teacher training programs and enabling meet for productive AI implementation in the classroom. While Tamil Nadu continues to be a forerunner in radical reforms in digital education across the nation, meaningful pedagogy that is augmented with AI requires addressing teachers concerns, which will strengthen their efficacy, and induce a positive outlook towards AI-driven learning. The study adds to wider discussion around AI in education by prioritizing teacher voice and calling for evidence-based policy decisions that connect the potential of AI for the classroom.

Keywords: Artificial Intelligence (AI), Teacher Beliefs, AI Integration, Instructional Quality, Teacher Attitudes, Self-Efficacy, ICT in Education.

1. Introduction

Artificial Intelligence (AI) has taken over various fields and when it comes to education, it is no different. AI tools have entered the education delivery scenes in recent years to support teaching and learning. AI's potential to automate administrative labor, customize learning experiences, and facilitate adaptive teaching practices have gathered a great deal of international visibility (Holmes et al., 2019). AI is being increasingly adopted in the Indian education sector particularly in Tamil Nadu with great potential for growth for both students and educators. However, there is still a lack of exploration to fully understand teachers' perceptions, attitudes, and teaching outcomes with respect to the integration of AI in the classroom from the perspective of the teachers themselves. Education research shows that AI technologies improve learning outcomes by providing tailored and scalable solutions for students (Luckin et al., 2016). More than anything, the success of these technologies depends on the perceptions and implementations of our educators in the classroom. Thus, teachers' beliefs about AI play a crucial role in their adoption and productive implementation of such technologies (Ertmer & Ottenbreit-Leftwich, 2010). In the context of active educational reforms in Tamil Nadu, understanding the ways in which AI-related tools impact teachers' pedagogical practices will be crucial to realizing the potential of utilizing AI in teaching and learning. While there is an increasing body of research regarding AI and education, few studies examine teachers' perspectives in our country, especially in Tamil Nadu. This is the gap which this research aims to bridge, by investigating AI in education through the lens of teacher insights. The analysis will explore the challenges, advantages, and limitations of integrating AI into teaching practices from a teacher's perspective. Additionally, it will delve into the implications of these findings on how they can guide the formulation of AI-based education policies and teacher training initiatives specifically designed to meet the distinct requirements of Tamil Nadu's educational landscape. Using a qualitative approach, this study will attempt to achieve an in-depth appraisal of AI's influence on the educational framework of Tamil Nadu. This study seeks to add value to the ongoing conversations around AI and education in an Indian context as well as globally, by focusing on the voices and perspectives of the educators.

2. Scope and importance of the study

This study scope is limited to study the effect of Artificial Intelligence (AI) in education field of Tamil Nadu through the eyes of the teachers. As AI technologies have been introduced into classrooms, understanding how educators view and use these technologies as part of their pedagogical practices becomes necessary. This study will examine the extent of AI adoption by teachers in Tamil Nadu and its impact on teaching effectiveness, teacher attitude and classroom atmosphere. It will also explore teachers' struggles with incorporating AI, the advantages they gain using it, and any obstacles in the effective utilization of AI tools. It will also examine the readiness of teachers and their willingness to embrace AI, as well as the training and support they require to be able to use these technologies effectively in their classrooms. This study can generate insights around the transformative role of AI in education work for which it is uniquely positioned, given its set of interdependent skill sets. This research aims to add to the discourse on whether AI will improve the quality of education in Tamil Nadu by examining teachers' perspectives. With the Indian government and academic community advocating for digitalization and technology led reforms, it is important to see what contribution AI can make towards existing pedagogical practices. This research will provide evidence-based suggestions for decisionmakers, educators, and educational technology developers on how to integrate AI into classrooms in the most optimal way. Additionally, this research will guide the design of targeted teacher training programs to help educators effectively use AI tools, thus positively impacting student learning outcomes and overall education experience.

3. Literature Review

The growing integration of Artificial Intelligence (AI) into education has been widely discussed, with research indicating potential revolutionizing shifts in education (Holmes, Bialik, & Fadel, 2019). AI technologies provide personalized learning opportunities, and are able to automate a range of administrative processes making them very promising for educators (Luckin et al., 2016). Nonetheless, integrating AI into the classroom frequently relies on the attitude of teachers towards technology and their confidence in using it effectively (Ertmer & Ottenbreit-Leftwich, 2010). Teacher attitudes have emerged as a major factor in the successful integration of technology in the classroom (Gulbahar & Aydin, 2008). Teacher self-efficacy as mediating factor in technology acceptance plays significant role in how teachers feel they capable of adopting AI tools into their teaching methods (Bandura, 1997) There is evidence that the more self-efficacious teachers believe they are, the better they are at implementing technology (Teo, 2009). Additionally, teachers generally have improved teaching outcomes when they think that they can use AI tools effectively (Klassen & Tze, 2014). It magnifies why necessity training, and support to use the AI technologies confidently is the mother of invention. In India, for example, the state of Tamil Nadu has led the global adoption of digital technology in education by having initiatives to improve teacher training and experience (Govindarajan & Kannan, 2020). An insightful analysis of NEP 2020's impact in Tamil Nadu, highlighting educators' perspectives, policy challenges, and regional implementation concerns (Gurunathan & Krishna, 2024). Challenges in higher education, addressing policy gaps, institutional inefficiencies, and recommendations for reform (Hariharan & Gurunathan, 2016). Higher education economics in Tamil Nadu, focusing on financial challenges, sustainability, and policy implications for self-financed institutions (Hariharan, 2017). Yet there is limited research that has investigated teachers' perception of AI integration in this context, which makes this study highly relevant for understanding the implications of AI for teaching effectiveness in Tamil Nadu. This study seeks to fill this gap by exploring the effects of teacher attitudes and self-efficacy when it comes to AI adoption in the education sector, providing preliminary insights for policymakers and educators.

4. Objectives of the Study

1. To study the impact of AI integration in classrooms on teacher's perception and attitude towards the teaching practices in Tamil Nadu.

2. To examine teacher self-efficacy and teacher attitudes towards AI as mediators in the relationship between AI integration in classrooms and teacher effectiveness.

5. Materials and Methods

This quantitative study sought to examine how Artificial Intelligence (AI) influences education, particularly teacher effectiveness (TE), teacher attitudes (TA), and teacher self-efficacy (TSE) in the context of Tamil Nadu. A structured survey questionnaire was used for data collection from 100 teachers from different engineering colleges and was used for measuring their perception toward AI, their teaching effectiveness and self-efficacy. The survey consisted of standardized scales measuring TE, TA and TSE. TE was evaluated using a scale for assessing their instructional (Tsai & Wu, 2021), classroom management (Klassen & Tze, 2014), and student engagement. As for TA, it was evaluated by scale measuring teachers' beliefs of usefulness and difficulty of using AI in educational settings (Ertmer & Ottenbreit-Leftwich, 2010). The TSE was measured using a scale targeting teachers' confidence for effective utilization of technology and AI tools in the classroom (Bandura, 1997). The data obtained through the data collection were used for serial mediation model analyses employing Hayes' PROCESS to examine the total, direct and indirect effects of TE on AI adoption and the mediating roles of TA and TSE in this effect. SPSS and the PROCESS macro were used to analyze the data, with bootstrapping techniques used to test indirect effects and their confidence intervals.

6. Results from the Analysis

Table 1-Teachers Attitude

R	R-sq	MSE	F	df1	df2	p	
0.7115	0.5062	0.3628	100.4754	1	98	0.0000	**Standardized Coefficients**
Model	**Coeff**	**se**	**t**	**P**	**LLCI**	**ULCI**	
Constant	0.5135	0.1601	3.2077	0.0018	0.1958	0.8311	
TE	0.7147	0.0713	10.0237	0.0000	0.5732	0.8562	0.7115

Source: Computation by the researchers

The above regression analysis for the outcome variable Teacher Attitudes (TA) shows that the best-fit model accounts for 50.62% of the variance in TA (R-sq = 0.5062), with a statistically significant F-value of 100.4754 ($p < 0.0001$), indicating a strong relationship between TA and the predictor variables. $TA = \beta_0 + \beta_1 TE + \epsilon$ with β_1-TE = 0.7147 (0.0713) t = 10.0237, $p < 0.0001$. TE has a standardized coefficient of 0.7115, which solidifies this relationship even more.

Table 2-Teachers Self-Efficacy

R	R-sq	MSE	F	df1	df2	p	
0.667	0.4450	0.4401	38.8796	2	97	0.0000	**Standardized Coefficients**
Model	**Coeff**	**se**	**t**	**p**	**LLCI**	**ULCI**	
Constant	0.4452	0.1853	2.4021	0.0182	0.0774	0.8130	
TE	0.4562	0.1118	4.0818	0.0001	0.2344	0.6780	0.4394
TA	0.2880	0.1113	2.5884	0.0111	0.0672	0.5088	0.2786

Source: Computation by the researchers

The above table 2 depicts that coefficient of determination (R-sq = 0.4450) in the regression analysis for the output variable Teacher Self-Efficacy (TSE). The final significance test shows F-value of 38.8796 with degree = 1, $p < 0.0001$. TE and TA are significant predictors of TSE. TE and TA positively influence TSE, with TE having a coefficient of 0.4562 ($p = 0.0001$), and TA has a coefficient of 0.2880 ($p = 0.0111$). Additional evidence is provided for the relative importance of these predictors in determining TSE (TE has a standardized coefficient of 0.4394 vs. TA:0.2786).

Table 3-Artificial Intelligence

R	R-sq	MSE	F	df1	df2	p	
0.7656	0.5862	0.2905	45.3295	3	96	0.0000	**Standardized Coefficients**
Model	**Coeff**	**se**	**t**	**p**	**LLCI**	**ULCI**	
Constant	0.4961	0.155	3.2009	0.0019	0.1884	0.8037	
TE	0.3314	0.0983	3.3718	0.0011	0.1363	0.5265	0.3410
TA	0.2437	0.0935	2.6075	0.0106	0.0582	0.4292	0.2519
TSE	0.2625	0.0825	3.1826	0.002	0.0988	0.4263	0.2805

Source: Computation by the researchers

The above regression analysis (table 3) shows that the model on the outcome variable AI explains 58.62% of the variance in AI (R-sq = 0.5862) (F-Value: 45.3295; $p < 0.0001$). It is significant that all predictors of Teacher Effectiveness (TE), Teacher Attitudes (TA), and Teachers Self-Efficacy (TSE) TE; 0.3314 $p = 0.0011$; TA; 0.2437 $p = 0.0106$; TSE; 0.2625 $p = 0.0020$ all found to positively affect AI adoption. The quantities are the standardized coefficients indicate that TE (0.3410), TA (0.2519), and TSE (0.2805) have considerable effects, whereas TE has the greatest impact on AI.

Table 4- Total Effect Model: Artificial Intelligence

R	R-sq	MSE	F	df1	df2	p
0.6991	0.4887	0.3516	93.6820	1	98	0.0000

Model	Coeff	Se	t	p	LLCI	ULCI	Standardized Coefficients
Constant	0.7769	0.1576	4.9303	0.0000	0.4642	1.0896	
TE	0.6794	0.0702	9.6789	0.0000	0.5401	0.8187	0.6991

Source: Computation by the researchers

As shown in table 4, the full model for the outcome variable AI, the model explained 48.87% of the variance in AI (R-sq = 0.4887) with F-value of 93.6820 ($p < 0{\cdot}0001$) indicating overall fit of the model. This coefficient for Teacher Effectiveness (TE) is 0.6794 ($p < 0.0001$), a strong positive effect of TE on AI adoption. The standardized coefficient for TE, 0.6991 indicates that TE is the most important predictor of AI adoption in this model. The findings validate that improving teacher effectiveness is significantly correlated with increased integration of AI in education.

Table 5-Total, Direct, and Indirect Effects of X on Y

Total Effect	**Se**	**t**	**p**	**LLCI**	**ULCI**	**c_cs**
0.6794	0.0702	9.6789	0.0000	0.5401	0.8187	0.6991
Direct Effect	**Se**	**t**	**p**	**LLCI**	**ULCI**	**c'_cs**
0.3314	0.0983	3.3718	0.0011	0.1363	0.5265	0.3410
Indirect effect(s) of X on Y			**Effect**	**BootSE**	**BootLLCI**	**BootULCI**
Total			0.3480	0.1126	0.1159	0.5682
Ind1			0.1742	0.1016	-0.0344	0.3656
Ind2			0.1198	0.0703	-0.0137	0.2664
Ind3			0.0540	0.0454	-0.0079	0.1697
Standardized indirect effect(s) of X on Y						
Total			0.3581	0.1179	0.1175	0.5893
Ind1			0.1792	0.1040	-0.0354	0.3736
Ind2			0.1232	0.0733	-0.014	0.2780
Ind3			0.0556	0.0469	-0.0081	0.1774
Indirect effect key						
Ind1 TE -> TA -> AI						
Ind2 TE -> TSE -> AI						
Ind3 TE -> TA -> TSE -> AI						

Source: Computation by the researchers

TE affects AI through direct and indirect channels, and the estimated total, direct and indirect effects of teacher effectiveness (TE) on AI are illustrated in table 5.

Total Effect: TE on AI was 0.6794 ($p < 0.0001$), suggesting a significant, positive correlation. The highly standardized coefficient (0.6991) is also an indication of the importance of TE antecedents regarding organizational AI adoption.

Direct Effect: TE on AI is 0.3314 ($p = 0.0011$), and thus statistically significant, indicating the direct contribution of TE on AI integration.

Indirect Effects: Mediating role of TA and TSE. The total indirect effect is 0.3480 (BootSE = 0.1126; BootLLCI = 0.1159, BootULCI = 0.5682), indicating significance for the indirect paths through TA and TSE. These indirect effects of a specific nature include:

- Ind1 (TE→TA→AI) effect = 0.1742 (BootLLCI = -0.0344, BootULCI = 0.3656).
- Ind2 (TE →TSE→AI) with an effect size of 0.1198 (BootLLCI = -0.0137, BootULCI = 0.2664).
- Ind3 (TE→TA→TSE→AI) bootstrapped results of effect 0.0540 (BootLLCI = -0.0079, BootULCI = 0.1697).

The fully standardized indirect effects yielded similar results with an overall effect size of 0.3581 (BootLLCI = 0.1175, BootULCI = 0.5893). The results of standardized coefficients indicate that TE is significantly affecting AI adoption directly and indirectly through TA and TSE, with TE → TA→AI being

the strongest the indirect path. Again, the study concludes that despite the direct TE and AI effects, the indirect ones through teacher's attitudes and self-efficacy offer more paths for TE impact on AI involvement, indexing the need of improving teacher's attitude and self-efficacy for the successful integration of AI.

7. Discussion

This study's findings strongly support the role of teacher effectiveness (TE) in the uptake of AI in education. Total standard coefficients indicated that TE had a significant impact on the integration of AI into the engineering college system (0.6991). This supports past research that emphasizes teachers as key in the integration of educational technologies (Luckin et al., 2016). The coefficient for the direct effect of TE on AI adoption was also significant (coefficient = 0.3314), revealing that teacher effectiveness positively affects AI usage. Moreover, the results indicate that TE's correlation with AI adoption is even mediated by teacher attitude (TA) and teacher self-efficacy (TSE). As it was evidenced from the indirect effects, TE affects AI adoption directly through TA and TSE but also indirectly through TE → TA → TSE → AI path. This indicates that, in addition to switching belief and enthusiasm to integrate artificial intelligence technologies, it is important to develop a positive attitude and confidence in the teachers. As such, teacher training programs should put more emphasis on improving teacher effectiveness, attitudes, and self-efficacy, all of which are necessary for the successful integration of artificial intelligence into education. This research provides significant considerations to policymakers and educators seeking to leverage AI in improving the teaching and learning experience.

8. Policy Framework for Social Relevance

Policymakers should focus on improving teacher performance, attitude and self efficacy as part of the strategies to integrate AI in education. To overcome this challenge, teacher training programs may focus on skills that increase teacher confidence in using AI tools while addressing individual concerns or technology resistance. Positive attitudes towards AI can be encouraged through targeted training with teachers and can play a key role in the success of AI applications in the classroom. Such policies will not only boost learning, they will also enhance social relevance of AI integration by ensuring it works across a range of learning contexts.

9. Future Studies and Conclusion

Another area for future research might be the long-term impact of AI integration on educational outcomes and development, specifically student performance and engagement of the teachers. Indian classrooms' postures have not been compared with different regions of India. This could be a comparative study to see how cultures and infrastructures affect the adoption of AI in the classroom. An alternative aspect may relate to the influence of AI on diverse subjects or education levels (Schooling), which could give helpful knowledge about optimizing AI devices to distinct demands of teaching. Future research may also utilize a bigger sample size to improve the generalizability of the results and investigate the influence of additional factors, such as organizational support and governmental policies, on AI adoption. Teaching quality and attitudes, as well as self-efficacy, play a pivotal role in the implementation of artificial intelligence in the educational domain (Symeonidis, 2023). The study highlights the need for focused professional development to improve these factors and thus facilitate AI implementation in classrooms. Educators may then harness the transformative power of AI by creating tailored teaching strategies that benefit both educators and learners, all while maintaining a positive attitude toward the novel technology in use.

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