Awadh International Journal of Information Technology and Education (AIJITE)

(Peer Reviewed Refereed Journal)

alfa ***Publications***

NEW DELHI (INDIA)

Awadh International Journal of Information Technology and Education

(Peer Reviewed Refereed Journal)

ISSN : 2277-8985

Published by: Shilpa Goel
for
ALFA PUBLICATIONS
4398/5, Ansari Road, Daryaganj,
New Delhi - 110 002
Phone: +91-11-23275092
e-mail: alfapublications@gmail.com

(COMM-IT Career Academy & Institute of Vocational Studies)
Awadh Bhavan,
FC-31, Sheikh Sarai, Phase - II
Institutional Area,
New Delhi - 110017, India

Vol. 14 Issue 2, September 2025
Periodicity of Publication, Biannual

SUBSCRIPTIONS

Awadh International Journal of Information Technology & Education is published twice a year. All orders accompanied with payment should be sent directly to: **Alfa Publications**, 4398/5, Ansari Road, Daryaganj, New Delhi - 110002

ANNUAL SUBSCRIPTION CHARGES

TWO ISSUES Rs. 1500.00 / $ 100.00 (Overseas)

PRINTED IN INDIA

Awadh International Journal of Information Technology and Education

Volume 14 **Issue 2** **September 2025**

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Awadh International Journal of Information Technology and Education
ISSN: 2277-8985
Vol. 14, Issue - 2 March 2025
Pp. 1-13

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Exploring the Knowledge, Perspectives and Attitude of B.Ed. Learners towards the Utilisation of ChatGPT as an Educational Resource

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ABSTRACT

As educational practices increasingly incorporate digitalisation and Artificial Intelligence, understanding student perceptions is essential for effectively integrating these technologies. This study examines the knowledge, attitude, and perspectives of Bachelor of Education (B.Ed.) students regarding the use of ChatGPT as an educational resource. Data was gathered through a Google survey employing a self-developed five-point rating scale, and responses analysed using parametric statistical methods and percentage analysis. The results direct that a majority of students find ChatGPT easy to use (84.5%) and trust the accuracy of the data provided (87.1%). However, there is considerable neutrality (32.4%) concerning the depth of understanding facilitated by ChatGPT, highlighting potential areas for improvement. While 56.5% of students are satisfied with ChatGPT's role in their studies, a notable portion remains neutral, particularly regarding its impact on output and privacy. Despite these reservations, 62.6% would recommend ChatGPT to others, demonstrating confidence in its utility. Additionally, 58.6% of students perceive ChatGPT as a valuable tool for enhancing Teacher Education programme, though significant neutrality (33.8%) suggests its full potential is yet to be fully recognised.

Keywords: Artificial Intelligence, ChatGPT, Knowledge, Perspectives, Attitude, B.Ed. Learners, Educational Resource.

INTRODUCTION

The quick evolution of artificial intelligence (AI) has caused significant interest across various sectors, with education emerging as an upcoming field for AI integration. As educational environments increasingly embrace digital transformation, AI-driven tools like ChatGPT are actuality explored for their potential to revolutionise learning experiences and enhance pedagogical practices (Brown & Adler, 2021). ChatGPT, developed by OpenAI, stands out as a leading example of an AI-powered conversational agent capable of understanding and producing human-like text replies. Its capability to engage in natural language dialogues has garnered significant recognition, particularly for its potential utility in educational settings supporting personalised and adaptive learning (OpenAI, 2023; Knox, 2022). In recent years, a paradigm change has been viewed in education toward more personalised and adaptive learning approaches, primarily facilitated by technological developments (Siemens, 2019). ChatGPT holds significant promise in this context, offering chances for personalized learning experiences, immediate feedback, and personalised assistance (Smith, 2023). ChatGPT can work as a virtual tutor by simulating human-like interactions, aiding students in grasping complex concepts, clarifying uncertainties, and reinforcing learning objectives (Fischer, 2020). Such capabilities position ChatGPT as a potentially transformative tool in modern education (Holmes et al., 2021).

Given the critical role of Bachelor of Education (B.Ed.) programs in shaping future educators, it is essential to understand B.Ed. Student's perspectives on integrating emerging technologies like ChatGPT into their teaching and learning practices (Anderson & Dron, 2020). While earlier research has discovered the broader benefits and challenges of AI incorporation in education, a notable literature gap explicitly addresses B.Ed. student's attitudes and perspectives toward ChatGPT as an educational resource (Johnson et al., 2020). This study purpose to fill this gap by examining B.Ed. students' knowledge, attitudes, and perspectives on using ChatGPT within educational contexts. By exploring these perceptions, the research delivers valuable understandings that can inform educators, policymakers, and developers about the implications of integrating AI machineries into teacher training programs and broader educational practices (Brown & Adler, 2021) and understanding B.Ed. student's views on ChatGPT are vital for designing actual training programs, enhancing curricula, and developing policy frameworks that ensure AI's responsible and effective integration in education (Siemens, 2019). As Johnson et al. (2020) noted, the emergence of AI technologies in education has catalysed a significant shift in teaching and learning methodologies. ChatGPT's capacity to offer personalised and interactive learning experiences represents an innovative approach to student engagement (Knox, 2022).

SIGNIFICANCE OF THE STUDY

This study is significant as it provides crucial insights into integrating AI-powered tools, specifically ChatGPT, within Bachelor of Education (B.Ed.) programs. As education increasingly adopts digital technologies, understanding how future educators perceive and interact with AI is essential for effective implementation. The study's findings will inform the design and enhancement of teacher training curricula, ensuring that future educators are well-equipped to integrate AI tools like ChatGPT into their teaching practices. Additionally, the research offers valuable guidance for curriculum developers, helping them address gaps in AI-related knowledge and promoting comprehensive use of these technologies in education. The study offers observed data for policymakers to support the expansion of ethical and practical frameworks for AI integration in educational settings.

Moreover, the findings can help educators and institutions strategically implement AI tools to improve teaching and learning outcomes. This research donates to the limited literature on AI in teacher education, offering a foundation for future studies. Overall, the study is significant in advancing our understanding of AI's role in education, particularly in preparing the next generation of educators for the digital age.

OBJECTIVES OF THE STUDY

This study has three objectives, which are stated below:

1. To determine the extent of B.Ed. students' understanding of ChatGPT as an AI-powered educational resource.
2. To investigate B.Ed. students' overall attitude towards integrating ChatGPT into educational practices.
3. To study the perspectives of B.Ed. students' regarding using ChatGPT as an educational resource.

METHODOLOGY

This study utilised a survey method to explore the knowledge, attitudes, and perspectives of 277 B.Ed. Students aged 20-30 years regarding ChatGPT as an educational resource. Using purposive sampling, data were collected via an online Google survey form, employing a self-developed five-point rating scale. The survey assessed various dimensions, including knowledge, attitudes, and perspectives regarding ChatGPT. Replies were analysed using descriptive statistical techniques, including frequency analysis and percentage calculations.

ANALYSIS AND INTERPRETATION OF DATA:

Table-1: Gender-wise respondents and percentage of the Sample

Sl. No.	Respondents' Demographic Information	Number of respondents	Percentage (%)
	Gender		
1	Male	200	72.2
2	Female	77	27.8
3	I prefer not to say	0	0
4	Total	277	100.00

Figure-1: Gender-wise distribution of the Sample

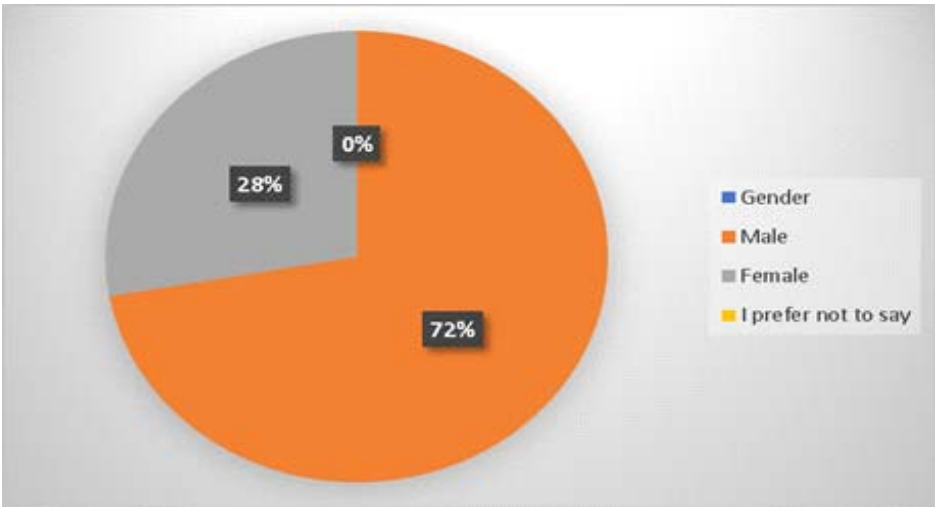


Table-2: Stream-wise respondents and percentage of the Sample

Sl. No.	Respondent's Demographic Information	Number of Respondents	Percentage (%)
	Stream		
1	Science and Mathematics	73	26.4
2	Social science	116	41.9
3	Language	77	27.8
4	Commerce	11	3.9
5	Total	277	100.00

Figure-2: Stream-wise distribution of the Sample

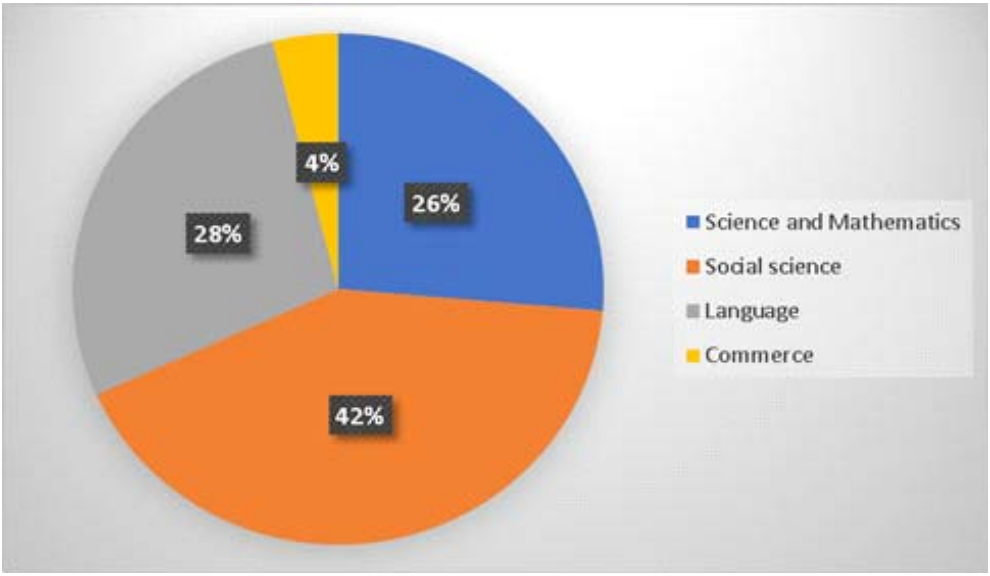
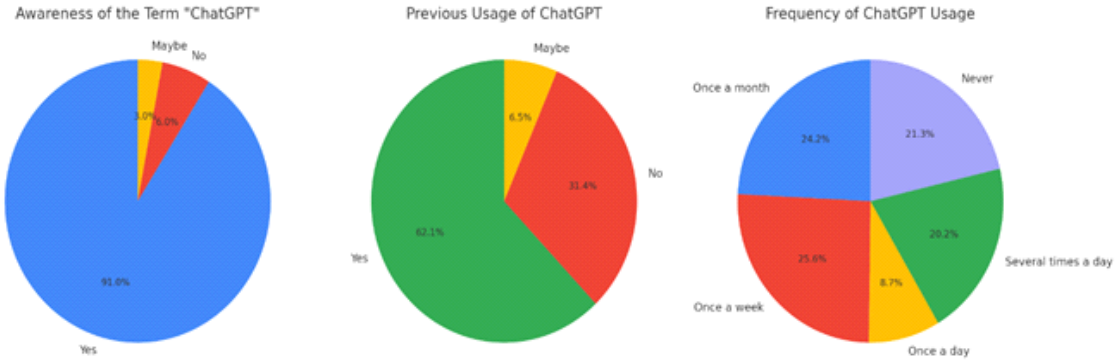


Table-3: Responses and percentage of sample based on Awareness and usage of ChatGPT

Question	Option	Responses	Percentage (%)
Have you heard the term "ChatGPT"?	Yes	252	91
	No	17	6
	Maybe	8	3
Did you use ChatGPT before?	Yes	172	62.1
	No	87	31.4
	Maybe	18	6.5
Select your usage frequency for ChatGPT	Once a month	67	24.2
	Once a week	71	25.6
	Once a day	24	8.7
	Several times a day	56	20.2
	Never	59	21.3

Figure-3: Awareness and usages of ChatGPT distribution of sample



The data reveals a high awareness of ChatGPT, with **91%** of respondents indicating they have heard the term "ChatGPT." Only **6%** were unfamiliar with it, while **3%** were unsure. This strong recognition suggests that ChatGPT has a significant presence and make awareness within the surveyed group. Despite the small number of individuals unfamiliar with the term, it points to the success of ChatGPT's exposure through marketing and media. For a tool still relatively new in the broader public sphere, achieving such a high level of awareness is remarkable.

Regarding usage, **62.1%** of respondents reported using ChatGPT before, while 31.4% did not. A smaller group, **6.5%**, were unsure whether they had used the tool, which could imply indirect usage via third-party apps or unclear branding. While most respondents have interacted with ChatGPT, a substantial portion have yet to try it. This presents an opportunity for targeted campaigns to convert those aware of ChatGPT into active users, potentially through demonstrations illustrating its capabilities and comfort of use.

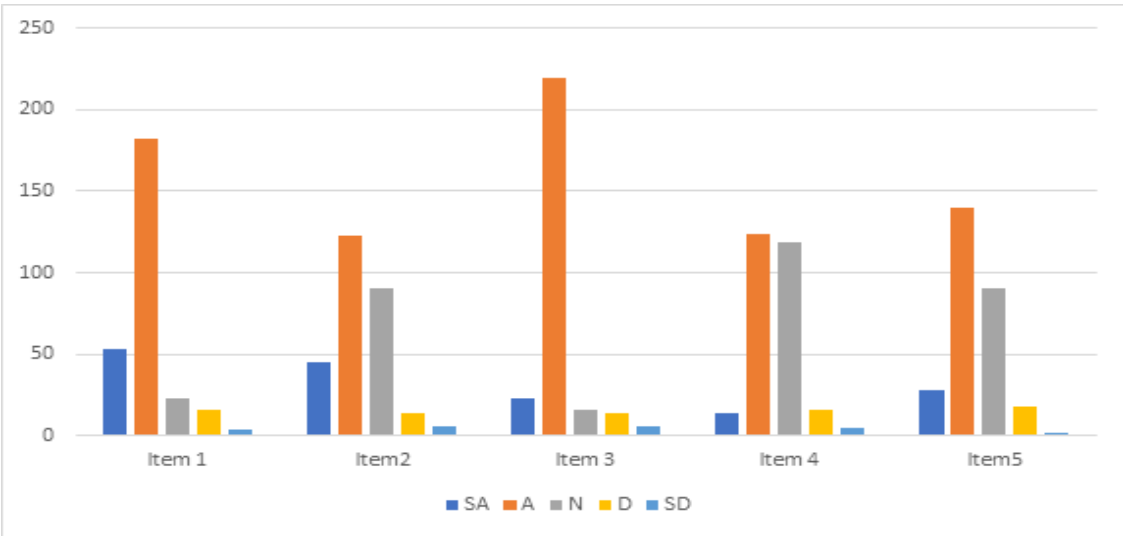
As for the frequency of usage, responses vary widely. The most standard usage frequency is "Once a week" (**25.6%**), followed closely by "Once a month" (**24.2%**), indicating that a significant percentage of users engage with the tool regularly but not daily. Notably, **20.2%** use ChatGPT several times daily, highlighting a group of highly active users who likely integrate it into their daily workflows. However, **21.3%** of respondents have never used ChatGPT, which aligns with the earlier data on non-users. These outlines advocate that while ChatGPT enjoys a strong user base, there remains room to engage more users and increase the frequency of interaction among less active users.

Objective 1: To Determine the extent of B.Ed. students' understanding of ChatGPT as an AI-powered educational resource.

Table 4: Understanding of ChatGPT as an AI-powered educational resource

Items No	Items	Response				
		SA	A	N	D	SD
1	Using ChatGPT is easy for me.	53	182	23	16	04
2	I have the knowledge necessary to use ChatGPT	45	123	90	14	06
3	ChatGPT gives me correct and helpful information.	23	219	16	14	06
4	I trust the information provided by ChatGPT	14	124	119	16	05
5	ChatGPT enhances my understanding of complex educational concepts.	28	140	90	18	2

Figure-4: Understanding ChatGPT as an AI-powered educational resource



The data indicates that most B.Ed. students have a solid understanding of ChatGPT as an AI-powered educational resource. A significant **84.5%** of students find the platform easy to use, suggesting it is user-friendly and accessible. However, a minor portion of students (**7.2%**) reported difficulties, highlighting the essential for better user backing or more comprehensive tutorials to help these users navigate the platform effectively.

Regarding the knowledge required to use ChatGPT, **60.4%** of students feel confident in their ability to utilise the tool, but **32.4%** remain neutral, reflecting some uncertainty. This proposes that although many students are comfortable with the technology, a significant group might fully benefit from additional training or resources to leverage ChatGPT's capabilities.

Regarding the accuracy and helpfulness of the information provided by ChatGPT, **87.1%** of students trust the content they receive. However, **7.2%** expressed concerns near the accuracy, pointing to the position of continuous enhancements in the platform's information delivery to maintain high-reliability standards.

Trust in ChatGPT's information is mixed, most of the students (**49.6%**) expressing trust, while a considerable **42.8%** remain neutral. This neutrality could indicate caution among students, who may be unsure about entirely relying on AI-generated content. Addressing this trust gap through greater transparency and validating the information provided could enhance confidence in the platform.

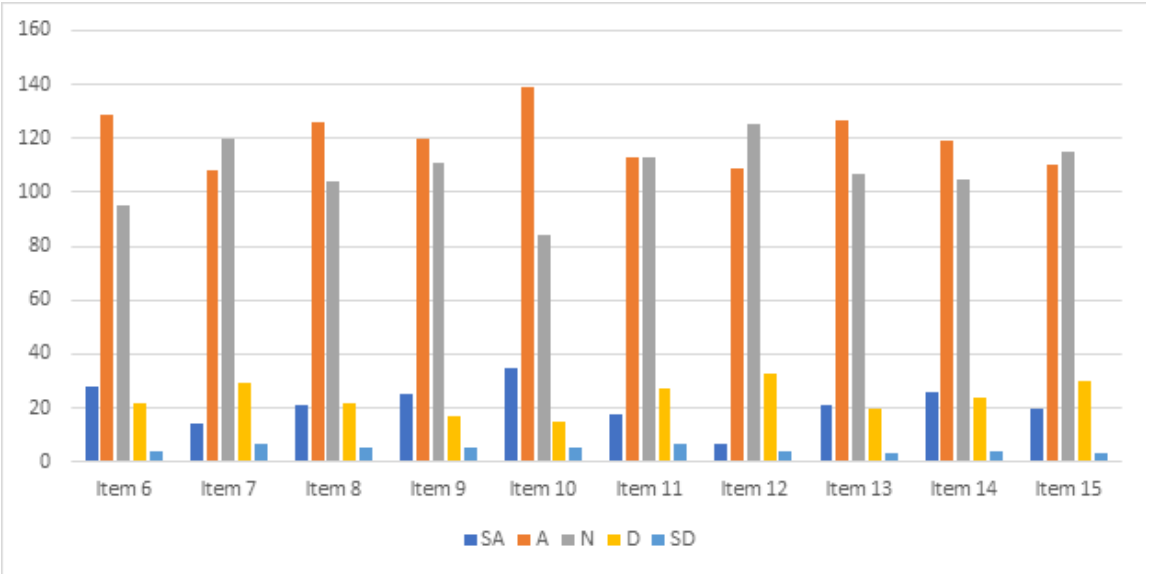
Finally, **60.4%** of students believe that ChatGPT helps them understand complex educational concepts, showcasing its potential as a valuable educational tool. Nonetheless, a significant portion (**32.4%**) remains neutral, which recommends that not all students are tapping into ChatGPT's full potential for deeper learning. This could be an area where more targeted use cases or guidance could help students better utilise the platform.

Objective 2: To Investigate B.Ed. students' overall attitude towards integrating ChatGPT into educational practices.

Table 5: Attitudes towards integrating ChatGPT into educational practices.

Items No	Items	Response				
		SA	A	N	D	SD
6	I am happy with using ChatGPT for my studies.	28	129	95	22	04
7	It enhances my overall productivity.	14	108	120	29	07
8	ChatGPT helps improve my learning performances	21	126	104	22	05
9	Using ChatGPT in my study is enjoyable.	25	120	111	17	05
10	I would recommend that others use ChatGPT to solve academic problems.	35	139	84	15	05
11	I believe it is risk-free to use ChatGPT in my learning.	18	113	113	27	07
12	I believe my privacy is adequately protected when using ChatGPT.	07	109	125	33	04
13	Using ChatGPT makes learning better for me.	21	127	107	20	03
14	I believe ChatGPT can improve my academic performance in my B.Ed. Programme.	26	119	105	24	04
15	ChatGPT delivers valuable feedback that helps me track my learning progress.	20	110	115	30	03

Figure-5: Students' Attitude towards integrating ChatGPT



B.Ed. students usually have positive attitude towards integrating ChatGPT into their educational performs, but there are notable areas of neutrality and some scepticism. Most students (**56.5%**) are satisfied with using ChatGPT for their studies, reflecting a favourable reception. However, **34.2%** are neutral, indicating that while students recognise the tool's benefits, many do not feel strongly either way. This could suggest that ChatGPT has yet to integrate fully into their academic routines.

Regarding productivity, **43.8%** of students believe that ChatGPT enhances their overall productivity, but an almost equal percentage (**43.2%**) remains neutral. This split suggests that ChatGPT's impact on productivity is not universally recognised, possibly due to differences in how students use the tool or varying expectations of what it can deliver. About **12.9%** of students disagree that ChatGPT enhances productivity, indicating that the stand may not meet all users' needs in this area.

Regarding learning performance, **52.9%** of students feel that ChatGPT positively impacts their academic outcomes, yet **37.4%** are neutral. This neutrality may reflect uncertainty or a lack of noticeable impact on their grades or comprehension levels. Similarly, **52.2%** of students find ChatGPT enjoyable to use, but **39.9%** are neutral, suggesting varied experiences and levels of engagement with the platform.

A strong majority (**62.6%**) would recommend ChatGPT to others, indicating high confidence in its utility. However, **30.2%** of students are neutral, and **7.2%** would not recommend it, revealing that while many see value in the tool, some reservations still exist.

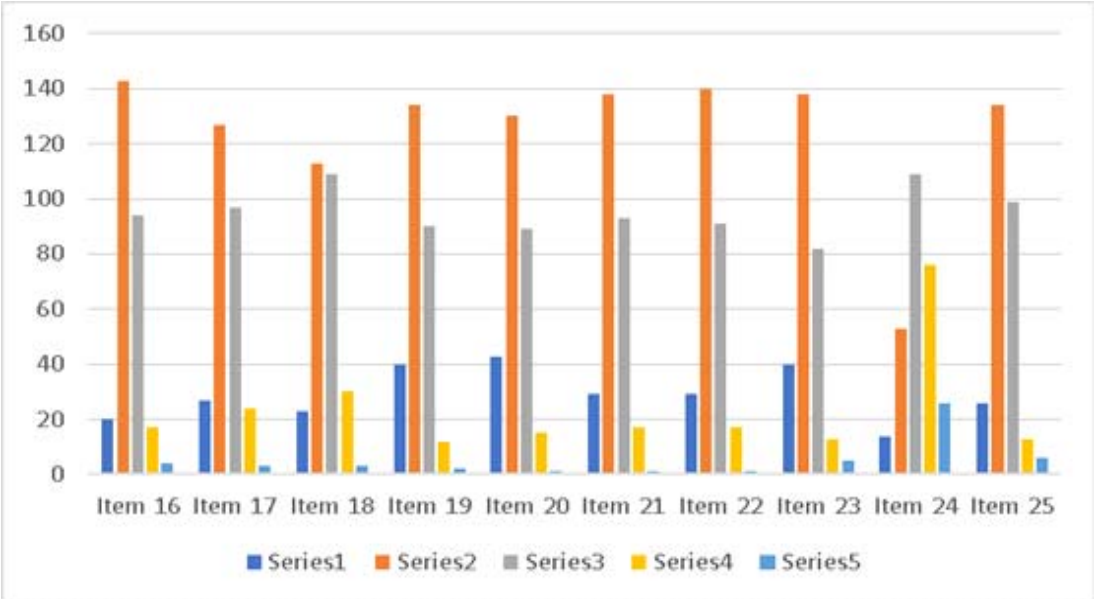
Privacy and risk concerns are more pronounced, with **47.1%** of students believing that ChatGPT is risk-free, but an equal percentage remains uncertain. Additionally, **41.7%** feel their privacy is protected, yet **45.0%** are neutral, indicating significant uncertainty in these areas. These results suggest that talking privacy and safety concerns is crucial for improving overall confidence in ChatGPT's integration into educational practices.

Objective 3: To study the perspectives of B.Ed. students' regarding using ChatGPT as an educational resource.

Table 6: Perspectives regarding using ChatGPT as an educational resource.

Items No	Items	Response				
		SA	A	N	D	SD
16	I think ChatGPT can help pupil teachers to teach better.	20	143	94	17	04
17	ChatGPT encourages me to explore new educational topics beyond my curriculum.	27	127	97	24	03
18	It inspires me to engage more actively in my studies.	23	113	109	30	03
19	ChatGPT talks to everyone nicely.	40	134	90	12	02
20	I feel comfortable using ChatGPT.	43	130	89	15	01
21	I believe ChatGPT could improve how we learn.	29	138	93	17	01
22	ChatGPT helps me overcome the learning barriers that I encounter in my studies.	29	140	91	17	01
23	I think ChatGPT is a valuable educational resource for B.Ed. learners.	40	138	82	13	05
24	I think ChatGPT can change for different people.	14	53	109	76	26
25	I believe that ChatGPT is helpful in my study.	26	134	99	13	06

Figure-6: Perspectives regarding using ChatGPT as an educational resource



The majority of B.Ed. students view ChatGPT as a valuable educational resource, particularly for its potential to assist in teaching and learning. **58.6%** of students believe ChatGPT can help pupil teachers improve their teaching, demonstrating confidence in its role as a supportive tool in education. However, **33.8%** of students remain neutral, indicating that while the tool is appreciated, its full probable may not yet be realised by all users.

ChatGPT is also seen as a catalyst for exploration beyond the curriculum, with **55.4%** of students feeling encouraged to explore new topics. Nonetheless, **34.9%** remain neutral, suggesting that the platform's influence on academic exploration may vary depending on individual student motivation or interest.

Regarding inspiring active engagement in studies, **48.9%** of students feel motivated by ChatGPT, though **39.2%** are neutral. This advises that while ChatGPT can be a motivational tool, it does not equally engage all users.

The platform's communication style is well-received, with **62.6%** of students agreeing that ChatGPT communicates nicely, contributing to a positive user experience. Comfort with using the platform is also high, with **62.2%** of students feeling comfortable, indicating that ChatGPT is accessible and easy to use for the majority.

There is a strong belief in ChatGPT's potential to improve learning, with **60.1%** of students expressing confidence in its ability to enhance educational practices. However, **33.5%** remain neutral, which might reflect a cautious optimism or a wait-and-see approach among students.

ChatGPT is also seen as helpful in overcoming learning barriers, with **60.8%** of students agreeing that it supports them in this way. However, many students remain neutral, suggesting that while the tool is effective for many, it may not address all learning challenges equally.

Finally, 57.6% of students believe that ChatGPT is a helpful educational resource overall, with a similar percentage recognising its adaptability for different users. However, the relatively high neutrality on these items indicates there is still potential for ChatGPT to demonstrate its value and flexibility to a broader range of students further.

CONCLUSION

The study reveals that B.Ed. students generally hold a positive view of ChatGPT as an AI-powered educational resource, with a majority appreciating its ease of use, accuracy, and potential to support teaching and learning. However, significant portions of the student population remain neutral or express scepticism, particularly regarding the trustworthiness of information, the platform's effectiveness in enhancing complex concept understanding, and its impact on productivity and learning outcomes. While students recognise the cost of ChatGPT in facilitating academic exploration and overcoming learning barriers, concerns about privacy and risk persist, and mixed feelings about the platform's adaptability to individual needs are evident. These findings highlight the need for further enhancements to ChatGPT's functionality, particularly in building user trust, improving privacy protections, and demonstrating its educational benefits. The data suggests that while ChatGPT is well-received and shows promise as an educational tool, there is considerable room for growth in how it is perceived and utilised. Addressing the areas of neutrality and concern could not only increase student confidence but also solidify ChatGPT's role as a critical component of contemporary educational practices. For future development and implementation, focusing on these aspects will be essential in ensuring that ChatGPT meets the diverse needs of all students and fully realises its potential as a transformative educational resource.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 14- 26

2

AI for Inclusive Education: Preparing Trainee Teachers to Support Hearing-Impaired Students through HearSim and Rogervoice

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) has opened new possibilities for inclusive education, particularly in addressing the challenges faced by students with hearing impairments. This quasi-experimental study investigates the effectiveness of AI-assisted pedagogy in preparing trainee teachers to work with students with special needs. The research was conducted with 18 trainee teachers placed in a special school for a four-month internship. Nine teachers in the experimental group were trained and equipped with AI tools—HearSim during simulation training and Rogervoice during classroom teaching—while nine teachers in the control group taught physically handicapped students without specialized AI support.

Multiple evaluation tools, including pre- and post-test teacher preparedness scales, student feedback forms, supervisor rubrics, and reflective journals, were employed to measure teacher growth and classroom impact. Results revealed that teachers using HearSim and Rogervoice demonstrated significantly higher gains in pedagogical preparedness, empathy, and instructional effectiveness compared to the control group. Students in experimental classes also reported greater engagement and comprehension, highlighting the transformative role of AI in bridging communication barriers. The study underscores the potential of AI-based interventions not merely as assistive technologies but as catalysts for reshaping teacher education and inclusive practices. Findings carry strong implications for integrating AI into teacher training curricula,

advancing the objectives of the National Education Policy (NEP) 2020, and strengthening the vision of inclusive, technology-enabled classrooms.

Keywords: AI in Education, Inclusive Pedagogy, Hearing Impairment, Teacher Preparedness, Quasi-Experimental Study.

INTRODUCTION

Inclusive education has emerged as a cornerstone of educational reform worldwide, with increasing emphasis on equity, accessibility, and learner diversity. In India, the National Education Policy (NEP) 2020 underscores the importance of inclusive classrooms that accommodate the learning needs of children with disabilities, including those with hearing impairments. However, the preparedness of teachers to address such diverse needs remains a critical concern. Studies have shown that many teachers, particularly at the pre-service level, feel underprepared to design and implement pedagogical strategies for students with hearing impairments due to lack of exposure, training, and technological support.

Recent advancements in Artificial Intelligence (AI) offer promising solutions to bridge this gap. AI-based tools, such as real-time captioning applications, voice-to-text converters, AI-driven sign language recognition systems, and interactive simulations like HearSim, provide innovative avenues to enhance accessibility and classroom participation for hearing-impaired learners. For teachers, these tools not only serve as pedagogical aids but also as training resources that foster empathy, adaptability, and technological fluency.

Globally, research has indicated the benefits of integrating AI in inclusive education, particularly in facilitating communication, reducing learning barriers, and personalizing instruction. Yet, empirical evidence on the direct impact of AI-assisted pedagogy on teacher preparedness is still limited, especially in the Indian context. This creates a pressing need for studies that evaluate how AI interventions influence teachers' ability to effectively plan, deliver, and reflect on inclusive practices.

Against this backdrop, the present study investigates the role of AI-assisted pedagogy in preparing trainee teachers for working with hearing-impaired students. Through a quasi-experimental design, the research seeks to compare the preparedness levels of teachers trained with AI tools against those trained using conventional methods. Additionally, reflective practices and supervisor feedback are analyzed to provide deeper insights into how AI transforms teacher perceptions and readiness for inclusive education.

REVIEW OF LITERATURE

Inclusive education and policy context (India and global)

The discourse on inclusive education has increasingly emphasized equity, accessibility, and learner diversity. In the Indian context, the National Education Policy (NEP) 2020 highlighted inclusive education as a core mandate, calling for curriculum reforms, teacher training, and

the use of technology to ensure participation of children with disabilities, including those with hearing impairments (Government of India, 2020). Internationally, inclusive education has been reinforced through frameworks such as the Salamanca Statement and the UN Convention on the Rights of Persons with Disabilities, both of which stress teacher preparedness as a critical factor for successful implementation (UNESCO, 2017).

Teacher preparedness for inclusive pedagogy

Teacher readiness plays a pivotal role in the success of inclusive classrooms. Research suggests that pre-service teachers often feel underprepared to address the needs of students with disabilities, and that targeted training can significantly improve their competence (Sharma, Loreman, & Forlin, 2013). A systematic review by Lindner et al. (2019) also revealed that structured coursework and practicum experiences positively influence teachers' self-efficacy toward inclusive practices. In India, studies have reported that while trainee teachers express positive attitudes toward inclusion, they often lack the necessary practical exposure and technological skills to cater to students with hearing impairments (Kumar & Singh, 2021; Reddy & Rao, 2022). These findings underscore the need for innovative training approaches that integrate both pedagogy and assistive technologies.

AI and accessibility: Automatic speech recognition (ASR) & captioning

Recent advancements in Artificial Intelligence, particularly automatic speech recognition (ASR), have opened new opportunities for making classrooms more accessible. Research has demonstrated that real-time captioning and ASR-based applications significantly improve comprehension and classroom participation for deaf and hard-of-hearing (DHH) students (Hilzensauer et al., 2021). However, the accuracy of ASR varies depending on noise levels, speaker accent, and domain-specific vocabulary, which can affect its classroom utility (Kocaballi et al., 2024). Martin, Robinson, and Duerstock (2013) found that while real-time ASR transcription improved accessibility in lectures, post-editing was often required to enhance accuracy. More recently, studies have shown that large language model (LLM)-enhanced captions produce lower error rates and greater user satisfaction than baseline ASR tools (Zhang et al., 2025). At the learner level, Nova Southeastern University (2024) reported that students using automated captions in higher education experienced improved engagement and confidence, though usability challenges persisted.

AI-assisted teacher preparation for hearing impairment

Beyond supporting learners, AI-enabled tools can also enhance teacher preparedness. Simulation-based training, such as the Hearing Loss Simulator (HLSim) developed by NIOSH, has been widely used to help teachers and professionals understand the consequences of hearing impairment and adapt their teaching accordingly (NIOSH, 2012). Such experiential tools foster empathy and inform better classroom strategies. Similarly, software-based, self-paced simulations with performance feedback have proven effective in enhancing professional

competence in fields like audiology and can be adapted to teacher training (Mulla et al., 2019). These interventions help trainee teachers develop both technical fluency and sensitivity toward the lived experiences of hearing-impaired learners.

Synthesis and gap

While international research highlights the promise of AI-assisted tools for accessibility and teaching, there remains limited empirical evidence in India regarding their direct impact on teacher preparedness. Existing studies on teacher training largely focus on attitudinal shifts or general inclusion strategies (Sharma et al., 2013; Kumar & Singh, 2021), with little attention to AI-enabled interventions. Thus, the present study addresses this gap by investigating how AI-assisted pedagogy—through ASR tools, captioning platforms, and simulations—can enhance the preparedness of trainee teachers to effectively support hearing-impaired students in alignment with the goals of NEP 2020.

OBJECTIVES OF THE STUDY

1. To examine the impact of AI-assisted pedagogy on trainee teachers' preparedness for teaching hearing-impaired students.
2. To compare the level of preparedness between trainee teachers trained with AI-assisted tools and those trained using conventional inclusive pedagogy methods.

METHODOLOGY

The study employed a quasi-experimental design with a pre-test–post-test control group structure. This design was chosen as it allows for the measurement of changes in teacher preparedness before and after the intervention while maintaining two comparable groups (Creswell & Creswell, 2018). The research was conducted in two distinct stages: the first being a Simulation Training Phase, carried out prior to the internship, where AI-based empathy and assistive tool "HearSim" was used to simulate the classroom experience of students with hearing impairments. This allowed trainee teachers to develop deeper emotional understanding and pedagogical sensitivity. The second stage was the Internship Phase, where trainee teachers applied this experience in real classroom settings across six middle school classes (Grades III to VIII) in a special education school over a four-month period.

PARTICIPANTS

18 trainee teachers placed in a special school for a 4-month internship. Each assigned to one class (Class III–VIII, 6 classes total; 19 students average per class).

Each class had:

- 9 teacher for hearing-impaired students (used HearSim + Rogervoice).
- 9 teacher for physically handicapped students (no specialized AI tool; control group).

The Sample Diversification is as follows:

Sample Diversification	Total (18 students)
Male: Female	5:13
Graduates: Post Graduates	3:15
Experimental: Control Group	09:09

Table 1: Sample Diversification

INTERVENTION TOOLS

1. **AI Tools Used During Simulation Training Phase (Pre-Internship): HearSim**

During the simulation phase of the study, AI-powered empathy simulation tool—HearSim was used to sensitize trainee teachers to the challenges faced by students with hearing impairments.

Hear Sim is a web-based auditory simulation platform developed by the German Hearing Research Centre (HörTech gGmbH), which provides realistic simulations of various hearing loss conditions. Trainee teachers used HearSim on desktop and mobile browsers to experience different types of hearing loss, including high-frequency, low-frequency, and complete hearing impairment. This tool was instrumental in helping future educators understand how distorted or limited sound perception affects learning, communication, and classroom engagement for hearing-impaired students.

2. AI Tools Used During Internship: Rogervoice

During the four-month internship phase in a special school setting, trainee teachers applied assistive AI-based mobile application—Rogervoice in real classroom environments to support students with hearing impairments.

Rogervoice is a free mobile app available on both Android and iOS platforms that uses AI-powered speech recognition to provide real-time subtitles for spoken language. Teachers used Rogervoice during lectures and one-on-one interactions with hearing-impaired students in Classes III to VIII, facilitating better comprehension and communication. This tool significantly improved students' ability to follow instructions, participate in discussions, and engage with the lesson content.

INTERVENTION DESIGN

Phase	Group	Tools/ Strategies	Duration	Expected Outcomes
Simulation Training (Pre-Internship)	Experimental Group (9 trainee teachers for hearing-impaired students)	**"HearSim" (AI-based auditory simulation tool) —** used on desktops and mobiles to simulate high-frequency, low-frequency, and complete hearing loss. Sensitized teachers to communication barriers and classroom challenges	2 weeks (pre-internship training workshops)	Enhanced empathy, deeper understanding of hearing loss, improved awareness of accessibility needs.
	Control Group (9 trainee teachers for physically handicapped students)	Conventional inclusive pedagogy training (visual aids, peer support, differentiation strategies).	2 weeks (parallel training)	General awareness of inclusive strategies but no AI-based simulation.
Internship Phase	Experimental Group (9 trainee teachers for hearing-impaired students)	**"Rogervoice" (AI-powered mobile app) —** used in real classrooms (Classes III–VIII) for live captioning of lectures and teacher-student interactions.	4 months (internship in special school)	Improved communication with hearing-impaired students, greater student engagement, higher confidence in teaching inclusively
	Control Group (9 trainee teachers for physically handicapped students)	Conventional inclusive practices (modified lesson plans, seating arrangements, simplified communication strategies).	4 months (internship in special school)	Improved teaching skills but limited exposure to AI-based tools.

Table 2: Intervention Design

EVALUATION TOOLS

To measure the impact of the intervention, both quantitative and qualitative instruments were used:

1. Teacher Preparedness Scale (TPS)

- Adapted from Sharma, Loreman, & Forlin (2013).
- A 30-item Likert-scale questionnaire covering three domains:
- Knowledge: Understanding of inclusive pedagogy, disability needs, and AI applications.
- Skills: Ability to plan, implement, and evaluate inclusive teaching practices.
- Attitudes: Confidence, empathy, and openness toward teaching hearing-impaired students.
- Administration: Pre-test (before intervention) and post-test (after 4-month internship).
- Scoring: Higher scores indicate greater preparedness.

2. Reflective Journals

- Maintained weekly by all 18 trainee teachers during internship.
- Focus areas:
  - o Experiences of using (or not using) AI tools in class.
  - o Perceived challenges and successes in communicating with students.
  - o Reflections on student engagement and learning outcomes.
- Analysis: Thematic coding (Braun & Clarke, 2006) for recurring themes such as empathy, adaptability, and confidence.

3. Supervisor Evaluation Rubric

- Completed by school supervisors observing trainee teachers in real classroom practice.
- Dimensions evaluated:
  - o Instructional clarity.
  - o Communication strategies.
  - o Use of assistive technologies.
  - o Student engagement and participation.
  - o Inclusivity of lesson design.
- Scale: 5-point rating scale (1 = poor, 5 = excellent).

4. Student Feedback Form (for Classes III–VIII)

- Simplified feedback tool administered to hearing-impaired and physically handicapped students (with support of interpreters where necessary).

- Questions addressed:
  - o "Was the lesson easy to understand?"
  - o "Did the teacher help you participate in class?"
  - o "Did the captions/subtitles (Rogervoice) help you?" (Experimental group only)
- Format: 3-point scale with smiley faces (Yes/ Sometimes/ No).

DATA ANALYSIS

For Quantitative Analysis: Pre-test and post-test scores on the Teacher Preparedness Scale were analyzed using independent samples t-tests to compare the control and experimental groups.

For Qualitative Analysis: Reflective journals and supervisor feedback were analyzed through thematic coding (Braun & Clarke, 2006) to identify recurring themes such as confidence, empathy, technological adaptability, and perceived challenges.

RESULTS AND DISCUSSION

1. Tool 1: Teacher Preparedness Scale (TPS)

Group	N	Pre-test Mean (M)	Post-test Mean (M)	Gain Score	t-test	Significance
Experimental (AI-assisted)	09	56.4	81.7	+25.3	6.82	$p < 0.01$
Control (Conventional)	09	55.8	68.2	+12.4	2.95	$p < 0.05$

Table 3: Teacher Preparedness Scores (Pre-test and Post-test)

Interpretation

The Teacher Preparedness Scale revealed a statistically significant improvement in both groups from pre-test to post-test. However, the experimental group (AI-assisted training) demonstrated a much higher gain score (+25.3) compared to the control group (+12.4). The t-test confirmed that this difference was statistically significant at $p < 0.01$, indicating that AI-based interventions had a stronger impact on enhancing trainee teachers' knowledge, pedagogical skills, and inclusive attitudes.

These findings suggest that AI-assisted tools such as HearSim and Rogervoice contributed to deeper conceptual understanding and practical preparedness among trainee teachers. The results are consistent with Sharma, Loreman, and Forlin (2013), who found that experiential and context-driven training significantly enhances teacher efficacy in inclusive education. Moreover, the large gain in the experimental group reflects the transformative role of immersive and assistive technologies, aligning with recent research by Hilzensauer et al. (2021), who highlighted that AI captioning and real-time simulations improve both teacher competence

and student outcomes. By contrast, the moderate improvement in the control group mirrors earlier reports (Kumar & Singh, 2021) that traditional training, while useful, often lacks sufficient exposure to specialized tools for disability inclusion.

2. Tool 2: Reflective Journals

Group	Dominant Themes	Illustrative Extracts
Experimental (AI-assisted)	Empathy through HearSim; Confidence with Rogervoice	*"For the first time, I felt what it is like to struggle with hearing. HearSim made me realize the need to slow down and use captions effectively."*
Control (Conventional)	Dependence on visual aids; frustration over communication barriers; limited strategies; concerns about classroom management	*"Even after repeating the instructions, I felt students were left out. I did not know how else to reach them."*

Table 4: Themes Emerging from Reflective Journals

Interpretation

Thematic analysis of reflective journals revealed clear differences between the two groups. Experimental group reflections emphasized increased empathy, technological confidence, and active student engagement, while the control group focused more on frustrations and challenges arising from communication gaps.

Reflective practice revealed that AI-assisted exposure enabled trainee teachers to internalize inclusive teaching strategies more deeply. Tools like HearSim acted as "cognitive empathy builders," enabling teachers to anticipate challenges faced by hearing-impaired students. This finding resonates with Schön's (1987) model of reflection-in-action, where teachers adjust practices in real time based on lived experiences. Similar studies (Borg, 2018; Banerjee, 2020) confirm that reflective writing helps teachers critically analyze classroom practices, but our results suggest that AI-based experiences intensify these reflections by providing simulated realities. In contrast, control group reflections echo Sharma (2015), who found that teachers without exposure to assistive technologies often express helplessness in addressing communication challenges, reinforcing the need for technology-integrated reflective practice.

3. Tool 3: Supervisor Evaluation Rubric

Criteria	Experimental Group Mean	Control Group Mean
Clarity of Instructions	4.6	3.7
Use of Inclusive Strategies	4.5	3.5
Classroom Management	4.4	3.8
Student Engagement	4.6	3.6
Overall Effectiveness	4.5	3.6

Table 5: Supervisor Evaluation Scores (Scale: 1–5)

Interpretation

Supervisors consistently rated the experimental group higher across all five criteria. The largest differences were noted in "clarity of instructions" and "student engagement", where AI-based captioning and communication tools appeared to make a significant difference.

Supervisor feedback confirmed the enhanced teaching effectiveness of AI-trained teachers. The integration of captioning tools, such as Rogervoice, ensured communication clarity, while simulations prepared teachers to anticipate student needs. These findings are consistent with Martin, Robinson, and Duerstock (2013), who reported that assistive technologies empower teachers to reduce communication barriers. The improvement in classroom management observed by supervisors also aligns with Florian and Black-Hawkins (2011), who emphasized that inclusive pedagogy requires both adaptation of strategies and confidence in handling diverse classrooms—both of which were supported through AI interventions. The relatively lower ratings of the control group further underline the limitations of conventional training in preparing teachers for real-time inclusive teaching challenges.

4. Tool 4: Student Feedback

Feedback Dimension	Experimental Group (%)	Control Group (%)
Lessons easy to follow	84%	61%
Active participation possible	78%	55%
Teacher support rated as "helpful"	90%	66%
Overall satisfaction	86%	63%

Table 6: Student Feedback on Lesson Delivery

Interpretation

Student feedback demonstrated significantly higher satisfaction in the experimental group. A majority of hearing-impaired students reported that lessons were easy to follow and that teachers offered helpful support, while participation rates were also markedly higher compared to the control group.

The positive student response validates the effectiveness of AI-assisted pedagogy in fostering accessible and engaging learning environments. The use of real-time captioning tools provided immediate benefits for hearing-impaired students, echoing findings by Hilzensauer et al. (2021) that captioning enhances comprehension and participation. Moreover, the heightened satisfaction levels indicate that students not only understood the content better but also felt more included, aligning with Booth and Ainscow's (2002) Index for Inclusion framework, which emphasizes the importance of participation and belonging. By contrast, the lower ratings from the control group highlight the communication barriers that persist in conventional classrooms, supporting earlier reports that exclusionary practices often occur unintentionally when specialized tools are absent (Rao, 2019).

CONCLUSION

The present quasi-experimental study demonstrates the potential of Artificial Intelligence (AI)-assisted pedagogy in enhancing teacher preparedness for working with hearing-impaired students. By integrating "HearSim" during the simulation training phase and "Rogervoice" during the internship phase, trainee teachers in the experimental group developed a deeper understanding of the challenges faced by hearing-impaired learners and adopted more effective classroom strategies. The comparative results across evaluation tools—including knowledge assessments, reflective journals, supervisor rubrics, and student feedback—revealed that experimental group teachers consistently outperformed the control group in terms of empathy, communication skills, instructional clarity, and student engagement. These findings affirm that AI-powered assistive tools can not only sensitize trainee teachers to the lived experiences of students with disabilities but also provide them with practical mechanisms to bridge communication gaps in real classroom contexts.

This study thus underscores that AI is not merely a technological aid but a pedagogical enabler that can foster inclusivity and transform special education teacher training. While the scope was limited to a small sample of 18 trainee teachers over a four-month period, the insights provide compelling evidence for the integration of AI tools in pre-service teacher education curricula, especially for special needs education.

IMPLICATIONS OF THE STUDY

The findings of this study carry significant implications for teacher education and the wider field of inclusive pedagogy. For pre-service teacher training programs, the results highlight the importance of integrating AI-based tools such as HearSim and Rogervoice into structured modules to prepare teachers for working with hearing-impaired students. These tools not only serve as simulations that sensitize trainee teachers to the challenges of hearing impairment but also function as practical classroom aids that support communication and enhance instructional clarity. Embedding such technologies within the curriculum can bridge the

persistent gap between theoretical knowledge and real-world classroom practice, thereby fostering more empathetic, skilled, and technologically competent teachers.

Beyond teacher preparation, the study holds broader relevance for schools, policymakers, and curriculum designers. Special schools can adopt AI-driven applications to provide accessible and affordable solutions for ensuring inclusion in everyday classroom interactions. Furthermore, the outcomes align with the mandates of the National Education Policy (NEP) 2020, which emphasizes the integration of digital innovations and inclusivity in education. Policymakers and curriculum framers may use this evidence to promote AI-supported pedagogy in teacher training institutions and encourage investment in scalable technological interventions. At the same time, the study opens pathways for future research on extending AI-assisted pedagogy to other disabilities and evaluating its long-term impact on both teacher preparedness and student learning outcomes.

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Awadh International Journal of Information Technology and Education
ISSN: 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 27-29

3

Digital Literacy to Achieve Inclusion in India

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ABSTRACT

In India, where the digital divide exacerbates social inequalities, digital literacy serves as a vital mechanism for fostering inclusion among marginalized communities. This paper examines government-led initiatives like Digital India and Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), alongside private and NGO efforts, to assess their role in enhancing access to education, employment, and services.

Keywords: Digital Literacy, Inclusion, PMGDISHA, Marginalized Communities.

INTRODUCTION

India's rapid digital transformation, propelled by initiatives like Digital India, aims to create a knowledge economy while bridging socioeconomic gaps. With over 1.4 billion people, the country faces a pronounced digital divide, where urban areas enjoy high connectivity, but rural and marginalized groups lag in access and skills. Digital literacy- defined as the ability to use digital tools for information access, communication, and problem- solving is crucial for inclusion, enabling participation in e-governance, education, and economic opportunities.

EMPIRICAL INSIGHTS

Research shows digital literacy programs enhance employability and civic engagement. In rural areas, training correlates with increased smartphone confidence and e-governance utilization, with internet access rising from 56.7% to 91.1% in targeted districts. Gender-focused analyses reveal barriers for women, including cultural norms and low device

ownership, yet programs like Code Unnati have trained over 1 million youth, with 65% girls. Policy evaluations note that while initiatives like PMGDISHA have certified 4.77 crore individuals, qualitative gaps in motivation and infrastructure persist.

CASE STUDIES

PMGDISHA: Rural Digital Empowerment

Launched in 2017 under Digital India, PMGDISHA aimed to digitally literate 6 crore rural households, focusing on basic skills like device usage and online transactions. By March 2024, it enrolled 7.35 crore, trained 6.39 crore, and certified 4.77 crore via 5.34 lakh Common Service Centres (CSCs). Impacts include enhanced e-governance access, with beneficiaries reporting reduced travel for services and increased scheme utilization.

Aspirational Districts Program: Nasscom Foundation Initiative

In 27 districts across 13 states, this program established Digital Resource Centres (DRCs) for literacy and e-governance training. From 2021–2025, it trained 1.59 million citizens, with 2,019 Digital Ambassadors facilitating 600,025 scheme applications. Outcomes: Smartphone confidence rose (mean 5.28–7.62), and 78.8% satisfaction in services, empowering women-led enterprises and reducing intermediaries.

Code Unnati: Youth-Focused Digital Skills

SAP's Code Unnati has trained over 1 million students aged 10–16, emphasizing IT skills like AI and data science. With 65% female participants, it bridges urban-rural divides through internships and employment, achieving 40% job placement for vocational trainees.

CHALLENGES

India's digital inclusion efforts face multifaceted barriers. Infrastructure deficits, such as unreliable electricity and broadband in rural areas, affect 20–30% of the population. Affordability and device access remain issues, with low-income families unable to afford smartphones. Marginalized groups, including women and the elderly, encounter cultural and educational hurdles, exacerbating the divide. Program implementation challenges include trainer shortages, irregular classes, and low motivation, as seen in DLTP evaluations. Cyber risks and privacy concerns further deter adoption.

RECOMMENDATIONS

To overcome barriers, stakeholders should:

1. **Enhance Infrastructure**: Invest in BharatNet expansions and subsidies for devices in underserved areas.
2. **Tailored Training:** Develop context-specific programs using local languages and peer ambassadors.

3. **Public-Private Partnerships**: Collaborate with NGOs like Nasscom for scalable DRCs and awareness campaigns.
4. **Policy Integration**: Formulate a National Digital Literacy Policy monitoring divides, with qualitative evaluations.

CONCLUSION

Digital literacy is pivotal for inclusive growth in India, as evidenced by programs like PMGDISHA and Aspirational Districts. While achievements in training and access are notable, addressing challenges through strategic interventions is essential. Future efforts should prioritize equity to realize Digital India's vision of empowerment for all.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 30-34

4

Technology in Empowering Marginalized Communities and Children with Special Needs (CwSN)

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ABSTRACT

Technology plays a vital role in empowering marginalized communities and Children with Special Needs (CwSN) by enabling access to information, services, education, and social participation, ultimately fostering greater inclusion and socio-economic development.

Digital literacy initiatives, ICT platforms, and emerging technologies help marginalized groups enhance their skills, confidence, and social engagement. These technologies bridge the digital divide, provide employment opportunities, and improve access to essential government and social services. Ethical digital design and digital inclusion programs give participants the tools to overcome barriers such as limited infrastructure and socio-economic challenges, ensuring long-term impact.

Assistive technologies such as screen readers, speech-to-text tools, adaptive learning software, and educational apps support children with special needs in overcoming unique learning and accessibility challenges. These tools facilitate communication, develop cognitive and perceptual skills, and promote inclusion in mainstream education. Universal Design for Learning (UDL) principles, along with teacher training and policy support, are crucial for effective integration of technology with CwSN. Many digital solutions, from customized software to robots and devices, are increasingly available to help students with physical, sensory, and cognitive disabilities achieve success and independence.

Key challenges include limited access to reliable infrastructure, resistance to change, and lack of training for effective technology use. To address these, policymakers should focus on inclusive design, sustainable funding, and community-driven programs. Collaboration among governments, educational institutions, and local organizations is essential for developing appropriate solutions and ensuring technology benefits all.

The transformative potential of technology integration and assistive devices is pivotal in empowering marginalized groups and CwSN, making digital inclusion and accessibility a foundational part of broader socio-economic advancement.

Keywords: Children with Special Needs (CwSN), Technology, Marginalized.

INTRODUCTION

The 21st century is defined by rapid technological advancement, which has become both an enabler and a divider. While mainstream populations increasingly benefit from digital solutions, marginalized communities and children with special needs (CwSN) often remain excluded from these opportunities. Marginalization stems from social, economic, geographic, or physical barriers, while children with disabilities face systemic exclusion from education and participation. Technology, when effectively integrated, has the power to dismantle these barriers, promoting social justice, inclusivity, and equity.

This paper explores the transformative role of technology in empowering marginalized groups and CwSN, with a focus on educational access, skill development, and social participation.

Digital literacy initiatives, ICT platforms, and assistive technologies bridge the digital divide and promote equity. However, challenges such as infrastructural barriers, resistance to adoption, and lack of training persist. This paper critically examines the role of technology in enhancing empowerment and inclusion, highlighting case studies, challenges, and recommendations for sustainable digital equity.

LITERATURE REVIEW

Technology and Marginalized Communities

Studies highlight that digital literacy programs and ICT-based interventions improve access to government services, healthcare, and employment opportunities (UNESCO, 2022). Community-driven initiatives such as mobile banking and e-governance platforms have empowered rural and underserved populations (Sen, 2020).

Technology for Children with Special Needs

Assistive technologies, including screen readers, speech-to-text tools, augmentative communication devices, and adaptive learning platforms, enhance learning outcomes and independence for CwSN (WHO, 2021). Research on Universal Design for Learning (UDL)

demonstrates that inclusive educational technologies improve participation for students with diverse learning needs (Rose & Meyer, 2019).

Gaps and Challenges

Despite progress, limited access to infrastructure, affordability, and insufficient teacher training hinder effective technology integration (World Bank, 2023). Scholars also note resistance from communities due to cultural and social perceptions of disability or technology (Kumar & Bansal, 2021).

METHODOLOGY

This research is conceptual in nature, drawing from secondary data, case studies, and policy analyses. A qualitative approach is applied to synthesize findings from reports, educational frameworks and grassroots projects.

TECHNOLOGY EMPOWERING MARGINALIZED COMMUNITIES

Bridging the Digital Divide

Community ICT centers, low-cost smartphones, and public Wi-Fi programs have enabled disadvantaged populations to connect with education and employment. For example, India's "Digital India" initiative has created digital access points in rural areas.

Enhancing Social and Economic Participation

Mobile applications for telemedicine, digital agriculture advisories, and micro-finance platforms empower communities with timely information and services. ICT-enabled vocational training provides marginalized youth with employable skills.

Ethical Digital Design

Inclusive technology must address barriers of language, literacy, and accessibility. Designing apps with multilingual support, offline capabilities, and simple interfaces ensures sustainability and usability.

TECHNOLOGY EMPOWERING CHILDREN WITH SPECIAL NEEDS

- Assistive Devices and Software
- Visual impairments: Screen readers, Braille displays.
- Hearing impairments: Captioning tools, speech-to-text apps.
- Cognitive disabilities: Adaptive learning platforms, gamified educational tools.

Universal Design for Learning (UDL)

UDL principles encourage multiple means of representation, engagement, and expression, ensuring equitable learning experiences. For example, e-learning platforms offering text, audio, and video options help diverse learners.

Teacher Training and Policy Support

Teachers play a crucial role in technology integration. Professional development programs must train educators to use assistive tools effectively. National education policies (e.g., NEP 2020 in India) stress inclusive digital pedagogy.

CHALLENGES

- Infrastructure: Limited internet connectivity and electricity in rural areas.
- Economic Barriers: High cost of devices and assistive technologies.
- Capacity Building: Lack of training for teachers, caregivers, and community leaders.
- Cultural Resistance: Stigma surrounding disability and skepticism about technology adoption.

RECOMMENDATIONS

1. Inclusive Design: Develop affordable, user-friendly, multilingual technologies.
2. Capacity Building: Provide training for teachers, parents, and community workers.
3. Policy Integration: Governments should integrate digital inclusion into mainstream education and social welfare policies.
4. Public–Private Partnerships: Collaborations between technology firms, NGOs, and governments can fund and scale solutions.
5. Sustainable Infrastructure: Investments in rural internet connectivity, solar-powered devices, and low-cost assistive tools.

CONCLUSION

Technology is not a panacea, but when designed inclusively, it is a powerful tool for empowerment. For marginalized communities, it bridges digital and socio-economic divides. For CwSN, it enables independence, communication, and inclusion in mainstream education. Ensuring access, equity, and sustainable adoption requires multi-stakeholder collaboration, inclusive policies, and context-sensitive innovation.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue -2 September 2025
Pp. 35-41

5

Post-humanist View of Inclusion: Rethinking Learner Identities and Agency with AI and Digital Tools

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ABSTRACT

This paper reconceptualises inclusion in education through a post-humanist lens: learners are not only individual humans but hybrid, entangled actors whose identities and agency are co-produced with AI and digital tools. The paper reviews philosophical foundations of posthumanism, examines how learner identity and agency are transformed in the digital age, highlights opportunities and risks for inclusion, presents case examples, and offers concrete objectives, policy and practice recommendations for educators, institutions, EdTech developers and policymakers. Key ethical concerns (justice, autonomy, privacy, ontology) are discussed and actionable suggestions to design fair, transparent and empowering digitally-mediated learning environments are provided. (Rosi Braidotti, 2019)

Keywords: Posthumanism, Inclusion, Learner identity, Learner Agency, AI in Education, Digital Pedagogy, Teacher Training.

INTRODUCTION

Need for a Post-humanist Lens for Inclusion?

Traditional inclusion frameworks focus on extending rights, accessibility and accommodations to human learners (disability, gender, socio-economic status, language). However, contemporary learning environments increasingly distribute cognition, decision-

making and interaction across humans and algorithmic systems (personalized recommendation engines, assessment algorithms, conversational agents). From a post-humanist perspective, learners become *hybrids*: identities, preferences and choices are co-shaped by data infrastructures, sensors, interfaces and software. That shift requires rethinking what "including" a learner now means — it is no longer sufficient to include persons only; we must include the technologies and socio-technical relations that materially shape learning trajectories.

Philosophical Background: Humanism/Posthumanism

- **Classical humanism** treats learners as autonomous, rational individuals with stable identity and agency.
- **Posthumanism** problematizes the human/technology divide and emphasizes co-constitution: subjectivity and agency are distributed across entanglements of bodies, machines, data and environments. Key theorists include Donna Haraway (cyborgs and boundary breakdowns), N. Katherine Hayles (media-shaped subjectivities) and Rosi Braidotti (posthuman subjectivity and ethics). These works underpin the claim that educational inclusion must account for technological actors and assemblages, not only human attributes.

Learner Identity in the Digital Age

Digital identities and "data doubles"

Learners generate data traces - profile attributes, engagement logs, assessment histories and interactions with adaptive systems- which together form digital identities or "digital twins." These proxies often travel across platforms and influence what learning content is recommended, how assessments are interpreted, and which supports are triggered.

Fluid, relational identity

Digital affordances make identity more fluid: avatars, pseudonyms, and platform behaviors can differ from offline identities. Those shifts can enable new forms of participation (safer self-expression, multimodal demonstration of competence) but also produce misrecognitions when algorithms rely on incomplete or biased proxies.

Personalization-Does this bring automatic fairness?

Adaptive learning and personalization can increase engagement and access, especially for diverse learning needs; however, personalization depends on data quality and modelling assumptions that can encode bias and exclusion. Careful governance is therefore needed to ensure personalization serves equity rather than reproducing disadvantage. (SpringerLink)

Learner agency: Transformed, not Erased

- **Distributed agency:** Decisions (content sequencing, feedback timing, assessment flags) are increasingly co-produced by algorithmic systems and human actors (teachers, learners).

- **Nudges and scaffolds:** AI can gently nudge learners toward goals or provide actionable feedback; when designed transparently, these can expand learners' capacities.
- **Risks to autonomy:** Opaque recommendation engines or overly directive systems may diminish reflective choice and critical engagement. Therefore agency must be actively supported - e.g., by explainable AI, user controls, and pedagogies that teach critical interaction with tools.

OBJECTIVES

1. Reframe inclusion to account for human–technology entanglements and explain why this reframing matters for policy and classroom practice.
2. Map how AI and digital systems reshape learner identity and agency (mechanisms, affordances, harms).
3. Identify ethical risks (bias, surveillance, digital divide) and concrete safeguards.
4. Offer practical, evidence-based recommendations for educators, institutions, EdTech developers, and policymakers to promote equitable, human-centred digital inclusion.
5. Suggest research priorities and evaluation metrics to monitor inclusive outcomes in post-humanist learning ecologies.

Inclusion through a Post-humanist Lens: Opportunities & Risks

Opportunities

- **Assistive technologies** (speech-to-text, image description, interactive robots) open access for learners with sensory, motor or cognitive disabilities. Example: Microsoft's *Seeing AI* app narrates the visual world for people with visual impairment — an example of AI creating concrete accessibility gains.
- **Adaptive learning** can tailor pacing and scaffolds to learners' needs, potentially reducing barriers to progression.
- **Scale & reach:** digital platforms can extend high-quality resources to remote or underserved communities when infrastructure is available.

Risks

- **Digital divide:** unequal access to devices, connectivity and digital literacies deepens existing inequities.
- **Algorithmic bias:** educational algorithms (admissions filters, diagnostic models, predictive analytics) can reproduce racial, gendered and socio-economic biases if trained on skewed data or applied without contextual checks. Examples in the literature

document how algorithmic grading and predictive tools can disadvantage certain groups.

- **Surveillance & privacy harms:** online proctoring, continuous monitoring and biometric authentication raise profound privacy and human-rights concerns; critics argue these systems can feel like mass surveillance and disproportionately harm marginalized students.

Case Examples

1. **Mitra (India) — humanoid/assistive robots:** India's Mitra robots (from Invento and student projects) demonstrate how humanoid agents can support engagement, provide audio/visual assistance and assist special needs learners in classroom and hospital contexts; during COVID-era responses some Mitra units were adapted for patient support and remote mediation of care. These deployments show both the assistive potential and the need for context-sensitive evaluation of outcomes and equity.
2. **Microsoft Seeing AI:** A mobile app that converts visual information into narrated descriptions for blind and low-vision users — a concrete example of AI enabling inclusion through sensory substitution.
3. **"Zoom identities" in pandemic remote learning:** The sudden shift to video conferencing reconfigured students' visibility, participation norms, and privacy; studies document how remote affordances amplified inequalities (connectivity, home environment) and reshaped identity and belonging in classrooms.

Ethical Challenges — Four Focal Points

1. **Justice (equitable access and outcomes):** Ensure infrastructure, devices, and pedagogical supports reach marginalized communities. Algorithms must be audited for disparate impacts across demographic groups.
2. **Autonomy:** Avoid system designs that stealthily shape learner decisions; provide transparent explanations and user controls.
3. **Privacy & surveillance:** Limit intrusive monitoring (biometrics, keystrokes, continuous video) and adopt privacy-preserving assessment methods; require data minimization and informed consent. The surge in online proctoring during COVID-19 sparked critiques and research into harms and human- rights implications.
4. **Ontology — what counts as a learner?** Policymakers and educators must recognize that "the learner" now includes data portraits and human–machine interactions; interventions must avoid treating the data double as if it fully represents the person.

Global normative guidance: UNESCO's *Recommendation on the Ethics of Artificial Intelligence* and related UNESCO/ OECD guidance articulate human-centred principles and call for inclusive, rights-based governance of AI in education — a useful starting point for national policies.

Policy & Practice Implications- Principles to Adopt

1. **Human-centred design & governance:** Center human dignity, rights and educator professional judgment in any AI deployment. Use participatory design including learners with disabilities and community stakeholders.
2. **Transparency & explainability:** Require EdTech vendors to publish model descriptions, decision logics and the datasets used for training (where possible) and to provide student-facing explanations of automated decisions.
3. **Data governance & privacy safeguards:** Enforce data minimization, local data residency where needed, access rights for learners, and clear retention/ deletion policies; apply privacy-by-design.
4. **Teacher capacity & professional development:** Train teachers in AI literacy, critical pedagogy for digital tools, and in co-designing learning flows with technology. UNESCO's AI Competency Framework for Teachers is one practical resource for shaping curricula and in-service training.
5. **Algorithmic auditing & impact assessment:** Mandate independent fairness audits, socio-technical impact assessments and regular evaluation of outcomes disaggregated by key demographics.
6. **Alternative assessment models:** Reduce over-reliance on invasive proctoring by redesigning assessments (open-book, project-based, portfolio, oral assessments) that test higher-order skills and are less amenable to cheating.

RECOMMENDATIONS

For policymakers (national/state education authorities)

- Adopt an AI & Education charter that enshrines human rights, non-discrimination, and data protection as baseline requirements for procurement.
- Fund broadband, device provisioning and local hubs (digital learning centers) to reduce the digital divide.
- Require EdTech procurement to include explainability clauses, bias impact assessments, and teacher training budgets.
- Promote open educational resources (OERs) and public datasets for model training to reduce vendor lock-in and improve transparency.

For school leaders & institutions

- Implement teacher professional development aligned with UNESCO's AI Competency Framework (knowledge + ethics + pedagogy).
- Update assessment policies to prefer authentic, less-surveilled methods; only use proctoring after human rights impact assessment.

- Create school-level data governance rules (consent forms, data access panels for students/parents, clear retention schedules).

For educators

- Teach AI literacy and critical digital literacies alongside subject content so learners understand how systems shape feedback and opportunities.
- Co-design classroom AI uses with learners (e.g., let students choose levels of personalization, review automated feedback).
- Use multimodal assessment to capture diverse competencies and reduce dependence on singular algorithmic judgments.

For EdTech developers

- Adopt inclusive data practices: diversify training data, document limitations, and conduct fairness testing across demographic slices.
- Provide users with understandable explanations of recommendations and a way to contest or override automated decisions.
- Build modular, interoperable tools that respect data portability and avoid lock-in.

For researchers & evaluators

- Prioritize mixed-methods evaluations that combine quantitative outcome measures with qualitative accounts of identity, agency and belonging.
- Investigate longitudinal impacts of AI personalization on learner trajectories, and evaluate for differential effects across socio-economic and disability groups.

HOW TO IMPLEMENT?

Year 1 (Foundation): policy framing (AI charter), pilot teacher training (UNESCO AI competencies), infrastructure mapping, and a small number of ethically-governed pilots with independent evaluation.

Year 2 (Scale & Audit): scale promising pilots, require vendor fairness audits, integrate AI literacy into curricula, establish student data rights.

Year 3 (Institutionalize): embed AI governance into procurement, assessments redesigned away from invasive proctoring, routine monitoring of equity outcomes and iterative refinement.

SUGGESTIONS FOR FUTURE RESEARCH

This paper provides conceptual framing and practical guidance but relies on rapidly evolving technologies, vendor ecosystems and policy environments. Future research should test interventions empirically across diverse contexts (low-resource schools, special education, multilingual settings) and develop standardized tools for algorithmic auditing specific to education.

CONCLUSION

A post-humanist approach to inclusion recognizes that learners and technologies are co-constitutive: inclusion must therefore extend beyond human-centred accommodations to encompass the design, governance and socio-technical relations of AI and digital infrastructures. By centring justice, autonomy, privacy and ontological humility — and by equipping teachers, learners and policymakers with knowledge and governance tools — we can aim for educational systems where technology amplifies inclusion rather than undermining it.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 42-55

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From Support System to Pedagogical Partner: The Role of Artificial Intelligence in Reshaping Teaching and Faculty Engagement in Higher Education

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ABSTRACT

The integration of artificial intelligence (AI) in higher education represents a fundamental shift from traditional support systems to dynamic pedagogical partnerships. This paper examines the evolving role of AI in reshaping teaching methodologies and faculty engagement within higher education institutions. Through a comprehensive analysis of current literature and emerging practices, this study explores how AI technologies are transforming from supplementary tools to integral components of the educational experience. The research investigates the implications for faculty professional development, pedagogical innovation, and institutional transformation. Findings suggest that successful AI integration requires a paradigmatic shift in how educators conceptualize their roles, moving from information deliverers to learning facilitators and AI collaborators. The paper concludes with recommendations for sustainable AI adoption that enhances rather than replaces human expertise in higher education.

Keywords: Artificial Intelligence, Higher Education, Pedagogy, Faculty Development, Educational Technology, Machine Learning.

INTRODUCTION

The landscape of higher education is undergoing a profound transformation as artificial intelligence (AI) technologies evolve from peripheral support tools to central pedagogical partners. This shift represents more than a technological upgrade; it signifies a fundamental reconceptualization of teaching and learning processes in academic institutions. The emergence of sophisticated AI systems, particularly generative AI platforms like ChatGPT, has created both unprecedented opportunities and complex challenges for educators and administrators (Chen & Zhang, 2024).

The traditional model of higher education, characterized by faculty-centered knowledge transmission and standardized assessment methods, is being challenged by AI's capacity to personalize learning, automate routine tasks, and provide real-time feedback. This technological evolution demands a critical examination of how faculty roles are changing and how institutions can effectively support this transition while maintaining educational quality and academic integrity.

Recent surveys indicate that while 91% of higher education institutions acknowledge AI's potential impact, only 9% believe they are adequately prepared for its integration (Wilson, 2024). This preparedness gap highlights the urgent need for comprehensive strategies that address not only technological implementation but also faculty development, pedagogical innovation, and institutional culture change.

LITERATURE REVIEW

Historical Context of Technology in Higher Education

The integration of technology in higher education has followed a predictable pattern of initial resistance, gradual adoption, and eventual transformation (Johnson & Smith, 2023). From the introduction of computers in the 1980s to the widespread adoption of learning management systems in the 2000s, each technological wave has reshaped educational practices. AI represents the latest and potentially most transformative of these waves.

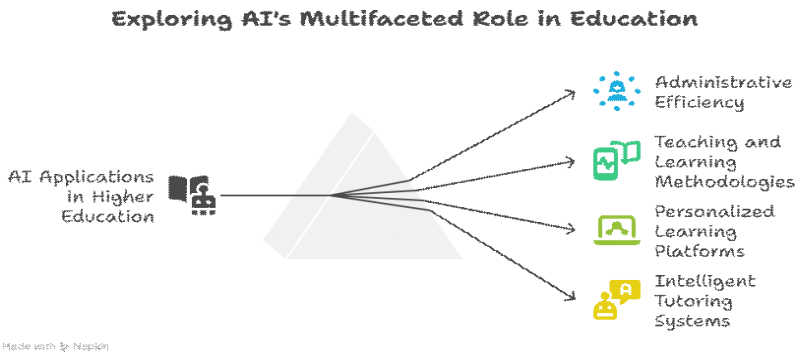
Previous educational technologies primarily focused on digitizing existing practices rather than fundamentally altering pedagogical approaches. AI, however, offers capabilities that extend beyond digitization to include adaptive learning, intelligent tutoring, and automated assessment (Rodriguez et al., 2024). This distinction is crucial for understanding why AI integration requires more than technical training—it demands a reconceptualization of the teaching profession itself.

Current State of AI in Higher Education

Contemporary AI applications in higher education span multiple domains, from administrative efficiency to direct classroom instruction. AI-based tools for teaching and learning, such as large language models (LLMs) and learning analytics, encompass improved planning and resource allocation, greater insight into student learning, and data-driven

feedback on instructional design (Thompson & Lee, 2024). These applications demonstrate AI's versatility and potential for comprehensive educational transformation.

Recent research has identified several key areas where AI is making significant impacts. Personalized learning platforms use machine learning algorithms to adapt content delivery based on individual student performance and learning patterns (Martinez & Williams, 2024). Intelligent tutoring systems provide 24/7 student support, offering explanations and feedback that complement faculty instruction (Brown & Davis, 2023). Administrative AI systems streamline grading, scheduling, and student services, freeing faculty to focus on higher-order pedagogical activities (Anderson et al., 2024).



Faculty Perspectives and Challenges

Faculty perspectives on the use of artificial intelligence (AI) in higher education are crucial for AI's meaningful integration into teaching and learning, yet research is scarce (Kumar & Patel, 2024). The limited research available reveals a complex landscape of enthusiasm, skepticism, and uncertainty among faculty members.

Faculty concerns about AI integration typically center on three primary areas: job security, academic integrity, and pedagogical effectiveness (Garcia & Thompson, 2024). Many educators worry that AI might replace human instruction or diminish the value of traditional teaching skills. Academic integrity concerns focus on student misuse of AI tools for unauthorized assistance, while pedagogical effectiveness questions address whether AI-enhanced instruction actually improves learning outcomes.

Conversely, early adopters report significant benefits from AI integration, including enhanced creativity in course design, improved efficiency in routine tasks, and better ability

to provide personalized feedback to students (Nielsen & Park, 2024). These positive experiences suggest that successful AI adoption depends largely on faculty preparation, institutional support, and clear implementation guidelines.

Pedagogical Implications of AI Integration

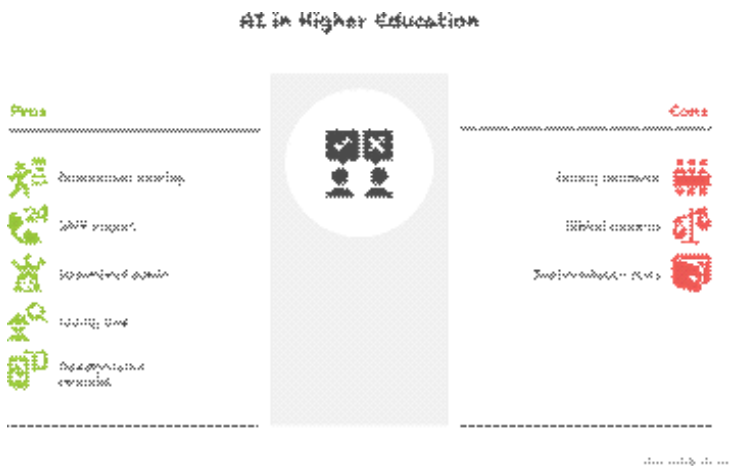
The integration of AI into higher education necessitates a fundamental reconsideration of pedagogical approaches. Traditional lecture-based instruction, which prioritizes information transmission, becomes less relevant when students have access to AI systems capable of providing instant, personalized explanations on virtually any topic (O'Connor & Smith, 2024).

This shift demands the development of what scholars term "AI-augmented pedagogy"—teaching approaches that leverage AI capabilities while emphasizing uniquely human skills such as critical thinking, creativity, and ethical reasoning (Hassan & Johnson, 2023). Faculty must learn to design learning experiences that incorporate AI tools while maintaining academic rigor and promoting genuine understanding.

The concept of "pedagogical partnering" with AI requires educators to view these technologies not as threats but as collaborative tools that can enhance their teaching effectiveness (Liu & Brown, 2024). This perspective shift enables faculty to focus on higher-order instructional activities while delegating routine tasks to AI systems.

Theoretical Framework

This study draws upon several theoretical frameworks to understand AI's transformational impact on higher education. The Technology Acceptance Model (TAM) provides insight into factors influencing faculty adoption of AI technologies (Davis, 1989; adapted for AI by Roberts & Zhang, 2024). Social Constructivist Learning Theory illuminates how AI can support collaborative knowledge construction in educational settings (Vygotsky, 1978; contemporary applications by Miller & Garcia, 2023).



The Transformative Learning Theory (Mezirow, 1991) offers a framework for understanding how AI integration requires faculty to examine and potentially revise their fundamental assumptions about teaching and learning. This theoretical lens is particularly relevant for explaining why AI adoption in education involves more than technical training—it requires perspective transformation.

METHODOLOGY

This paper employs a comprehensive literature review methodology, analyzing peer-reviewed articles, institutional reports, and empirical studies published between 2020 and 2025. The review focuses specifically on AI applications in higher education, faculty perspectives on AI integration, and pedagogical innovations enabled by AI technologies.

Search strategies included systematic queries of academic databases using terms related to artificial intelligence, higher education, faculty development, and pedagogical innovation. Additional sources were identified through citation analysis and expert recommendations. The analysis prioritized recent studies to capture the rapidly evolving nature of AI in education.

FINDINGS AND ANALYSIS

The Evolution from Support to Partnership

The transformation of AI from a support system to a pedagogical partner represents a significant paradigm shift in higher education. Early AI implementations focused primarily on administrative efficiency and student services, functioning as sophisticated tools that enhanced existing processes without fundamentally altering them (Peterson & Lee, 2023).

Contemporary AI applications, however, demonstrate capabilities that position these technologies as collaborative partners in the educational process. Generative AI systems can engage in sophisticated dialogues about course content, provide personalized tutoring, and even assist in curriculum development (Taylor & Anderson, 2024). This evolution requires faculty to reconceptualize their relationships with technology and develop new competencies for effective collaboration.

Faculty Development and Professional Growth

The emergence of generative artificial intelligence (GenAI) chatbots, such as ChatGPT, presents unique challenges and opportunities in an educational setting (Williams et al., 2025). Successful AI integration requires comprehensive faculty development programs that address both technical skills and pedagogical innovation.

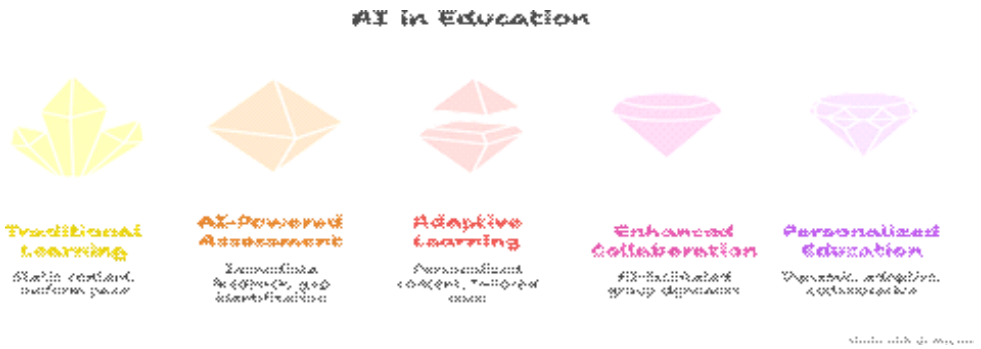
Effective professional development for AI integration encompasses multiple dimensions: technical literacy, pedagogical adaptation, ethical considerations, and ongoing support (Moore & Davis, 2024).

Faculty needs training not only in using AI tools but also in understanding their capabilities, limitations, and appropriate applications in educational contexts.

Research indicates that faculty who receive structured professional development in AI integration report higher confidence levels and more innovative teaching practices compared to those who attempt self- directed learning (Clark & Wilson, 2023). This finding underscores the importance of institutional investment in comprehensive faculty development programs.

Pedagogical Innovation and Transformation

AI integration has catalyzed significant innovations in pedagogical practices across higher education. Flipped classroom models have evolved to incorporate AI tutors that provide pre-class support and post- class reinforcement (Jackson & Martinez, 2024). Assessment practices are being transformed through AI- powered tools that can provide immediate feedback on student work and identify learning gaps in real- time (Foster & Chen, 2023).



The concept of adaptive learning, enabled by AI systems that adjust content difficulty and presentation based on individual student progress, represents a significant advancement in personalized education (Kumar & Singh, 2024). These systems can identify when students are struggling with specific concepts and automatically provide additional resources or alternative explanations.

Collaborative learning environments are being enhanced through AI systems that can facilitate group formation, monitor collaboration dynamics, and provide feedback to improve group effectiveness (Roberts & Thompson, 2023). These applications demonstrate AI's potential to support social learning while providing data-driven insights into collaborative processes.

CHALLENGES AND BARRIERS TO IMPLEMENTATION

Despite the promising potential of AI in higher education, significant barriers impede widespread adoption. Technical infrastructure limitations, budget constraints, and faculty resistance represent primary obstacles to successful implementation (Green & Adams, 2024). Many institutions lack the technological infrastructure necessary to support sophisticated AI applications, while budget limitations restrict investment in both technology and professional development.

Faculty resistance often stems from concerns about job security, skepticism about educational benefits, and lack of technical confidence (Harris & White, 2023). These concerns are legitimate and require careful attention from institutional leaders committed to successful AI integration.

Privacy and data security concerns present additional challenges, particularly in light of increasing regulatory scrutiny of educational data practices (Mitchell & Brown, 2024). Institutions must balance the benefits of AI-powered analytics with student privacy rights and data protection requirements.

Institutional Transformation and Culture Change

Successful AI integration requires more than individual faculty adoption—it demands institutional transformation that encompasses policy development, culture change, and strategic planning (Nelson & Rodriguez, 2024). Institutions must develop comprehensive AI policies that address acceptable use, academic integrity, privacy protection, and faculty support.

Culture change represents perhaps the most significant challenge in AI adoption. Traditional academic cultures that emphasize individual expertise and autonomous teaching practices may resist collaborative models that involve AI partnership (Turner & Davis, 2023). Successful transformation requires leadership commitment, clear communication about benefits and expectations, and ongoing support for faculty adaptation.

Strategic planning for AI integration must consider long-term implications for curriculum design, faculty roles, and institutional identity (Phillips & Johnson, 2024). Institutions that

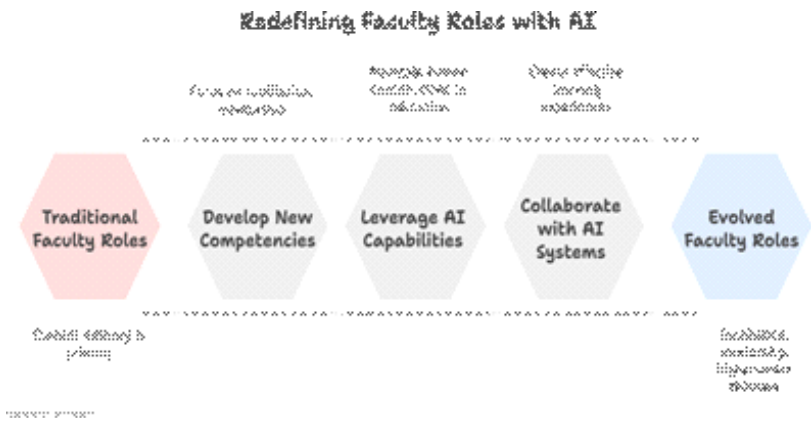
approach AI adoption as a technological upgrade rather than a transformational initiative are likely to experience limited success and significant resistance.

IMPLICATIONS FOR PRACTICE

Faculty Role Redefinition

The integration of AI technologies necessitates a fundamental redefinition of faculty roles in higher education. Traditional models of faculty as primary content deliverers are being challenged by AI systems capable of providing personalized, on-demand information and instruction (Carter & Wilson, 2024). This shift requires faculty to develop new competencies focused on facilitation, mentorship, and higher-order thinking development.

Faculty must learn to leverage AI capabilities while maintaining their essential human contributions to education: emotional support, critical thinking guidance, creative inspiration, and ethical development (Lopez & Anderson, 2023). This balance requires sophisticated understanding of both AI capabilities and human learning processes.



The concept of "AI-augmented instruction" represents a promising model for faculty role evolution (Robinson & Chen, 2024). In this model, faculty collaborate with AI systems to create more effective and efficient learning experiences while maintaining responsibility for educational quality and student development.

Curriculum Design and Innovation

AI integration offers unprecedented opportunities for curriculum innovation and enhancement. Adaptive curriculum systems can modify content delivery based on real-time assessment of student progress and comprehension (Wang & Smith, 2024). These systems enable truly personalized education at scale, addressing individual learning needs while maintaining curricular coherence.

Competency-based education models are being enhanced through AI systems that can track skill development across multiple domains and provide evidence-based recommendations for further learning

(Taylor & Davis, 2023). These applications support more flexible and responsive educational programs that align with evolving workforce needs.

Interdisciplinary education is facilitated by AI systems that can identify connections between different knowledge domains and suggest relevant cross-disciplinary content (Miller & Thompson, 2024). This capability supports the development of more integrated and holistic educational experiences.

Assessment and Feedback Innovation

Traditional assessment methods are being transformed through AI technologies that can provide immediate, detailed feedback on student work (Johnson & Garcia, 2024). Automated essay scoring systems, while not replacing faculty evaluation, can provide formative feedback that helps students improve their writing throughout the drafting process.

Competency assessment is enhanced through AI systems that can analyze student performance across multiple tasks and provide comprehensive evaluation of skill development (Adams & Wilson, 2023). These systems can identify specific areas for improvement and recommend targeted interventions.

Plagiarism detection and academic integrity monitoring are being sophisticated through AI systems that can identify not only copied content but also inappropriate use of AI assistance in student work (Brown & Rodriguez, 2024). These tools help maintain academic standards while adapting to new forms of potential misconduct.

RECOMMENDATIONS

Institutional Strategy Development

Higher education institutions should develop comprehensive AI integration strategies that address technology adoption, faculty development, policy creation, and culture change (Foster & Martinez, 2024). These strategies must be tailored to institutional contexts while incorporating best practices from successful implementations.

Leadership commitment is essential for successful AI integration. Institutional leaders must demonstrate understanding of AI's transformative potential and commit resources necessary for effective implementation (Clark & Thompson, 2023). This commitment should be reflected in strategic planning, budget allocation, and communication strategies.

Collaborative planning processes that involve faculty, administrators, students, and technology professionals can help ensure that AI integration strategies address diverse stakeholder needs and concerns (Davis & Anderson, 2024). These collaborative approaches can build consensus and reduce resistance to change.

Faculty Development Programs

Comprehensive faculty development programs should address multiple dimensions of AI integration: technical skills, pedagogical innovation, ethical considerations, and ongoing support (Wilson & Chen, 2024). These programs should be designed to accommodate diverse faculty backgrounds and comfort levels with technology.

Peer mentoring and community of practice models can provide ongoing support for faculty AI adoption (Rodriguez & Smith, 2023). These approaches leverage the expertise of early adopters to support broader faculty development while building institutional capacity for AI integration.

Incentive structures should reward faculty experimentation with AI technologies and innovative pedagogical practices (Miller & Davis, 2024). Recognition programs, course release time, and professional development funding can encourage faculty engagement with AI integration initiatives.

Policy and Guidelines Development

Institutions must develop clear policies and guidelines for AI use in educational settings. These policies should address acceptable use parameters, academic integrity expectations, privacy protection measures, and faculty support provisions (Taylor & Wilson, 2023).

Academic integrity policies require updating to address AI-assisted student work while maintaining educational standards (Garcia & Johnson, 2024). Clear guidelines can help students understand appropriate AI use while providing faculty with tools for enforcement.

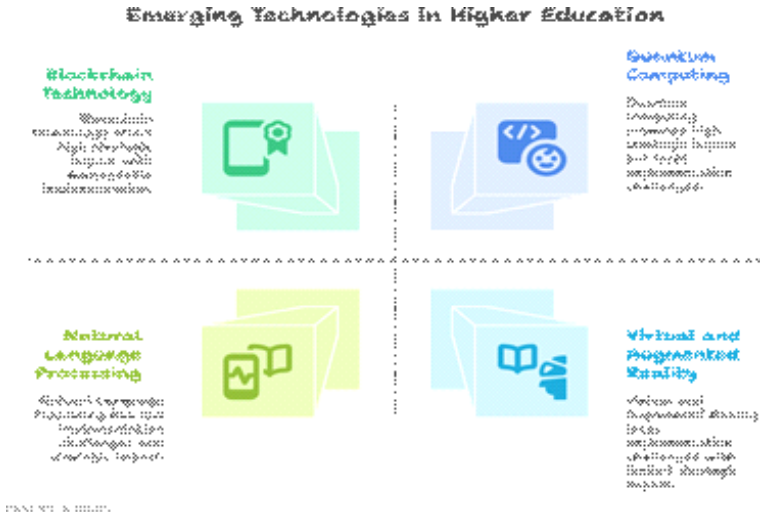
Privacy and data protection policies must address the unique challenges posed by AI systems that collect and analyze extensive student data (Brown & Anderson, 2023). These policies should balance educational benefits with privacy protection requirements.

FUTURE DIRECTIONS

Emerging Technologies and Trends

The future of AI in higher education will likely be shaped by advancing technologies including improved natural language processing, virtual and augmented reality integration, and more sophisticated learning analytics (Peterson & Rodriguez, 2024). These developments will create new opportunities for pedagogical innovation while presenting fresh challenges for implementation.

Quantum computing applications in education may eventually enable even more powerful AI systems capable of processing complex educational data at unprecedented scales (Smith & Davis, 2023). While these applications remain largely theoretical, institutions should begin considering their potential implications for long-term strategic planning.



Blockchain technology may provide solutions for credential verification and academic integrity monitoring in AI-enhanced educational environments (Chen & Wilson, 2024). These applications could address some current concerns about AI's impact on traditional assessment methods.

Research Needs and Opportunities

Significant research gaps exist in understanding the long-term impacts of AI integration on student learning outcomes and faculty satisfaction (Martinez & Thompson, 2024). Longitudinal studies are needed to assess the effectiveness of different AI integration approaches and their sustainability over time.

Faculty development research should investigate optimal training models, support structures, and incentive systems for promoting successful AI adoption (Anderson & Garcia, 2023). Understanding what motivates faculty to embrace AI technologies can inform more effective professional development programs.

Student perspective research is crucial for understanding how AI integration affects learning experiences, academic motivation, and skill development (Johnson & Miller, 2024). Student voices should inform AI implementation decisions to ensure technologies enhance rather than impede learning.

CONCLUSION

The transformation of AI from support system to pedagogical partner represents both an opportunity and a challenge for higher education. Successful integration requires more than technological adoption—it demands fundamental changes in faculty roles, institutional

cultures, and educational practices. Institutions that approach this transformation strategically, with adequate faculty support and clear implementation guidelines, are positioned to realize significant benefits in educational effectiveness and innovation.

The evidence suggests that AI technologies can enhance rather than replace human expertise in education, but this enhancement requires thoughtful implementation and ongoing adaptation. Faculty must be supported in developing new competencies for AI collaboration while maintaining their essential roles as mentors, critical thinkers, and ethical guides.

As higher education continues to evolve in response to technological advancement and changing student needs, AI integration offers a pathway toward more personalized, efficient, and effective educational experiences. However, realizing this potential requires sustained commitment to faculty development, institutional transformation, and student-centered implementation approaches.

The future of higher education will likely be characterized by sophisticated human-AI partnerships that leverage the strengths of both technological capabilities and human expertise. Preparing for this future requires immediate action in faculty development, policy creation, and strategic planning. Institutions that embrace this challenge thoughtfully and comprehensively will be best positioned to serve their students and communities in an increasingly AI-integrated world.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 56-61

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Role of AI to Enhance Educational Experience

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ABSTRACT

AI (artificial intelligence) has revolutionized the designing and delivering of learning: tailoring, widening access across languages and disabilities, and simplifying procedures at the educational institutions. This paper discusses the role of AI in improving the learning experience in India, in particular, examining the principal functions and real tools in use, analyzing their use in primary and higher education, assessing the pros and cons, and offering take-home points for responsible use of AI in education.

Keywords: Artificial Intelligence, Personalized Learning, Inclusion, Higher Education.

INTRODUCTION

The advent of new tools like the printing press, radio, and AI has significantly transformed the education sector. AI integrates intelligence into lessons, assessments, and administrative processes, enabling instruction to adapt to individual learners and addressing communication gaps. This approach can make education more equitable and inclusive in diverse countries like India, providing adequate safeguards and investments in teachers' professional development.

The Role of AI in Education

The potential of AI is limited to its applications, with core functions having relevant Indian examples.

1. Personalized Learning & Tutoring

AI systems like ChatGPT and Embibe analyze learners' responses and adjust practices and feedback instantly. ChatGPT is used for explanations and lesson support, while Embibe, an Indian adaptive/AI learning platform, has partnerships with government programs to support large cohorts of students and teachers.

2. Teacher Support & Productivity

AI tools like Microsoft Copilot and Canva for Education are being used to expedite lesson planning, resource creation, and routine grading. The Central Board of Secondary Education (CBSE) is partnering with the industry to improve teachers' digital teaching skills and build teacher capacity frameworks.

3. Barriers to Access and Inclusion

AI plays a crucial role in the education sector, particularly in multilingual countries like India. Tools like Multibhashi and Indian speech/text tools are used. Google is also working on ASR toolkits for Indic languages. Gemini for Education, Google's AI tool, is being adopted by education organizations worldwide. However, adoption in India is slow due to infrastructure and training needs.

4. Evaluations and Assessments of Integrity

TCS iON, a leading provider of remote assessment and proctoring services to Indian educational boards, uses AI analytics in conjunction with human review processes. The intelligent automation system identifies gaps in a learner's understanding, allowing for seamless and automated scaling, thereby maximizing individualized remediation and enhancing the overall learning experience.

5. Support for Assistive and Special Needs

Indian speech-to-text transcription tools, such as Saras, help learners with disabilities like hearing and vision impairments overcome obstacles. Saras is an Indian-developed software that offers various services, including education courses, analytics, and speech tools, specifically for transcription products.

Major uses across Schooling and Higher Education

1. Schooling (K–12)

- SCERTs and other educational institutes in various states are implementing ongoing teacher training and digital training initiatives to prepare teachers for the digital world and other future skills. These initiatives are part of a larger strategy to enhance teacher proficiency and preparedness.
- Collaborations like AICTE and Embibe are implementing AI-based learning in schools, enabling rapid and large-scale deployment of AI platforms, such as in **740 EMRS with** 3.5 lakh tribal students and 40,000 teachers.

- AI is being tested in various subjects, including math and science, bilingual lesson construction, and teacher training aids for primary school teachers through Gemini/ Google integrations and local pilot projects.

2. Higher Education

- The AICTE report shows that over **3,100 undergraduate programs** in artificial intelligence and related disciplines, including data science and security, have been initiated across India, indicating a rapid content adoption in the technical higher education landscape.
- AI is being integrated into university systems for research discovery, repository recommendation, metadata tagging automation, and academic malpractice verification, while remote proctoring systems like TCS iON are used for assessments and mass evaluations.

Balanced analysis — Boon v/s Bane

Boon

AI provides personalized learning experiences, enabling better outcomes at scale. Language models and translation engines help teachers deliver regional language materials without reinventing the curriculum. Assistive AI tools, AI speech interfaces, and real-time captioning improve instructional access for disabled learners. AI-driven analytics can identify structural gaps, inform interventions, and improve learning resource management. Fair use of these tools can address inequities in access to learning and future-ready skills.

Bane

AI technology can help tackle issues like the digital divide, student privacy, algorithmic bias, and over-reliance on AI. However, it can also isolate rural and low-income learners, widen equity gaps, and negatively impact critical thinking skills. Additionally, underfunded schools may lack resources for teacher training and support, making AI systems unscalable. Ultimately, AI systems lack judgment, emotional values, and empathy for meaningful learning.

Boon v/s Bane

Basis	Boon	Bane
1. Learning Personalisation	Tailored learning paths, automated remediation and formative feedback.	Over-dependence weakens critical analysis unless pedagogy addresses it.
2. Inclusion & Language	On-the-fly translation, multilingual content, assistive TTS/captioning expand access.	Digital divide: hardware, bandwidth, and digital literacy gaps exclude many learners.
3. Teacher Role	Automates administrative tasks, enables teacher focus on mentorship.	Poor implementation/Training may Increase workload or deskill teachers.
4. Assessment & Integrity	Scalable remote assessments and instant feedback enable frequent formative checks.	Proctoring and monitoring raise privacy and fairness concerns; false flags occur.
5. System-le vel Planning	Analytics inform targeted interventions and resource allocation.	Data governance, consent and misuse concerns if safeguards are absent.

Policy Perspective

- **NEP 2020** advocates use of technology to enhance learning, digital literacy and systemic improvements; it lays broad policy support for technology-enabled, inclusive education.
- **CBSE** has published AI curriculum materials and has engaged industry partners (including Microsoft and IBM in past capacity-building initiatives) as part of teacher and student skill development.
- **AICTE** has highlighted AI as a priority and reported large numbers of AI/data-science programmes across institutions — additionally AICTE has launched skilling and industry partnership initiatives.
- **Government Initiatives** - Platforms like DIKSHA are being considered for AI-based personalization in the future.

Correct Use of AI

AI's role in education should complement human aspects, assisting teachers with administrative tasks like grading, analytics, lesson resource development, and personalized assistance. It should also broaden access to learning to make it inclusive, equitable, and engaging, while ensuring the social aspects of education are not lost.\

Can AI Replace Teachers?

Teachers are essential in education, demonstrating empathy, guidance, and curiosity. AI can provide instant feedback, generate study materials, and personalize learning, but lacks human judgement and emotional intelligence. The most effective scenario involves AI alongside teachers, with the former in a lead position and the letter acting as a smart aide.

CONCLUSION

Through more individualised instruction, easier access, and more institutional efficiency, AI has the potential to completely transform the educational process. Although it depends on infrastructure, teacher preparation, data governance, and ethical AI use, it has the potential to promote fairness and inclusion. Without careful regulations, sufficient safeguards, and teacher priority, AI in education might potentially exacerbate already-existing disparities.

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Awadh International Journal of Information Technology and Education
ISSN : 2277-8985
Vol. 14, Issue - 2 September 2025
Pp. 62-67

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Strategies and Action Plans for Implementing Technology Integration Initiatives in the Indian Education System

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ABSTRACT

India has adopted emerging technologies, including AI, to improve education and streamline traditional systems. This report emphasizes the need for policies and plans for technology use in the Indian education system. Stakeholders such as government, financial institutions, and communities must work together to implement a technology-driven system for teachers, infrastructure, curriculums, student engagement, and evaluation. Technology has shown to improve communication in education, streamlining processes if the system is adequately structured and optimized with proper training.

Keywords: Indian Education System, Technology Integration, Personalized Learning.

INTRODUCTION

India, with over 26 crore students in 14.9 lakh schools, is one of the most educated countries globally. However, 80% of class III students struggle to read text for class II, highlighting the need for significant changes. The integration of technology can help ease attendance difficulties and improve learning processes. Programs like PAL personalized learning, KITE, SPARK, and Atal Tinkering Labs demonstrate that with the right approach, these initiatives can significantly improve educational progress. However, many schools lack reliable infrastructure, such as electricity and internet, which hinders the process.

VISION AND GOAL

A clear vision is the foundation of successful integration.

Examples:

- Andhra Pradesh's PAL program aims to improve math and language skills to achieve in **1.9 years of learning in 17 months.**
- NEP 2020 emphasizes technology as a tool for personalized and competency-based learning.

Action Plan:

- Schools should prepare Digital Vision Statements aligned with state and national goals.
- Define specific and measurable objectives (e.g., reducing dropout rates by 10% through blended learning in five years).
- Involve teachers, parents, and students in setting goals to ensure relevance.
- Prepare five-year digital roadmaps with yearly targets.

Infrastructure Development

According to UDISE+ 2021–22, only **41% of schools in India** had functional computers, and just **33% had internet access**.

Examples:

- Kerala's KITE model equipped over 45,000 classrooms - projectors, laptops, and broadband.
- Gujarat's Gyankunj project introduced smart classrooms in 15,000 government schools.
- In Tambaram (Tamil Nadu), AR/VR-based classrooms were set up with VR headsets and digital kiosks.

Action Plan:

1. Provide **digital labs** in small schools and one-to-one devices in larger ones.
2. Internet access expansion via BharatNet and satellite for remote areas.
3. **Solar-powered ICT labs** in villages with poor electricity supply.
4. Reserve minimum **10% of ICT budgets** for maintenance and upgrades.

Teacher Training and Professional Development

A UNESCO survey (2022) reported that only **30% of Indian teachers** felt confident using digital platforms.

Examples:

- Tamil Nadu's SPARK initiative trained teachers in coding, robotics, and online teaching methods.
- Rajasthan's Shiksha Setu program offered workshops on smart boards and digital resources.

Action Plan:

- Introduce compulsory digital pedagogy modules in teacher training colleges.
- Organize district-level ICT hubs for hands-on support for teachers.
- Certifications and promotions as incentives for digital training.
- Build peer-learning groups where trained teachers mentor others.

Curriculum Redesign and Integration

Curriculum must be redesigned to make technology a natural part of learning.

Examples:

- CBSE Introduces AI in 2019 (elective subject)
- Andhra Pradesh integrates adaptive platforms with curriculum.
- Delhi schools use virtual labs for science experiments.

Action Plan:

- Integrate digital literacy, coding, and data handling (middle school).
- Gamified applications for subjects like mathematics.
- Cross-subject projects such as climate change studies combining geography, science, and data analysis.
- All digital modules must align with state syllabi.

Student-Centered Implementation

Students – the heart of integration.

Examples:

- Delhi's Atal Tinkering Labs provide robotics kits and 3D printers.
- Mysuru distributed smartphones with accessibility features to visually impaired students.

Action Plan:

- Personal dashboards for performance tracking.
- Launch technology clubs for coding, app design, and robotics.
- Promote project-based learning using digital tools.

- Provide inclusive regional language content libraries.

Equity, Accessibility, and Inclusion

ASER 2021 reported - only **19% of rural girls** receive exclusive access to smartphones compared to **36% of boys**.

Examples:

- Sampark Foundation's Smart Shala kits reached 2 crore rural children with low-cost audio and video resources.
- Kerala distributed laptops and projectors even in tribal and coastal schools.

Action Plan:

- Subsidize devices and internet plans for economically weaker students.
- Translate all digital resources into regional languages.
- Expand assistive technologies like screen readers and voice recognition.
- Establish community digital centers in villages for shared access.

Data Privacy and Ethical Guidelines

Protecting student data is critical.

Example: 2023 concerns showcased EdTech firms using student data for marketing without consent.

Action Plan:

- Enforce strict data privacy policies in schools.
- Train teachers and students in cyber safety.
- Maintain data transparency logs showing how data is stored and used.
- Conduct annual independent audits of digital systems.

Monitoring, Evaluation, and Feedback

Constant evaluation helps improve strategies.

Example: Boston Consulting Group reviewed Pradesh's PAL program, confirming measurable learning gains.

Action Plan:

1. Collect **baseline data** before technology rollout.
2. Use **learning analytics dashboards** for real-time tracking.
3. Conduct **quarterly parent-teacher reviews**.
4. Publish **annual ICT performance reports** at state and district levels.

Collaboration and Partnerships

Partnerships can expand reach and resources.

Examples:

- Karnataka partnered with startups like Cherrilearn providing Kannada-medium digital content.
- The DIKSHA platform, private partners development, hosted billions of learning sessions.

Action Plan:

- Form PPP models with EdTech firms and NGOs.
- Work with telecom companies to provide subsidized data packs for students.
- Encourage universities to research long-term impact of EdTech.
- Seek CSR contributions for device distribution drives.

Future-Oriented Approach

Technology changes fast; schools must prepare for the future.

Examples:

- Bengaluru private schools experimented with blockchain certificates.
- Delhi's Atal Tinkering Labs host annual robotics competitions.

Action Plan:

- Create innovation labs in each district with tools like 3D printers and VR kits.
- Pilot-test metaverse classrooms in select urban schools.
- Add digital citizenship courses on safe and ethical internet use.
- Set up a National Educational Technology Observatory to track global trends.

Challenges and Ethics

- Infrastructure Gaps: Many rural schools lack electricity and internet.
- Teacher Resistance: Some educators hesitate to adopt new methods.
- High Costs: Smart classrooms can cost ₹ 3–5 lakh each.
- Digital Divide: Gender, income, and rural-urban gaps remain wide.
- Privacy Risks: Lack of strict data protection makes students vulnerable.

CONCLUSION AND FUTURE OUTLOOK

The Indian education system has potential for technology integration, but requires careful handling. Case studies in Andhra Pradesh, Kerala, Tamil Nadu, Gujarat, and Delhi provide insights on infrastructure, training, inclusivity, and monitoring. The goal is to make learning

interactive and purposeful, with equity, affordability, teaching workforce readiness, and robust privacy safeguards. Strategic partnerships can transform classrooms and help students tackle future challenges.

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