The Role of Artificial Intelligence and Digitalization in Advancing Inclusive Education in Bangladesh

Nayma Afroz and Charanjit Kaur Swaran Singh

Abstract- ***Artificial Intelligence (AI) is increasingly positioned as a transformative force in advancing inclusive education by enabling adaptive, personalized, and accessible learning environments. However, evidence from developing country contexts remains limited, particularly regarding how such technologies are enacted in everyday classroom practice. This study addresses this gap by examining the integration of AI and digital technologies in inclusive secondary education in Bangladesh, with a focus on teachers' experiences, pedagogical practices, and contextual constraints. Adopting a qualitative case study design, data were collected through semi-structured interviews, classroom observations, and document analysis, and analyzed using thematic analysis. The findings reveal that while AI-enabled and digital tools have the potential to enhance accessibility and learner engagement, their pedagogical integration remains largely superficial. This limitation is shaped by fragmented technological pedagogical competencies, inadequate professional training, infrastructural constraints, and a persistent misalignment between policy intentions and classroom realities. The study extends the Technological Pedagogical Content Knowledge (TPACK) framework by foregrounding the role of contextual and institutional conditions in shaping technology integration within inclusive education. It argues that AI functions as a socio technical system whose impact is contingent upon the alignment of teacher capacity, infrastructure, and policy implementation. The findings contribute to a more critical and context sensitive understanding of AI in education, challenging deterministic narratives of technological transformation. This study highlights that the future of AI in inclusive education depends not on technological innovation alone, but on the strategic alignment of pedagogy, teacher capacity, infrastructure, and policy implementation. Without such alignment, the transformative potential of AI will remain limited, particularly in resource-constrained contexts.***

Keywords- ***Artificial Intelligence (AI), Digitalization, Inclusive Education, Assistive Technology, Teacher Perspectives, Bangladesh***

I. INTRODUCTION

The integration of artificial intelligence (AI) and digital technologies is reshaping contemporary education, offering new possibilities for enhancing teaching, learning, and accessibility (UNESCO, 2023; OECD, 2023). These technologies enable personalized instruction, real-time feedback, and adaptive learning environments that can better support diverse learners. In the context of inclusive education where equitable access and meaningful participation for all students are central AI-driven tools such as speech recognition, text to speech systems, and intelligent tutoring platforms present important opportunities to address varied learning needs.

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Despite this potential, the impact of AI on inclusive education depends not on its availability alone, but on how it is meaningfully integrated into pedagogical practices. In developing country contexts such as Bangladesh, this integration remains uneven and complex. Although policy initiatives increasingly promote digitalization and inclusive education, many schools continue to face structural challenges, including limited infrastructure, unequal access to digital resources, and insufficient teacher training. Consequently, technology use often remains supplementary, with limited influence on transforming classroom practices or improving outcomes for students with disabilities.

Teachers play a central role in mediating the relationship between technology and inclusive pedagogy. Effective integration requires not only access to digital tools but also the ability to align technological, pedagogical, and content knowledge within specific classroom contexts. However, without adequate professional support and institutional alignment, the use of AI risks reinforcing existing inequalities rather than addressing them.

While existing research highlights the growing role of AI in education, much of it focuses on technological capabilities or large-scale adoption trends, with limited attention to classroom level practices in under researched contexts. In particular, there is a lack of qualitative, practice-oriented studies that examine how teachers experience and implement AI in inclusive settings in developing countries. This study addresses this gap by exploring teachers' experiences, classroom practices, and contextual challenges in integrating AI and digital technologies for inclusive education in Bangladesh

II. PROBLEM STATEMENT

Despite increasing emphasis on inclusive education and the rapid advancement of artificial intelligence (AI) and digital technologies, their integration into classroom practice remains uneven in developing country contexts such as Bangladesh. While digitalization initiatives have expanded, the use of AI in inclusive education is often limited to basic or supplementary functions, with minimal impact on transforming teaching practices or improving learning outcomes for students with disabilities.

A key challenge underlying this issue is the limited preparedness of teachers to integrate AI within inclusive pedagogical frameworks. Although teachers generally demonstrate positive attitudes toward technology, many lack the technological pedagogical competencies, professional training, and institutional support required for effective implementation. This indicates that the problem is not solely technological, but fundamentally pedagogical and structural.

Furthermore, existing research on AI in education has largely focused on technological developments and adoption trends, with insufficient attention to classroom-level practices, particularly in inclusive settings within developing

countries. There is a lack of qualitative, context-sensitive studies that examine how teachers interpret, adapt, and implement AI in real educational environments.

This gap is critical because without understanding how technology is enacted in practice, efforts to promote AI driven inclusive education risk remaining symbolic rather than achieving meaningful transformation. Therefore, this study aims to examine how teachers experience, implement, and perceive AI integration in inclusive secondary classrooms in Bangladesh.

III. LITERATURE REVIEW

AI in Inclusive Education

The integration of artificial intelligence (AI) and digital technologies has been widely recognized as a transformative approach to advancing inclusive education. Existing studies highlight that AI-driven tools, such as assistive technologies, speech-to-text systems, and adaptive learning platforms, can enhance accessibility, participation, and personalized learning for students with disabilities. For example, recent research demonstrates that AI enables real-time feedback and multimodal learning experiences, aligning with the principles of inclusive education that emphasize equity and learner diversity.

However, scholars caution against overly optimistic assumptions regarding the transformative potential of AI. While many studies emphasize its benefits, others argue that technology alone does not guarantee inclusion. In particular, research suggests that without appropriate pedagogical integration, digital tools often reinforce traditional, teacher-centred practices rather than supporting meaningful inclusion. This indicates a divergence between technological capability and actual classroom implementation, highlighting the need to examine how AI is enacted in practice.

TPACK Framework and Pedagogical Integration

The Technological Pedagogical Content Knowledge (TPACK) framework provides a valuable lens for understanding effective technology integration in education. TPACK emphasizes that meaningful use of technology occurs at the intersection of technological, pedagogical, and content knowledge. In inclusive education contexts, this integration is especially critical, as teachers must adapt digital tools to meet diverse cognitive, sensory, and physical needs.

Empirical studies consistently show that teachers with well-developed TPACK are more likely to design inclusive, technology-enhanced learning environments. However, other studies suggest that in many cases, teachers' technological knowledge develops faster than their pedagogical integration skills. As a result, technology is often used at a substitution level rather than for transformative learning. This contrast highlights a key limitation of existing practice: while TPACK is theoretically robust, its practical application remains uneven, particularly in resource-constrained contexts.

Challenges in Developing Contexts

Despite growing global interest in AI and inclusive education, significant disparities exist between developed and developing countries. In contexts such as Bangladesh, the integration of digital technologies is shaped by structural and institutional constraints. Studies identify persistent challenges, including limited infrastructure, inadequate access to devices and internet connectivity, and insufficient teacher training.

Moreover, there is a consistent gap between policy aspirations and classroom realities. While policy frameworks advocate for inclusive, technology enhanced education, implementation is often fragmented. Some studies argue that digitalization initiatives tend to prioritize access over pedagogical integration, resulting in superficial use of technology. In contrast, research from high-income contexts shows more advanced integration, supported by stronger institutional systems and continuous professional development.

A key limitation across the literature is its emphasis on macro-level analysis, such as access, adoption rates, and policy frameworks, with limited attention to classroom-level practices. Few studies adopt qualitative approaches to explore how teachers interpret, adapt, and implement AI in inclusive settings, particularly in developing countries. This gap underscores the need for context-sensitive, practice-oriented research.

In response, the present study adopts a qualitative, teacher-centred approach to examine how AI and digital technologies are integrated into inclusive classroom practices in Bangladesh. By focusing on lived experiences, pedagogical strategies, and contextual challenges, the study contributes to a more nuanced understanding of technology integration as a situated and practice driven process.

Overall, existing literature demonstrates significant potential for AI in advancing inclusive education, particularly in enhancing accessibility, personalization, and learner engagement (Li et al., 2025; Melo-López et al., 2025). However, a consistent gap remains between technological advancement and its pedagogical enactment, especially in developing country contexts where structural and institutional limitations persist (Irwanto, 2025; UNESCO, 2023). While some scholars present AI as a transformative force capable of reshaping educational inclusion, others adopt a more critical stance, arguing that without adequate teacher preparedness, contextual adaptation, and institutional support, AI integration risks reinforcing existing inequalities rather than addressing them (Selwyn, 2022; Zawacki-Richter et al., 2022).

This divergence in perspectives highlights the need for context-sensitive, practice-oriented research that moves beyond technological optimism to examine how AI is meaningfully integrated within real classroom settings.

Based on the reviewed literature, the integration of artificial intelligence (AI) and digital technologies in inclusive education is not a linear process. Instead, it is shaped by the interaction between technological tools, teacher competencies, and contextual factors. Drawing on the Technological Pedagogical Content Knowledge (TPACK) framework, this study proposes a conceptual

model illustrating how AI-enabled tools influence inclusive classroom practices through teachers' integrated knowledge and skills, while being moderated by institutional and structural conditions.

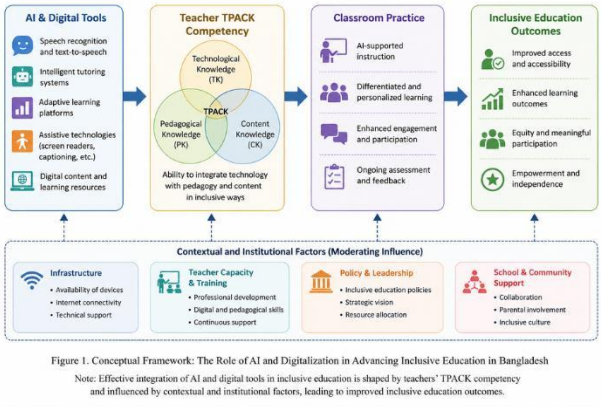


Figure 1. Conceptual Framework: The Role of AI and Digitalization in Advancing Inclusive Education in Bangladesh

As illustrated in Figure 1, AI and digital tools support inclusive education through their interaction with teachers' TPACK competencies. The framework shows that effective classroom practices emerge when teachers integrate technology with pedagogy and content knowledge. However, this process is influenced by contextual and institutional factors such as infrastructure, training, and policy support, which shape the overall effectiveness of inclusive education outcomes.

IV. METHOD

Research Design

This study adopted a qualitative case study design to explore how artificial intelligence (AI) and digital technologies are integrated into inclusive education practices in Bangladesh. A qualitative approach was considered appropriate as it enables an in depth understanding of teachers' experiences, perceptions, and classroom practices within their real-life contexts. The case study design allows for a holistic examination of the complex interaction between technology, pedagogy, and inclusion, particularly in settings where contextual factors significantly influence implementation.

Participants and Sampling

The study involved a total of 12 participants, including 8 secondary school teachers, 2 school administrators, and 2 education stakeholders involved in inclusive education initiatives. Participants were selected using purposive sampling, as they possessed relevant experience in teaching in inclusive classrooms and engaging with digital technologies.

The selection criteria included: (a) experience in working with students with diverse learning needs, (b) familiarity with digital tools or AI related technologies, and (c) willingness to participate in interviews and classroom observations. This approach ensured that participants could provide rich, relevant, and context-specific insights into the integration of AI in inclusive education.

Data Collection

Data were collected through multiple sources to ensure depth and triangulation. These included semi-structured interviews, classroom observations, and document analysis.

Semi-structured interviews were conducted with all participants, with each session lasting approximately 30-60 minutes. This format allowed flexibility to explore participants' experiences, perceptions, and challenges in integrating AI and digital tools in inclusive classrooms. All interviews were audio-recorded with participants' consent and later transcribed verbatim for analysis.

Classroom observations were carried out to examine actual teaching practices, focusing on the use of digital technologies, instructional strategies, and student engagement in inclusive settings. In addition, relevant policy documents and institutional guidelines related to inclusive education and digitalization were analyzed to provide contextual understanding and support data triangulation.

Data Analysis

The data were analyzed using thematic analysis, following the six-phase framework proposed by Braun and Clarke (2006). The analysis process involved several systematic steps. First, the researcher familiarized herself with the data through repeated reading of interview transcripts and observation notes. Second, initial codes were generated by identifying meaningful segments of the data. Third, related codes were grouped to form preliminary themes. Fourth, the themes were reviewed and refined to ensure coherence and consistency with the data. Fifth, the themes were clearly defined and named. Finally, the findings were organized and reported in a structured manner.

This analytical approach enabled the identification of key themes related to accessibility, teacher readiness, implementation challenges, and the policy practice gap in the use of AI and digital technologies in inclusive education.

Trustworthiness and Ethical Considerations

To ensure the trustworthiness of the study, several strategies were employed. Triangulation was achieved by using multiple data sources, including interviews, observations, and document analysis. Member checking was conducted by sharing summaries of the findings with selected participants to verify the accuracy of interpretations. In addition, the researcher maintained reflective notes throughout the research process to minimize potential bias.

Ethical considerations were strictly observed. Informed consent was obtained from all participants prior to data collection. Participants were assured of confidentiality and anonymity, and all personal and institutional identifiers were removed from the data. The study adhered to standard ethical guidelines for research involving human participants.

V. FINDINGS

The thematic analysis of the data revealed several recurring patterns that reflect teachers' experiences, perceptions, and challenges in integrating AI and digital technologies in inclusive classrooms.

The analysis revealed four major themes: (1) potential of AI for accessibility, (2) teacher readiness and attitudes, (3) barriers to implementation, and (4) policy–practice disconnect.

AI and Accessibility

Participants highlighted that AI and digital tools can significantly improve accessibility for students with disabilities. Tools such as speech recognition, text-to-speech, and multimedia resources were found to support diverse learning needs.

One teacher explained:

"When I use text to speech tools, my visually impaired students can finally follow the lesson independently."

Another participant noted:

"Videos and audio materials help students who struggle with reading to understand concepts better."

This suggests that AI has strong potential to enhance inclusive education by enabling more flexible and personalized learning experiences.

Teacher Readiness and Attitudes

Teachers generally expressed positive attitudes toward using technology in inclusive classrooms. However, many reported limited confidence in using advanced AI tools effectively.

One teacher stated:

"I am willing to use AI tools, but I don't really know how to apply them in my teaching."

Another participant added:

"We were never properly trained on how to integrate these technologies for students with disabilities."

This indicates that positive attitudes alone are insufficient without adequate pedagogical training and technological competence.

Barriers to Implementation

Participants identified key challenges, including lack of infrastructure, limited access to devices, insufficient training, and lack of technical support.

A teacher commented:

"Sometimes the internet does not work, so even basic digital tools become useless in class."

Another participant mentioned:

"We have limited computers, and many students have to share one device."

These findings show that structural and institutional constraints significantly limit the effective use of AI in inclusive education.

Policy Practice Disconnect

Although policies promote inclusive education and digitalization, their implementation remains limited at the classroom level.

One administrator stated:

"We have policies encouraging digital learning, but schools are not fully equipped to implement them."

A teacher added:

"What is written in policy is very different from what we can actually do in class."

This reflects a gap between policy intentions and practical realities, reducing the impact of digital initiatives.

VI. DISCUSSION

The findings of this study provide a nuanced understanding of how artificial intelligence (AI) and digital technologies interact with inclusive education practices in secondary schools in Bangladesh. While participants acknowledged the potential of AI to improve accessibility and support diverse learners, the study demonstrates that such potential is largely constrained by systemic, pedagogical, and institutional limitations. This reinforces the argument that technological innovation alone is insufficient to transform educational inclusion without parallel transformation in pedagogy, teacher capacity, and institutional structures.

A key theoretical contribution of this study lies in its application and contextual extension of the Technological Pedagogical Content Knowledge (TPACK) framework. While TPACK has been widely used to explain technology integration in general education contexts, this study extends its relevance to inclusive education in a developing country setting. The findings suggest that teachers' technological knowledge is relatively more developed than their integrated pedagogical-technological-content knowledge. In practice, this results in a fragmented form of TPACK, where technology is used as an add on rather than being meaningfully embedded into inclusive pedagogical strategies. This indicates that in resource constrained environments, TPACK does not evolve linearly but is instead shaped by structural inequalities and contextual limitations.

Furthermore, the study critically challenges the assumption that positive teacher attitudes toward technology naturally lead to effective implementation. Although teachers expressed willingness to adopt AI tools, their practices remained largely at a basic or substitution level. This highlights a critical disconnect between affective readiness and practical capability. From a theoretical perspective, this suggests that TPACK alone may be insufficient unless it is supported by what can be conceptualized as "context-enabled TPACK," where institutional support, infrastructure, and continuous professional development act as enabling conditions for effective integration.

Another important contribution of this study is its critique of the dominant policy discourse surrounding digitalization in education. The findings reveal a persistent policy–practice gap, where national commitments to inclusive and technology-enhanced education are not matched by classroom-level realities. This disconnect reflects a form of symbolic implementation, where policies exist at the rhetorical level but fail to translate into meaningful pedagogical transformation. This study therefore extends existing literature by demonstrating that

policy effectiveness in educational technology is not determined by formulation alone but by its alignment with teacher capacity, resource distribution, and institutional readiness.

The study also contributes to the growing critical literature on AI in education by challenging overly optimistic narratives of technological determinism. While much of the existing literature frames AI as inherently transformative, the findings of this study suggest that AI operates within existing educational inequalities and may even reproduce them when access and competencies are unevenly distributed. In this sense, AI should not be viewed as a neutral tool but as a socio-technical system whose impact is mediated by power relations, infrastructure, and pedagogical culture.

Importantly, the study highlights that inclusive education in the context of AI integration is not merely a technical challenge but a deeply pedagogical and structural one. Effective inclusion requires more than access to digital tools; it requires rethinking instructional design, teacher education, and institutional support systems. Without this holistic alignment, AI risks reinforcing traditional teaching practices rather than transforming them toward greater inclusivity.

In summary, this study contributes theoretically by extending the TPACK framework to include contextual and structural dimensions, and critically by challenging linear assumptions about technology-driven educational transformation. It demonstrates that the effectiveness of AI in inclusive education is contingent upon the interaction between teacher competencies, institutional support systems, and broader policy environments. These findings call for a shift from technology-centric approaches toward ecosystem-based strategies that integrate pedagogy, infrastructure, and policy in a coherent and context sensitive manner.

VII. CONCLUSION

This study examined the integration of artificial intelligence (AI) and digital technologies in inclusive secondary education in Bangladesh. The findings indicate that while teachers recognize the potential of these technologies to enhance accessibility and support diverse learners, their classroom use remains largely limited and supplementary. This gap is shaped by insufficient pedagogical training, infrastructural constraints, limited technical support, and a misalignment between policy initiatives and classroom realities.

The study highlights that effective integration of AI requires more than access to digital tools; it depends on the development of teachers' integrated competencies and the alignment of pedagogy, institutional support, and policy implementation. Without such alignment, the potential of AI to advance inclusive education is unlikely to be fully realized.

This study is limited by its small qualitative sample and focus on a specific national context. Future research could adopt larger or mixed-method approaches and include multiple stakeholder perspectives to provide a more comprehensive understanding of technology integration in inclusive education.

Overall, the study underscores the need for context-sensitive and system-level strategies to support meaningful and sustainable integration of AI in inclusive educational practices.

This study highlights that the future of AI in inclusive education depends not on technological innovation alone, but on the strategic alignment of pedagogy, teacher capacity, infrastructure, and policy implementation. Without such alignment, the transformative potential of AI will remain limited, particularly in resource constrained contexts.

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