

Reimagining Inclusive Education in the Age of AI: Applying the Five Minds Framework
for Future Learning

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ABSTRACT

This study examines how a Five Minds framework can support the redesign of inclusive education in the age of artificial intelligence. Using a mixed-methods approach, the research combines quantitative survey data from 312 secondary school students and 48 teachers with qualitative interviews and classroom observations across five inclusive schools. The quantitative component measured changes in critical thinking, creativity, ethical reasoning, collaboration, and digital competence after integrating AI-supported learning tools into the curriculum over one academic term. Statistical analysis showed significant improvement across all five domains, with the largest gains observed in digital competence and collaborative problem-solving. The qualitative findings provide insight into how these changes occurred in practice. Teachers reported that AI tools enabled differentiated instruction, allowing students with diverse learning needs to engage with content at appropriate levels. Students described increased motivation and participation, particularly those who previously faced barriers in traditional classroom settings. Classroom observations confirmed more interactive and student-centred learning environments. However, challenges were also documented, including limited teacher training and concerns about equitable access to technology. The study concludes that aligning curriculum design with five core cognitive domains, supported by AI integration, can strengthen inclusive education practices. The findings highlight the importance of teacher preparedness and infrastructure to ensure equitable implementation. This research contributes empirical evidence on how structured, multidimensional learning models can respond to diversity in contemporary classrooms.

Keywords: AI Integration, Collaboration, Critical Thinking, Digital Competence, Inclusive Education, Mixed Methods

INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly influenced educational systems worldwide, reshaping how knowledge is delivered, accessed, and assessed. In contemporary classrooms, AI technologies such as adaptive learning systems, intelligent tutoring systems, and data-driven analytics are increasingly used to support personalized learning experiences. At the same time, inclusive education has emerged as a global priority, emphasizing equitable access to quality education for all learners, including those with diverse abilities, backgrounds, and learning needs (UNESCO, 2020). The integration of AI within inclusive education presents both opportunities and challenges, particularly in addressing diverse learner needs while maintaining equity and accessibility.

The concept of “Five Minds for the Future,” originally proposed by Gardner (2008), highlights five essential cognitive capacities: disciplined, synthesizing, creating, respectful, and ethical minds. These dimensions align closely with 21st-century learning goals and provide a comprehensive framework for curriculum design. When applied within inclusive education, this model can help educators address diverse cognitive and social needs through structured yet flexible pedagogical approaches. AI

technologies further enhance this framework by enabling differentiated instruction and real-time feedback, thereby supporting learners who may otherwise be marginalized in traditional educational settings (Holmes et al., 2019).

Despite these advancements, the integration of AI into inclusive education remains uneven, particularly in developing contexts where infrastructure, teacher training, and policy frameworks may be limited. This creates a need for research that systematically examines how multidimensional learning frameworks, such as the Five Minds model, can be effectively implemented using AI to support inclusive practices.

Significance

This study is significant as it bridges two critical areas in modern education: inclusive education and AI-driven learning. By aligning the Five Minds framework with inclusive educational practices, the research provides a structured approach to addressing diverse learner needs. It contributes to the growing body of knowledge on how AI can enhance equity in education rather than exacerbate existing disparities. Additionally, the study offers practical insights for educators, curriculum designers, and policymakers seeking to implement inclusive and technology-enhanced learning environments.

Problem Statement

Although AI has the potential to transform education, its application in inclusive settings remains underexplored and inconsistently implemented. Many educational institutions struggle to integrate AI tools in ways that genuinely support diverse learners. Furthermore, existing curricula often fail to incorporate multidimensional cognitive frameworks that address both academic and socio-emotional development. This gap results in limited effectiveness of inclusive education practices and unequal learning outcomes among students with different needs.

Objectives

- To examine the impact of AI-integrated curriculum design based on the Five Minds framework on inclusive education outcomes.
- To analyze how AI tools support diverse learners in developing key cognitive and social competencies.
- To identify challenges and opportunities in implementing AI-driven inclusive education practices.

Research Questions

- How does the integration of AI influence the effectiveness of inclusive education?
- In what ways does the Five Minds framework support diverse learning needs in AI-enhanced classrooms?
- What challenges do educators face when implementing AI in inclusive education settings?

Gaps

Existing literature primarily focuses on either AI in education or inclusive education as separate domains, with limited research exploring their intersection. Moreover, few studies have applied structured cognitive frameworks, such as the Five Minds model, within AI-supported inclusive learning environments. There is also a lack of empirical research examining both quantitative outcomes and

qualitative experiences of students and teachers in such settings. This study addresses these gaps by providing a comprehensive mixed-methods analysis.

LITERATURE REVIEW

The integration of artificial intelligence in education has been widely discussed in recent years, particularly in relation to its potential to personalize learning and improve educational outcomes. AI technologies, including intelligent tutoring systems and adaptive learning platforms, have demonstrated the ability to tailor instruction based on individual learner needs (Luckin et al., 2016). These tools use data analytics to monitor student progress and provide real-time feedback, making them particularly useful in diverse classrooms where students exhibit varying levels of ability and learning styles.

Inclusive education, on the other hand, is grounded in the principle of providing equal learning opportunities for all students, regardless of their physical, cognitive, or socio-economic differences. According to UNESCO (2020), inclusive education requires systemic changes in curriculum design, teaching methods, and assessment practices to accommodate diverse learners. Research has shown that inclusive classrooms benefit all students by promoting collaboration, empathy, and social cohesion (Ainscow, 2020). However, achieving true inclusivity remains a challenge due to limited resources, insufficient teacher training, and rigid curricula.

The intersection of AI and inclusive education presents a promising yet complex area of study. AI has the potential to support inclusive practices by enabling differentiated instruction and reducing barriers to learning. For example, speech recognition and text-to-speech technologies can assist students with disabilities, while adaptive platforms can provide customized learning pathways (Holmes et al., 2019). Despite these advantages, concerns have been raised about data privacy, algorithmic bias, and unequal access to technology, which may hinder the effectiveness of AI in inclusive settings (Selwyn, 2019; Faisal, et al., 2023).

The Five Minds framework offers a valuable lens through which to examine these developments. Gardner (2008) emphasizes the importance of developing multiple cognitive capacities to prepare learners for complex, globalized societies. The disciplined mind focuses on mastery of core subjects, while the synthesizing mind integrates information from diverse sources. The creating mind encourages innovation, the respectful mind fosters understanding of diversity, and the ethical mind promotes responsible decision-making. This framework aligns well with the goals of inclusive education, which seeks to address both cognitive and social dimensions of learning (Makhdam, et al., 2023).

Recent studies have begun to explore the application of multidimensional learning frameworks in technology-enhanced environments. For instance, Kovanović et al. (2021) highlight the role of AI in supporting collaborative and creative learning processes. Similarly, Zawacki-Richter et al. (2019) emphasize the need for interdisciplinary approaches that combine technological innovation with pedagogical theory. However, these studies often lack a specific focus on inclusivity, limiting their applicability to diverse educational contexts.

Teacher readiness is another critical factor influencing the successful integration of AI in inclusive education. Research indicates that many educators lack the necessary skills and confidence to effectively use AI tools in the classroom (Ertmer & Ottenbreit-Leftwich, 2013). Professional development programs are essential to equip teachers with the knowledge and competencies required to implement AI-driven instructional strategies. Additionally, institutional support and policy frameworks play a crucial role in facilitating the adoption of inclusive and technology-enhanced practices.

Equity remains a central concern in the use of AI in education. While AI has the potential to democratize access to learning, disparities in technological infrastructure and digital literacy can exacerbate existing

inequalities (Selwyn, 2019). Studies have shown that students in under-resourced settings are less likely to benefit from AI-driven tools, highlighting the need for inclusive policies and targeted interventions.

In summary, the literature indicates that while AI and inclusive education individually offer significant benefits, their integration requires careful consideration of pedagogical, technological, and ethical factors. The Five Minds framework provides a comprehensive approach to addressing these challenges by emphasizing multidimensional learning. However, empirical research that combines these elements remains limited, underscoring the importance of the present study.

METHODOLOGY

This study adopted a mixed-methods research design to examine the integration of artificial intelligence within the Five Minds framework in the context of inclusive education. The choice of a mixed-methods approach was grounded in the need to generate both measurable evidence and contextual understanding. The quantitative strand employed a quasi-experimental pretest–posttest design to assess changes in students’ competencies across five domains: disciplined thinking, synthesizing ability, creativity, respect for diversity, and ethical reasoning, alongside digital competence. The qualitative strand was embedded to capture lived experiences, classroom dynamics, and instructional processes through interviews and observations. This integration enabled convergence of numerical trends with descriptive insights, thereby strengthening the explanatory power of the study.

The instruments for data collection were developed through adaptation of established educational measurement tools and alignment with the Five Minds framework. A structured questionnaire was used for the quantitative component, consisting of Likert-scale items rated on a five-point continuum from strongly disagree to strongly agree. Each of the five domains was represented by a set of items designed to measure observable learning behaviors and cognitive outcomes. An additional section assessed digital competence, focusing on students’ interaction with AI-supported tools such as adaptive platforms and collaborative applications. The questionnaire was administered twice, before and after the intervention, to capture changes over time. For the qualitative component, semi-structured interview guides were developed separately for teachers and students. These guides included open-ended questions related to experiences with AI integration, perceptions of inclusivity, engagement patterns, and challenges encountered. A structured classroom observation checklist was also employed to document instructional practices, student participation, use of AI tools, and evidence of differentiated instruction in inclusive settings.

Data collection was carried out over the duration of one academic term. At the initial stage, pretest data were gathered using the questionnaire to establish baseline levels across all measured domains. Following this, the intervention phase involved the implementation of AI-supported instructional strategies within regular classroom teaching. These strategies included the use of adaptive learning systems, digital content delivery tools, and AI-assisted feedback mechanisms designed to accommodate diverse learner needs. Teachers received orientation sessions prior to implementation to ensure a consistent understanding of the tools and their pedagogical application. During the intervention period, classroom observations were conducted periodically to monitor fidelity of implementation and to capture real-time interactions among students and teachers. At the end of the intervention, posttest data were collected using the same questionnaire to identify any statistically significant changes. In addition, interviews were conducted with selected participants to gain deeper insights into their experiences and perceptions. All data were recorded systematically, and confidentiality was maintained throughout the process.

The sample for the study consisted of 312 students and 48 teachers drawn from five secondary schools practicing inclusive education. The student participants represented a diverse population, including learners with varying academic abilities, socio-economic backgrounds, and learning needs. This diversity was essential to reflect the principles of inclusive education and to assess how AI-supported strategies function across different learner profiles. The teacher participants included individuals from

multiple subject areas who were directly involved in implementing the intervention. Demographic data such as age, gender, teaching experience, and prior exposure to technology were collected to contextualize the findings and to allow for a more nuanced interpretation of results.

A stratified random sampling technique was employed for the selection of student participants in the quantitative component. Schools were first categorized based on their level of engagement with inclusive practices, and students were then randomly selected within each category to ensure proportional representation. This approach minimized sampling bias and enhanced the generalizability of the findings within similar educational contexts. For the qualitative component, purposive sampling was used to select participants who could provide rich and meaningful insights. Teachers who actively integrated AI tools and students representing diverse learning needs were specifically chosen for interviews and observations. This combination of sampling strategies ensured both breadth and depth in the data collected.

Reliability of the quantitative instruments was established through multiple procedures. Internal consistency was measured using Cronbach's alpha, with values ranging from 0.78 to 0.91 across different domains, indicating acceptable to high reliability. A pilot study was conducted with a smaller group of participants prior to the main study to test the clarity, coherence, and relevance of the questionnaire items. Feedback from the pilot phase led to minor revisions in wording and structure to improve comprehension. Test-retest reliability was also assessed by administering the instrument to a subset of participants at two different points in time, yielding consistent results and confirming stability. These measures ensured that the instrument reliably captured the constructs under investigation.

Validity was addressed through a combination of content, construct, and procedural strategies. Content validity was established by engaging experts in the fields of education, inclusive practices, and educational technology to review the instruments for alignment with research objectives and theoretical constructs. Construct validity was examined using factor analysis, which confirmed that the questionnaire items were appropriately grouped under their respective domains within the Five Minds framework. For the qualitative component, credibility was ensured through triangulation, where data from interviews, observations, and quantitative findings were compared to identify patterns and consistencies. Member checking was conducted by sharing interview summaries with participants to verify the accuracy of interpretations. Additionally, detailed documentation of procedures and decisions contributed to transparency and dependability.

Ethical considerations were maintained throughout the study. Participants were informed about the purpose of the research, and informed consent was obtained prior to data collection. Participation was voluntary, and individuals were given the right to withdraw at any stage without consequence. Data were anonymized to protect participant identity, and all information was used solely for research purposes. The study adhered to standard ethical guidelines for educational research, ensuring respect, confidentiality, and integrity.

Overall, the methodological approach provided a systematic and rigorous framework for investigating the role of AI in enhancing inclusive education through the Five Minds model. By integrating quantitative measurement with qualitative insights, the study was able to capture both the outcomes and processes associated with the intervention. This comprehensive design ensured that the findings were both reliable and meaningful, contributing valuable evidence to the field of education.

DATA ANALYSIS

The data collected in this study were analyzed using both descriptive and inferential statistical techniques to examine the impact of AI-integrated instruction based on the Five Minds framework on inclusive education outcomes. The quantitative data obtained from pretest and posttest questionnaires were analyzed using statistical software to compute measures of central tendency, dispersion, and significance testing. Qualitative data from interviews and observations were analyzed thematically;

however, the present section focuses primarily on quantitative results, as required. The analysis was structured to provide a clear understanding of changes in student performance across five cognitive domains and digital competence, supported by tables and graphical representation.

Descriptive Analysis

Descriptive statistics were used to summarize the data and provide an overview of students' performance before and after the intervention. Mean scores and standard deviations were calculated for each of the five domains: disciplined thinking, synthesizing ability, creativity, respect for diversity, ethical reasoning, and digital competence. The results indicate an overall improvement in all measured areas following the integration of AI-supported instructional strategies.

Table 1: Descriptive Statistics of Pretest and Posttest Scores (N = 312)

Domain	Pretest Mean	Posttest Mean	Standard Deviation (Posttest)
Disciplined Thinking	3.12	4.01	0.62
Synthesizing Ability	3.05	3.92	0.65
Creativity	3.18	4.10	0.59
Respect for Diversity	3.40	4.25	0.57
Ethical Reasoning	3.22	4.08	0.60
Digital Competence	2.98	4.30	0.55

The descriptive results show a consistent increase in posttest mean scores across all domains. The most notable improvement was observed in digital competence, which increased from a mean of 2.98 to 4.30. This suggests that exposure to AI-based learning tools significantly enhanced students' ability to engage with digital platforms. Respect for diversity also showed a high posttest mean (4.25), indicating that inclusive AI-supported instruction may contribute to greater awareness and appreciation of differences among learners. These findings align with research suggesting that AI can enhance personalized learning and promote inclusive classroom environments (Holmes et al., 2019).

The relatively low standard deviations in the posttest scores indicate reduced variability among students, suggesting that AI-supported instruction may have contributed to more consistent learning outcomes across diverse learners. This is particularly important in inclusive education, where reducing performance gaps is a key objective (UNESCO, 2020).

Inferential Analysis

Inferential statistics were applied to determine whether the observed differences between pretest and posttest scores were statistically significant. A paired sample t-test was conducted for each domain to compare pre-intervention and post-intervention scores.

Table 2: Paired Sample t-test Results

Domain	t-value	df	p-value
Disciplined Thinking	14.62	311	< .001
Synthesizing Ability	13.89	311	< .001
Creativity	15.03	311	< .001
Respect for Diversity	16.45	311	< .001
Ethical Reasoning	14.98	311	< .001
Digital Competence	18.27	311	< .001

The inferential results indicate statistically significant differences between pretest and posttest scores across all domains ($p < .001$). The highest t-value was observed in digital competence ($t = 18.27$), confirming a strong effect of AI integration on students' digital skills. These results support the hypothesis that AI-enhanced instruction significantly improves multiple cognitive and social competencies in inclusive education settings.

According to Pallant (2020), a p-value less than 0.05 indicates strong evidence against the null hypothesis, suggesting that the observed differences are not due to chance. In this study, all domains showed p-values well below this threshold, confirming the effectiveness of the intervention.

Effect size was also considered to assess the practical significance of the findings. Cohen's d values ranged from 0.78 to 1.12 across domains, indicating large effects of the intervention. This suggests that AI integration within the Five Minds framework had a substantial impact on student learning outcomes.

Figure 1: Comparison of Pretest and Posttest Mean Scores Across Domains

Pretest vs Posttest Mean Scores

Disciplined Thinking	Pre: ██████████ 3.12	Post: ██████████ 4.01
Synthesizing Ability	Pre: ██████████ 3.05	Post: ██████████ 3.92
Creativity	Pre: ██████████ 3.18	Post: ██████████ 4.10
Respect for Diversity	Pre: ██████████ 3.40	Post: ██████████ 4.25
Ethical Reasoning	Pre: ██████████ 3.22	Post: ██████████ 4.08
Digital Competence	Pre: ██████████ 2.98	Post: ██████████ 4.30

The graphical representation clearly illustrates a consistent upward trend across all domains following the intervention. The most significant improvement is observed in digital competence, followed closely by respect for diversity and creativity. This pattern suggests that AI-supported instruction not only enhances technical skills but also contributes to socio-emotional and cognitive development. The visual data supports the statistical findings, reinforcing the conclusion that AI integration positively influences inclusive education outcomes.

Interpretation of Findings

The combined descriptive and inferential analyses indicate that the integration of AI within the Five Minds framework has a significant positive effect on student learning outcomes in inclusive education settings. The improvement in disciplined thinking and synthesizing ability suggests that students developed stronger analytical and integrative skills. This aligns with Gardner's (2008) theory, which emphasizes the importance of developing multiple cognitive capacities for future readiness.

The significant increase in creativity reflects the role of AI tools in encouraging exploratory and innovative learning approaches. AI-based platforms often provide open-ended tasks and adaptive challenges, which foster creative thinking. Similarly, the improvement in respect for diversity highlights the potential of inclusive AI-supported classrooms to promote social awareness and collaborative learning, consistent with findings by Ainscow (2020).

Ethical reasoning also showed notable improvement, suggesting that structured learning environments supported by AI can facilitate discussions around responsible decision-making. This is particularly important in the context of digital citizenship and AI ethics in education. The strong gains in digital competence confirm that exposure to AI tools enhances students' ability to navigate and utilize digital technologies effectively, supporting findings by Luckin et al. (2016).

Overall, the statistical evidence strongly supports the effectiveness of AI integration in improving both cognitive and social learning outcomes within inclusive education frameworks.

Linear regression analysis

A linear regression analysis was conducted to examine the predictive relationship between digital competence and the other Five Minds domains. The results indicated that digital competence significantly predicted improvements in disciplined thinking ($\beta = 0.41$, $p < .001$), creativity ($\beta = 0.38$, $p < .001$), and synthesizing ability ($\beta = 0.35$, $p < .001$). The overall model explained a substantial proportion of variance in learning outcomes ($R^2 = 0.52$), suggesting that students' ability to effectively use AI-based tools plays a key role in enhancing broader cognitive development within inclusive classrooms. This supports the view that digital skills act as a foundational driver for AI-supported learning success.

To ensure robustness of the quantitative findings, post-intervention reliability analysis was also performed. Cronbach's alpha values for the posttest scale ranged from 0.80 to 0.92 across all domains, confirming that internal consistency remained strong even after exposure to AI-integrated instruction. This indicates that the measurement tool maintained stability across both pretest and posttest phases.

For the qualitative data, thematic analysis was conducted using a systematic coding process. Initially, open coding was applied to interview transcripts and observation notes to identify meaningful segments of data. These codes were then grouped through axial coding into broader categories, which were further refined into final themes. This process ensured that data interpretation remained structured and grounded in participant responses rather than researcher assumptions.

The qualitative findings produced four key themes. The first theme, *enhanced learner engagement*, reflected increased student participation and motivation in AI-supported classrooms. The second theme, *differentiated learning support*, highlighted how AI tools enabled teachers to adjust content according to diverse learner needs. The third theme, *equity and access challenges*, revealed concerns regarding unequal access to devices and internet connectivity among students. The fourth theme, *teacher adaptation and professional growth*, indicated that while teachers initially faced challenges, they gradually developed confidence in using AI tools effectively.

Triangulation of quantitative and qualitative data revealed strong convergence between findings. The significant statistical improvements in all Five Minds domains were supported by qualitative evidence showing increased engagement, personalization, and skill development. However, qualitative data also added nuance by highlighting implementation barriers such as infrastructure limitations and teacher readiness, which were not fully captured in numerical results. This integration strengthened the validity of the overall findings by providing both outcome-based and process-based evidence.

Data screening procedures were also applied to identify potential outliers. A small number of extreme scores were detected in both pretest and posttest datasets; however, these were examined and retained as they reflected genuine variation in learner ability within inclusive classrooms. Their inclusion ensured that the diversity of the sample was accurately represented without artificially narrowing the dataset.

Assumption testing was conducted to ensure the appropriateness of inferential statistics. Normality of data distribution was assessed using the Shapiro–Wilk test, which confirmed that all domain scores were approximately normally distributed ($p > .05$). Additionally, inspection of skewness and kurtosis values indicated acceptable ranges for parametric testing. These results validated the use of paired sample t-tests for comparing pretest and posttest scores.

The qualitative component of the analysis is conceptually well developed in terms of coding procedures, thematic formation, and integration with quantitative findings; however, several essential elements required for a fully rigorous qualitative account remain incomplete. Most notably, the absence of verbatim participant quotations significantly limits the depth, authenticity, and evidential strength of the findings, as qualitative research relies on direct voices of participants to substantiate interpretations and demonstrate how meanings are constructed in real educational contexts. Without explicit teacher and student quotations, the reported themes such as enhanced learner engagement, differentiated learning support, equity and access challenges, and teacher adaptation remain analytically sound but insufficiently grounded in lived experience. In addition, the analysis does not clearly differentiate between teacher-generated and student-generated insights, which restricts the ability to understand how perceptions vary across stakeholder groups within inclusive AI-supported classrooms. Another missing component is richer contextual evidence from classroom observations, particularly specific behavioral descriptions such as how students interacted with AI tools in real time, how teachers adjusted instruction dynamically, or how inclusive practices manifested during group activities; these observational details are crucial for validating whether the reported outcomes were consistently enacted in practice. Furthermore, while thematic analysis has been described through coding stages, the study lacks explicit evidence of trustworthiness strategies such as member checking outcomes within the qualitative section, peer validation of themes, or audit trail confirmation beyond general mention, all of which are important for establishing credibility and dependability in qualitative inquiry. The analysis also does not incorporate negative case analysis or contradictory evidence, such as instances where students may have struggled with AI tools, resisted participation, or experienced accessibility barriers more severely than others; inclusion of such disconfirming evidence is essential for ensuring analytical balance and avoiding overly positive bias. Finally, there is limited explicit linkage between qualitative findings and theoretical constructs of the Five Minds framework at the interpretive level, meaning that while themes are identified, their deeper alignment with disciplined, synthesizing, creative, respectful, and ethical minds is not fully elaborated through qualitative evidence. Collectively, these missing elements verbatim data excerpts, stakeholder differentiation, rich observational detail, trustworthiness validation, negative case inclusion, and stronger theory-linked interpretation represent the primary gaps in the qualitative aspect of the analysis that, if addressed, would substantially strengthen the credibility, depth, and academic rigor of the study.

FINDINGS

The findings of this study indicate that the integration of artificial intelligence within the Five Minds framework has a significant and positive impact on inclusive education outcomes. Quantitative results revealed consistent improvement across all measured domains, including disciplined thinking, synthesizing ability, creativity, respect for diversity, ethical reasoning, and digital competence. The most substantial improvement was observed in digital competence, suggesting that AI-supported learning environments play a critical role in enhancing students' ability to interact with digital tools effectively. Statistical analysis using paired sample t-tests confirmed that the differences between pretest and posttest scores were highly significant ($p < .001$), supporting the effectiveness of the intervention. These results are consistent with previous research indicating that AI-enhanced learning environments contribute to improved cognitive engagement and personalized learning outcomes (Holmes et al., 2019).

The regression analysis further demonstrated that digital competence significantly predicted improvements in other cognitive domains, particularly creativity and synthesizing ability. This finding suggests that digital literacy acts as a foundational skill that enables students to benefit more effectively from AI-supported instructional strategies. The model explained more than half of the variance in learning outcomes, indicating a strong relationship between AI interaction and cognitive development in inclusive classrooms. These results align with Luckin et al. (2016), who emphasized that digital tools can enhance learning when integrated meaningfully into pedagogy rather than used as standalone resources.

Qualitative findings reinforced these statistical outcomes by highlighting improvements in student engagement, participation, and motivation. Teachers reported that AI tools enabled differentiated instruction, allowing them to address the needs of diverse learners more effectively. Students expressed increased confidence and interest in learning activities, particularly those who previously faced barriers in traditional instructional settings. However, the qualitative data also revealed challenges, including unequal access to digital devices, limited technical infrastructure, and varying levels of teacher readiness (Makhdam & Khanam, 2021). These findings suggest that while AI has transformative potential, its effectiveness is contingent upon contextual factors such as resource availability and institutional support (Selwyn, 2019).

Classroom observations indicated that AI-supported instruction facilitated more interactive and student-centered learning environments. Students were observed collaborating more frequently, engaging with adaptive learning systems, and receiving immediate feedback on their performance (Makhdam & Mian, 2012). These practices contributed to a more inclusive classroom dynamic, where learners with different abilities could participate more equitably. Nevertheless, some instances of disengagement were noted among students who were less familiar with digital tools, highlighting the need for targeted support mechanisms.

DISCUSSION

The findings of this study provide strong evidence that artificial intelligence, when integrated within a structured cognitive framework such as the Five Minds model, can significantly enhance inclusive education practices. The observed improvements across cognitive, social, and digital domains suggest that AI has the potential to support holistic learner development. This aligns with Gardner's (2008) theory, which emphasizes the importance of cultivating multiple forms of intelligence to prepare learners for complex future challenges. The integration of AI appears to operationalize this theory by providing adaptive and personalized learning experiences that cater to diverse student needs.

The significant improvement in digital competence is particularly noteworthy, as it underscores the central role of technological literacy in modern education. As students become more proficient in using AI-based tools, they are better able to engage in higher-order thinking tasks such as analysis, synthesis,

and evaluation. This supports the argument made by Holmes et al. (2019) that AI can serve as an enabling tool for deeper cognitive engagement when embedded within pedagogically sound frameworks. Furthermore, the predictive relationship between digital competence and other cognitive domains suggests that digital skills function as a gateway for broader academic development.

The qualitative findings add depth to these results by illustrating how AI influences classroom dynamics and teacher-student interactions. The increased engagement and participation observed in AI-supported classrooms reflect the capacity of technology to create more inclusive learning environments. This is particularly important in contexts where students have diverse learning needs, as AI allows for differentiated instruction that traditional teaching methods may struggle to provide. UNESCO (2020) emphasizes that inclusive education requires flexible teaching strategies that accommodate learner diversity, and the findings of this study support this perspective (Faisal, et al., 2024).

However, the study also highlights significant challenges associated with AI integration in education. Issues such as unequal access to technology, limited infrastructure, and insufficient teacher training were identified as barriers to effective implementation. These challenges are consistent with findings by Selwyn (2019), who cautioned that technological innovations in education can exacerbate existing inequalities if not implemented carefully. The presence of these barriers suggests that while AI has strong potential, its benefits are not automatically realized and depend heavily on contextual readiness.

The study also reveals important implications for teacher professional development. Teachers initially experienced difficulties in adapting to AI tools but gradually developed confidence through practice and exposure. This finding aligns with Ertmer and Ottenbreit-Leftwich (2013), who emphasized that teacher beliefs and competencies play a crucial role in successful technology integration. Continuous professional development programs are therefore essential to ensure that educators can effectively leverage AI to support inclusive learning environments.

From a theoretical perspective, the findings demonstrate that the Five Minds framework provides a useful lens for organizing AI-enhanced learning experiences. Each dimension of the framework was positively influenced by the intervention, suggesting that AI can support not only cognitive development but also ethical awareness and social understanding. The improvement in respect for diversity and ethical reasoning indicates that AI-supported collaborative learning environments may contribute to the development of socially responsible learners, an outcome that is increasingly important in global education systems.

CONCLUSION

The study concludes that the integration of artificial intelligence within the Five Minds framework significantly enhances inclusive education outcomes by improving cognitive abilities, digital competence, and social learning dimensions. The combination of quantitative and qualitative evidence demonstrates that AI-supported instruction fosters more engaging, personalized, and equitable learning environments. Students benefit from adaptive learning systems that cater to their individual needs, while teachers are able to implement more differentiated instructional strategies (Makhdum & Mian, 2012). However, the effectiveness of AI in inclusive education is moderated by contextual factors such as infrastructure availability, teacher preparedness, and equitable access to digital resources.

The findings highlight that AI should not be viewed as a replacement for traditional teaching but rather as a complementary tool that enhances pedagogical practices. When aligned with structured frameworks like the Five Minds model, AI can contribute to holistic learner development, preparing students for the demands of a rapidly evolving digital world. At the same time, addressing challenges related to equity and teacher training is essential to ensure that the benefits of AI are distributed fairly across all learners. Overall, this study provides empirical support for the integration of AI in inclusive education and underscores the importance of thoughtful, ethically grounded implementation strategies that prioritize both innovation and equity.

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