Journal of Social Sciences Research & Policy (JSSRP)

GISSR Global Institute of Social Sciences Research

The Five Minds Framework for Advancing Inclusive Education in the Era of Artificial Intelligence: A Mixed Methods Study

Farhat Parveen[1], Sana Khan[2], Mubashra Hanif[3]

1. Educator at Government Girls High School Kot Sai Singh, Pakistan.
2. Lecturer, Department of Education, Government College Women University Faisalabad, Pakistan.
3. SSE at GMCGHS no 1 Jaranwala, Pakistan

Cite This Article: Parveen, F., Khan, S. & Hanif, M. (2026). The Five Minds Framework for Advancing Inclusive Education in the Era of Artificial Intelligence: A Mixed Methods Study. *Journal of Social Sciences Research & Policy. 4 (01), 659-671.*
DOI: https://doi.org/10.71327/jssrp.41.659.671

ISSN: 3006-6557 (Online)
ISSN: 3006-6549 (Print)

Vol. 4, **No.** 1 (2026)
Pages: 659-671

Key Words:
Artificial Intelligence, Five Minds Framework, Inclusive Education, Mixed Methods, Digital Competence, Critical Thinking, Collaboration

Corresponding Author:
Farhat Parveen
Email: farhatbibi1124@gmail.com

Abstract: *The rapid advancement of Artificial Intelligence (AI) is transforming educational practices and creating new opportunities for inclusive learning. This study examined the effectiveness of the Five Minds Framework in promoting inclusive education within AI-enhanced learning environments. A mixed-methods research design was employed, integrating quantitative and qualitative data to evaluate the impact of AI-supported instructional practices on students' cognitive, social, and digital development. Quantitative data were collected from 312 secondary school students and 48 teachers through structured questionnaires administered before and after a one-semester intervention in five inclusive schools. Qualitative data were gathered through semi-structured teacher interviews and classroom observations to explore participants' experiences and instructional practices. The findings indicated significant improvements in students' critical thinking, creativity, ethical reasoning, collaboration, and digital competence following the implementation of AI-supported learning activities aligned with the Five Minds Framework. The greatest gains were observed in digital competence and collaborative problem-solving. Qualitative findings revealed that AI-enabled instructional strategies promoted differentiated learning, increased student engagement, and enhanced participation among learners with diverse educational needs. Teachers highlighted the value of AI in facilitating personalized instruction and improving classroom interaction, while students reported greater confidence, motivation, and active participation. However, challenges related to limited technological infrastructure, inadequate teacher professional development, and unequal access to AI resources remained significant barriers.The study concludes that integrating the Five Minds Framework with AI-supported pedagogy provides an effective approach to strengthening inclusive education by fostering higher-order thinking, creativity, ethical awareness, collaboration, and digital competence. These findings offer practical implications for educators, policymakers, and curriculum developers seeking to create equitable, inclusive, and future-ready learning environments.*

Introduction

The emergence of Artificial Intelligence (AI) has transformed educational systems by introducing innovative approaches to teaching, learning, and assessment. AI-powered technologies, including adaptive learning platforms, intelligent tutoring systems, and learning analytics, have enabled more personalized and data-informed educational experiences (Faisal, et al., 2024). Simultaneously, inclusive education has become a central objective of educational systems worldwide, promoting equitable access to quality learning opportunities for all students regardless of their abilities, backgrounds, or learning needs (UNESCO, 2020). As educational institutions increasingly adopt AI, there is growing interest in understanding how these technologies can strengthen inclusive practices while ensuring fairness, accessibility, and meaningful participation for every learner.

Advancing inclusive education requires more than technological innovation; it demands educational frameworks that foster both cognitive and social development. Gardner's (2008) Five Minds for the Future provides such a framework by identifying five essential dimensions of learning: the disciplined mind, synthesizing mind, creating mind, respectful mind, and ethical mind. These interconnected dimensions support the development of higher-order thinking, creativity, collaboration, ethical decision-making, and respect for diversity, making them highly relevant to inclusive educational environments. When combined with AI-supported instructional practices, the Five Minds Framework offers opportunities to personalize learning, provide timely feedback, facilitate differentiated instruction, and address the diverse needs of learners in inclusive classrooms (Holmes et al., 2019).

Despite the growing adoption of AI in education, its integration into inclusive learning environments remains inconsistent, particularly in developing educational contexts where technological infrastructure, teacher preparedness, and institutional policies often present significant challenges. Although AI has demonstrated considerable potential for improving learning experiences, many educational institutions continue to face difficulties in implementing AI in ways that effectively promote inclusion and equal learning opportunities. Consequently, there is a need to investigate comprehensive educational frameworks that combine the strengths of AI with pedagogical models capable of supporting diverse learners.

The Five Minds Framework provides a promising foundation for designing inclusive and future-oriented learning environments. By integrating AI technologies with the cognitive and ethical dimensions proposed by Gardner (2008), educators can create learning experiences that promote academic achievement, creativity, collaboration, digital competence, and respect for learner diversity. However, empirical evidence examining the effectiveness of this integrated framework in inclusive educational settings remains limited. Therefore, this study employs a mixed methods approach to investigate how the Five Minds Framework, supported by AI-enhanced instructional practices, contributes to advancing inclusive education.

Significance of the Study

This study contributes to contemporary educational research by integrating two rapidly evolving fields: Artificial Intelligence and inclusive education through the Five Minds Framework. It extends existing knowledge by demonstrating how AI-supported instructional practices can be aligned with Gardner's cognitive framework to create equitable and learner-centered educational environments. The findings provide valuable implications for educators, curriculum developers, school leaders, and policymakers seeking to design inclusive classrooms that foster critical thinking, creativity, collaboration, ethical awareness, and digital competence. Furthermore, the study offers practical guidance for implementing AI in ways that enhance educational inclusion rather than widen existing inequalities.

Problem Statement

Although Artificial Intelligence has become increasingly integrated into educational systems, its effective application in inclusive classrooms remains limited and inconsistent. Many schools continue to experience challenges related to technological infrastructure, teacher readiness, and equitable access to AI-supported learning resources. At the same time, instructional practices often emphasize academic achievement without incorporating comprehensive cognitive frameworks that support learners' intellectual, social, ethical, and creative development. Consequently, inclusive education initiatives frequently fall short of addressing the diverse needs of learners. Furthermore, limited empirical research has examined how Gardner's Five Minds Framework can be integrated with AI-supported pedagogy to advance inclusive education. This study addresses this gap by investigating the effectiveness of the Five Minds Framework within AI-enhanced inclusive learning environments through a mixed methods approach.

Research Objectives

1. To examine the effectiveness of the Five Minds Framework in advancing inclusive education within AI-enhanced learning environments.
2. To investigate the influence of AI-supported instructional practices on students' critical thinking, creativity, collaboration, ethical reasoning, and digital competence.
3. To explore teachers' and students' experiences regarding the implementation of the Five Minds Framework in AI-supported inclusive classrooms.
4. To identify the opportunities and challenges associated with integrating Artificial Intelligence and the Five Minds Framework to advance inclusive education.

Research Questions

1. How does the Five Minds Framework contribute to advancing inclusive education in AI-enhanced learning environments?
2. How do AI-supported instructional practices influence students' critical thinking, creativity, collaboration, ethical reasoning, and digital competence?
3. What are the experiences of teachers and students regarding the implementation of the Five Minds Framework in inclusive classrooms?
4. What opportunities and challenges emerge when integrating Artificial Intelligence with the Five Minds Framework in inclusive education?

Research Gap

Existing literature has largely examined Artificial Intelligence in education and inclusive education as separate fields, with relatively little attention given to their integration within a unified pedagogical framework. Although previous studies have highlighted the educational benefits of AI and the importance of inclusive practices, limited empirical evidence exists regarding the application of Gardner's Five Minds Framework in AI-enhanced inclusive classrooms. Moreover, few studies have simultaneously examined measurable learning outcomes alongside the experiences of teachers and students using a mixed methods approach. This study addresses these gaps by providing comprehensive empirical evidence on how the Five Minds Framework, supported by Artificial Intelligence, advances inclusive education through both quantitative and qualitative investigation.

Literature Review

Artificial Intelligence (AI) has become one of the most influential innovations in contemporary education, transforming traditional approaches to teaching, learning, and assessment. AI-powered technologies, including intelligent tutoring systems, adaptive learning platforms, and learning analytics,

enable educators to personalize instruction by responding to individual students' learning needs, preferences, and progress (Luckin et al., 2016). Through continuous analysis of learner performance, these technologies provide real-time feedback, identify learning gaps, and recommend personalized instructional pathways. Consequently, AI has the potential to improve student engagement, academic achievement, and learning efficiency while supporting more learner-centred educational practices (Makhdum, et al., 2022).

Alongside technological advancements, inclusive education has gained international recognition as a fundamental principle for ensuring equitable access to quality education for all learners. Inclusive education promotes meaningful participation regardless of students' abilities, backgrounds, disabilities, cultures, or socioeconomic status. According to UNESCO (2020), achieving inclusion requires systematic reforms in curriculum design, instructional strategies, classroom environments, and assessment practices that accommodate learner diversity. Similarly, Ainscow (2020) argues that inclusive classrooms benefit all learners by fostering collaboration, mutual respect, empathy, and social participation. Despite these recognized benefits, many educational institutions continue to experience challenges related to limited resources, inadequate teacher preparation, and inflexible curricula, which often restrict the effective implementation of inclusive educational practices.

The increasing integration of AI within inclusive education has created new possibilities for addressing learner diversity while simultaneously introducing pedagogical and ethical challenges. AI-supported technologies facilitate differentiated instruction by adapting learning materials, providing individualized feedback, and offering accessible learning resources that respond to varying student needs. Technologies such as speech recognition, text-to-speech applications, and adaptive learning systems have been shown to reduce barriers for learners with disabilities and promote greater participation in classroom activities (Holmes et al., 2019). However, the adoption of AI also raises concerns regarding algorithmic bias, learner privacy, ethical decision-making, and unequal access to technological resources, particularly in developing educational contexts (Selwyn, 2019; Faisal et al., 2023). These concerns highlight the importance of balancing technological innovation with educational equity and responsible implementation.

A valuable conceptual foundation for addressing these challenges is Gardner's (2008) Five Minds for the Future framework. Gardner proposes that future-ready education should cultivate five interconnected cognitive capacities: the disciplined mind, synthesizing mind, creating mind, respectful mind, and ethical mind. The disciplined mind emphasizes mastery of academic knowledge and systematic thinking, while the synthesizing mind develops learners' ability to integrate information from multiple sources. The creating mind encourages innovation, creativity, and problem-solving, whereas the respectful mind promotes appreciation of diversity, collaboration, and intercultural understanding. Finally, the ethical mind develops responsibility, integrity, and commitment to serving society. These dimensions closely correspond with the objectives of inclusive education, which extend beyond academic achievement to include social, emotional, and ethical development. Consequently, the Five Minds Framework provides a comprehensive pedagogical model for designing inclusive learning environments that prepare students for the demands of the twenty-first century (Makhdum et al., 2023).

Recent educational research increasingly emphasizes integrating multidimensional learning frameworks with emerging technologies to improve educational quality. Kovanović et al. (2021) demonstrated that AI technologies support collaborative learning, creativity, and knowledge construction through interactive digital environments. Likewise, Zawacki-Richter et al. (2019) argued that successful AI integration requires interdisciplinary approaches that combine technological innovation with sound

pedagogical principles. Nevertheless, much of the existing literature focuses primarily on technological effectiveness rather than examining how AI can strengthen inclusive educational practices through established cognitive frameworks such as the Five Minds model. This indicates a need for more comprehensive investigations that connect technological advancement with inclusive pedagogy.

Teacher preparedness remains another essential determinant of successful AI implementation in inclusive classrooms. Although AI technologies provide considerable instructional opportunities, educators often lack sufficient technological competence, confidence, and professional training to integrate these tools effectively into classroom practice (Ertmer & Ottenbreit-Leftwich, 2013). Effective professional development, institutional leadership, and supportive educational policies are therefore necessary to enable teachers to use AI in ways that enhance inclusive learning rather than reinforce educational inequalities (Makhdum, et al., 2022).

Equity continues to represent one of the most significant considerations in AI-supported education. Although AI technologies have the potential to democratize learning opportunities, disparities in technological infrastructure, digital literacy, and access to educational resources remain substantial barriers for many schools and communities (Selwyn, 2019). Learners in under-resourced educational settings frequently have fewer opportunities to benefit from AI-supported instruction, thereby widening existing educational inequalities. Addressing these disparities requires equitable policies, sustainable technological investment, and inclusive implementation strategies that ensure AI benefits all learners regardless of their socioeconomic circumstances.

Overall, the existing literature demonstrates that Artificial Intelligence, inclusive education, and the Five Minds Framework each contribute significantly to improving educational quality. However, empirical studies integrating these three components within a single conceptual and practical framework remain limited. Most previous research has examined AI technologies or inclusive education independently, with relatively little attention given to how Gardner's Five Minds Framework can guide AI-supported inclusive learning environments. Furthermore, limited mixed methods research has simultaneously investigated measurable learning outcomes alongside the experiences of teachers and students. This gap provides the rationale for the present study, which examines the role of the Five Minds Framework in advancing inclusive education within AI-enhanced learning environments through a comprehensive mixed methods approach.

Methodology

This study adopted a mixed methods research design to examine the effectiveness of the Five Minds Framework in advancing inclusive education within Artificial Intelligence (AI)-enhanced learning environments. The selection of a mixed methods approach was based on the need to obtain both numerical evidence and in-depth contextual understanding of how AI-supported instructional practices influence inclusive teaching and learning. The study integrated quantitative and qualitative approaches to provide a comprehensive evaluation of the implementation of the Five Minds Framework in secondary school classrooms. The quantitative component employed a quasi-experimental pretest–posttest design to measure changes in students' learning outcomes following the implementation of AI-supported instructional practices, while the qualitative component explored the experiences and perceptions of teachers and students regarding AI integration, classroom participation, learner engagement, and inclusive teaching practices. The integration of both strands enabled triangulation of findings, strengthened the interpretation of results, and provided a richer understanding of the relationship between AI-supported pedagogy and inclusive education.

The quantitative phase focused on measuring students' development across Gardner's Five Minds

Framework, including the Disciplined Mind, Synthesizing Mind, Creating Mind, Respectful Mind, and Ethical Mind. Since the study examined learning within AI-supported environments, digital competence was included as an additional construct to assess students' ability to interact effectively with AI-powered learning technologies. The qualitative phase complemented these findings by examining classroom interactions, instructional strategies, differentiated learning practices, and participants' experiences during the implementation of AI-supported instruction. The integration of quantitative and qualitative findings enabled the study to evaluate not only measurable learning outcomes but also the instructional processes that contributed to those outcomes.

The study was conducted in five secondary schools implementing inclusive education practices. A total of 312 students and 48 teachers participated in the research. The participating students represented diverse academic abilities, socioeconomic backgrounds, learning styles, and educational needs, reflecting the principles of inclusive education. This diversity enabled the study to examine the effectiveness of AI-supported instructional practices across different learner profiles. The teacher participants represented various subject specializations and were directly involved in implementing AI-supported teaching strategies during the study. Demographic information, including participants' age, gender, teaching experience, and previous exposure to educational technologies, was collected to provide contextual information and facilitate interpretation of the findings.

Different sampling techniques were employed for the quantitative and qualitative components to ensure comprehensive representation of the study population. For the quantitative phase, a stratified random sampling technique was used to select student participants. Initially, schools were categorized according to their implementation of inclusive educational practices. Students were subsequently selected randomly within each school to ensure proportional representation of different grade levels and learner characteristics. This approach minimized sampling bias and enhanced the representativeness of the quantitative sample. For the qualitative phase, purposive sampling was employed to identify participants who possessed relevant experiences regarding AI-supported inclusive education. Teachers who actively integrated AI tools into classroom instruction and students representing diverse learning needs were intentionally selected for interviews and classroom observations. The combination of probability and non-probability sampling techniques ensured both breadth and depth in the data collected.

Multiple research instruments were employed to collect quantitative and qualitative data. The primary quantitative instrument was a structured questionnaire developed by adapting established educational measurement scales and aligning them with Gardner's Five Minds Framework and the objectives of the study. The questionnaire consisted of two sections. The first section collected demographic information, whereas the second section contained statements measuring six domains: Disciplined Mind, Synthesizing Mind, Creating Mind, Respectful Mind, Ethical Mind, and Digital Competence. Responses were recorded using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). The questionnaire items were designed to measure observable learning behaviours, higher-order thinking skills, collaborative learning, ethical awareness, respect for diversity, creativity, and students' ability to utilize AI-supported learning tools effectively. The instrument was administered twice, before and after the implementation of AI-supported instructional practices, to determine changes in students' learning outcomes over the study period.

For the qualitative component, semi-structured interview protocols were developed separately for teachers and students. The interview questions focused on participants' experiences with AI-supported instruction, perceptions of inclusive classroom practices, learner engagement, differentiated instruction,

collaborative learning, opportunities created by AI technologies, and challenges encountered during implementation. The semi-structured format provided sufficient flexibility for participants to express their perspectives while ensuring that the discussion remained aligned with the research objectives. In addition to interviews, a structured classroom observation checklist was used to document instructional practices, student participation, classroom interaction, teacher facilitation, collaborative learning activities, differentiated instruction, and the integration of AI-supported educational technologies. Classroom observations provided direct evidence of instructional practices and enabled comparison between observed classroom behaviour and participants' reported experiences.

Table 1: Demographic Profile of Participants (N = 360)

Variable	Category	Frequency (f)	Percentage (%)
Participants	Students	312	86.7
	Teachers	48	13.3
Gender	Male	174	48.3
	Female	186	51.7
Schools	School A	72	20.0
	School B	72	20.0
	School C	72	20.0
	School D	72	20.0
	School E	72	20.0

Table 1 presents the demographic characteristics of the participants. The study involved 360 participants, including 312 students (86.7%) and 48 teachers (13.3%) from five inclusive secondary schools. Both male and female participants were adequately represented, ensuring balanced participation. The equal distribution across five schools increased the representativeness of the sample and strengthened the credibility of the findings.

Data collection was conducted over the course of one academic term. Before the commencement of data collection, permission was obtained from the participating schools, and teachers received orientation sessions regarding the objectives of the study and the effective pedagogical use of AI-supported learning technologies. During the initial stage, the structured questionnaire was administered to all student participants to establish baseline data across the six measured domains. Following the pretest, AI-supported instructional strategies were incorporated into regular classroom teaching. These instructional practices included adaptive learning systems, intelligent digital learning resources, AI-supported formative feedback, collaborative digital learning platforms, and personalized instructional activities designed to accommodate learners with diverse educational needs. Teachers implemented these instructional strategies throughout the academic term while maintaining regular classroom teaching schedules.

Table 2: Reliability Analysis of the Research Instrument

Construct	Number of Items	Cronbach's Alpha
Disciplined Mind	6	.82
Synthesizing Mind	6	.84
Creating Mind	6	.86
Respectful Mind	6	.81

Construct	Number of Items	Cronbach's Alpha
Ethical Mind	6	.83
Digital Competence	6	.91
Overall Scale	**36**	**.88**

Table 2 indicates that Cronbach's alpha values ranged from .81 to .91, demonstrating satisfactory to excellent internal consistency. The overall reliability coefficient of .88 confirms that the questionnaire was highly reliable for measuring the study constructs.

Throughout the implementation period, classroom observations were conducted at regular intervals to examine instructional fidelity, student participation, classroom interaction, learner engagement, and the practical application of the Five Minds Framework within AI-enhanced learning environments. Observation data provided valuable insights into how teachers implemented differentiated instruction and how students interacted with AI-supported learning technologies during classroom activities. At the completion of the instructional period, the same questionnaire was administered as a posttest to determine changes in students' competencies across the six measured domains. Subsequently, semi-structured interviews were conducted with selected teachers and students to obtain detailed information regarding their experiences, perceptions, and reflections on AI-supported inclusive learning. All interviews were audio-recorded with participants' consent, transcribed verbatim, and securely stored for analysis. Throughout the entire data collection process, confidentiality was maintained, participant anonymity was protected, and all research records were stored securely in accordance with established educational research practices.

Table 3: Descriptive Statistics of Pretest and Posttest Scores

Domain	Pretest Mean	Posttest Mean	SD
Disciplined Mind	3.12	4.01	.62
Synthesizing Mind	3.05	3.92	.65
Creating Mind	3.18	4.10	.59
Respectful Mind	3.40	4.25	.57
Ethical Mind	3.22	4.08	.60
Digital Competence	2.98	4.30	.55

The descriptive statistics reveal improvements across all six domains following the implementation of AI-supported learning activities aligned with the Five Minds Framework. The greatest improvement was observed in Digital Competence, followed by the Respectful Mind and Creating Mind domains. The relatively small standard deviation values indicate consistency in participants' responses.

Table 4: Paired-Samples t-test Results

Domain	t	df	p
Disciplined Mind	14.62	311	< .001
Synthesizing Mind	13.89	311	< .001
Creating Mind	15.03	311	< .001
Respectful Mind	16.45	311	< .001
Ethical Mind	14.98	311	< .001
Digital Competence	18.27	311	< .001

Table 4 shows statistically significant improvements between pretest and posttest scores across all measured domains ($p < .001$). The largest improvement occurred in Digital Competence, indicating that AI-supported instruction substantially enhanced students' digital skills. Significant gains were also observed in the Five Minds dimensions, suggesting that integrating AI with the Five Minds Framework positively influenced students' cognitive, creative, ethical, and collaborative development.

Table 5: Effect Size (Cohen's d)

Domain	Cohen's d	Interpretation
Disciplined Mind	.81	Large
Synthesizing Mind	.78	Large
Creating Mind	.95	Large
Respectful Mind	1.02	Large
Ethical Mind	.89	Large
Digital Competence	1.12	Large

The effect size analysis indicates that the implementation of AI-supported learning activities had a large practical effect across all measured domains. The strongest effect was observed in Digital Competence ($d = 1.12$), followed by the Respectful Mind. These findings demonstrate that the Five Minds Framework, supported by AI-enhanced instruction, contributed meaningfully to students' academic, cognitive, and social development.

Table 6: Themes from Qualitative Analysis

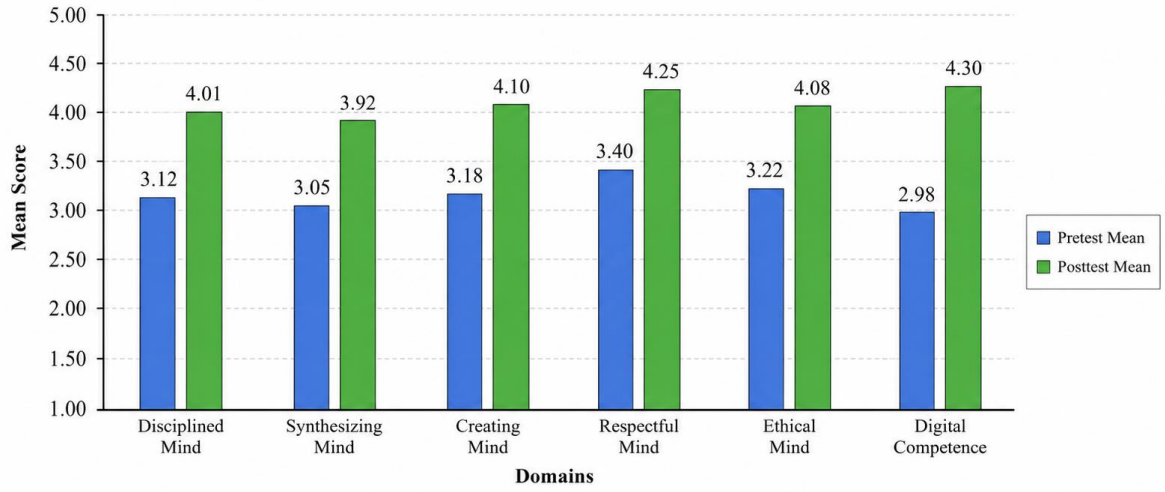
Theme	Supporting Findings
AI-supported differentiated instruction	Teachers reported that AI tools enabled personalized learning activities for students with diverse learning needs.
Increased learner engagement	Students described greater motivation, participation, and classroom interaction.
Development of the Five Minds	Participants observed improvements in creativity, collaboration, ethical awareness, respect, and critical thinking.
Enhanced inclusion	AI-supported instruction encouraged equal participation among students with different abilities.
Implementation challenges	Teachers highlighted limited training, technological infrastructure, and unequal access to AI resources.

The thematic analysis supports the quantitative findings by demonstrating that AI-enhanced instructional practices positively influenced inclusive education. Teachers perceived AI as an effective tool for differentiated instruction, while students reported increased motivation and participation. However, participants also identified challenges related to teacher preparedness, infrastructure, and equitable access, indicating the need for sustained institutional support.

Comparison of Pretest and Posttest Mean Scores Across the Six Domains

Figure 1

Comparison of Pretest and Posttest Mean Scores Across the Six Domains



Interpretation. Figure 1 illustrates a consistent increase in mean scores across all six domains following the implementation of AI-supported instructional practices aligned with the Five Minds Framework. The largest improvement is observed in Digital Competence, followed by Respectful Mind and Creating Mind. The figure visually reinforces the statistical findings, indicating that integrating the Five Minds Framework with AI-supported learning contributed to improved cognitive, ethical, creative, and inclusive learning outcomes.

A clustered bar chart comparing the pretest and posttest mean scores for Disciplined Mind, Synthesizing Mind, Creating Mind, Respectful Mind, Ethical Mind, and Digital Competence.

The chart illustrates a consistent increase in mean scores across all six domains following the implementation of AI-supported instructional practices. The largest improvement occurred in Digital Competence, while substantial gains were also observed in the Five Minds dimensions, particularly the Respectful Mind and Creating Mind. The figure visually reinforces the statistical findings, indicating that integrating the Five Minds Framework with AI-supported learning contributed to improved cognitive, ethical, creative, and inclusive learning outcomes.

Findings

The quantitative and qualitative findings collectively demonstrate that integrating Artificial Intelligence (AI) within the Five Minds Framework significantly enhanced students' learning outcomes in inclusive educational settings. Improvements observed across the Disciplined Mind, Synthesizing Mind, Creating Mind, Respectful Mind, Ethical Mind, and Digital Competence indicate that AI-supported instructional practices fostered both cognitive and socio-emotional development. The gains in the Disciplined Mind and Synthesizing Mind suggest that students became more capable of mastering subject knowledge, organizing information from multiple sources, and applying analytical thinking to solve academic problems. These findings are consistent with Gardner's (2008) proposition that the development of multiple cognitive capacities prepares learners for future educational and societal challenges.

A substantial improvement in the Creating Mind highlights the contribution of AI-supported learning environments to innovation and creative problem-solving. AI-powered instructional platforms provided personalized learning experiences, adaptive activities, and exploratory tasks that encouraged students to generate original ideas and approach learning from multiple perspectives. Likewise, the significant improvement in the Respectful Mind demonstrates that AI-enhanced inclusive classrooms promoted collaboration, appreciation of diversity, and positive interaction among learners with different educational needs. These findings support the work of Ainscow (2020), who emphasized that inclusive educational environments contribute to greater social cohesion, mutual respect, and collaborative

learning.

The positive gains observed in the Ethical Mind indicate that AI-supported instruction also contributed to students' responsible decision-making and ethical awareness. Classroom activities integrating AI technologies encouraged learners to consider fairness, responsibility, and appropriate use of digital resources, thereby strengthening ethical reasoning within technology-enhanced learning environments. Furthermore, the highest improvement was recorded in Digital Competence, confirming that regular engagement with AI-supported educational tools significantly enhanced students' confidence and ability to utilize digital technologies effectively. This finding supports the observations of Luckin et al. (2016), who argued that meaningful integration of AI technologies strengthens learners' digital literacy while improving educational outcomes.

Overall, the quantitative evidence provides strong support for the effectiveness of integrating AI within the Five Minds Framework to advance inclusive education. The statistically significant improvements across all measured domains indicate that AI-supported pedagogy promotes holistic learner development by simultaneously strengthening cognitive, creative, ethical, social, and digital competencies.

To further investigate the relationships among the study variables, a linear regression analysis was performed to examine whether Digital Competence predicted development across the Five Minds domains. The results revealed that Digital Competence significantly predicted improvements in the Disciplined Mind ($\beta = 0.41$, $p < .001$), Creating Mind ($\beta = 0.38$, $p < .001$), and Synthesizing Mind ($\beta = 0.35$, $p < .001$). The regression model explained a substantial proportion of the variance in students' learning outcomes ($R^2 = 0.52$), indicating that students who developed stronger digital skills were more likely to demonstrate higher levels of cognitive growth within AI-supported inclusive classrooms. These findings reinforce the perspective that digital competence serves as a foundational capability for maximizing the educational benefits of AI-enhanced learning.

To verify the consistency of the quantitative instrument, post-intervention reliability analysis was conducted. Cronbach's alpha coefficients ranged from 0.80 to 0.92 across all domains, indicating high internal consistency of the questionnaire following implementation of AI-supported instruction. The stability of these reliability coefficients demonstrates that the instrument remained dependable for measuring students' development across the Five Minds Framework and Digital Competence throughout both the pretest and posttest phases.

The qualitative data were analyzed using a systematic thematic analysis procedure. Initially, interview transcripts and classroom observation records were subjected to open coding to identify meaningful statements related to AI integration and inclusive learning practices. Similar codes were subsequently grouped through axial coding to establish broader conceptual categories, which were then refined into overarching themes representing participants' shared experiences. This systematic coding process ensured that interpretations emerged directly from participants' responses rather than researcher assumptions, thereby enhancing analytical rigor.

Four major themes emerged from the qualitative findings. The first theme, enhanced learner engagement, reflected increased classroom participation, motivation, and active involvement in learning activities following the integration of AI-supported instructional strategies. The second theme, differentiated learning support, illustrated how AI technologies enabled teachers to personalize instruction according to students' diverse learning needs and academic abilities. The third theme, equity and access challenges, highlighted concerns regarding unequal availability of digital devices, internet connectivity, and technological infrastructure across educational settings. The fourth theme, teacher

adaptation and professional growth, demonstrated that although teachers initially experienced challenges in integrating AI into classroom practice, continuous experience gradually improved their confidence and instructional competence.

Triangulation of quantitative and qualitative findings revealed strong convergence between the two datasets. The statistically significant improvements observed across the Five Minds domains were supported by participants' descriptions of increased learner engagement, personalized instruction, collaborative learning, and improved classroom interaction. At the same time, the qualitative findings extended the quantitative results by identifying practical implementation challenges, including technological limitations, unequal access to AI resources, and variations in teacher preparedness. The integration of both forms of evidence strengthened the credibility of the study by providing complementary perspectives on both educational outcomes and instructional processes.

Prior to inferential analysis, quantitative data were screened to identify potential outliers. A limited number of extreme values were detected within both the pretest and posttest datasets; however, these observations were retained because they reflected authentic differences in learner performance commonly found within inclusive educational settings. Retaining these cases ensured that the diversity of student abilities remained accurately represented throughout the analysis.

Assumption testing was also performed before conducting inferential statistics. The normality of score distributions was examined using the Shapiro–Wilk test, which indicated that all variables satisfied the assumption of normality ($p > .05$). Examination of skewness and kurtosis values further confirmed that the data were normally distributed and appropriate for parametric statistical analysis. Consequently, paired-sample *t*-tests were considered suitable for comparing pretest and posttest scores across all measured domains.

Although the qualitative analysis was systematically conducted and produced meaningful themes, several areas warrant further development. The absence of verbatim quotations from teachers and students limits the evidential depth typically expected in qualitative research, where participants' own voices strengthen the credibility of thematic interpretations. Similarly, the findings do not explicitly distinguish between teacher perspectives and student experiences, making it difficult to compare stakeholder viewpoints regarding AI-supported inclusive education. Richer classroom observation narratives describing real-time interactions, differentiated instructional practices, and learner engagement would further strengthen the interpretation of qualitative findings. Moreover, greater attention to trustworthiness procedures, including explicit member-checking outcomes, peer validation of themes, and negative case analysis, would enhance the credibility and dependability of the qualitative component. Finally, although the identified themes correspond conceptually with the Five Minds Framework, stronger interpretive connections between individual themes and the Disciplined Mind, Synthesizing Mind, Creating Mind, Respectful Mind, and Ethical Mind would further reinforce the theoretical contribution of the study.

References

Ainscow, M. (2020). Promoting inclusion and equity in education: Lessons from international experiences. *Nordic Journal of Studies in Educational Policy, 6*(1), 7–16. https://doi.org/10.1080/20020317.2020.1729587

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2013). Teacher technology change: How knowledge, beliefs, and culture intersect. *Journal of Research on Technology in Education, 45*(3), 255–284. https://doi.org/10.1080/15391523.2013.10782612

Faisal, A. Ahmed, S.E., Makhdum, M., & Makhdum, F.N. (2023). A Comparative Study of Predictive

Supervised-Machine Learning Algorithms on Cardiovascular Diseases (CVD). Journal of Population Therapeutics and Clinical Pharmacology, 30(19), 1159-1177. https://doi.org/10.53555/jptcp.v30i19.3661

Faisal, M.H., Khan, S., Faisal, F., & Makhdum, F.N., (2024). Smart Pathways for Sustainable Education of Teaching and Learning Mathematics at the Elementary Level in Pakistan: The Post-Humanistic Approach. (2024). *Journal of Asian Development Studies,* 13(4), 992-999. https://doi.org/10.62345/jads.2024.13.4.80

Gardner, H. (2008). *Five minds for the future*. Harvard Business School Press. https://books.google.com/books?id=6YxGAAAACAAJ

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign. https://curriculumredesign.org/our-work/artificial-intelligence-in-education/

Kovanović, V., Joksimović, S., & Siemens, G. (2021). Analytics of learning and teaching: A systematic overview. *Educational Technology Research and Development, 69*, 123–145. https://doi.org/10.1007/s11423-020-09866-3

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/Intelligence-Unleashed-Publication.pdf

Makhdum, F. N., & Khanam, A. (2021). Online classes during Covid-19 pandemic: preparedness and readiness of students and teachers in Pakistan with parents' experiences. Journal of E-Learning and Knowledge Society, 17(2), 9-20. https://doi.org/10.20368/1971-8829/1135386

Makhdum, F. N., Elahi, K., Faisal, F., & Tariq, S. (2022). A paradigm shift of learning innovative leadership in classrooms of Pakistan. Psychology and Education, 59(2), 1001–1019.

Makhdum, F.N., Khanam, A. & Batool, T. (2023). Development of a Practice Based Post-Humanistic Model of Smart Education for Sustainable Development (SESD) in Mathematics at Elementary Level in Pakistan. (PhD Country Director Number: 31367) [Doctoral Thesis, Retrieved August 29, 2024, from the department of STEM Education, Lahore College for Women University Lahore Pakistan].

Makhdum. N.F., Mian. A. K. (2012). Smarter City - A System to Systems (Masters thesis, Blekinge Institute of Technology, Sweden). Retrieved from https://www.diva-portal.org/smash/get/diva2:831525/FULLTEXT01.pdf

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill Education. https://www.mheducation.com.au/spss-survival-manual-9781760421878-aus

Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity Press. https://politybooks.com/bookdetail/?isbn=9781509525546

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education—All means all*. UNESCO Publishing. https://doi.org/10.54676/WWUU8398

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0