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Artificial Intelligence-Enabled Adaptive and Inclusive Curriculum Implementation: Evidence from School Administrators and Teachers in District South Karachi

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ABSTRACT

Artificial Intelligence (AI) has entered the educational landscape to open up fresh avenues for implementing adaptive and inclusive curriculum practices. This study aimed to examine the implementation of Artificial Intelligence work-enabled Adaptive and Inclusive Curriculum practices among school Management and Teachers in District South Karachi. The method of the research was a quantitative research design, while the data collection instrument was a structured questionnaire that was given to 300 teachers and school administrators. The data obtained were analyzed using descriptive statistics, exploratory factor analysis, independent samples t-test and regression analysis. The findings showed that AI-powered learning tools make a huge difference in inclusive education by meeting a wide range of learning needs and minimizing learning barriers for the students. The findings also showed that curriculum adaptations using artificial intelligence are more effective than traditional methods that utilize curriculum differentiation in addressing individual learning needs. Besides this, AI-driven insights greatly aid educators in making adaptive learning decisions and in the improvement of outcomes. Technical, ethical and practical challenges come with a downside, however, as they affect the successful implementation of AI. This study suggests that the effective use of AI in designing curriculum depends on it requires support from the institutional, teacher, and technological aspects, while emphasizing adaptivity and inclusiveness.

Introduction

Classrooms are increasingly diverse, composed of students with varying learning abilities, cultural and linguistic backgrounds, interests, and educational needs. The diversity has presented an unprecedented challenge to "one size fits all" approaches to curriculum, which often do not meet the needs of each learner and offer equal educational opportunities to all learners. Thus, an increasing focus on adaptive and inclusive curricula, which include adapting classroom instruction activities and assessment practices to the needs and context of children and youth (Sherin & Drake, 2009). These teaching practices enable equal opportunities for learning, increase participation and engagement and improve student learning throughout various education contexts (Bümen & Holmqvist, 2022).

Artificial Intelligence (AI) is evolving quickly, presenting new opportunities for shifting the focus in education toward more individualized, flexible and inclusive learning experiences. The infusion of AI technologies in education has led to the use of intelligent tutoring systems, adaptive learning platforms, and AI-based understanding tools that analyze the learning behaviour of the student(s) and offer real-time feedback and information to guide data-informed teaching decisions (Zawacki-Richter et al., 2019). As these tools rely on AI, they can assist educators in learning about each child and adapting teaching methods based on their learning proficiency, interests, and achievements in school, empowering them to adopt adaptable instruction and strengthen adaptive curriculum practice (Chen et al., 2020). Moreover, during the last years, the advent of AI-aided learning has opened the door to full potential in personalized learning, engagement, and accessibility, offering opportunities to improve the learning experiences of diverse learners by lowering barriers to learning and fostering more inclusivity (Melo-López et al., 2025; Fitas et al., 2025). Therefore, artificial intelligence is becoming an essential technology for educators and educational institutions to advance the integrated approach to education and the concept of the responsive curriculum.

In addition to personalized learning, Artificial Intelligence (AI) empowers educators to make informed choices in curriculum engagement and create responsive learning experiences. Learning analytics and intelligent educational systems can generate valuable insights about student behavior by learning, which can support teachers in assessing their strengths and learning challenges and strategies, as well as understanding their learning patterns, and consequently, adjust teaching strategies and curricular activities based on the student's learning needs (Ifenthaler & Yau, 2020). In the same way, technologies that rely on AI can help teachers in lesson planning, content development, differentiated teaching and content, and feedback in a timely manner, which are essential elements in the context of adaptive curriculum (Luckin et al., 2016). Furthermore, artificial intelligence has the potential to improve various aspects of the learning process and student participation through the inclusion of new accessibility tools, such as language translation, speech-to-text, text-to-speech, and adaptive learning support, to support students with a wide range of learning needs (Thomas Holmes, 2022). In conclusion, the implementation of AI in the teaching of curriculum can assist teachers and education institutions in developing more flexible, responsive, and inclusive teaching and learning spaces.

Although Artificial Intelligence (AI) can help address the challenges of inclusive education and adaptive curriculum (AC), there are various technical, ethical, and practical considerations to consider for successful implementation. A key challenge is the technological infrastructure necessary for effective implementation of AI tools in education, such as having access to digital devices, internet or reliable connectivity and/or institutional resources and equipment, which can hinder beneficial use of them, especially in contexts with limited resources (OECD 2024). Moreover, the ethical implications of AI-generated data driven by data privacy parameters, algorithmic biases and their implications for fairness, as well as responsible use of AI in education, are important concerns (UNESCO, 2025). Beyond this, some teachers may lack the expertise needed to leverage AI tools in their teaching practice effectively, and low levels of professional development and institutional support can pose barriers for teachers to utilize AI tools effectively during the implementation of the curriculum (Yuensook et al., 2026). All of this makes it critical to understand these challenges and to take steps to ensure that AI benefits education inclusively and equitably.

The Pakistani education system is an emerging field of incorporating AI, and there are some structural, technological and institutional hurdles in Pakistan. Access to digital infrastructure, lack of teacher training programs, and readiness of institutions are potential barriers to effectively integrating the use of AI in educational practices (Pakistan Economic Survey, 2023). These obstacles are greater in multi-ethnic settings where teachers must try to accommodate differences in students' orientations, cultural attitudes, background learning, socioeconomic situations, and languages. A district like District South Karachi is such a context where students have different backgrounds of origin and there is a variation in technological resources, preparedness of teachers and support to the school. While prior studies have addressed the role and implications of using AI in learning and inclusive classrooms, there has been little empirical research into facilitating teachers and school leaders in the implementation of AI tools to ensure adaptable and inclusive learning programs, specifically in the context of Pakistani schools. Hence, this study aims to examine the implementation of Artificial Intelligence (AI)-enabled adaptive and inclusive curriculum practices among school administrators and teachers in District South Karachi.

Objectives of Research

To examine Artificial Intelligence (AI)-enabled adaptive and inclusive curriculum implementation, it is essential to investigate how AI-driven learning tools contribute to inclusive education, support adaptive curriculum practices, enhance teaching outcomes, and influence the successful integration of AI within educational settings. Therefore, the following objectives have been developed for the present study:

1. To examine the effect of AI-driven learning tools on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students.

2. To investigate the influence of technical, ethical, and practical challenges on the successful implementation of Artificial Intelligence tools in inclusive education.

3. To compare the effectiveness of AI-enabled curriculum implementation with traditional curriculum approaches in meeting the individual learning needs of diverse students.

4. To evaluate the effect of AI-generated insights on teachers' ability to implement adaptive curricula and improve overall teaching outcomes.

Research Questions

The study was designed to address the following research questions:

1. What is the effect of AI-driven learning tools on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students?

2. What is the influence of technical, ethical, and practical challenges on the successful implementation of Artificial Intelligence tools in inclusive education?

3. Is there a significant difference between AI-enabled curriculum implementation and traditional curriculum adaptation approaches in meeting the individual learning needs of diverse students?

4. What is the effect of AI-generated insights on teachers' ability to implement adaptive curricula and improve overall teaching outcomes?

Research Hypothesis

H1: AI-driven learning tools have a significant positive effect on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students.

H2: Technical, ethical, and practical challenges have a significant negative effect on the successful implementation of Artificial Intelligence tools in inclusive education.

H3: AI-enabled curriculum implementation is significantly more effective than traditional curriculum adaptation approaches in meeting the individual learning needs of diverse students.

H4: AI-generated insights have a significant positive effect on teachers' ability to implement adaptive curricula and improve overall teaching outcomes.

Literature Review

Artificial Intelligence (AI) has become one of today's most transformative innovations in the field of education, providing new opportunities to carry out curriculum implementation, teaching and learning, and educational experiences that enhance the experience of students (Chen et al., 2020; Chiu et al., 2023). At the same time, however, the rise in learner diversity has driven the need for adapting and including more into teaching and learning. This need is best met by a curriculum that is flexible and responsive to the differences between learners, enabling it to address learners' diverse academic, linguistic, cultural and learning needs (Florian, 2019; UNESCO, 2020). Increasingly, educational research is turning towards the diverse use of AI technologies to enhance more flexible, learner-centered, and inclusive implementation of the curriculum.

In recent years, cutting-edge AI applications have led to the creation of smart educational technologies for personalized learning, adaptive teaching, automated evaluation, learning analytics, and accessibility support for various student types.AI has facilitated the emergence of smart technologies for education that encompass personalized learning, adaptive teaching, automated assessment, learning analytics, and accessibility services for a wide range of learners (Kasneci et al., 2023; Holmes et al., 2022). Instead of supplanting teachers, they are seen more and more as resources to enhance the process of instructional decision-making and curriculum enactment by empowering teachers to meet better individual learning differences (Luckin & Holmes, 2021). Achieving the successful use of AI in education, however, is also dependent on the teachers' readiness, institutional support, technological infrastructure, ethical governance, and equal access to digital resources (UNESCO, 2021; Williamson & Kizilcec, 2022).

Theoretical Background

The current research is based on four complementary theories which together underline the way to implement an adaptive and inclusive curriculum in the AI-supported educational context. Vygotsky's Sociocultural Theory emphasizes that learning is a socially-constructed and constructed pursuit that is achieved when students interact with guidance, and when the instruction experiences are integrated appropriately to cater to their various learning needs (1978). Universal Design for Learning (UDL) builds on this foundation, promoting flexibility in relation to the curriculum and multiple means of engagement, representation and expression so all students can have access to the learning (CAST, 2024). The Technological Pedagogical Content Knowledge (TPACK) framework also emphasizes the role of the teacher in linking together the technological, pedagogical, and content aspects of teaching. It helps explain how teachers' ability to integrate them creatively contributes to the success of the curriculum into everyday teaching practice (Mishra & Koehler, 2006). Concomitant with these viewpoints, Diffusion of Innovation Theory provides a framework on how teachers' openness, desire to support the learning process with AI, leadership, and organizational capabilities influence the successful assimilation of AI in education (Rogers, 2003). Together, these theories offer a framework for the discussion of how AI might contribute to adaptive and inclusive implementation of curricula, and also outline the pedagogical and institutional constraints to successful deployment.

AI-Driven Learning Tools and Inclusive Education

The principle of inclusive education is based on equality of opportunity to learn and aimed at providing equal opportunities for the participation and achievement of all students, including those with special educational needs and a wide range of abilities and backgrounds (UNESCO, 2021). AI-based learning techniques have come to be recognized as valuable tools to support inclusive educational practice in a variety of ways, including through customization for individual instruction, greater accessibility and learning difficulties removal (Holmes et al., 2022). Instead of giving similar learning experiences to all learners, AI technologies analyze learners' learning progress and create personalized learning support through learning needs analysis (Pedro et al., 2019).

Okonkwo and Ade-Ibijola (2021) stated that Artificial Intelligence (AI) assistive technology can promote participation through features such as speech-to-text, speech-to-speech, automated translation, and artificial intelligent tutoring systems for learners with disabilities, language barriers, and cognitive differences. In the same way, the adaptive learning platform that uses AI offers an opportunity to design differentiated instruction along with adjusting activities and the associated teaching materials based on each student's characteristics (Seo et al., 2021). These technologies also allow for more learner-centered teaching and improve participation in a variety of learning environments (Alam, 2022).

Recent research further demonstrates that AI-based learning environments can enhance inclusive education by tracking students' engagement and academic progress in an ongoing manner, enabling educators to intervene with students in real time or offer personalized learning support (Holmes et al., 2022; Seo et al., 2021).

H1: *AI-driven learning tools have a significant positive effect on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students.*

Challenges in AI Implementation for Inclusive Education

Although AI has emerged as a promising tool for adaptive and inclusive learning, some technical, ethical, and practical barriers need to be addressed to ensure its effectiveness in this field.AI presents great opportunities for adaptive and inclusive learning. Still, there are various technical, ethical, and practical considerations to address for its effective implementation in this domain. Previous studies have repeatedly shown that in addition to the availability of advanced technologies, teachers' readiness, institutional support, technological infrastructure and responsible practices contribute to the effectiveness of AI use (e.g., Chiu et al., 2023; OECD, 2021). This support can pose many challenges to schools if they are not established.

One of the most commonly cited challenges for implementing AI in education is teacher readiness. Insufficient professional training and limited experience in teaching with AI technologies and applications, as well as platforms of adaptive learning processes and learning analytics for making decisions in teaching and learning (Kohnke et al., 2023), constitute a further main challenge for many teachers. Similarly, if not supported by continuous professional development and institutional support, teachers may feel less confident about and competent in using AI tools and tools in general in their teaching (Ng et al., 2021; Tondeur et al., 2021). Some of these paradoxes can hinder the successful application of AI to support adaptive curriculum and inclusive education.

However, there are also technical and infrastructural constraints that prevent the widespread use of AI in schools. Inaccessible and unreliable internet connections, digital devices and technological facilities persist in forming a digital divide between schools and students (van Dijk, 2020). Limiting technological resources and institutional investments has also been highlighted as diminishing schools' ability to effectively use AI in teaching and learning (Bozkurt et al., 2021; Selwyn, 2022). These discrepancies can hinder many students, especially those at under-resourced educational institutions, from accessing AI-powered learning opportunities equally.

Beyond their technical challenges, ethical concerns also play a pivotal role in the application of AI within educational settings. Large datasets are gathered for students by AI-based learning systems, which can present challenges with respect to privacy, confidentiality, transparency and responsible data governance (Williamson & Kizilcec, 2022; UNESCO, 2021). Additionally, AI hopes to create fair educational outcomes only when the AI algorithms are built with unbiased and representative data sets (Baker & Hawn, 2021; Holmes et al., 2022). Teachers may also experience loss of professional autonomy and be negatively impacted in inclusive educational practices due to issues of fairness, accountability and dependence on AI technologies (Floridi et al., 2021; Castañeda & Selwyn, 2023).

H2: *Technical, ethical, and practical challenges have a significant negative effect on the successful implementation of Artificial Intelligence tools in inclusive education.*

AI-Enabled Curriculum Implementation and Adaptive Curriculum

Adaptive curriculum focuses on being flexible both in the delivery of the curriculum, instruction, assessment and learning activities to allow for students with a wide variety of learning needs, abilities and educational backgrounds (Marienko et al., 2020; Johnson, 2020). The traditional curriculum models have adopted a uniform approach for teaching, whereas in an adaptive curriculum, the instructional approach is customized on the basis of the individual characteristics of the learners and classroom context (Arumugam, 2024). This has become even more prominent due to its focus on learner-centeredness, which leads to equal participation, better accessibility and improved learning outcomes for pupils with varied academic and social backgrounds (Bessarab, 2025).

The advent of Artificial Intelligence (AI) in recent years has further reinforced the ability to implement an adaptive curriculum by introducing intelligent technologies that enable personalized teaching and data-driven strategies. Chiu et al. (2023) suggested that AI allows teachers to utilize adaptive curricula: it can provide personalized instructional plans, track students' progress, and suggest modifications to ensure that any student gets a learning experience tailored to their needs. Likewise, AI tools like adaptive learning platforms and intelligent tutoring platforms gather data and suggest modifications to the learning path as students perform, allowing educators to better cater to the diversity in classrooms (Holmes et al., 2022; Kerr, 2020). These technologies enable the flexibility in curriculum implementation that enables teachers to adjust content and instructional activities and assessment methods to children's learning speed and educational needs.

There are also some clear benefits indicated in the literature to using an AI-supported curriculum implementation approach compared to a more traditional approach to curriculum implementation where students' differences are not sufficiently accounted for by standardized curriculum instruction (Darling-Hammond et al., 2020; Zhao & Watterston, 2021). AI can support educators to make informed pedagogical decisions by analyzing learning analytics and real-time educational data, which can be used to identify challenges in learning and to adapt the curriculum (Kushawagi et al., 2023; Tlili et al., 2023).

H3: *AI-enabled curriculum implementation is significantly more effective than traditional curriculum adaptation approaches in meeting the individual learning needs of diverse students.*

AI-Generated Insights and Adaptive Curriculum Implementation

As AI has become more prevalent in the education landscape, educators have the opportunity to make data-informed decisions about students' learning without just looking at their in-class behaviour. AI-driven tools like learning analytics, automated assessment tools/predictive analysis tools, and intelligent feedback systems provide valuable insights into students' learning progress, strengths, weaknesses, and participation or engagement levels (Ifenthaler & Schumacher, 2021). The information conveyed here enables the teachers to understand their students' individual learning needs better and make adjustments in the curriculum's implementation and instructional approach as needed at the appropriate time.

According to recent research, AI-supported assessment and feedback mechanisms have the potential to enhance teaching efficacy by delivering real-time and individualized feedback and alleviating teachers' administrative burdens (Zhai et al., 2021). Teachers will be able to dedicate much less time to background assessment measures and instead dedicate time to planning for differentiated instruction and to providing extra academic support for their students. Wollny et al. (2021) also proposed that adaptive systems for feedback through the usage of AI technologies would support earlier identification of learning gaps and would allow teachers to make tailored decisions on instructional interventions. This data-directed instructional support can help to enhance classroom participation, student engagement and effectiveness.

The literature also highlights that AI-generated insights are supplementary and complement teachers' professional judgment. While technology like AI can make educational recommendations and track student performance, teachers still need to make pedagogical choices, interpreting the insights in light of classroom dynamics (Pedro et al., 2019). Likewise, Trust et al. (2023) argued that AI applications in education enhance educators' ability to use adaptive curricula by supporting them in various aspects (such as lesson planning, differentiated instruction, classroom management, and ongoing surveillance of student learning). Yet pedagogical, techno-pedagogical, and pedagogical competence with the AI-generated insights are important in the effectiveness of these insights (Kong et al., 2021; Holmes et al., 2022).

H4: *AI-generated insights have a significant positive effect on teachers' ability to implement adaptive curricula and improve overall teaching outcomes.*

Methodology

The research methodology used in this study was quantitative and the research design was cross-sectional. The study focused on the impact of AI learning tools, implementation of AI in curriculum, AI-generated teaching insights, and challenges in implementation on inclusive education and teaching outcomes from the perspective of teachers and administrators. The study was carried out in the district of South Karachi of Pakistan. The target population was teachers and school administrators in public and private schools. The total number of respondents to the study was 300. Teachers and school administrators from the two sectors were included in the sample, so as to represent a range of educational environments. The data were gathered with a structured questionnaire comprising 39 items (on a 5-point Likert scale – from Strongly Disagree – 1 to Agree Strongly – 5). The questionnaire quantified the major constructs examined in the study, such as the AI learning tools, inclusive Education, Technical, ethical and practical implementation challenges, successful implementation of AI, AI-generated teaching insights and overall teaching outcomes. Data were analyzed using IBM SPSS Statistics. Demographic characteristics and the study variables were summarized using descriptive statistics such as frequencies and percentages, means and standard deviations. Simple linear regression analysis was used in assessing all the hypothesized relationships between the AI-driven learning tools and inclusive education, AI-generated teaching insights and overall teaching outcomes, and implementation barriers and successful implementation of AI. To compare perceptions of effectiveness of implementing the curriculum using AI with those implementing the curriculum using traditional curriculum adaptation methods, an independent samples t-test was performed. In addition, construct validity of the measurement tools was examined by Exploratory Factor Analysis (EFA) based on the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity, and the internal consistency reliability was assessed by Cronbach's alpha coefficient. A pilot study was done prior to the survey to guarantee that the questionnaire was clear and reliable, and that the instrument had high internal consistency with a Cronbach's alpha score of 0.912 for the whole instrument.

Table 1 *Reliability of the Variables*

Variables	**Items**	**Alpha**
Use of AI-driven learning tools	5	.874
Inclusivity score	4	.835
Technical Challenges	3	.994
Practical Barriers	3	.959
Ethical Concerns	3	.966
Successful Implementation of AI Tools in Inclusive Education	5	.993
Effectiveness in Meeting Individual Learning Needs of Diverse Students	5	.910
Use of AI tools/insights	4	.869
Overall Teaching Outcomes	7	.849
Overall	39	.912

Data Analysis and Findings of Study

Demographic Information of Respondents

A total of 300 participants were involved in this quantitative part. The distribution of these respondents is given in the following tables and shown in the corresponding figures.

Table 2 *Gender Distribution of Participants*

Gender	**Frequency**	**Percentage**
Male	50	33.3%
Female	100	66.7%
Total	**150**	**100%**

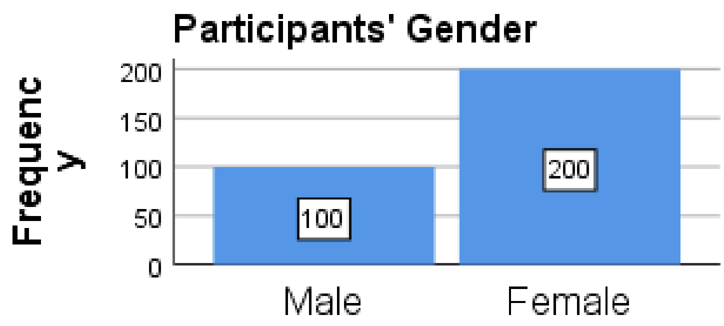

Figure 1

The above table presents the percentage and frequency of respondents' gender with a bar figure. The above table and figure show total number of respondents was n = 300. The total male respondents were one hundred (100), with 33.3% of the overall sample and two hundred (200) respondents were female, with 66.7% of the overall sample. Therefore, more than 50% of respondents were female in the current study.

Table 3 *Age Distribution of Participants*

Age	Frequency	Percentage
Below 25 Years	34	23%
25-34 Years	23	15%
35-44 Years	32	21%
45-54 Years	37	25%
55+ Years	24	16%
Total	**150**	**100%**

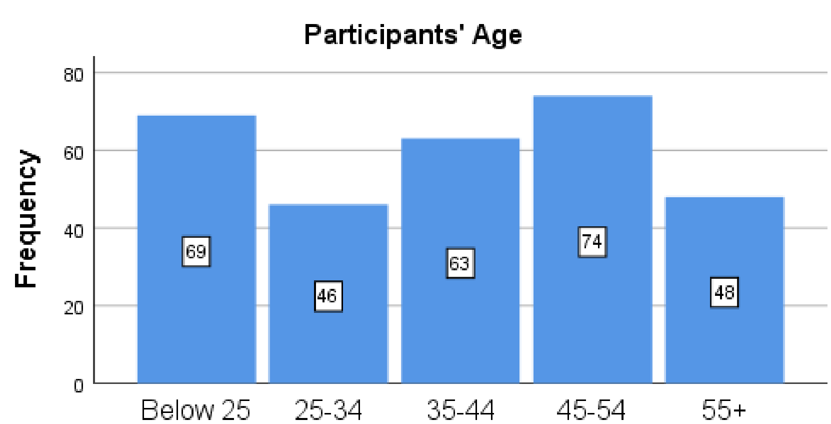

Figure 2

The above table presents the percentage and frequency of respondents' age with a bar graph. The above table and figure show total number of respondents was n = 300. Therefore it shows that sixty nine (69) respondents were below 25 year with 23% of overall sample, forty six (46) respondents fall into the 25-34 age group with 15% of overall sample, sixty three (63) respondents were between the 35-44 age range with 21% of overall sample, seventy four (74) respondents were between 45-55 years of age group with 25% of overall sample and forty eight (48) respondents were 55 or above years with 16% of overall sample. Therefore, the majority of the respondents fall into the 45-54 years age group.

Table 4 *Occupation of Participants*

Occupation	Frequency	Percentage
Teachers	125	83.3%
School Administrators	25	16.7%
Total	150	100%

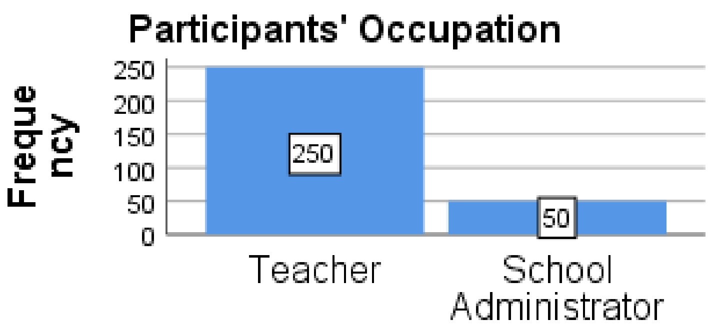

Figure 3

The above table presents the percentage and frequency of respondents' occupation with bar figures. The above table and figure show total number of respondents was n = 300. Therefore, it shows that two hundred fifty (250) respondents were teachers with 83.3% of the overall sample and fifty (50) respondents were school administrators with 16.7% of the overall sample. Therefore, the majority of the respondents were teachers in this study.

Table 5 *Experience of Participants*

Experience	Frequency	Percentage
Less than 1 year	36	24%
1-5 years	42	28%
6-10 years	40	27%
More than 10 years	32	21%
Total	150	100%

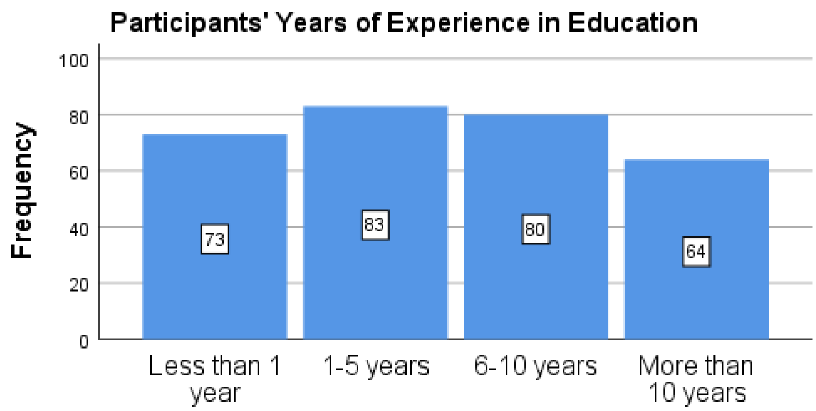

Figure 4

The above table presents the percentage and frequency of respondents' years of experience with bar figures. The above table and figure show total number of respondents was n = 300. Therefore, it shows that seventy three (73) respondents had less than 1 year experience with 24% of overall sample, eighty three (83) respondents had between 1-5 years of educational experience with 28% of overall sample, eighty (80) respondents had between 6-10 years of experience with 27% of overall sample and sixty four (64) respondents had more than 10 years of experience in education with 21% of overall sample.

Table 6 *Curriculum Type Distribution*

Curriculum Type	**Frequency**	**Percentage**
Traditional	69	46%
AI-Based	81	54%
Total	150	100%

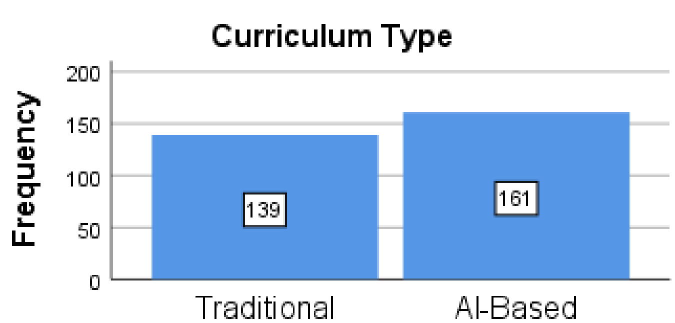

Figure 5

The above table presents the percentage and frequency of respondents based on the type of curriculum they were taught with a bar figure. The above table and figure show total number of respondents was n = 300. The respondents who were taught with the traditional method were one hundred thirty-nine (139), with 46% of the overall sample and one hundred sixty-one (161) respondents were taught with AI-based curriculum methods, with 54% of the overall sample. Therefore, more than 50% of respondents were taught with AI-based curriculum methods.

Table 7 *School Type Distribution*

Curriculum Type	Frequency	Percentage
Public School	75	50%
Private School	75	50%
Total	150	100%

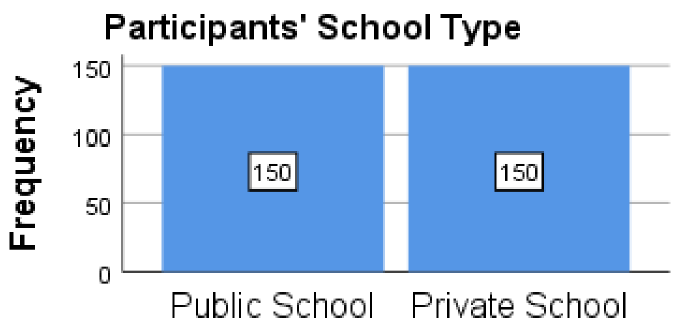

Figure 6

The above table presents the percentage and frequency of respondents based on the type of school with a bar figure. The above table and figure show the total number of respondents, that were n = 300. The respondents from public schools were one hundred fifty (150), with 50% of the overall sample and one hundred fifty (150) respondents were from private school with 50% of the overall sample. Therefore, the sample was equally distributed between both sectors, such as public and private schools.

5 Exploratory Factor Analysis (EFA) for Construct Validity

Table 8 Kaiser–Meyer–Olkin Measure and Bartlett's Test of Sphericity

Measure	Value
Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy	.835
Bartlett's Test of Sphericity (χ^2)	17280.540
Degrees of Freedom (df)	666
Significance (p)	< .001

The Kaiser -Meyer-Olkin (KMO) measure of sampling adequacy of the dataset is 0.835, which is above the minimum of 0.60. Based on the classification done by Kaiser (1974), a KMO value of more than 0.80 is said to be meritorious, which shows that the size of the sample is sufficient and that there are enough tight and clear correlations between variables to be able to derive satisfactory and discrete down-to-earth factors. This affirms that the data can be analyzed using factor analysis. His Test of Sphericity is also statistically significant (χ^2 = 17,280.540, df = 666, p < .001) and shows that there is a significant deviation of the correlation matrix when compared to an identity matrix. This finding proves that there is some meaningful relationship between the variables and that the data is what is best suited to be analyzed by exploratory factor analysis (EFA). The combination of KMO and Test results offered by Bartlett shows that the data used in the research satisfy the conditions to extract the required factors and thus offers good empirical support to the fact that exploratory factor analysis may be used in this case.

Table 9 Total Variance Explained by Extracted Factors

Factor	**Eigenvalue**	**% of Variance**	**Cumulative %**
1	10.824	29.254	29.254
2	8.394	22.687	51.940
3	4.688	12.670	64.610
4	2.588	6.995	71.605
5	1.426	3.854	75.458
6	1.013	2.737	78.195

Table 9 shows that the six factors were obtained under the eigenvalue greater than one rule. Taken as a block, these six factors explain away 78.20 percent of the overall variance, hence representing a strong and significant factor structure. In a social-science study, a cumulative variance of 60 percent and above is generally considered satisfactory; hence, the resulting factors of how the data are extracted have a significant share of explanatory power. The former explains 29.25 percent of the total variance and the latter explains 22.69 and the total percent that the first two factors explain is 51.94. The other four factors individually add smaller but significant amounts to the variance, meaning that the constructs of the instrument are multidimensional as opposed to being influenced by one underlying factor. In line with the single-factor test developed by Harman, the first unrotated factor variance was tested to determine the existence of a common-method bias. Since the first factor is a cause, which is already 29.25% of the total variance, which is certainly less than 50%, which is widely recognized as a significant factor, the results of this study show that no single factor is dominating the structure of the variance of the data. It implies that common-method bias is not likely to become a big issue in this study. In addition, the fact that several factors with eigenvalues larger than one are extracted is another indication that the relationships found between the variables are not data-collection method artifacts, but they are the relationships between different underlying constructs.

Hypothesis Testing

H1: AI-driven learning tools have a significant positive effect on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students.

Table 10 *Simple Linear Regression Analysis*

Variable	B	β	SE	t	p
Use of AI-driven learning tools	.527	.614	.041	12.854	.000***
R^2	.377				

Note: n = 150, ***p < .001, Dependent variable: Inclusivity Score.

The above table shows that AI-driven customized learning tools significantly improve inclusivity by providing personalized learning pathways that accommodate diverse student needs, thus reducing learning barriers for students with disabilities, learning differences, and language barriers. The R^2 value of .377 showed that predict variable explained 38% of the changes in the outcome variable with F (1, 148) = 89.38, p < .001. The findings revealed that AI-driven customized learning tools significantly improve inclusivity by providing personalized learning pathways that accommodate diverse student needs, thus reducing learning barriers for students with disabilities, learning differences, and language barriers. Hence, the result of this study was accepted: AI-driven customized learning tools significantly improve inclusivity by providing personalized learning pathways that accommodate diverse student needs, thus reducing learning barriers for students with disabilities, learning differences, and language barriers.

The findings on the hypothesis have shown that AI-driven learning tools have a significant positive effect on promoting inclusive education by addressing diverse learning needs and reducing learning barriers among students. It hints that increased application of AI-based personalization is linked with better consideration of student diversity, such as disabled individuals, with learning deviations, language barriers, etc. Even though the analysis was more of a correlational study despite the lack of causality, the results suggest empirical support for Hypothesis 1. The findings will directly answer Objective 1 of the research to assess the level of inclusiveness of AI-based customized learning tools that cater to diverse student requirements and learning obstacles.

H2: Technical, ethical, and practical challenges have a significant negative effect on the successful implementation of Artificial Intelligence tools in inclusive education.

Technical Challenges Impact

Table 11 *Simple Linear Regression Analysis*

Variable	B	β	SE	t	p
Technical Challenges	-0.428	-0.512	0.047	-9.106	<.001***
R^2	.262				

Note: n = 150, ***p < .001, Dependent variable: Successful Implementation of AI Tools in Inclusive Education

The above table shows the impact of technical challenges on successful implementation of AI tools in inclusive education. The R^2 value of .262 showed that predict variable explained 26% changes in the outcome variable with F (1, 148) = 82.92, p < .001, β = -.428. The findings revealed that technical challenges negatively impact the successful implementation of AI tools in inclusive education.

Practical Barriers

Table 12 *Simple Linear Regression Analysis*

Variable	B	B	SE	T	P
Practical Barriers	-.391	-.463	.045	-8.689	.000***
R^2	.214				

Note: n = 150, ***p < .001, Dependent variable: Successful Implementation of AI Tools in Inclusive Education

The above table shows the impact of practical barriers on successful implementation of AI tools in inclusive education. The R^2 value of .214 showed that predict variable explained 21.4% changes in the outcome variable, with F (1, 148) = 75.50, p < .001, β = -.391. The findings revealed that practical barriers negatively impact the successful implementation of AI tools in inclusive education.

Ethical Concerns

Table 13 *Simple Linear Regression Analysis*

Variable	B	B	SE	T	P
Ethical Concerns	-.347	-.421	.043	-8.070	.000***
R^2	.177				

Note: n = 150, ***p < .001, Dependent variable: Successful Implementation of AI Tools in Inclusive Education

The above table shows the impact of ethical concerns on successful implementation of AI tools in inclusive education. The R^2 value of .177 showed that predict variable explained 17.7% changes in the outcome variable, with F (1, 148) = 65.23, p < .001, β = -.347. The findings revealed that ethical concerns negatively impact the successful implementation of AI tools in inclusive education.

H3: AI-enabled curriculum implementation is significantly more effective than traditional curriculum adaptation approaches in meeting the individual learning needs of diverse students.

Independent t-test

Table 14 *T-Test Comparison among Two Groups*

Variables	Traditional Curriculum		AI-Based Curriculum		T	P
	M	SD	M	SD		
Effectiveness in Meeting Individual Learning Needs of Diverse Students	3.46	1.041	4.12	0.864	3.847	0.000***

Note. *N*= 150, *M*= mean, *SD*= standard deviation *p<.05, **p<.01, ***p<.001

The independent samples t -test was used to determine the existence of a statistically significant difference between the traditional framework of curriculum adaptation and AI -based curriculum solutions in terms of effectiveness in addressing the individual needs of various students. The findings, as shown in the above table, reveal that teachers expressed greater efficacy with AI-based curriculum models (M =4.12, SD=0.864) than traditional curriculum models (M=3.46, SD=1.041). The average difference indicates that AI-based solutions can be viewed as significantly more effective in addressing all the individual learning requirements with the dynamic adaptation of the content and pace. According to the t-test outcomes, this difference is found to be statistically significant, t= 3.847, p = 0.000. The p-value is very low, which suggests that the differences between the two groups are not likely to have occurred by chance. Therefore, the findings verify that AI-based curriculum interventions are very effective in addressing the unique learning needs of diverse students as opposed to the use of traditional curriculum adaptation frameworks. The findings are empirical evidence to support Hypothesis 3, and they directly correspond to Objective 3, which determines the shortcomings of existing curriculum adaptation frameworks and the impact of AI tools on eliminating the shortcomings.

H4: AI-generated insights have a significant positive effect on teachers' ability to implement adaptive curricula and improve overall teaching outcomes.

Table 15 *Simple Linear Regression Analysis*

Variable	B	Β	SE	T	P
Use of AI tools/insights	.472	.538	.049	9.633	.000***
R^2	.513				

Note n = 300, ***p < .001, Dependent variable: Overall Teaching Outcomes

The above table shows the effect of the use of AI tools/insights on overall teaching outcomes. The R^2 value of .513 showed that predict variable explained 51% of the changes in the outcome variable, with F (1, 148) = 92.79, p < .001, β = .472. The findings revealed that use of AI tools/insights positively affects overall teaching outcomes. Hence, the findings supported the hypothesis of this study, which was accepted, that AI tools enhance teachers' ability to design and implement adaptive curricula by providing actionable insights based on student data, allowing teachers to tailor instruction more effectively to the specific needs and contexts of their classrooms, thereby improving overall teaching outcomes.

Discussion of Findings

The results related to Hypothesis 1 point to the fact that the Artificial Intelligence-enabled individualized learning tools are influential in terms of making the process of inclusivity more effective, as they contribute to the individualized learning processes among the students of a heterogeneous generation. According to the quantitative findings, the correlation between the utilization of the Artificial Intelligence-based learning tools and the inclusiveness scores is positive and statistically significant, which indicates that technology-generated personalization can play a significant role in alleviating learning barriers that are caused by differences in ability, learning rate and engagement. What this observation shows is that systems developed by Artificial Intelligence can underpin a shift in the homogenous approach to instructional delivery to a more learner-oriented and flexible educational process. These results are consistent with the existing literature that argues that differentiated instruction can be accomplished through adaptive learning environments that are supported by Artificial Intelligence by dynamically modifying content-pacing-feedback based on the performance of an individual learner (Farhood et al., 2025; Shireesha and Jeevan, 2024). Theoretically, this is in line with the inclusive education and Universal Design for Learning (UDL) models that focus on the multiple means of engagement, representation, as well as expression of learners to meet the diversity of learners. The application of Artificial Intelligence towards personalization realizes these values, as it helps learners to access content in a way that enhances their unique learning requirements and does not force every learner to follow the same model of delivery.

The results related to Hypothesis 2 show that although the use of Artificial Intelligence technologies has the potential to make education inclusive, the adoption of Artificial Intelligence in the educational context faces significant technical, ethical, and practical issues that may hinder effective use. Even though the quantitative analysis has reported the presence of these issues, it has shown that their effects are not felt universally, meaning that an absolute barrier does not exist. This partial verification underscores the interaction of the issue of technological potential and constraints of reality. In line with more general studies on the use of educational technology, the technical and infrastructural aspects of barriers highlighted in the present study are the manifestations of an old-time debate over unequal access to digital resources, unreliable connectivity, and inadequate compatibility with the existing education systems (Sutton & Habib, 2024). These authors claim that even high-technology Artificial Intelligence tools cannot easily provide the desired benefits without long-term assistance in terms of infrastructure and system integration, especially in school environments that have a limited amount of resources. Likewise, the privacy of data, algorithmic bias, and inability to establish clear rules regarding the use of Artificial Intelligence have also been identified as factors reluctant to adopt Artificial Intelligence into educational settings (Williams & De Silva, 2023). These are not only technical difficulties, but they also pose some rather basic questions of trust, accountability, and fair access.

The Hypothesis 3 results indicate that traditional curriculum adaptation models that are strong and have generalized strategies are not very productive in addressing the unique learning requirements of diverse students as compared to the adaptive solutions using AI. Numerical data prove that mechanisms based on AI-assisted curricula are considered more responsive and influential in resolving the variability of learners in comparison with traditional methods of adapting to the curriculum. This indicates that conventional one-size-fits-all curriculum models find it difficult to offer any meaningful differentiation, especially in situations where there is a high level of variation in the needs of students. The findings can be supported with the use of the available literature on the topic of curriculum construction and technology integration, which shows that adaptive AI systems can provide a certain degree of flexibility and responsiveness that standard curricular structures do not (Alwatban et al., 2024). Individual learner performance can be studied and specific recommendations given by adaptive learning platforms. Rigid models of the curriculum cannot achieve this feature without the intensive mediation of a teacher. Hypothetically, this is in line with the constructivist thinking on designing the curriculum, where learner agency and flexibility dominate over prescriptive teaching. Through differentiated scaffolding supported by data-driven, personally informed curriculum frameworks, which promote more equitable learning settings, improve differentiation in order to support the diverse needs of students, according to Voogt et al. (2024), this would help support more equitable learning settings.

The results of Hypothesis 4 indicate that AI tools help teachers to create and apply adaptive curricula, which can be better achieved, as tools offer useful information based on the data about students and thus can positively affect the overall teaching results. The quantitative findings show there is a positive relationship between the application of AI-generated insights and teaching performance, as the instructional decisions that are based on data reinforce the ability of teachers to address the varied needs of learners. Instead of substituting the knowledge of teaching, AI seems to act as an enabler mechanism, which does not substitute teachers in their professional practice. The given interpretation is validated by previous studies, where the importance of learning analytics and AI-based systems of feedback in improving instructional design and pedagogical responsiveness is highlighted. According to Zawacki-Richter et al. (2019), AI applications in the learning sector can be best used in assisting teachers in making their decisions by processing intricate student data into meaningful information. Pedagogically, these tools meet the recommendation of evidence-based teaching frameworks based on formative assessment and ongoing adjustment of instruction as the main elements of positive learning outcomes. On the same note, Roll and Wylie (2016) illustrate that information-based instructional support systems have the potential to assist educators in recognizing gaps in learning more precisely and acting more effectively, and classroom outcomes can be enhanced.

Conclusion

The current study aimed at analyzing the implementation of artificial intelligence, i.e. adaptive, inclusive curriculum, among the school administrators and teachers of District South Karachi. Overall, the results show that AI-powered learning tools play a crucial role in fostering inclusive education by providing personalized learning paths, meeting varied learning needs, and minimizing learning obstacles for those with a learning profile. The analysis showed that implementing AI had a better effect than the other curriculum adaptation strategies in addressing individual learning needs through adaptive and flexible instruction methods. Furthermore, AI-powered learnings were seen to facilitate teachers in implementing adaptive curricula, to augment teaching outcomes and decision-making regarding the regimen. There are various technical, ethical, and practical obstacles to the effective application of AI in inclusive education, such as technical and infrastructural constraints, limitations in compatible data sources, and a lack of teacher preparedness. Overall, the study findings indicate that better integration of AI in curriculum implementation needs proper institutional support, teacher training, ethics and technology readiness. These challenges can be met with the application of capacities related to AI and knowledge that can lead to more adaptive, inclusive, and learner-centered curriculum practices in educational institutions.

Future Research Recommendations

Future research can investigate how AI can be applied in the curriculum at other educational levels and regions to confirm the generalizability of the outcomes further. The long-term impact of implementing AI on learning outcomes and pedagogical practices of students can be explored in future studies, using longitudinal designs. Factors not included in the present study, such as digital competency, institutional readiness and policy support, could also be explored in future research to demonstrate the influence of these in successful inclusive education and using AI.

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