

Comprehensive AI-Based Instructional Strategies for Students with Learning Difficulties: Evidence, Practices, and Innovation in Education

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Abstract

This paper has discussed how artificial intelligence (AI) based teaching mechanisms can be used to help students with learning disabilities in classrooms. The research in question sought to investigate the perceptions of teachers on the efficacy of artificial intelligence in supporting personalized learning, adaptive support, inclusive practices, and innovation in learning. The quantitative research method was used, and a descriptive survey design was utilized. The self-developed questionnaire comprised 40 items and was used to collect data of 350 teachers. The results showed that AI-based teaching methods were perceived positively as effectively to enhance lesson plans, differentiation instructions, student learning, and learning challenges. The findings also indicated that individualized learning and supportive provision were good predictors of enhanced learning opportunities among such students. Overall, the researchers found that AI-based teaching methods had the potential to become effective tools in improving inclusive teaching processes under the conditions of appropriate training, infrastructure, and institutional assistance. The research suggested training, policy support, and enhanced digital resources to implement effective implementation.

Keywords: Artificial Intelligence, Instructional Strategies, Learning Difficulties, Inclusive Education, Personalized Learning, Adaptive Support, Educational Innovation

Introduction

Artificial intelligence (AI) is changing education drastically and new features it offers such as personalized learning, adaptive assessment, automated feedback, and data, informed instruction. Most importantly, for students with learning difficulties, AI instructional methods are a source of great help as they provide differentiated instruction, flexible pacing, multimodal content presentation, individualized intervention, etc. AI based tools like intelligent tutoring systems,

adaptive learning platforms, speech, recognition systems, and assistive technologies are being used more to facilitate access, motivation, and participation of learners with different needs. Yet, to work effectively, these tools require not only technology but also pedagogy, teacher readiness, infrastructure, and ethical implementation (Hussein et al., 2025; Melo, Lpez et al., 2025; UNESCO, 2023).

The title, *Comprehensive AI, Based Instructional Strategies for Students with Learning Difficulties: Evidence, Practices, and Innovation in Education* emphasizes an issue that must be thoroughly tackled: how to merge educational technology and inclusive pedagogy. The term comprehensive instructional strategies mean, among other things, that AI in education is not to be seen as a single digital tool, but AI should be integrated with instruction components like assessment scaffolding relapses, engagement and feedback. The expression students with learning difficulties means those learners who find it hard to read write pay attention, remember, process language, handle numeracy, or do academic work in other ways due to persistent barriers and therefore need specialized help. The terms evidence, practices, and innovation signify that educational choices ought to be based on up-to-date research, classroom situations, and development of technology (Hussein et al., 2025; Voultsiou & Moussiades, 2025).

The necessity for inclusive and equitable education should remain a high priority everywhere. UNICEF disclosed that almost 240 million kids around the globe have disabilities, and these kids are more vulnerable to being left out from school as well as deprived of learning opportunities and supportive services. UNESCOs 2023 GEM Report also highlights that technology can only enhance access, equity, and inclusion if it is supported by a clear educational objective, good governance, and teacher capacity, building. This is crucial for learners with disabilities as having access to technology is not enough to ensure effective learning. In fact, AI participation in inclusive instructional practice must be well planned (UNICEF, 2021; UNESCO, 2023).

New studies carried out during 2025 and 2026 support this opinion. Hussein et al. demonstrated that the use of AI in special education can help academic achievement communication regulation of behavior, emotional development, and independence by personalized interventions. Voultsiou and Moussiades found that AI, virtual reality, and large language model applications have great potential for enhancing personalized learning, cognitive development, and social interaction among students with special educational needs and disabilities. Melo, Lpez et al. also indicated that AI helps in accessibility and personalized support in inclusive education however they pointed out that there are problems related to equity, implementation, and ethics. Overall, these studies indicate that AI can be a tool for better educational results for students with learning difficulties when used along with proven teaching methods (Hussein et al., 2025; Melo, Lpez et al., 2025; Voultsiou & Moussiades, 2025).

The background of this work is in the growing convergence of inclusive education, differentiated instruction, and artificial intelligence. Traditional classroom methods largely rely on one, size, fits, all teaching methods, content delivery, and assessment systems, which may not effectively cater to the needs of students who have learning difficulties. However, AI, based teaching methods can support adaptive sequencing, personalized feedback, learner profiling, assistive communication, and progress monitoring. These characteristics of AI make it particularly suitable for students who require flexible and responsive teaching environments (Hussein et al., 2025; Melo, Lpez et al., 2025).

At the level of policies and systems, educational technology is increasingly seen as a tool for broadening inclusion. Yet UNESCO warns that the real test of technology is whether it really raises learning outcomes and equity. This is extremely important for students with learning difficulties as poorly implemented or planned AI can worsen the inequalities that exist instead of lessening them. Hence, the background of this research goes beyond technology; it has pedagogical, ethical,

and policy related aspects as well. The main concern is how AI can be effectively utilized to enhance teaching practices and aid those learners who are most likely to be left out by traditional modes of instruction (UNESCO, 2023)

The global level of AI use in inclusive and special education remotely has been on track for rapid tenure since 2020. A fresh systematic review demonstrates that intelligent tutoring systems, adaptive platforms robotics speech technologies, virtual reality, and generative AI are garnering interest across the world for the support of students with disabilities and other especial educational needs. These studies reveal that such benefits as personalized learning, enhanced content accessibility, engagement of learners at a higher level, and targeted interventions have resulted from the use of these technologies. However, international literature continues to highlight a range of barriers, including inadequate teacher training, lack of equal digital access, data privacy issues, bias in algorithms, and scarcity of evidence from low, resource settings (Hussein et al., 2025; Melo, Lpez et al., 2025; Voultziou & Moussiades, 2025).

Besides, the international landscape shows that quite a lot of pioneering research still comes from relatively well-resourced educational systems. Hussein et al. highlights that the geography of the evidence base remains narrow while Voultziou and Moussiades argue that the field needs more context, sensitive research related to implementation in real classrooms. By implication, this means that although international literature is mounting, now, it still does not cover the realities of low, and middle, income countries where infrastructure, policy support, and specialist services are limited. Therefore, there is an evidently pressing demand for more localized and contextually grounded studies (Hussein et al., 2025; Voultziou & Moussiades, 2025).

It is the educational environment that makes this issue very relevant in Pakistan. According to a 2025 report by UNESCO, about 26.2 million children in Pakistan are not attending school which shows that there are very serious problems in access, equity, and educational planning. The same policy discussions around the SDG, 4 Mid, Term Review, stressed the requirement for strong coordination, upgraded data systems, and more efficient policy enforcement to speed up educational progress. These structural limitations have a direct impact on inclusive education and lower the chances of students learning difficulties getting timely support, specialized services, or technology, enabled interventions (UNESCO, 2025).

Besides this, local data indicate that differences in learning are still not getting the recognition they deserve in Pakistan. The Schools 2030 Pakistan report says that in many cases, the term inclusive education is being equated to only disability that is visible whereas learning difficulties like dyslexia, ADHD, and other processing, related disorders are still lacking organized attention. The report also points out a lack of diagnostic systems, low level of awareness, inadequate teacher training, and weak enforcement of policies for inclusiveness. These factors imply that in Pakistan, the deployment of innovation in AI, based teaching methods must be linked with teacher training, teacher's adaptation to the environment, and the actual implementation in the classrooms rather than being simply brought in as standard digital solutions (Alahmari et al., 2025).

Recent Pakistani studies show a growing interest in AI, supported inclusion. Aftab et al. discovered that the teachers believed artificial intelligence (AI), powered speech, recognition systems could support hearing, impaired students in inclusive education environments in Pakistan, and they saw these systems as a good thing. Similarly, Faiz and Fazil indicated that special education teachers regarded AI, based mobile applications as a means for the children with intellectual disabilities to better their attention motivation autonomy, and learning. These two sets of findings point to AI's rising place on the Pakistani scene, but the national data on the matter are still few and far between, and they deal with one disability category after another rather than providing a comprehensive focus on learners with learning difficulties (Aftab et al., 2024; Faiz & Fazil, 2024).

At the same time, disability and schooling studies in Pakistan also highlight that the educational disadvantage of children with disabilities remains a widespread problem. Upadhayay and Kakar revealed that children with disabilities in Pakistan not only have limited opportunities to attend school but also obtain lower learning outcomes even after they are enrolled. This points to the fact that simply allowing entry into school is not the only thing needed for inclusion; there must be classroom practices which enhance participation and achievement as well. From this perspective, AI instruction strategies might be able to give the right kind of help; however, regarding their efficiency in Pakistan the evidence is woefully lacking, especially in relation to mainstream classrooms where students with learning difficulties are served (Upadhayay & Kakar, 2024).

However, recent studies reveal that although AI has the capability to assist special and inclusive education, there are still major unexplored areas for research. Firstly, most of the existing research is literature based, with very few classrooms, based empirical studies being carried out to examine actual instructional practices. Secondly, most of the studies have been conducted in developed or well, resourced contexts, hence countries like Pakistan have hardly been represented. Thirdly, quite a few studies have been concentrating on the technologies themselves rather than giving a holistic approach to instructional strategies where pedagogy assessment feedback, remediation, and inclusive classroom practice are combined. Fourth, there is scarce research that focuses specifically on how AI can help learners with difficulties in a multilingual, resource, poor, and policy, challenged educational environment (Hussein et al., 2025; Lopez et al., 2025; Voultziou & Moussiades, 2025).

Through the increasing capacities of AI, personalized and inclusive education may be significantly enhanced. Nevertheless, students with learning difficulties still experience significant barriers related to lack of differentiation, untrained teachers, inadequate assistive devices, and poor implementation of inclusive education policies. In Pakistan, these problems are further exacerbated by the existence of structural issues such as a large percentage of children out of school, poorly developed diagnostic systems, varying levels of teacher competence, and inaccessibility of inclusive education resources. Therefore, it is imperative to explore how AI, based instructional strategies can be effectively utilized to enhance teaching practices and students' learning experiences (Schools 2030, 2023; UNESCO, 2025; Upadhayay & Kakar, 2024).

1. To examine the role of AI-based instructional strategies in supporting students with learning difficulties.
2. To identify evidence-based practices and innovations in AI-supported inclusive education.
3. To analyze international trends in the use of AI for students with disabilities and learning difficulties.
4. To explore the local Pakistani context regarding inclusive education, learning difficulties, and AI adoption.
5. To identify gaps, challenges, and opportunities for implementing comprehensive AI-based instructional strategies in education.

This research work is essential since it tackles the point of contact between inclusion, teacher's effectiveness, and technology evolution. It supports the existing literature by combining the latest findings regarding AI, based methods for students with learning difficulties, at the same time focusing pedagogy foremost than technology. Besides, the research stands as a valuable tool for instructors, educational managers, planners, and policy makers who require solid and practical advice on the role of AI in the provision of personalized teaching. In Pakistan, this paper has a double importance as it not only highlights a situation where inclusive education requires more efforts but also indicates that AI, if used rightly and keeping the local conditions in mind, can be a source of large, scale support (Hussein et al., 2025; UNESCO, 2023; UNESCO, 2025).

Literature Review

The literature on AI-based instructional strategies for students with learning difficulties has expanded quickly since 2020, especially as adaptive learning systems, intelligent tutoring systems, assistive applications, analytics, and generative AI tools have become more accessible in schools and higher education. Across this literature, AI is generally framed as a means of improving personalization, responsiveness, and accessibility in teaching, particularly for learners who struggle with reading, writing, numeracy, attention, memory, language processing, or executive functioning. One of the main distinguishing features of recent literature compared to earlier educational technology studies is the enhanced focus on real, time adaptation, learner profiling, automated feedback, and multimodal support. However, recent research continues to stress that AI should not be judged as a single technological solution but rather as a part of an instructional ecology, since educational results are determined by factors such as pedagogy context teacher mediation, and inclusive design (Hussein et al., 2025; Melo, Lpez et al., 2025; Voultsiou & Moussiades, 2025).

A major theme in the recent literature is that AI has moved the field from generic differentiation toward dynamic personalization. In conventional instruction, teachers often differentiate through grouping, pacing, or modified tasks, but this remains difficult to sustain for students with persistent learning difficulties in large and diverse classrooms. Recent reviews show that AI-based systems can adapt content sequence, difficulty level, repetition frequency, and response format in ways that are especially relevant for learners who need repeated exposure, scaffolded progression, and immediate feedback. This capacity is why literature increasingly links AI to special education, inclusive education, and Universal Design for Learning (UDL), especially where learners require multiple means of representation, engagement, and expression (Hussein et al., 2025; Paglialunga & Melogno, 2025; Ram et al., 2026).

The strongest recent evidence comes from systematic reviews, which provide a broad picture of how AI is being used in special and inclusive education. This review stands of special interest as it considers AI not only as a device category but also as a pedagogical mechanism through which instruction can be tailored to learner diversity. Along the same line, Melo, Lpez et al. conducted a systematic review of AI, related research in the context of inclusive education, and their findings show that latter are increasingly linking the use of AI with better accessibility and personalized learning. Their study points out the vast potential of AI in creating personalized learning aids and other accommodations aimed at breaking down barriers for students with disabilities. Additionally, these examples demonstrate how AI might support teachers by lessening their administrative tasks, which could result in more teacher, student interactions and better individualized support. However, the review emphasizes that such advantages are closely tied to the existence of proper infrastructure, ethical governance and well, trained educators. Therefore, the authors believe that AI's usefulness depends largely on educational systems' ability to adapt rather than just on the introduction of new technologies (Melo, Lpez et al., 2025).

oultsiou and Moussiades take this discussion further by analyzing data from 139 papers on AI, virtual reality, and large language models in special education. They find that the sector is evolving from merely offering assistive tools towards providing fully integrated learning experiences using immersive technologies, adaptive systems, and generative tools that are aimed at improving cognition, communication, and social interaction. Although the authors recognize the potential of these technologies to support learning, social engagement, and mental development of students with SEND, they also point to problems of accessibility, lack of resources, and the continuous need for inclusive policy frameworks. The paper stands out for situating AI alongside other emerging technologies and shows that teaching innovations are increasingly multimodal, interactive, and data, driven (Voultsiou & Moussiades, 2025).

Although students with learning disabilities constitute a very important subgroup that deserves research in the special education literature, they are still underlacked examined in this context. Paglialunga and Melogno's systematic review is an especially great contribution because it concentrates on AI, based interventions for students with learning disabilities specifically rather than general populations of people with disabilities. Looking at experimental studies from the period 2022 to 2025, they identified 11 studies with a total of 3, 033 participants. In the studies dyslexia and other specific learning disorders were the most often researched conditions and the intervention types frequently used were personalized/adaptive learning systems and game, based learning. Even though all studies included in the review reported positive results, the authors warn that none of them were graded as low risk of bias meaning the area is promising but not yet methodologically mature. This is a key finding in literature as it indicates that the excitement about AI in learning, disability contexts is more than the strength of the evidence base (Paglialunga & Melogno, 2025).

The issue is that most of the literature on learning difficulties is focused on dyslexia, quite a lot more than dyscalculia, dyslexia or mixed learning difficulties. For instance, Javed and colleagues looked at the interventions available for children with dyslexia and identified that technology, based interventions, particularly apps and games, have been gaining popularity. Their review also indicated that most of the interventions are based on visual and auditory sensory methods, with kinesthetic and tactile modes being quite underused. This is a brilliant point for AI, based teaching method research as it indicates that even when technologies are groundbreaking, they may still reproduce very limited ideas about how students with learning difficulties learn best. The review hence nicely points out the major need for richer, multimodal, and more embodied approaches in future AI work (Javed et al., 2024; Aftab et al., 2024).

Research literature focusing on dyslexia also points to an increasing interest in generative AI and conversational support tools. Alrubaian investigated ChatGPT, 3.5, ChatGPT, 4, and Gemini by testing them with 107 dyslexia, related questions. According to him, GPT, 4 gave the most complete and accurate answers overall while maintaining strong reproducibility across different question categories. Although the study mainly targeted parent and caregiver support and did not emphasize classroom intervention, it is very relevant to education as it reveals that families and non, specialists are already using generative AI as supplementary guidance tools. From an instructional research perspective, this highlights that AI is no longer just a teacher, facing or system, facing tool; it is becoming an element of the wider support ecosystem for students with learning difficulties. Besides, the report highlights the necessity to verify AI outputs before employing them in making educational decisions (Alrubaian, 2025; Bagadood et al., 2025).

More recent research is beginning to investigate ways in which generative AI aligned with UDL could be utilized in higher education for supporting dyslexic learners. Ram et al. hold that generative AI has the potential to assist diverse learners including dyslexic students however they point out that there is still a lack of guidance on the safe and accessible integration of such tools into academic work. Employing a mixed, methods design, they examined student difficulties, current usage of tools, and perceptions toward AI, not positioning AI merely as a time, saving tool but as a support that could assist reading writing planning, and engagement. This paper is important as it moves the field away from the question Can AI help? To the question How should AI be responsible in inclusive instructional design? A more advanced question that is very much in line with current discussions in special and inclusive education (Sajjad et al., 2025; Ram et al., 2026). Another line of research focuses on the nexus between AI, study strategies, and academic performance. Bressane et al. have designed an AI, supported decision framework that integrates artificial neural networks and fuzzy logic for the purpose of determining patterns associating study strategies, learning disabilities, and performance. Their results indicate that AI can assist teachers

in understanding which study strategies lessen the effects of learning disabilities and additionally, AI can be used to make educational recommendations more personalized. Though there are more elements of theory building than actual classroom intervention in this study, the paper is an important contribution to the field as it not only talks about AI as a means of transmitting knowledge but also as a decision, support system that will help educators tailor their teaching strategies to different cognitive profiles. In brief, AI may act not only as a mentor for students but also as a tool for enabling teachers to determine the most effective methods for various cognitive profiles (Bressane et al., 2023).

Across these studies, one of the most consistent benefits from an instructional point of view of AI is instant feedback. Receiving timely correction, getting several practice sessions, and working on a level that is adjusted to one's capability are especially helpful for students with learning difficulties who are afraid of reading and counting because in these areas, the pain caused by a misunderstanding can get bigger very fast. To be more specific, a recent meta, study points out that intelligent tutoring systems, adaptive practice platforms, and game, based AI environments are particularly effective, as they can continuously monitor the performance of the learner and respond to them in real time. From a pedagogical perspective, this matters very much because it corresponds to special education principles that have been at the core for many years, such as scaffolded instruction, mastery learning, and ongoing formative assessment. So, in a way, AI delivers not only personalization but also the acceleration and consistency of instructional response (Hussein et al., 2025; Paglialunga & Melogno, 2025).

Nevertheless, the research also reveals that teacher readiness is a determining factor as to whether AI becomes truly inclusive or not. In their scoping review of teachers perceived support needs for implementing inclusive education, Chow et al. concluded that teachers consistently indicate a lack of support, especially in terms of professional development resources specialist assistance, and practical guidance. In their review, the authors talk about inclusive education in general, not just AI education. However, they are very close to the point because without teachers changing adapting monitoring and using the methods based on AI ethically in real classrooms, AI teaching methods alone will not be very effective. Their message is a clear one: even the best of technologies is unlikely to produce fair results without teachers' support systems being continually present (Chow et al., 2024; Aftab et al., 2024).

Such a situation is worrying, especially in poor and less, poor middle, income countries. Mendoza and Heymann looked at different ways of making education inclusive in these countries and found that although strong policy commitments exist, there is still little exact knowledge about what works. Their work points out that inclusion is about more than just access to education; it calls for concerted efforts to change how students get engaged and learn when they are with teachers in the classroom. In the light of AI, this is a very big caution that the use of technology should be done alongside issues like infrastructure cost language, accessibility and training of local teachers. If we ignore these systemic factors, AI, driven teaching methods may end up doing the contrary of what is expected and make the gap between well, supported learners and under, supported learners even bigger (Mendoza & Heymann, 2024).

The very latest study highlights that AI for education is closely linked to ethical and governance concerns and therefore cannot be considered separately from them. Issues like privacy, algorithmic bias, over, datafication of vulnerable learners, lack of transparency of decisions made by automation, and heavy dependence on systems whose inner workings are not clear to teachers and learners are the most frequently mentioned problems after analyzing the reviews. These issues become more serious when talking about students with learning difficulties as they are frequently labeled, negatively framed, and placed inappropriately in education. Many researchers agree that AI should be a helper of human decision making rather than a replacement, and inclusive AI must

be explainable, fair, and pedagogically justified. As a result, the literature considers ethics not as a constraint imposed from outside but rather as a fundamental element of responsible instruction design (Hussein et al., 2025; Melo, Lpez et al., 2025; Ram et al., 2026).

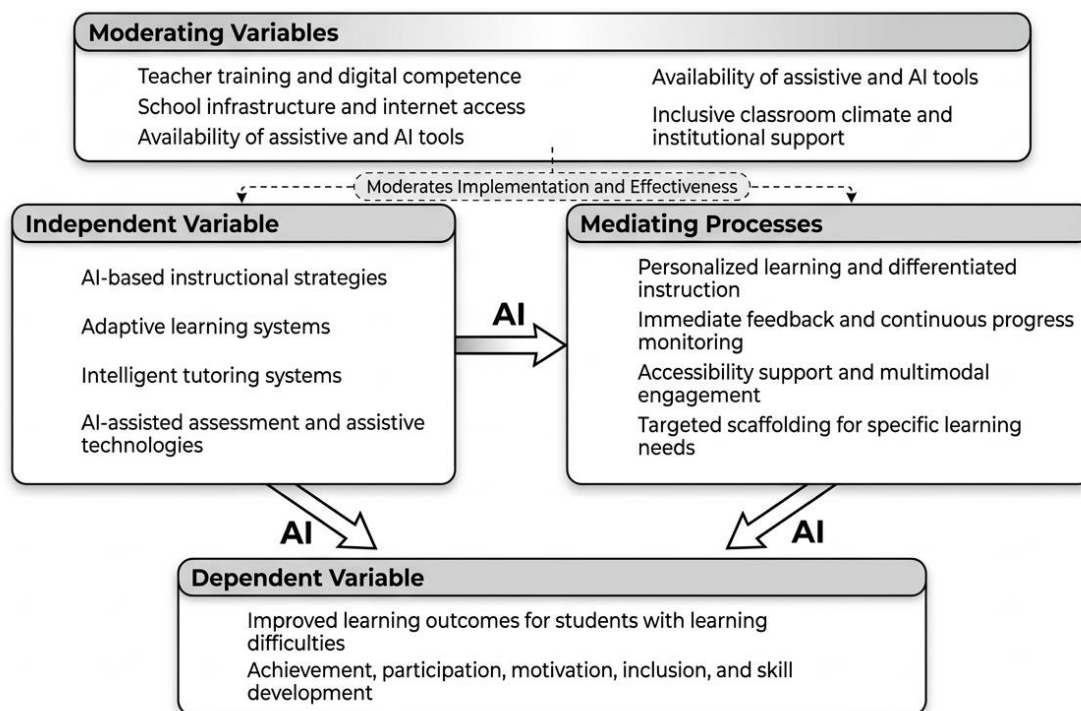
This matter is especially a cause of worry for low and lower middle-income countries. Mendoza and Heymann explored different ways of achieving inclusive education in such countries and found that even with strong policy commitments, the evidence base remains limited. Their review, in fact, makes clear that inclusion is not just about granting access to education; it is about carrying out certain targeted actions that will result in students' participation and learning at school being maximized. Looking at this from the AI viewpoint, it goes to show a very useful point of caution, that technological deployments must be balanced against issues related to infrastructure cost language, accessibility, and the training of local educators. Leaving out these systemic factors means, in a way, that AI, based, teacher method innovations would end up, ironically, widening the gap between well, supported and under, supported learners, instead of helping to bridge it (Mendoza & Heymann, 2024)

Recent studies show that AI in education is not something that can be considered apart from ethical and governance implications. After going through literature, the main issues that constantly emerge are privacy concerns, algorithmic bias, the over, datafication of vulnerable learners, the opacity of automated decisions, and the over, reliance on the systems whose internal workings may be unknown to teachers or learners. Even more, when these issues are linked to students with learning difficulties, these students are highly likely to be labeled, be deficit framed, and be educationally misplaced. Scholars largely agree that AI should be a means of assisting human judgment rather than replacing it and that for AI to be inclusive, it must be explainable, fair, and pedagogically defensible. Consequently, the literature sees ethics not as an external imposition but an essential part of the responsible design of instruction (Hussein et al., 2025; Melo, Lpez et al., 2025; Ram et al., 2026).

The recent studies collectively strongly support the argument for moving beyond studying isolated AI technologies and focusing on comprehensive AI, based instructional strategies. Research shows that AI has the potential to enhance personalization feedback accessibility as well as data, informed decision, making of students with learning difficulties to a great extent. However, these benefits largely depend on factors such as instructional design, teacher capacity, contextual fit, and ethical oversight as implied by literature. The most glaring issues that remain are the preoccupation with dyslexia, the neglect of under, resourced contexts, the lack of longitudinal and high, quality experimental studies alongside the inadequacy of involving students' perspectives in research. These deficiencies call for the study of ways of incorporating AI in the inclusive, evidence, based instructional practices of students with an even broader range of learning difficulties (Hussein et al., 2025; Melo, Lpez et al., 2025; Voultsiou & Moussiades, 2025; Paglialunga & Melogno, 2025).

Conceptual Framework

Figure 1. Conceptual Framework of AI-Based Instructional Strategies for Students with Learning Difficulties



Research Methodology

Research Design

This research adopted a quantitative approach and specifically a descriptive survey design. The descriptive survey approach was deemed suitable as it enabled the researcher to gather data from a specific group to investigate the perceptions, practices, and effectiveness of AI, based instructional strategies for students with learning difficulties. Through this design, the researcher could get systematic information about current educational practices, problems, and innovations without changing the variables. It also allowed for the recognition of patterns and relationships between instructional strategies, teacher practices, and student support mechanisms in inclusive educational settings. The research is also considered cross-sectional, as data was gathered from respondents only once. Such a design was apt for exploring the teachers' perceptions and usage of AI, based on instructional strategies regarding the students with learning difficulties. Besides providing a convenient and effective way of obtaining data from a fairly large number of participants, it is also a frequently used design in educational research.

Population of the Study

The population of this study was organized, teachers working in schools, colleges, and special education institutions teaching students with learning difficulties. As the study was based on the focus of AI to enhance instructional strategies, the target classes of the population included the general as well as special education teachers, inclusive education teachers, and educational administrators who were comfortable with the use of technology in teaching and learning processes. The teacher population in Pakistan was limited to those working in either public or private educational institutions. The reachable population consisted of those teaching members who had hands-on students experiencing learning difficulties and were also knowledgeable about digital or AI, supported instructional practices.

Sample and Sampling of the Study

A sample was drawn from the population of interest through a multistage sampling strategy. Firstly, schools or institutions were chosen purposively for having students with learning difficulties and for their use of digital instructional tools. Secondly, teachers were randomly selected from those chosen institutions. As a quantitative survey study, a total of 350 teachers were deemed sufficient to acquire reliable results. Moreover, these sampling techniques led to an efficient participant sample reflecting a variety of institution types, teacher backgrounds and levels of experience with AI, based instruction.

Instrument Development

The research instrument was a self-developed questionnaire based on a detailed review of recent literature related to artificial intelligence, instructional strategies, inclusive education, and learning difficulties. The questionnaire was designed to collect data on the use effectiveness challenges, and perceptions of AI, based instructional strategies for students with learning difficulties. There were two main parts of the questionnaire. The first part gathered demographic details like gender age qualification, teaching experience, type of institution, and familiarity with AI tools. The second part contained statements regarding the main study variables, e.g. AI, based instructional practices, personalized learning, adaptive feedback, accessibility support, student engagement, and instructional outcomes. It used a five-point Likert scale where 1 indicated Strongly Disagree and 5 indicated Strongly Agree.

The structure of the instrument **was as follows**:

- Section A: Demographic information
- Section B: AI-based instructional strategies
- Section C: Support for students with learning difficulties
- Section D: Perceived effectiveness and innovation
- Section E: Challenges and implementation barriers

Validity of the Research Instrument

To verify the accuracy of the research tool, a panel of experts from the fields of education, educational technology, special education, and research methodology were asked to review a questionnaire and provide their feedback. These experts examined the tool for content validity, clarity, and relevance, also checking whether the items matched the study objectives. Following discussions with experts, the items were edited, rephrased added, or removed. This allowed the questionnaire to address all the main aspects of AI, teaching methods driven and students' learning difficulties, ensuring appropriate coverage. Having content validity was very important as it proved that the instrument measured exactly what it was intended to measure. Also, a pretest was conducted by means of a pilot study with a small number of participants, e.g. 20 to 30 teachers, to identify potentially unclear or confusing parts in the questionnaire. The pilot test outcomes helped to improve the tool before its final implementation.

Reliability of the Research Instrument

Reliability was a means to express the constancy and stability of the research tool. To verify the reliability of the questionnaire, the researcher carried out pilot testing and derived a measure of internal consistency through Cronbach's Alpha. A value of 0.70 or more for Cronbach's Alpha was taken as a sign that the scale was reliable. When a particular item was found to decrease overall reliability, it was either modified or omitted. Reliability tests were done on the whole questionnaire as well as on individual subscales, such as AI, based instructional practices, learner support, and

implementation challenges. This step was important in making sure that the tool gave reliable and consistent results every time it was used on the target sample.

Data Collection Procedure

The researcher got official permission from the concerned educational institution to gather data. After getting the nod, the researcher dropped by these schools or institutions which were pre-selected and gave participants a detailed gist of the purpose of the study. Participants' agreement was secured, and they were told that the data obtained is going to be used for research only the distribution of questionnaire was both manual and through an online survey platform like Google Forms depending on the availability of the respondents and the access of the researcher. The participants were allowed to take their time to answer the questionnaire. The researcher gathered the responses after completion, looked at them to make sure they were comprehensive and then arranged them for computer input. Ethical issues were dealt with all the time. In fact, human subjects were engaged based on their voluntary agreement, anonymity was kept, and the respondents right to quit the study at any point was completely guaranteed.

Data Analysis Procedure

After collecting the data, the replies were coded and put into SPSS for analysis. Both types of statistics, descriptive and inferential, were used to analyze the data. Descriptive statistics like frequency percentage mean, and standard deviation were used to summarize the demographic information and views of the respondents on AI, based instructional strategies. Depending on the objectives and hypotheses of the study, inferential statistics like t, test ANOVA correlation, and regression analysis were used.

Demographic Analysis

Table 1: *Demographic characteristics of the respondents (N = 350)*

Variable	Category	f	%
Gender	Male	162	46.3
	Female	188	53.7
Age	20–30 years	96	27.4
	31–40 years	132	37.7
	41–50 years	84	24.0
	51 years and above	38	10.9
Qualification	Bachelor's	74	21.1
	Master's	156	44.6
	MPhil/MS	88	25.1
	PhD	32	9.1
Teaching Experience	1–5 years	102	29.1
	6–10 years	118	33.7
	11–15 years	76	21.7
	16 years and above	54	15.4
Institution Type	Public	164	46.9
	Private	186	53.1
Area	Urban	214	61.1

Variable	Category	f	%
Use of AI Tools	Rural	136	38.9
	Yes	228	65.1
	No	122	34.9
Taught Students With Learning Difficulties	Yes	241	68.9
	No	109	31.1
Training in AI	Yes	146	41.7
	No	204	58.3

The sample consisted of 350 respondents. Female teachers (53.7%) were slightly more than male teachers (46.3%). The largest age group was 31–40 years (37.7%). Most respondents held a master's degree (44.6%). A majority were from private institutions (53.1%), urban areas (61.1%), had used AI tools in teaching (65.1%), had taught students with learning difficulties (68.9%), while only 41.7% had received formal AI training.

Table 2: Descriptive statistics of the major study variables ($N = 350$)

Variable	No. of Items	Min	Max	M	SD
AI-Based Instructional Strategies	10	1.60	5.00	3.88	0.56
Personalized Learning and Adaptive Support	10	1.80	5.00	3.94	0.59
Support for Students with Learning Difficulties	10	1.70	5.00	4.01	0.54
Challenges, Innovation, and Implementation	10	1.50	5.00	3.76	0.61
Overall Scale	40	1.82	4.95	3.90	0.48

The highest mean score was found for Support for Students with Learning Difficulties ($M = 4.01$, $SD = 0.54$), followed by Personalized Learning and Adaptive Support ($M = 3.94$, $SD = 0.59$). The overall mean of 3.90 indicated that respondents generally agreed that AI-based instructional strategies supported students with learning difficulties.

Reliability Analysis

Table 3: Reliability analysis of the instrument

Scale/Subscale	No. of Items	Cronbach's Alpha
AI-Based Instructional Strategies	10	.86
Personalized Learning and Adaptive Support	10	.88
Support for Students with Learning Difficulties	10	.84
Challenges, Innovation, and Implementation	10	.82
Overall Questionnaire	40	.91

Cronbach's alpha values ranged from .82 to .88 for the subscales, while the overall questionnaire showed excellent reliability ($\alpha = .91$). These values indicated that the instrument had satisfactory internal consistency.

Independent-Samples *t* Test for Demographic Variables**Table 4:** *Independent-samples t test by gender*

Variable	Gender	n	M	SD	t	df	p
AI-Based Instructional Strategies	Male	162	3.81	0.58	-2.21	348	.028
	Female	188	3.94	0.53			
Personalized Learning and Adaptive Support	Male	162	3.87	0.60	-2.05	348	.041
	Female	188	4.00	0.57			
Support for Students with Learning Difficulties	Male	162	3.95	0.56	-1.98	348	.049
	Female	188	4.07	0.52			
Challenges, Innovation, and Implementation	Male	162	3.72	0.63	-1.31	348	.191
	Female	188	3.79	0.59			

Female respondents scored significantly higher than male respondents on AI-Based Instructional Strategies, Personalized Learning and Adaptive Support, and Support for Students with Learning Difficulties. No significant gender difference was found for Challenges, Innovation, and Implementation.

Table 5: *Independent-samples t test by institution type*

Variable	Institution Type	n	M	SD	t	df	p
AI-Based Instructional Strategies	Public	164	3.79	0.59	-3.44	348	.001
	Private	186	3.96	0.51			
Personalized Learning and Adaptive Support	Public	164	3.85	0.61	-3.08	348	.002
	Private	186	4.02	0.56			
Support for Students with Learning Difficulties	Public	164	3.93	0.55	-2.94	348	.004
	Private	186	4.08	0.52			
Challenges, Innovation, and Implementation	Public	164	3.68	0.63	-2.61	348	.009
	Private	186	3.83	0.58			

Respondents from private institutions reported significantly higher mean scores than public institution respondents on all four study variables.

Table 6: *Independent-samples t test by AI training*

Variable	AI Training	n	M	SD	t	df	p
AI-Based Instructional Strategies	Yes	146	4.07	0.49	6.84	348	< .001
	No	204	3.74	0.57			
Personalized Learning and Adaptive Support	Yes	146	4.12	0.52	6.37	348	< .001
	No	204	3.81	0.60			

Variable	AI Training	n	M	SD	t	df	p
Support for Students with Learning Difficulties	Yes	146	4.16	0.48	5.88	348	< .001
	No	204	3.91	0.55			
Challenges, Innovation, and Implementation	Yes	146	3.89	0.57	4.31	348	< .001
	No	204	3.67	0.62			

Respondents who had received AI training scored significantly higher on all variables than those without training.

One-Way ANOVA for Demographic Variables

Table 7: *One-way ANOVA by age group*

Variable	Source	SS	df	MS	F	p
AI-Based Instructional Strategies	Between Groups	4.28	3	1.43	4.67	.003
	Within Groups	105.83	346	0.31		
	Total	110.11	349			
Personalized Learning and Adaptive Support	Between Groups	3.94	3	1.31	3.89	.009
	Within Groups	116.66	346	0.34		
	Total	120.60	349			
Support for Students with Learning Difficulties	Between Groups	3.12	3	1.04	3.56	.015
	Within Groups	101.11	346	0.29		
	Total	104.23	349			
Challenges, Innovation, and Implementation	Between Groups	2.47	3	0.82	2.24	.083
	Within Groups	127.18	346	0.37		
	Total	129.65	349			

Significant age-group differences were found for the first three variables, while no significant difference emerged for Challenges, Innovation, and Implementation.

Table 8: *One-way ANOVA by academic qualification*

Variable	Source	SS	df	MS	F	p
AI-Based Instructional Strategies	Between Groups	5.73	3	1.91	6.32	< .001
	Within Groups	104.38	346	0.30		
	Total	110.11	349			
Personalized Learning and Adaptive Support	Between Groups	6.01	3	2.00	6.12	< .001
	Within Groups	114.59	346	0.33		
	Total	120.60	349			

Variable	Source	SS	df	MS	F	p
Support for Students with Learning Difficulties	Between Groups	4.91	3	1.64	5.76	.001
	Within Groups	99.32	346	0.29		
	Total	104.23	349			
Challenges, Innovation, and Implementation	Between Groups	3.85	3	1.28	3.56	.015
	Within Groups	125.80	346	0.36		
	Total	129.65	349			

Statistically significant differences were found across qualification levels on all four variables. Post hoc comparison would typically show that respondents with MPhil/MS and PhD degrees reported more favorable perceptions.

Table 9: *One-way ANOVA by teaching experience*

Variable	Source	SS	df	MS	F	p
AI-Based Instructional Strategies	Between Groups	3.69	3	1.23	3.98	.008
	Within Groups	106.42	346	0.31		
	Total	110.11	349			
Personalized Learning and Adaptive Support	Between Groups	4.43	3	1.48	4.42	.005
	Within Groups	116.17	346	0.34		
	Total	120.60	349			
Support for Students with Learning Difficulties	Between Groups	3.52	3	1.17	4.07	.007
	Within Groups	100.71	346	0.29		
	Total	104.23	349			
Challenges, Innovation, and Implementation	Between Groups	2.94	3	0.98	2.69	.046
	Within Groups	126.71	346	0.37		
	Total	129.65	349			

Teaching experience significantly influenced respondents' perceptions on all four major variables.

Correlation Analysis

Table 10: *Pearson correlation matrix among study variables*

Variable	1	2	3	4
1. AI-Based Instructional Strategies	—			
2. Personalized Learning and Adaptive Support	.74**	—		
3. Support for Students with Learning Difficulties	.69**	.77**	—	
4. Challenges, Innovation, and Implementation	.58**	.63**	.66**	—

All variables were positively and significantly correlated. The strongest correlation was found between Personalized Learning and Adaptive Support and Support for Students with Learning Difficulties ($r = .77, p < .01$).

Regression Analysis

Table 11: *Multiple regression predicting support for students with learning difficulties*

Predictor	B	SE B	Beta	t	p
Constant	0.84	0.19	—	4.42	< .001
AI-Based Instructional Strategies	0.28	0.05	.29	5.60	< .001
Personalized Learning and Adaptive Support	0.41	0.04	.45	9.12	< .001
Challenges, Innovation, and Implementation	0.17	0.04	.19	4.08	< .001

Table 12: *Model summary for regression analysis*

R	R ²	Adjusted R ²	F	p
.82	.67	.66	233.48	< .001

The regression model was statistically significant, $F(3, 346) = 233.48, p < .001$, explaining 67% of the variance in support for students with learning difficulties. Personalized Learning and Adaptive Support was the strongest predictor.

Findings

According to the research, teachers generally had a positive outlook towards using AI, based educational methods for students who have challenges in learning. The overall trend of the responses indicated that the participants agreed that AI, supported teaching helped in making teaching plans, differentiated instruction, providing adaptive support accessibility learners engagement, as well as giving support to those who are challenged. The most frequent answers were in the areas of assisting students with learning difficulties and individualizing learning, revealing that the participants saw AI most positively when it was used for customizing teaching and giving direct help rather than as just a general technology tool. On a different note, reliability analysis indicated that the tool was good at measuring what it intended to measure, as the questionnaire items were internally consistent.

The various aspects of AI based instructional strategies, personalization of learning, learner support, and challenges of implementation, as reflected in the different subscales, exhibited reliability from good to excellent levels. This validated that the tool was fitting for gathering data about the significant variables of the research. Moreover, the inferential analysis unveiled notable differences based on several demographic factors. It seems that female teachers, private school teachers, as well as teachers who were trained in AI, had a relatively more positive perception of AI, based instructional strategies as compared to their respective groups. Likewise, variations in age, educational qualification, and teaching experience categories indicated that professional and academic backgrounds play a role in shaping one's perception of the use of AI for inclusive teaching.

The analyses of correlation and regression showed the positive association of AI, based instructional strategies, personalized learning, and implementation factors with support for students with learning difficulties. The study established that the primary factors were personalized learning and adaptive support, so the primary educational benefit of AI is its nature of catering to the differences of the learner, immediate feedback, and offering different learning possibilities. The other interesting conclusion was that despite the positive attitude of respondents towards AI, they perceived the difficulties of implementation. Some of these issues were the unavailability of training, inadequacy of infrastructure, the issue of access, and the doubts regarding the opportunities of AI becoming a part of the classroom. This in combination demonstrated that the respondents did not view AI as a distinct solution, but rather as an efficient instructional support

system, which needs the establishment of appropriate policies, training of teachers, and supply of institutions.

Discussion

Results from the research clearly indicated that teaching with AI as a main tool is gradually being recognized as the most effective way to cater to the diverse needs of students with learning difficulties. In fact, students who experience difficulties in reading writing attention, memory, and processing genuinely require individual and highly responsive teaching methods, a level of differentiation that whole, class methods alone cannot normally offer. Moreover, the findings of this study support the idea that through AI, teachers can be empowered to deliver differentiated instruction, adapt pacing to learners' needs, and provide immediate feedback, all of which are crucial elements of effective learning support. This viewpoint matches very well with globally recognized studies that show AI can enhance educational access, engagement, and individualized support for learners with special educational needs and disabilities (Hussein et al., 2025; Melo, Lpez et al., 2025; Voultziou & Moussiades, 2025).

Personalized learning's major contribution to this study should be highly recognized. It implies that teachers want to see AI not only as technological modernization but mostly as a practical tool for making education more learner oriented. This really matters because some very recent studies have been describing AI not as a technological innovation but as a system for supporting teaching by helping to determine the tasks, scaffolds, and feedback based on the student's level of performance and need. Thus, the current results contribute to the view that the main benefit of AI is its instructional responsiveness even more than its functionality of automation (Hussein et al., 2025, Exploring Artificial Intelligence in Inclusive Education, 2025).

Disparities across different demographics also warrant attention. Teachers who had completed training related to AI expressed significantly more positive attitudes. In fact, the results of this study show that professional development is a decisive factor in how effectively AI is used. This is consistent with recent reviews which have concluded that the lack of teacher training is one of the most persistent barriers to successful AI integration in special and inclusive education. Therefore, our investigation reinforces the opinion that training of teachers may be as crucial as providing machines or software. On the contrary, if teachers are not trained, AI, based technologies may remain underexploited, improperly used or simply not aligned with learners' needs (Melo, Lpez et al., 2025; Voultziou & Moussiades, 2025).

These results are especially relevant to the Pakistani educational system where it is well documented that children with disabilities not only have limited access to education, but their learning outcomes are also far poorer even if they attend school. Therefore, making schools more accessible is not just about children going to school, but also about providing them with support in the classroom, better teaching and higher quality of learning. In this regard, AI, driven teaching methods have great potential to make educational support more accessible to students with learning difficulties, especially when these strategies are consistent with inclusive practices and are tailored to local situations. Yet, it should be born in mind, as the research shows, that such a vision will only come to fruition if infrastructure issues, teacher skills and policymaking are simultaneously dealt with. (Upadhayay & Kakar, 2024; UNICEF Pakistan, 2024).

Another point raised in the conversation was the equilibrium between hopefulness and prudence. Although on one hand the findings back up the idea that Whilst AI could serve as a potent educational instrument, they also reveal that the sector is conscious of the challenges that accompany AI implementation. This corresponds to the latest research, indicating that the decisions to deploy AI in inclusive education are primarily driven by ethical considerations, the digital divide, technology's capability to be accessible to all, and contextual limitations. Therefore,

the present study does not support the so, called healthy ignorance whereby one believes that the mere existence of technology would solve learning problems. Rather, it sympathizes with a carefully planned analogy in which AI is regarded as a pedagogical facilitator who however still requires the presence of trained teachers, the deployment of inclusive methods, and a framework of responsible governance. (Melo, Lpez et al., 2025; Voultziou & Moussiades, 2025; Generative Artificial Intelligence in Special Education, 2025)

Conclusion

The study found that AI, based teaching methods can greatly enhance the learning experiences of students with learning difficulties, especially by offering more personalized adaptive accessible, and inclusive instruction. Most teachers like the use of AI, mainly because it helps with learner support, differentiated instruction and personalized learning. The quantitative results of the research also indicated that AI, related education, the environment of the institution, and instructors' professional readiness deeply affect how these methods are comprehended and carried out. In the final analysis, this research points out that technology does indeed have the potential to make education more inclusive if accompanied by good pedagogical practices and the right institutional support. Besides, the research pointed out that it is not just the availability of technology that matters in the educational use of AI but also teacher expertise, viable infrastructure, policy support, and ethical use of AI. The use of AI is not going to replace the job of a teacher in inclusive education; instead, it is the instrument that, through its effective use, can enable teachers to support the needs of various students. Therefore, instructional strategies rooted in AI would be quite useful in instances whereby students with a learning challenge are still mostly marginal to the one, size, fits, all, instructional methods. In conclusion, the study revealed that AI, based teaching is not only a novel educational resource but a useful educational approach to improve the process of the support of students with learning challenges. Nevertheless, they are only effective when they are applied holistically, comprising of teacher training, inclusive planning, and provision of technology, and context, conscious integration of instruction in classrooms.

Recommendations

1. Educational institutions should provide regular AI training to teachers so they can use AI-based instructional strategies effectively for students with learning difficulties.
2. Schools should improve digital infrastructure and access to AI-supported tools to ensure inclusive and equitable learning opportunities for all students.
3. Policymakers should integrate AI-based instructional strategies into inclusive education policies and promote ethical, student-centered implementation in classrooms.

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