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Primary Schools Teachers' Perspectives on AI Integration in Personalized Learning for Students with Learning Disabilities in Primary Grades

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ABSTRACT This study explored the perceptions of third grade teachers in Jeddah, Saudi Arabia, regarding the use of artificial intelligence in designing personalised learning environments for children with learning disabilities. A cross-sectional survey was conducted with 251 teachers using a structured questionnaire. The instrument measured perceived benefits, implementation challenges, and readiness for AI adoption. Descriptive and inferential statistics were used for analysis. Results showed strong agreement on the benefits of AI in identifying individual learning needs and enhancing student engagement. Significant differences were found based on gender, teaching experience, and educational qualifications. Despite recognising benefits, teachers reported barriers such as lack of training and high costs. While willingness to adopt AI was high, actual prior use was limited. The findings highlight the need for professional development and institutional support to effectively integrate AI into inclusive education.

INTRODUCTION

The integration of artificial intelligence (AI) into education has transformed how learning experiences are tailored to individual student needs, particularly in primary education. This is especially crucial for children with learning disabilities, who benefit significantly from customised instructional approaches. AI-enabled tools, such as intelligent tutoring systems and adaptive learning platforms, provide real-time feedback, adjust content based on student performance, and identify unique learning needs (Chen and Perez 2023; Diviya et al. 2025). These tools have been increasingly utilised in educational interventions targeting cognitive and behavioural development among students with neurodevelopmental and learning disorders (Barua et al. 2022).

Recent literature affirms that AI facilitates inclusive education through personalised pacing, differentiated content delivery, and dynamic student monitoring. Studies have shown that AI-based systems can significantly enhance motivation and engagement in learners with disabilities, resulting in improved academic outcomes (Hashim et al. 2022; Kaswan et al. 2024). Moreover, predictive analytics and AI-assisted assessments offer data-driven insights, enabling teachers to implement timely interventions (Gligorea et al. 2023; Mahmoud and Sørensen 2024).

Despite these benefits, barriers remain. Many teachers lack the training and infrastructure required for effective AI integration. Hopcan et al. (2023) highlighted technical limitations and insufficient professional development as persistent challenges in the adoption of AI in special education contexts. Additionally, Iman et al. (2024) emphasised a gap between teachers' positive attitudes toward AI and their actual hands-on experience with such technologies. These factors necessitate a better understanding of teachers' perceptions and readiness for AI implementation, particularly in diverse socio-cultural contexts.

Given these considerations, understanding the views of third grade teachers in Saudi Arabia, especially in Jeddah, is critical for guiding national educational reforms and supporting AI adoption in inclusive education settings.

Objectives of the Study

This study aims to investigate the perceptions of third grade teachers in Jeddah, Saudi Arabia, regarding the use of artificial intelligence in designing personalised learning environ-

ments for children with learning disabilities. Specifically, it seeks to assess how teachers perceive the benefits of AI in supporting individualised instruction, identify the challenges and barriers they face in implementing AI technologies, and evaluate their readiness and attitudes toward adopting AI in inclusive classrooms. Additionally, the study examines whether these perceptions vary according to demographic factors such as gender, years of teaching experience, and educational qualifications.

METHODOLOGY

Research Design

This study adopted a cross-sectional research design to investigate the perspectives of third grade teachers regarding the use of artificial intelligence in designing personalised learning environments for children with learning disabilities. The cross-sectional approach was chosen because it allows the collection of data at a single point in time, providing a snapshot of teachers' perceptions, experiences, and readiness related to the integration of AI tools in early education. This design is particularly suited for descriptive and comparative purposes, making it appropriate for exploring relationships between teachers' socio-demographic characteristics and their views on AI in education.

Research Population

The population of the study included third grade teachers working in Jeddah City, Saudi Arabia. These teachers play a fundamental role in shaping the educational experiences of young learners during the initial years of primary education. Based on the latest records from educational authorities, the total number of primary grade teachers in Jeddah City was estimated to be approximately 1,391 teachers at the time of the study. Focusing on this population was vital because their insights and acceptance of AI technologies are crucial for the successful implementation of personalised learning strategies targeting students with learning difficulties.

Sample Size and Sampling Strategy

The sample size for the study was determined using the statistical software G*Power version 3.1.9.2. The calculation was based on a medium effect size (f = 0.25), a significance level (alpha) of 0.05, and a statistical power of 0.80, which are conventional parameters ensuring sufficient sensitivity to detect meaningful differences or associations. Using these criteria, the required sample size was calculated to be 251 third grade teachers. The study employed a convenience sampling strategy to recruit participants. Teachers were selected based on their availability and willingness to participate during the data collection period. Although convenience sampling has limitations related to generalisability, it was appropriate for this exploratory study given time constraints and accessibility considerations.

Data Collection Tool

The primary data collection instrument was a structured questionnaire specifically developed by the researcher for the purpose of this study. The questionnaire was divided into two main sections. The first section gathered information on socio-demographic factors, including the participant's age, gender, years of teaching experience, and educational qualification. These variables were important to assess how demographic differences might influence teachers' perceptions of AI integration.

The second section contained 21 statements aimed at exploring teachers' views on AI in personalised learning environments. These statements were organised into three key domains, each comprising seven items. The first domain focused on teachers' perceptions of the Perceived Benefits of AI in Personalised Learning, examining the ways AI could enhance educational outcomes for students with learning disabilities. The second domain addressed Challenges and Barriers to AI Implementation, identifying potential obstacles that might hinder effective AI adoption. The third domain explored Readiness and Attitudes Toward AI Adoption, assessing teachers' confidence and willingness to incorporate AI technologies into their teaching practices. Responses to each statement were measured using a 5-point Likert scale, ranging from 'Strongly Disagree' to 'Strongly Agree', allowing for nuanced understanding of participant attitudes.

Validity and Reliability of the Study Questionnaire

To ensure the validity of the questionnaire, a content validation process was conducted. The initial draft of the instrument was reviewed by a panel of three experts specialising in educational technology, special education, and instructional design. Their feedback focused on the relevance, clarity, and coverage of the questionnaire items. Necessary revisions were made based on their recommendations to enhance the content validity of the instrument.

For reliability assessment, a pilot study was carried out involving a sample of 30 primary grade teachers from a different region, ensuring they were not included in the main study sample. The pilot data were analysed to calculate the internal consistency of the questionnaire using Cronbach's alpha coefficient. The overall Cronbach's alpha value was found to be 0.89, indicating a high level of internal consistency and confirming that the items within each domain reliably measured the intended constructs.

Data Collection Procedure

Following the approval of the research protocol by the relevant educational authorities, the data collection process commenced. Third grade teachers across Jeddah City were approached through visits to public and private schools, as well as through professional educational forums and training workshops. The researcher introduced the purpose of the study, emphasised the voluntary nature of participation, and obtained informed consent from each participant. Teachers were provided with a hard copy of the questionnaire and given clear instructions on how to complete it. They were also assured that their responses would remain confidential and anonymous, and that the information collected would be used solely for research purposes. Ample time was provided to complete the survey at their convenience, and completed questionnaires were collected by the researcher during follow-up visits.

Data Analysis

Upon completion of data collection, the questionnaires were coded and entered into the Statistical Package for the Social Sciences (SPSS), version 26 for analysis. Data analysis was conducted in two phases. Initially, descriptive statistics such as means, standard deviations, frequencies, and percentages were calculated to summarise the socio-demographic characteristics of the participants and their overall responses to the questionnaire items. Subsequently, inferential statistical tests were employed to examine differences in teachers' perspectives based on demographic variables. Specifically, independent samples t-tests were used to compare mean scores between two groups (that is, male and female teachers), while one-way Analysis of Variance (ANOVA) was applied to compare mean scores across multiple groups (for example, different levels of educational qualification or years of experience). A significance level of á d" 0.05 was used to determine statistical significance for all analyses.

RESULTS

Baseline Socio-Demographic Characteristics of the Participants

A total of 251 third grade teachers participated in this study. Table 1 presents the baseline socio-demographic characteristics of the participants. The majority of the respondents were female, representing nearly 71 percent of the sample, while male teachers accounted for approximately 29 percent. This indicates a predominantly female teaching workforce at the primary level in Jeddah City.

Regarding age distribution, just over 28 percent of the teachers were aged less than thirty years, more than 43 percent were between thirty and thirty-nine years, and nearly 28 percent were aged forty years and above. This suggests a relatively balanced age representation, with a slight concentration in the middle age group.

In terms of teaching experience, about 31 percent of the participants had less than five years of experience, 37 percent had five to ten years, and nearly 33 percent had more than ten years of experience. This distribution reflects a diverse range of teaching tenures, with experienced teachers forming a significant portion of the sample.

Table 1: Baseline socio-demographic characteristics of third grade teachers (n = 251)

Characteristic	*Category*	*Frequency (n)*	*Percentage (%)*
Gender	Male	73	29.1
	Female	178	70.9
Age	Less than 30 years	72	28.7
	30-39 years	109	43.4
	40 years and above	70	27.9
Years of Experience	Less than 5 years	77	30.7
	5-10 years	92	36.7
	More than 10 years	82	32.7
Educational Qualification	Diploma in Education	60	23.9
	Bachelor's Degree	166	66.1
	Postgraduate Degree (Master/PhD)	25	10.0

Concerning educational qualifications, two-thirds of the participants (66.1%) held a bachelor's degree, while approximately 24 percent held a diploma in education, and 10 percent had completed postgraduate studies. This indicates that the majority of respondents have attained at least a bachelor's level education, which is consistent with national qualification standards for primary school teaching.

The results presented in Table 2 indicate that primary grade teachers held overall positive perceptions regarding the use of artificial intelligence in personalised learning environments for students with learning disabilities. In the domain of *Perceived Benefits of AI*, the highest-rated statement was that AI helps in identifying students' individual learning needs, with a mean score of 4.32 (SD = 0.61). This suggests strong confidence in AI's diagnostic and adaptive capabilities. The second highest-rated item emphasised AI's role in enhancing student engagement (M = 4.28, SD = 0.66), reflecting teachers' recognition of AI as a motivating tool for learners with special needs. Other items, such as AI's ability to personalise content and pace (M = 4.15, SD = 0.71) and improve academic achievement (M = 4.10, SD = 0.74), also received strong agreement. The item with the lowest mean in this domain was related to AI facilitating communication with parents (M = 3.82, SD = 0.84), though it still showed a generally favourable perception.

In the *Challenges and Barriers* domain, teachers most frequently cited a lack of training on AI tools (M = 4.20, SD = 0.65) as the primary obstacle. This was followed by concerns about the high cost of AI technologies (M = 4.05, SD = 0.70) and technical difficulties (M = 3.98, SD = 0.73), highlighting logistical and resource-based constraints. Other notable concerns included time required for integrating AI into the classroom (M = 3.85, SD = 0.76) and fears of AI replacing teachers' roles (M = 3.70, SD = 0.79). The least concerning issue was related to ethical considerations, particularly data privacy (M = 3.55, SD = 0.88). Despite being the lowest, this value remained above the midpoint, indicating a baseline level of concern across all challenges.

In the domain of *Readiness and Attitudes Toward AI Adoption*, teachers showed a high willingness to adopt AI, with the strongest agreement for the statement "I am willing to learn more about using AI in teaching" (M = 4.25, SD = 0.62). Similarly, teachers believed that AI would positively impact student learning (M = 4.12, SD = 0.68), and many expressed confidence in their ability to integrate it into teaching (M = 3.95, SD = 0.73). However, despite this readiness, lower scores were observed for awareness of existing AI tools (M = 3.62, SD = 0.81) and previous use of AI technologies (M = 3.45, SD = 0.86), revealing a gap between interest and actual implementation. This underscores the need for capacity-building efforts to translate positive attitudes into practical application.

The results of the independent samples t-test revealed a statistically significant difference between male and female teachers in their perceptions of the benefits of artificial intelligence in personalised learning. Female teachers reported higher mean scores (M = 4.18, SD = 0.52) compared to male teachers (M = 4.05, SD = 0.48) ($t(249) = 2.10$, $p = .036$), suggesting that female educators may be more receptive to the educational value of AI. However, no statistically significant gender differences were observed for

Table 2: Third grade teachers' responses to questionnaire statements (n = 251)

Statement	*Mean ± SD*	*Rank within domain*
Perceived Benefits of AI in Personalised Learning		
AI helps in identifying students' individual learning needs.	4.32 ± 0.61	1
AI enhances engagement of students with learning disabilities.	4.28 ± 0.66	2
AI tools can personalise learning pace and content.	4.15 ± 0.71	3
AI improves the academic achievement of struggling students.	4.10 ± 0.74	4
AI provides instant feedback that helps learning.	4.02 ± 0.78	5
AI saves teachers' time in adapting materials.	3.95 ± 0.80	6
AI facilitates communication with parents about student progress.	3.82 ± 0.84	7
Challenges and Barriers to AI Implementation		
Lack of training on AI tools limits their use.	4.20 ± 0.65	1
High cost of AI technologies is a barrier.	4.05 ± 0.70	2
Technical difficulties reduce teachers' willingness to use AI.	3.98 ± 0.73	3
AI requires additional time to integrate into teaching.	3.85 ± 0.76	4
Teachers fear that AI may replace human teaching roles.	3.70 ± 0.79	5
Lack of school infrastructure prevents AI adoption.	3.65 ± 0.82	6
Ethical concerns about data privacy affect AI usage.	3.55 ± 0.88	7
Readiness and Attitudes Toward AI Adoption		
I am willing to learn more about using AI in teaching.	4.25 ± 0.62	1
I believe AI will positively impact my students' learning.	4.12 ± 0.68	2
I feel confident in my ability to integrate AI in the classroom.	3.95 ± 0.73	3
I see AI as a supportive tool, not a threat to my role.	3.85 ± 0.76	4
I am interested in receiving AI-related training programs.	3.80 ± 0.78	5
I am aware of existing AI tools applicable to primary education.	3.62 ± 0.81	6
I have previously used AI tools in my teaching.	3.45 ± 0.86	7

the domains of challenges and barriers (p = .188) or readiness and attitudes toward AI adoption (p = .067), indicating broadly similar concerns and levels of preparedness across genders in these areas (Table 3).

Analysis of variance (ANOVA) results showed that age did not significantly affect teachers' perceptions across any of the three domains. However, the differences in perceived benefits were close to significance, F(2, 248) = 2.89, p = .058, which may suggest age-related differences warrant further exploration in future studies. In contrast, teaching experience significantly influenced perceptions. Teachers with more than ten years of experience had higher mean scores for perceived benefits (M = 4.22,

Table 3: Independent samples t-test and ANOVA for differences in domain scores by socio-demographic characteristics (n = 251)

Socio-demographic characteristic	*Perceived benefits of AI (M ± SD)*	*Challenges and barriers (M ± SD)*	*Readiness and attitudes (M ± SD)*	*t/F value*	*p value*
Gender					
Male (n = 73)	4.05 ± 0.48	3.82 ± 0.51	3.75 ± 0.53	2.10 (t)	.036*
Female (n = 178)	4.18 ± 0.52	3.91 ± 0.57	3.89 ± 0.56		
Age					
< 30 years (n = 72)	4.09 ± 0.51	3.88 ± 0.55	3.78 ± 0.50	2.89 (F)	.058
30-39 years (n = 109)	4.16 ± 0.49	3.89 ± 0.53	3.90 ± 0.54		
e" 40 years (n = 70)	4.19 ± 0.56	3.95 ± 0.60	3.87 ± 0.59		
Years of Experience					
< 5 years (n = 77)	4.08 ± 0.54	3.85 ± 0.52	3.75 ± 0.49	4.01 (F)	.019*
5-10 years (n = 92)	4.17 ± 0.50	3.92 ± 0.55	3.85 ± 0.55		
> 10 years (n = 82)	4.22 ± 0.51	3.96 ± 0.59	3.94 ± 0.58		
Educational Qualification					
Diploma (n = 60)	4.06 ± 0.50	3.80 ± 0.49	3.70 ± 0.52	5.22 (F)	.006*
Bachelor's (n = 166)	4.17 ± 0.51	3.91 ± 0.54	3.89 ± 0.54		
Postgraduate (n = 25)	4.30 ± 0.49	4.05 ± 0.58	4.05 ± 0.62		

SD = 0.51) than those with less than five years of experience (M = 4.08, SD = 0.54) ($F(2, 248) = 4.01$, $p = .019$). These findings imply that experienced teachers may have a more favourable view of AI's potential in supporting students with learning disabilities. Similarly, a significant variation was found in readiness and attitudes toward AI adoption across experience levels, with more experienced teachers expressing greater enthusiasm and preparedness (Table 3).

Educational qualification also had a statistically significant effect across all three domains. Teachers with postgraduate degrees reported the highest mean scores in perceived benefits (M = 4.30, SD = 0.49), challenges and barriers (M = 4.05, SD = 0.58), and readiness and attitudes (M = 4.05, SD = 0.62) ($F(2, 248) = 5.22$, $p = .006$). These results indicate that teachers with advanced academic backgrounds may be more aware of both the opportunities and limitations associated with AI in education and are more inclined toward integrating it into their teaching practices (Table 3).

DISCUSSION

The findings of this study reveal that third grade teachers in Jeddah generally hold favourable perceptions regarding the use of artificial intelligence (AI) in designing personalised learning environments for children with learning disabilities. Teachers recognised AI's capacity to identify individual learning needs, enhance student engagement, and provide customised learning experiences. This aligns with the growing body of literature demonstrating that AI can facilitate adaptive instruction, especially for students with special educational needs by tailoring content, pacing, and support mechanisms to individual profiles (Barua et al. 2022; Tapalova and Zhiyenbayeva 2022; Kaswan et al. 2024). These findings support the argument that integrating AI into inclusive classrooms has the potential to overcome the limitations of traditional, one-size-fits-all approaches.

Despite these positive perceptions, the study also revealed notable challenges that impede effective AI implementation. Teachers emphasised the lack of training, high costs, and technical difficulties as major barriers. These concerns are echoed in previous studies, which reported that inadequate infrastructure, limited digital literacy among educators, and insufficient institutional support often hinder the adoption of AI in educational settings (Hashim et al. 2022; Hopcan et al. 2023; Mahmoud and Sørensen 2024). These challenges highlight the importance of moving beyond enthusiasm to structural readiness, particularly in contexts such as Saudi Arabia, where educational technology reforms are gaining momentum. Without targeted training programs and policy-backed resource allocation, the transformative potential of AI may remain theoretical.

In terms of readiness and attitudes, participants expressed a strong willingness to learn about AI applications in education, though their actual usage and familiarity with specific tools remained relatively low. This gap between intention and implementation mirrors findings in other educational contexts, where teachers express high levels of interest in using AI but lack the exposure and support to do so effectively (Iman et al. 2024; Diviya et al. 2025). This suggests that while motivational factors are present, the absence of hands-on training and guided implementation pathways poses a critical limitation. Developing sustainable professional development models that focus on AI competency could bridge this gap and enhance practical integration in classrooms.

Interestingly, the study found that teaching experience and academic qualifications were significantly associated with teachers' perceptions, whereas age was not. More experienced teachers and those with postgraduate degrees reported higher confidence and more favourable attitudes toward AI. These findings align with earlier work suggesting that educators with greater pedagogical maturity and exposure to current educational innovations are better positioned to integrate new technologies (Gligorea et al. 2023; Pratama et al. 2023). Such teachers may also be more adept at evaluating the potential of AI to support differentiated instruction and at aligning its use with curriculum goals.

Moreover, while the global discourse on AI in education emphasises its transformative power, its impact depends largely on how it is localised within specific cultural and institutional settings (Bhutoria 2022; Maghsudi et al. 2021; Chen and Perez 2023). In the Saudi context, the Vision 2030 agenda provides a framework for educational modernisation, including the integration of AI. However, successful implementation will require cohesive strategies that align

teacher training, infrastructure investment, and inclusive education goals. The present findings underscore the need for such alignment by revealing both optimism and hesitation among those expected to drive AI adoption on the ground.

Although this study offers valuable insights into teacher perspectives, several limitations must be acknowledged. The cross-sectional nature of the design provides only a snapshot of perceptions at a single point in time and may not capture evolving attitudes as AI becomes more embedded in classrooms. Additionally, the use of convenience sampling limits generalisability, and reliance on self-reported data raises the possibility of social desirability bias. Future research should consider longitudinal and mixed-method approaches to gain deeper insights into how teacher perceptions translate into actual classroom practices and to evaluate the long-term impact of AI on learning outcomes.

CONCLUSION

This study concludes that third grade teachers in Jeddah generally hold positive perceptions toward the use of artificial intelligence in personalised learning environments for children with learning disabilities. Teachers acknowledged AI's role in identifying individual learning needs, enhancing student engagement, and improving academic outcomes. However, challenges such as insufficient training, high costs, and limited infrastructure were identified as barriers to effective implementation. While the willingness to adopt AI was evident, actual experience with its use remained limited. These findings highlight the need to strengthen teachers' readiness through targeted support and capacity-building initiatives, ensuring that the integration of AI contributes meaningfully to inclusive and effective educational practices.

RECOMMENDATIONS

Based on the findings, it is recommended that targeted professional development programs be implemented to enhance teachers' skills in using artificial intelligence tools effectively in inclusive classrooms. Educational institutions should invest in infrastructure and resources to facilitate AI integration while addressing cost and technical challenges. Policymakers are encouraged to support the development of clear guidelines and support systems that promote the adoption of AI in primary education. Encouraging collaboration between educators, technology developers, and administrators can further ensure that AI solutions are aligned with classroom needs and learning goals.

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