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Artificial Intelligence in Early Childhood Education: Perceptions of Teachers in Sargodha, Pakistan

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Abstract

Artificial Intelligence (AI) is shaping the future of education by providing personalized learning experiences, streamlining administrative tasks, and improving engagement and interaction with students. But in developing countries such as Pakistan, teachers and students are not aware of such technological innovations to the greater extent. This is a quantitative study to explore the perception of Early Childhood Care and Education (ECCE) teachers of public schools of tehsil Shahpur in district Sargodha about the integration of AI in ECCE classrooms. A cross sectional survey was carried out; 100 ECCE teachers were selected from public schools of tehsil Shahpur randomly. The modified and validated Urdu questionnaire based on the Technology Acceptance Model (TAM) was used to gather data. The results showed that AI awareness ($M=2.85$) and digital literacy ($M=2.55$) were at low to moderate levels. The attitudes of teachers were mixed: they had medium perceived usefulness ($M=3.42$) and low perceived ease of use ($M=2.58$). Infrastructural barriers were a major concern (93% mentioning electricity as a major barrier), cultural incompatibility was a major concern ($M=3.72$ on concerns about AI teaching moral values) and the fear of job displacement was a major concern (65% expressed this concern). The factor that most strongly predicted behavioral intention to use AI is perceived ease of use. In conclusion, the study suggests that teachers understand the possibility of the benefits of using AI, but the move towards using AI in ECCE schools in Shahpur is still premature due to missing foundational infrastructure, teacher capacity building, cultural issues, and equity.

Keywords: Artificial Intelligence, Early Childhood Care and Education, Teacher Perceptions, Public Schools, Sargodha Pakistan, Technology Acceptance Model, Digital Divide

1. Introduction

In this chapter, the authors explore the rise of AI in education on a global scale. The authors go over the rise of AI in education on a global level in this chapter.

The current Fourth Industrial Revolution is defined by the convergence of digital, biological and physical technologies and is completely transforming the way society works. The driving force behind this change is Artificial Intelligence (AI), a technology

that mimics the processes of human intelligence, such as learning, reasoning, problem-solving, and decision making, by using machines. From healthcare to transportation, finance, entertainment, and beyond, AI has infiltrated almost every facet of contemporary life, and education is not an exception to the rule (Luckin et al., 2022). The introduction of AI into education is one of the greatest pedagogical transformations since the internet was created, with the potential to transform learning at every level.

Over the last ten years, AI has grown significantly in the field of education. With the development of intelligent tutoring systems, customized learning environments can be created, that is, the learning system can adapt to students' learning ability and learning style, and the teaching system can provide real-time feedback and intervention (Xu & Ouyang, 2022). Automated assessment tools lighten teachers' administrative workloads so teachers can spend more time teaching and engaging students. AI-driven learning analytics can help detect early indicators of student at-risk, forecast student learning outcomes, and supply information for instructional improvement based on these data (Yang et al., 2023). Natural language processing opens up the way for advanced language learning tools and computer vision technologies can interpret classroom dynamics, student engagement, and even emotions. The global EdTech market size was estimated to be around \$254 billion in 2021 and is expected to grow to \$605 billion by 2027, where AI-driven solutions are emerging as a rapidly growing area (HolonIQ, 2023). AI-driven educational platforms have been introduced by major tech firms such as Google, Microsoft, and IBM, and many startups have emerged developing niche AI solutions ranging from early childhood literacy to STEM education.

The developed nations, mainly the USA, the UK, China, and Singapore, have been the first to adopt AI to enhance education. Research on the potential of AI in Early Childhood Care and Education (ECCE) is growing rapidly in the United States, with efforts aimed at tailoring learning to the developmental readiness of children, identifying patterns in their learning and development, and creating an immersive learning experience by making learning spaces interactive and adaptive (Su & Yang, 2023). For example, the use of AI-driven robots in early learning contexts to foster engagement is studied, particularly in the contexts of teaching coding logic, second languages, and social-emotional skills (Yang et al., 2023). Technologies for measuring emotion are being created to measure student engagement and sentiment; automated speech recognition technologies monitor language acquisition progress and identify potential developmental delays for timely intervention. There are tests currently going on in preschools to use intelligent virtual agents and interactive storytelling apps to improve literacy development and promote creativity. Such innovations are frequently embedded in learning optimization, data-driven teaching, and for the preparation of kids for a future digital economy discourses.

AI's transformative impact on education has been acknowledged by international organizations too. UNESCO (2021) released detailed guidance for policy-makers on AI and education, underscoring the importance of human-centered approaches which emphasize equity, inclusion and learner rights. AI can solve many of the world's education problems, like the lack of teachers, gaps in education, and the need for lifelong learning in the rapidly changing job market, according to the World Economic Forum (2020). The OECD (2021) has reviewed the potential of using AI to help personalised learning and enhance educational outcomes, and considered key questions regarding data privacy, algorithmic bias and the evolving role of the teacher.

But the dominant narrative of using AI in education, which so far has been largely western-centric, faces the danger of constructing a homogeneous trajectory for the integration of AI in education that fails to account for the wide and diverse contexts of education around

the world. The context of implementation, or the culture, economy, pedagogies and infrastructure, is not just a variable, but rather the defining factor in whether a technology empowers or marginalizes. Development of educational technologies in Silicon Valley, or in American preschools, assume levels of infrastructure, teacher capacity, and cultural values that may differ from those found elsewhere. The danger is that developing countries, desperate to catch up with global technological advances, may be using AI tools that are inappropriate to their contexts and therefore are using precious resources, and may be increasing existing educational inequalities (Heeks, 2010).

1.2 Pakistan's Educational Landscape and the AI Gap

Pakistan is a large nation, with more than 240 million people which poses a complex and sometimes challenging educational situation. Access, quality, and resources in the country's education system are highly differentiated. As per Pakistan Education Statistics Report (2021-22), the country's overall literacy rate is around 60% with stark differences among urban and rural areas, as well as between provinces. These are national differences which are reflected in the most populous province of Punjab, over 127 million people, with its own distinct features. Although primary school enrolment has seen improvements over the past few years and is around 85%, there are concerns about the quality of education. National and international assessment of learning outcomes is the lowest regionally consistently (ASER Pakistan 2023).

Pakistan's education system consists of public (government) schools, private (non-government) schools and religious schools (madrasahs) which cater to different segments of the population. The government school system, which comprises some 60 % of the nation's schools, is frequently plagued by inadequate funding, too many students in a class, underqualified teachers and scarce educational materials. Private schools come in two types—elite schools for well-to-do families and low tuition private schools for middle and lower-income families. Private schools are found in the big cities such as Lahore, Karachi and Islamabad, some of which are of high standards, have proper qualified teachers and exposure to modern education technologies. By contrast, low cost private education is quite abundant in recent decades, especially in less well-situated quality.

The divide between technology-savvy and technology-literate students is evident in education. The majority of public and low-cost private schools in semi-urban and rural areas struggle with the basic problems, such as overcrowded classes (40-60 students per teacher), poorly trained teachers, inadequate teaching resources, and, in many cases, the lack of basic facilities like electricity, clean water, and working toilets (Mahboob et al., 2022). The digital divide in Pakistan is significant; as per Pakistan Telecommunication Authority (2023), Internet penetration in Pakistan stands around 36% with rural areas as well as lower income groups having very low penetration in the internet. Only 15% of Government schools possess computers and even lesser the Internet. The same applies to teachers as well, as most teachers' digital literacy is limited and even less have been trained in educational technology (Hussain, 2021). The vision of Digital Pakistan was launched in 2019 with a promise of promoting the use of technology in all sectors, but the use of technology in education has been slow and inconsistent, favouring those institutions who were already privileged.

1.3 Research Gap and Purpose

Although there is great interest in the use of AI in education around the world, there is a lack of empirical evidence regarding the perception of AI among ECCE teachers in rural public schools in Pakistan. It is a significant disconnect that helps policy makers' understanding of the realities, culture, and professional concerns of teachers in rural settings such as Shahpur. In order to address this, this study explores the perceptions of

ECCE teachers regarding the use of AI in public schools in Shahpur tehsil for raising awareness and providing insights for policy, practice, and future research. The study considers two main aspects: teachers' general knowledge, understanding, and literacies about AI; and teachers' attitudes, expectations, and anxieties about the use of AI in early childhood classrooms.

2. Objectives

1. To determine the level of awareness, conceptual understanding and digital literacy of ECCE teachers of public schools, tehsil Shahpur, district Shahpur, about AI.
2. To explore ECCE teachers' attitudes, expectations, and concerns towards the implementation of AI in ECC classrooms in public schools of tehsil Shahpur.

3. Methodology

The quantitative cross-sectional survey design was used and the adapted Technology Acceptance Model (TAM) was expanded with contextual variables like infrastructure, cultural norms and digital literacy. The targeted population was all ECCE teachers in Sargodha, tehsil Shahpur, public schools. Using simple random sampling, 100 teachers participated from public schools. A specially designed validated Urdu questionnaire based on TAM was used to gather data in person ($\alpha=0.79-0.87$). A data analysis program called SPSS version 26.0 was used to calculate descriptive statistics.

4. Results

Table 1: Demographic Profile of Participants (N=100)

Variable	Category	Frequency	Percentage
Gender	Female	93	93.0%
	Male	7	7.0%
Age	20-29 years	32	32.0%
	30-39 years	42	42.0%
	40-49 years	18	18.0%
	50+ years	8	8.0%
Qualification	Intermediate	15	15.0%
	Bachelor's	46	46.0%
	Master's	30	30.0%
	M.Ed./B.Ed.	9	9.0%
Experience	0-5 years	31	31.0%
	6-10 years	36	36.0%
	11-15 years	18	18.0%
	16+ years	15	15.0%
Location	Urban (Shahpur)	40	40.0%
	Rural (villages)	60	60.0%
Teacher Training	Received	30	30.0%
	Not received	70	70.0%

Interpretation: There was a significant majority of females in the sample (93.0%) and the majority of teachers were in their 30-39 age group (42.0%) with a majority having 6 to 10 years of experience (36.0%). There was an equal representation of school type. Notably, 70% indicated that they had not received any training in technology, indicating low professional development levels in rural areas.

Objective 1: AI Awareness and Digital Literacy**Table 2: AI Awareness and Digital Literacy**

Indicator	Finding
Digital Literacy (Mean)	2.55 (Low)
AI Awareness (Mean)	2.85 (Moderate-Low)
Abstract AI Understanding (Mean)	2.40 (Low)
Concrete AI Understanding (Mean)	3.30 (Moderate)

Cumulative Summary of Objective 1: Overall digital literacy was low (M=2.55) and AI awareness was moderate-low (M=2.85). Teachers showed significantly better understanding through concrete scenarios (M=3.30) than abstract concepts (M=2.40), indicating that professional development should use practical, relatable examples.

Objective 2: Attitudes, Expectations, and Concerns**Table 3: Teachers' Perceptions Regarding AI**

Category	Indicator	Mean Score
Perceptions	Perceived Usefulness	3.42
	Perceived Ease of Use	2.58
	Overall Concerns	3.78
	Behavioral Intention	3.25
Top Benefits	Engaging children through multimedia	3.95
	Reducing administrative burden	3.68
Top Concerns	No internet connectivity	4.10
	Children need human interaction	3.90
	AI cannot teach moral values (tarbiyat)	3.72
	Fear of job displacement	65% teachers

Cumulative Summary of Objective 2: Teachers demonstrated moderate perceived usefulness (M=3.42) but low perceived ease of use (M=2.58), indicating conditional acceptance. The highest-rated benefits were engaging children through multimedia (M=3.95) and reducing administrative burden (M=3.68). Major concerns included infrastructure (no internet M=4.10), cultural issues (AI cannot teach moral values M=3.72, children need human interaction M=3.90), and fear of job displacement (65%). Behavioral intention was moderate (M=3.25), with perceived ease of use emerging as the strongest predictor.

5. Findings

1. The overall digital literacy was low (M=2.55), and the students' awareness of AI was moderate-low (M=2.85). Teachers' understanding was greater in the scenarios than in the abstract concepts (M=3.30 vs M=2.40).
2. Teachers had moderate perceived usefulness (M=3.42) and low perceived ease of use (M=2.58).
3. Conditional Acceptance: Teachers perceived that there was potential, but they were not confident about the ease of use (M=2.58) or perceived usefulness (M=3.42).
3. The most important infrastructural issues were cited as no internet (M=4.10) and electricity (M=93% as major obstacle).
4. Teachers think that children require human interaction (M=3.90) and AI cannot teach moral values/tarbiyat (M=3.72). 65% indicated they were afraid of losing their jobs.
5. Teachers worry that the use of AI will only benefit the best schools and deepen the education divide.

6. Discussion

The results indicate that there are substantial differences in the digital literacy and awareness of AI among the ECCE teachers working in public schools in tehsil Shahpur. The presence of AI in educational language is growing more prominent in the world, but teachers in this rural area are still largely unaware of the educational potential of AI. This is indicative of educational disparities on a national level and the lack of professional development in rural public schools. The moderate perceived usefulness and low perceived ease of use by teachers reflects "conditional acceptance" – they see potential benefits, but aren't confident about implementation. The importance of infrastructure barriers highlights the need to tackle the current electricity, connectivity and device access problems first, most of which are severe in rural areas such as Shahpur, before the introduction of AI. Concerns about the lack of moral values (tarbiyat) in teaching with the help of AI, and the fear of losing jobs, highlights strong cultural values regarding the teacher as a moral role and the significance of human relations in early childhood education. These issues are similar to those identified in international literature that highlights the decline of 'relational pedagogy' (Plowman & McPake, 2013), but are more prominent in rural Pakistani settings. The issues of equity are paramount, and teachers are keenly aware that AI might exacerbate the existing gaps in education. The strongest predictor for behavioral intention found in this study is perceived ease of use, indicating that it is important to raise teachers' confidence and competence.

7. Conclusion

According to this quantitative study, public school teachers of ECCE in tehsil Shahpur show conditional acceptance of AI as they believe it could be useful but they have substantial concerns regarding feasibility, cultural compatibility and equity issues. The factors that affect behavioral intention most are perceived ease of use and awareness of AI, underscoring the need to build teacher confidence and awareness. Top themes are infrastructure barriers, concerns about tarbiyat in the Islamic context and equity. The study concludes that, without tackling the core problems of infrastructure deficiencies, teacher capacity building, cultural fit and equity, there is no point in integrating AI in the public ECCE schools of Shahpur. The discussion needs to move from the question "How do we implement AI?" to "How can we construct resilient, equitable, and high-quality ECCE systems in which technology may have a nuanced, thoughtful role to play?" This is a long-term system-strengthening approach for which teacher perceptions are important in rural Pakistan.

8. Recommendations

For Policymakers: Create a policy that focuses on ethics and equity; invest in solar powered electricity, connectivity, and devices in rural public schools; focus on areas that are under served.

For Teacher Education: Incorporate Digital and AI literacy into teacher training; provide workshops based on practical examples; establish teacher learning circles in rural areas.

For Technology Development: Develop offline, low cost, Urdu/Punjabi tools for public schools, engage rural teachers in design, focus on simplicity of interface.

For School Leaders: Create positive school cultures; champion resources; articulate clearly the value of AI as a support.

For International Organizations: Rethink funding for capacity building of rural public schools; support South-South learning; leverage investment to local priorities.

For Future Research: Comparative studies in the seven tehsils of Sargodha, qualitative studies, parent perspectives, intervention models for rural public school contexts.

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