

A Qualitative Exploration of Parent Engagement and Challenges with AI in
ECCE Homeschooling

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ABSTRACT

Early Childhood Care and Education (ECCE) is at a turning point, where play-based learning meets with generative and conversational artificial intelligence (AI). The present study examines the current practices of parents in integrating AI tools (ChatGPT, Gemini, Meta AI, Google Assistant, MagicSchool.ai and Khan Academy AI) in ECCE level homeschooling in Punjab, Pakistan, and examines the practical, pedagogical and technical challenges. A qualitative exploratory design with an interpretivist paradigm was used, and semi-structured interviews were held with a sample of 25 home schooling parents in four districts (Lahore, Rawalpindi, Gujrat and Multan). A hybrid analytical approach of reflexive thematic analysis using NVivo 14 and text analytics using python was adopted. Results show the parents have systematically adopted AI as an 'adaptive scaffolding' tool to personalize their instruction, create personalized curriculum content and find interactive resources, which increased children's learning engagement and self-regulation. Yet, there are limits to successful integration, including the absence of stable infrastructure (electricity supply and internet connectivity), subscription issues, Urdu language limitations, and strong ethical-cultural gaps between AI-generated products and the local curricula (e.g., Pakistan's Single National Curriculum). Of fundamental importance, the study finds that the parent is the first 'Interaction Variable', as they are required to engage in 'Parental Pedagogical Mediation' to protect against screen dependency, and to maintain a concrete and balanced Montessori inspired learning environment. Finally, a synthesized Human-Centered AI-Supported Homeschooling Framework is proposed, which demonstrates the pedagogical viability of AI is not dependent on the sophistication of the technology but rather structured and empathetic human mediation.

Keywords: Artificial Intelligence, Homeschooling, Early Childhood Care and Education (ECCE), Montessori Pedagogy, Parental Mediation, Human-Centered AI, Punjab Pakistan.

INTRODUCTION

Drawing on the findings of this paper, ultimately, the synthesized Human-Centered AI-Supported Homeschooling Framework is illustrated, which suggests that the pedagogical viability of AI is not a function of technological sophistication, but structural and empathetic human mediation.

Early Childhood Care and Education (ECCE) is recognized as a crucial cornerstone in human development, socio-economic development, and long-term cognitive and socio-emotional

outcomes (Heckman, 2011; Kim et al., 2024). The first five years of life constitute a critical period of brain development, when environmental enrichment is most receptive and systemic stressors are most impactful, with approximately 85% of the brain developing during this time (Schiariti et al., 2021). Therefore, Sustainable Development Goal (SDG) 4.2 emphasizes that, in order to reduce the systemic inequalities, the early childhood environments shall be accessible to everyone and of high quality (Rad et al., 2022). Economists second this intervention, arguing that quality early years are between 7% and 10% return on investment (ROI) each year (Heckman, 2011). But extensive use of digital tools was spurred by the COVID-19 pandemic and accentuated inequities in access to quality care and instruction (Bozkurt et al., 2020; Su et al., 2022). The changing face of education is also accompanied by a paradigm shift—Traditional school-centric education is connecting with the Fourth Industrial Revolution, in which Artificial Intelligence (AI) and data science are influencing education reform (Du & Song, 2024).

One of the most visible aspects of this change is the expansion of alternative home-schooling. Homeschool has gone from being a small and alternative choice to a bigger and more popular one and was especially boosted by the pandemic with students in the United States alone switching to homeschool by four to five million (Kunzman & Gaither, 2013; Ray 2021). This movement enables parents to have a level of autonomy in the education system to ensure that their children can be offered an education that is appropriate for their interests and pace (Eldeeb et al., 2024). AI is uniquely positioned to provide massive personalized learning opportunities in the intersection of AI and home-based education, where AI systems can monitor, adapt, and customize activities in real-time (Ali & Saleh, 2022; Guo, 2025; Du & Song, 2024). This offers homeschooling parents a valuable resource to deal with complicated administrative and teaching issues (Latorre-Medina & Abdelmaula-Mesaud, 2024).

But, there are pedagogical, behavioral and socio-cultural tensions associated with this technological change. There is a fundamental disagreement between the two approaches: the classic early childhood education (ECE) methods, with their focus on tactile and sensorial learning and experience, and the high-frequency, screen-mediated input of digital devices (Safar, 2018; Natalia et al., 2024). As digital immigrants' parents have to deal with e-safety, data privacy and screen dependency without the institutional IT infrastructure and safeguards that exist in formal school environments (Prensky, 2001; Whiteville, 2025). This challenge is especially high in developing areas like Punjab, Pakistan, where infrastructural obstacles and power failures, along with cultural difficulties with local curricula (e.g., Pakistan's Single National Curriculum), make the educational process challenging (Badiuzzaman, 2024; Xiong et al., 2025).

Although literature on the application of AI in education is growing, there is still a significant lack of research on the use of AI in informal early childhood settings, with most studies conducted in formal higher education institutions and most with cross-sectional descriptive survey designs (Ali et al., 2025). This study fills this gap by exploring the opportunities and challenges faced by parents in Punjab, Pakistan, in the context of AI and early childhood homeschooling. The study pursues the following two research objectives: (1) to explore how parents are currently using AI tools in ECCE at home and how they think these tools align with ECCE pedagogical standards; and (2) to understand the most common practical, pedagogical, and technical challenges that parents face when using AI-supported ECCE at home. This work suggests an inductive Human-Centered AI-Supported Homeschooling Framework rooted in the twentieth century pedagogy and twenty-first-century digital reality.

REVIEW OF RELATED LITERATURE

The present-day home-schooling movement is a shift from pre-industrial home schooling to digital pedagogy (Kunzman & Gaither, 2013). The home was the chief educational agent

before the large-scale introduction of mass public education in the nineteenth century. But with industrialization came the emphasis on conventional, classroom based models. John Holt started a modern homeschooling movement in the 1970s and promoted "unschooling" or free and natural forms of learning that involved the child-led exploration of the world (Holt, 1981). The homeschooling movement expanded over the next decades from unschooling (child-led) to more structured and curriculum-driven homeschooling (Eldeeb et al., 2024). Today, the typical homeschool family is generally referred to as a 'middle-grounder', willing to forgo some aspects of mainstream school education in favor of homeschooling, which is a conscious and proactive choice, and is able to access socializing through online cooperative networks, as well as diversity and flexibility in learning content through such options (Eldeeb et al., 2024; Medlin, 2013; Shahzad et al., 2022).

With the integration of Artificial Intelligence (AI) into the field of homeschooling, the results of homeschooling have become unprecedented in terms of 'precision' (Du & Song, 2024). Conversational tutoring systems and adaptive learning tablets, which are types of AI-learning platforms, have shown to improve scores by an average of 32.4% in language arts, 36.2% in mathematics and 28.7% in English (Xiong et al., 2025). These platforms use machine learning algorithms that analyze the interactions to provide real-time 'adaptive scaffolding' to match the child's Zone of Proximal Development (ZPD) (Ouyang & Hu, 2019). This customization of content for parents reduces the burden on parent-educators and creates a virtual assistant to make global education available at home (Wei & Jiang, 2023; Robinson, 2023).

But too much exposure to digital devices in early childhood can have significant developmental risks. The excessive stimulation of digital devices can create 'screen fatigue' and 'screen dependency', potentially decreasing attention span and interest in physical toys, given that 85% of brain development occurs in the first five years of life (Schiariti et al., 2021; Muppalla et al., 2023). It is important to note that classic early childhood researchers maintain that concrete, hands-on, play-based interaction is the basis of intellectual development; the substitution of tactile manipulatives with screen-based applications can break a child's 'unbroken work cycle' and hinder their learning of spatial and creative abilities (Safar, 2018; Natalia et al., 2024). Additionally, AI systems do not possess the same level of empathy and emotional sensitivity as humans, which can lead to a sense of educational alienation and emotional isolation (Guo, 2025; Kelso et al., 2025).

Legal, cultural and technical governance gaps increase these pedagogical risks. Some countries, such as Indonesia and the United States, have well-defined laws that support home-based education and standardized equivalencies in testing (Baihaqi, 2025; Duvall, 2021); however, in developing countries, including Pakistan, there are no well-defined and centralized policies, resulting in ambiguity in accreditation (Awan et al., 2017). Furthermore, the leading AI platforms are culturally biased on European values and lack Urdu language models, which makes them incompatible with the local values and the Single National Curriculum (SNC) of Pakistan (Benjamin, 2019; Matthews, 2023). For homeschooling parents, as digital immigrants, they are fully accountable for data privacy, cybersecurity, and cultural filtering, causing potential parental role strain and parental burnout (Prensky, 2001; Whiteville, 2025; Ma et al., 2024).

The conceptual framework of this study was based on Maria Montessori's scientific pedagogy which considers education as process of releasing the potential of a child through self-directed activity in a structured environment (Isaacs, 2018). This frame work is based on six principles: (a) Independence, which gives children the freedom to choose 'work' and learn at their own pace; (b) Scientific Observation, where the adult is a 'sensitive guide' who observes the child's readiness; (c) Following the Child, respecting the child's developmental timetable; (d) Control of Error, didactic equipment which enables the child to discover and correct errors without the help of the adult; (e) the Prepared Environment, an orderly space that meets

developmental needs; and (f) the Absorbent Mind, the young child's capacity to unconsciously absorb knowledge directly from their surrounding environment.

One of the key theoretical paradoxes is between Montessori's emphasis on tactile, physical, play-based exploration of the world, and the virtual, screen-mediated inputs of AI (Safar, 2018). AI tools can be thought of as digitally manipulatives giving 'adaptive scaffolding' and 'algorithmic 'control of error' (Ouyang & Hu, 2019; Robinson, 2023). But this is a direct conflict with the belief that sensory training is the basis of all early intellectual activity.

To solve the problem, the current study suggests that the home-schooling parent is the main 'Interaction Variable' that enters a dynamic 'Parental Pedagogical Mediation' loop. The home is the most direct environment for the child and is the base of the microsystems of the socio-ecological systems theory proposed by Bronfenbrenner (1979). It is not about letting AI do its work and become an independent authority; rather, the parent has to be the 'Directress' (Montessori, 1912), who filters what children are exposed to digitally, ensures their data privacy (Matthews, 2023), and prepares the environment to balance exposure to digital screens with concrete, sensory play-based exploration (Safar, 2018; Kelso et al., 2025). AI is looked at as a digital scaffold to be gradually removed as the child progresses towards cognitive and physical independence.

RESEARCH METHODOLOGY

This study uses an interpretivist approach to research, taking it as the reality is subjective, multi-layered and socially constructed by lived experiences (Bickman & Rog, 1998). The qualitative exploratory research design was used to explore the unprecedented integration of AI in home-based early childhood education (HBC) (Braun & Clarke, 2006). The population of the study were homeschooling families with children in grades 5 to 8 of Punjab Province, Pakistan.

Four urban districts were selected from Punjab using a multi-stage stratified sampling technique, with different contexts comprising of Lahore, Rawalpindi, Gujrat and Multan. Purposive, convenience, and snowball sampling were used to select 25 homeschooling parents from these strata who had intentionally incorporated AI technologies into their teaching. The number of participants in this study was 25 which was considered as a qualitative sampling that reached the data saturation. There was a wide spectrum of parental literacy, technical skill and professional status (doctors, military officers, lecturers, IT specialists, pharmacists, and business owners). The semi-structured interview was the main instrument for data collection, which was developed and tested in a pilot study and validated by experts.

The qualitative data analysis involved reflexive thematic analysis (Braun & Clarke, 2006) and Python-assisted text analysis of the qualitative data. All semi-structured interviews were transcribed, given coded numbers from P01 to P25 and loaded into NVivo 14 software for systematic coding. The reflexive thematization was conducted in six phases, according to the guidelines of Braun and Clarke, and generated 13 main themes: AI Adoption, Adaptive Learning, Resource Discovery, Implementation Challenges, Pedagogical Balance, Parental Competence, Ethical Concerns, Behavioral Changes, Learning Engagement, Cognitive Development, Social Balance, Feedback Alignment and Self-Regulation.

The transcripts were preprocessed and analyzed programmatically in Python 3.12 to guarantee analytical transparency. Responses were normalized using Pandas, NLTK, Scikit-learn and Word Cloud; word frequencies and theme co-occurrence computed. A number of steps were taken to ensure trustworthiness, such as credibility, dependability, confirmability, and

transferability (Bickman & Rog, 1998). All ethical aspects (informed written consent and complete voluntary participation) were rigorously observed.

RESULTS AND FINDINGS

The results of this study are presented in a systematic manner according to the two major research objectives, using NVivo coding frequencies, Python text analysis, and representative participant experiences (narratives). The sample group of 25 home-schooling parents in Punjab revealed that they have a selective and highly mediated relationship with AI, which they use as a 'co-teacher' in home-schooling.

The first research objective explored parents' existing implementation of AI in early childhood homeschooling and their thoughts on the suitability of AI tools in early childhood pedagogy. The coding resulted in three main themes: AI Adoption (14 references), Adaptive Learning (13 references), and Resource Discovery (13 references). Within the category of intermediate/basic technical literacy, it was observed that ChatGPT was the most used platform followed by Google Assistant and Meta AI in word-frequency analysis. MagicSchool.ai was utilized by highly tech-literate parents. Table 1 specifies the exact AI tools that were used by the parents, and their main educational uses.

Figure 1. AI Platform Utilization in ECCE Homeschooling

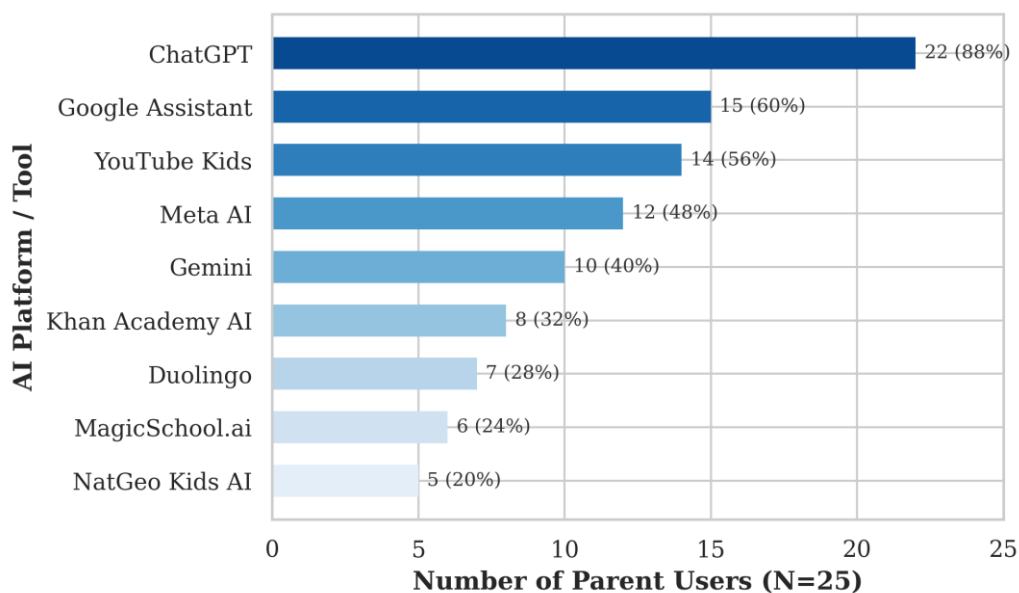


Figure 1. AI Platform Utilization in ECCE Homeschooling (N = 25 parents)

Table 1: AI Tools Utilized in Punjab ECCE Homeschooling

AI Tool Category	Primary Educational and Scaffolding Purpose
ChatGPT (OpenAI)	Concept explanations, interactive custom storytelling, generating math worksheets, curriculum translation.
Gemini (Google)	Personalized bilingual queries, visual exploration support,

	comparative educational research for parents.
Meta AI	Interactive conversations, instant question responses, and oral vocabulary exercises.
Google Assistant / Voice Search	Hands-free, voice-activated inquiry support for children with emergent literacy skills.
MagicSchool.ai	Parent-side lesson planning, developmental activity design, and individualized standard alignment.
Khan Academy AI / Kids	Structured mathematical exercises, adaptive cognitive scaffolding, and self-paced progress tracking.
Duolingo Kids	Phonics practice, vocabulary building, and conversational second-language (English) acquisition.
YouTube Kids AI Recommendations	Curated audio-visual demonstrations of science experiments and geography.
NatGeo Kids AI	Interactive science exploration, wildlife simulations, and independent ecological inquiry.
WhatsApp AI Chatbots	Rapid resource sharing, parent-to-parent lesson idea dissemination, and on-demand homework help.

There are three operational modes of parents' reported practices: Adaptive Learning, Resource Discovery, and Curriculum Adaptation. In Adaptive Learning, parents use real-time outputs to tune physical activities. For parents, Resource Discovery saves time by using AI to find new science experiments and ideas for playing. Parent capabilities are enhanced through actively creat the AI-generated outputs to fit local values and Pakistan's SNC guidelines in Curriculum Adaptation. Parents' practices and perceived benefits are summarized in Table 2.

Table 2: AI Integration Practices and Perceived Benefits

AI Practice Area	Specific Parental Activity/Method	Perceived Pedagogical Benefits
Adaptive Learning Support	Calibrating lesson prompts to match real-time performance and developmental age of child.	Fosters intrinsic motivation, provides personalized pacing, and targets learning gaps instantly.

Resource Discovery	Using ChatGPT and MagicSchool.ai to find novel science experiments, stories, and sensory play ideas.	Alleviates parental workload, reduces preparation time, and broadens curriculum variety.
Curriculum Adaptation	Filtering and translating AI outputs to fit local cultural values, religious guidelines, and SNC standards.	Maintains cultural relevance, avoids western pedagogical mismatch, and ensures policy alignment.
Interactive Explanations	Leveraging conversational voice assistants (Meta AI, Google Assistant) to address children's questions.	Nurtures curiosity, supports emergent literacy, and models critical inquiry skills.
Gamified Evaluation	Deploying Khan Academy Kids and Duolingo for self-paced mastery-based exercises.	Fosters self-regulation, ensures traceless developmental assessment, and builds confidence.

This is well supported by the qualitative narratives which show that parents are the first facilitators. A university lecturer from Lahore (Participant P09) said: “I use Chat GPT and YouTube Kids in a very highly curated order. I don't place my child in front of the screen. Rather, I use the AI to come up with a physics experiment in which I can use everyday objects such as empty bottles, and then I do the experiment in real life on the floor. The AI is my lesson planner; I am the real one. In the same way, Participant P16, an IT expert from Rawalpindi, reported: 'I can give three levels of difficulty to ChatGPT and MagicSchool.ai, and a simple story, so that my 5-year-old child learns simple language before we proceed. This offers a personalized mastery learning, which would not be possible in a busy classroom. Through these narratives, it can be seen that parents see AI as a strong cognitive scaffolding, which can only be seen as aligned with the standards of early childhood with active parental supervision.

The second research objective was to highlight some of the practical, pedagogical, technical, and ethical issues that parents face when using AI for homeschooling. Coding frequencies identified a complex matrix of systemic and behavioral challenges, namely Behavioral Changes (20 coding frequencies), Implementation Challenges (14 coding frequencies), Ethical Concerns (14 coding frequencies), Pedagogical Balance (13 coding frequencies) and Parental Competence (11 coding frequencies) as key factors that bound integration. Through the use of Python visual analytics, it was determined that technical and structural challenges are intertwined with cultural conflicts and developmental hazards. Families reported technical and contextual challenges as presented in Table 3.

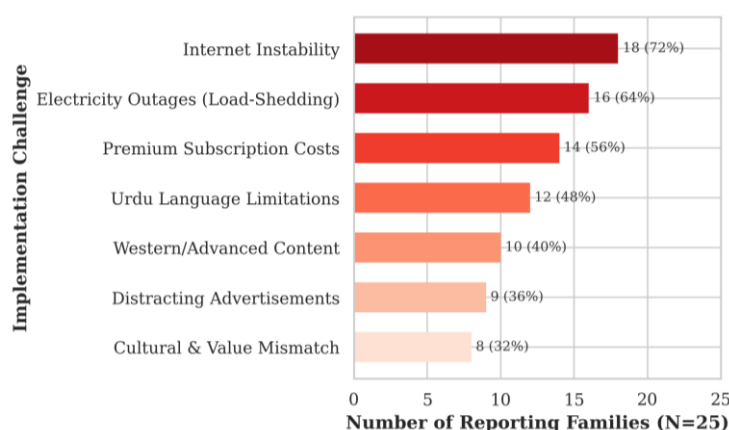


Figure 2 Practical, Technical, and Pedagogical Challenges (N = 25 parents)

Table 3: Technical and Contextual Challenges in AI Integration

Identified Challenge/s	Operational Context in Punjab	Socio-Pedagogical Impact on Home Learning
Internet Instability	Frequent connectivity disruptions, low-bandwidth networks in Southern Punjab.	Disrupts the child's unbroken work cycle, causing frustration and learning discontinuity.
Electricity Outages	Scheduled and unscheduled load-shedding across all urban districts.	Forces abrupt termination of digital interactive lessons and limits device accessibility.
Subscription Costs	High recurring paywalls for premium, ad-free AI tools (e.g., GPT-4, Magic School pro).	Exacerbates the digital divide, limiting advanced precision tools to affluent families.
Language Barriers	AI speech recognition struggles with Urdu pronunciation and localized accents.	Excludes emergent learners, misreports developmental status, and alienates non-English speakers.
Advanced Content Bias	AI platforms generate vocabulary and examples exceeding developmental age.	Triggers cognitive overload and requires extensive parental translation and editing.
Intrusive Advertising	Ubiquitous ad-popups in free versions of gamified educational applications.	Triggers high distractibility and screen overstimulation, disrupting independent play.
Cultural Value	AI-generated scenarios reference	Conflicts with domestic values,

Mismatch	Western norms (e.g., family structures, holidays).	requiring parents to actively rewrite and localize stories.
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Behavioral Changes (20 references) was the most common theme and reflects significant parental anxiety about the behavioral consequences of prolonged screen time. They have a two-way sword; on one hand positive cognitive engagement and on the other, critical developmental hazards. Table 4 shows the behavioral outcomes that were observed by parents in AI-supported homeschooling sessions.

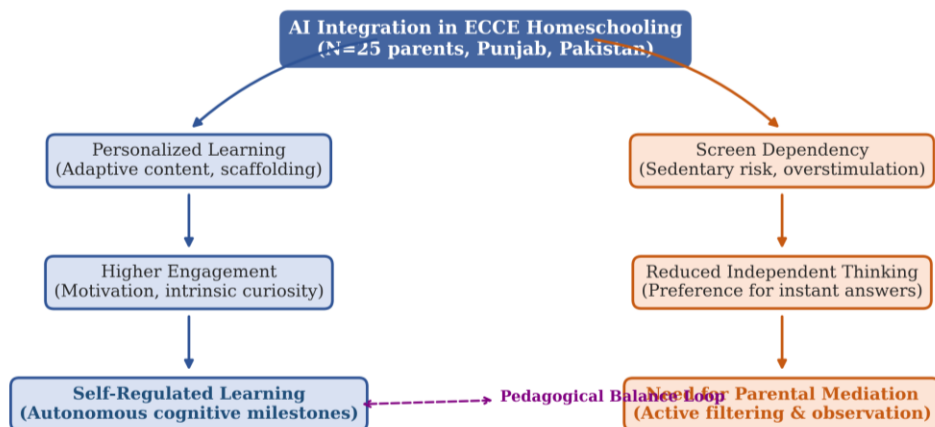


Figure 3: Socio-Pedagogical Dual-Pathway Model of AI Integration

Table 4: Observed Behavioral Outcomes and Developmental Challenges

Behavioral Dimension	Positive/Adaptive Indicators	Negative/Challenging Hazards
Cognitive Curiosity	Enhanced questioning, vocabulary acquisition, and independent exploration.	Preference for instant algorithmic answers, reducing physical critical thinking.
Learning Motivation	Excitement for gamified educational challenges and immediate feedback.	Impatience when facing complex tasks lacking instant digital rewards.
Physical Literacy	Ability to navigate digital voice-searches independently.	Sedentary screen fatigue, physical exhaustion, and eye strain.
Attention Regulation	Deep visual focus during animated storytelling sessions.	Fragmented attention span, high distractibility, and screen dependency.
Social-Emotional	Digital storytelling companions fostering verbal interaction.	Decreased interest in face-to-face play, potential digital isolation.

Literacy		
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These difficulties were vividly explained in the participant interviews and described a general 'role strain' of the homeschooling mother. Participant P01, mother, and a private tutor from Gujrat said, "Although ChatGPT is an amazing tool, the power cuts in my district for three hours daily." If there is an interactive session in progress and the power goes down, learning momentum is totally disrupted. My child is highly "now" orientee. There were also significant issues regarding the mismatches of ethical and cultural values. A school principal, P22, a mother from Multan, commented: 'Often, the stories produced by ChatGPT are about western holidays or make use of phrases that are not familiar to my child's life in Punjab. These texts will not match our values and Single National Curriculum (SNC) of Pakistan if I don't review, edit and localize them. In addition, cognitive dependency was a concern expressed by parents. Participant P11 from Lahore commented: 'My child has got so used to searching for answers on Google Assistant using her voice that she has stopped attempting to do basic puzzles on her own. She hopes the machine will provide her with a thought. I'm forced to take a hard line analog-only hour. These stories demonstrate the importance of precision in the use of AI, but also present some behavioral and cultural risks when using it without mediation.

DISCUSSION

This study's empirical results offer a solid, highly analytical basis for comprehending the socio-pedagogical dynamics of incorporating AI into early childhood homeschooling. The findings do not provide evidence for technological determinism, which posits that digital technology, and its use in education, per se, is a driver of educational quality; rather, they show that the value of AI to education is entirely dependent on the quality of pedagogical mediations from parents (Eldeeb et al., 2024; Ali et al., 2025). This is an extension of Heckman's (2011) pioneering research on investments in early childhood. Although Heckman focuses on structural interventions in school contexts, this study shows that personalized and data-driven scaffolding by artificial intelligence can mimic high-quality instructional environments at home, reducing the educational quality gap in areas where public institutions do not exist. This individualization is based on constructivist and social-constructivist theories, with the child's cognitive development as a target, and the digital 'More Knowledgeable Other' (MKO) as an individual support based on the 'Zone of Proximal Development' (Ouyang & Hu, 2019; Siemens, 2005).

When considering AI integration from a traditional Montessori perspective, however, a significant theoretical paradox arises. According to Maria Montessori, physical training of the five senses with tangible didactic materials is the base of early intellectual development (Safar, 2018). The AI platforms that rely on screens are more efficient mechanically, but at the same time give the user virtualized sensory feedback, which brings about a 'socialization paradox' and enormous screen fatigue (Muppalla et al., 2023; Natalia et al., 2024). Tutoring platforms also have short feedback cycles, which might overstimulate the young brain, causing to attention fragmentation and the dependence on instant digital answers (Schiariti et al., 2021). This leaves digital immigrant parents in a precarious position, as Prensky (2001) cautions, having to navigate these complicated, risky behaviour in the children without the institutional structures of IT support and protection found in formal schooling environments (Whiteville, 2025).

This study introduces a synthesized Human-Centered AI-Supported Homeschooling Framework in which the parent functions as the main interaction variable that facilitates a crucial 'Parental Pedagogical Mediation' (Bronfenbrenner, 1979). This is a model that has the parent as the traditional Montessori Directress. The directress does not let technology take over as an autonomous institution but rather curates technology inputs, screens for

algorithmic bias (Benjamin, 2019), ensures data privacy (Matthews, 2023), and regulates the prepared environment for balance with screen and concrete, sensory, play-based exploration (Safar, 2018; Kelso et al., 2025). AI is considered as a temporary digital scaffold (Ninio & Bruner, 1978) which is gradually withdrawn as the child acquires independent SRL and cognitive autonomy.

CONCLUSION

This study has critically examined the socio-pedagogical dynamics of integration of Artificial Intelligence (AI) in ECE homeschooling in Punjab, Pakistan. The inquiry revealed that parents strategically utilize conversational and generative AI to support their personalized teaching, create personalized learning resources and enable self-paced mastery-based learning, as articulated by three research goals (Eldeeb et al., 2024). But this digital innovation is limited by the critical infrastructural instability (connectivity problems and frequent load shedding), barriers of subscription paywall, Urdu-language deficiencies, and significant mismatches of ethical-cultural values with local curriculum standards (Badiuzzaman, 2024; Benjamin, 2019). Importantly, the findings show that the directress parent is the main Interaction Variable, using Parental Pedagogical Mediation to balance the use of the digital screen with concrete play with Montessori parents, so that no one becomes dependent on the digital screen and that no cognitive alienating behaviors occur.

The main theoretical contribution of this research is the formulation of the Human-Centered AI-Supported Homeschooling Framework, an induction process. As outlined in this model, the validity of AI education is not solely rooted in the technical complexity of the AI tools but in the quality of pedagogical mediation by humans in their own homes (Guo, 2025). The methodological contribution of the study is the use of a rigorous qualitative exploratory design, which has highlighted the potential of reflexive thematic coding in NVivo 14, and the advantages of text analytics, performed with the support of Python, for the exploration of an emergent paradigm in education in as transparent and creditable a manner as possible.

FUTURE RESEARCH

The study was qualitative and exploratory in nature, limiting the study to come with limitations like statistical generalizability, limited to urban areas of Punjab, Pakistan and the cross-sectional data collection cycle. Future studies need to test the proposed framework using a quantitative structural equation modeling approach with larger and more diverse samples, follow the cognitive and behavioral development of children educated in AI institutions in tertiary education, and investigate the viewpoints of other stakeholders, such as AI engineers and educators who specialize in children. Finally, this study suggests that Artificial Intelligence is not a teacher but a powerful ally of learning, a highly adaptive tool for early childhood home schooling, which can only be successful, then, if technology is precisely integrated with the empathetic qualities of parents, cultural knowledge and ethical mediation.

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