Beyond Screen Time: Effective Use of Digital Tools in Early Childhood Development

Dalal Aldhilan [1], Shahid Rafiq [2], Ayesha Afzal [3]

[1] *College of Humanities and Social Sciences, Northern Border University, Arar, Saudi Arabia*
[2] *Department of Social and Behavioral Sciences, Emerson University, Multan, Pakistan*
[3] *Department of Education, University of Management and Technology, Lahore, Pakistan*

Abstract **– This qualitative study explores the integration of digital tools in early childhood education (ECE) in Lahore, Pakistan, through semi-structured interviews with 25 educators and 25 parents of children aged 4–6 years. Employing thematic analysis, the study identifies seven themes: Educational Enhancement, Access and Equity Challenges, Developmental Concerns, Teacher Preparedness, Screen Time Regulation Strategies, Cultural and Contextual Relevance, and Parental Involvement. Findings reveal that digital tools, such as interactive apps, enhance engagement, literacy, numeracy, and motivation. Still, benefits are limited by unequal access to devices and the internet, particularly in public schools and low-income households. Excessive screen time and unsuitable content raise concerns about developmental impacts, while educators' limited training hinders effective technology use. Parents and educators employ strategies like time limits and guided interaction to balance digital engagement, emphasizing the need for culturally relevant tools reflecting local values. Parental collaboration with educators strengthens learning outcomes, though technological unfamiliarity poses challenges. Grounded in Piaget's constructivist theory, Vygotsky's sociocultural theory, and the Technology Acceptance Model, the study advocates for equitable access, teacher training, localized content, and parent-educator partnerships to ensure digital tools support holistic development in ECE, aligning with developmentally appropriate practices.**

Keywords **– Digital tools, screen time management, technology adoption, institutional barriers, educational practices.**

DOI: 10.18421/TEM144-34
https://doi.org/10.18421/TEM144-34

Corresponding author: Shahid Rafiq,
Department of Social and Behavioral Sciences,
Emerson University Multan, Pakistan
Email: shahid.rafiq@eum.edu.pk

Received: 17 June 2025.
Revised: 18 September 2025.
Accepted: 03 October 2025.
Published: 27 November 2025.

1. Introduction

The widespread adoption of digital technology has transformed early childhood education (ECE), with devices, educational apps, and interactive platforms supporting cognitive and social development. These tools enhance access to learning resources, enable personalized learning, and engage young learners innovatively. However, challenges persist in managing screen time and ensuring developmentally appropriate content [1].

The COVID-19 pandemic accelerated digital tool use in ECE globally, as online and hybrid learning models became essential for educational continuity. Apps, video platforms, and interactive games bridged traditional and remote learning environments [2]. In Pakistan, this shift offered opportunities but required careful implementation to avoid cognitive overload or reduced face-to-face interaction, which is vital for social and emotional growth [3].

Concerns about excessive screen time include risks of attention problems, sleep disturbances, and language delays, particularly for children under five. Conversely, high-quality digital content, such as interactive storybooks, phonics games, and math puzzles, can support literacy, numeracy, and emotional regulation when balanced with hands-on activities [4]. Educators and parents must select tools aligning with constructivist and socio-cultural learning theories, which emphasize interactive, hands-on experiences [5].

Technological literacy is increasingly critical for 21st-century skills. Early exposure to coding games, robotics kits, and design tools playfully fosters creativity and problem-solving [6]. Yet, parents often struggle to manage screen time due to the ubiquity of devices [7]. Digital tools must complement, not replace, play-based learning, physical activity, and social interaction. Collaboration among educators, parents, and policymakers is crucial to developing guidelines ensuring equitable and developmentally appropriate technology use.

Future research and policies should identify the best practices to integrate digital tools effectively, supporting holistic child development across socio-economic backgrounds.

Digital technology has transformed early childhood education (ECE), introducing tools like tablets, interactive whiteboards, and educational apps alongside traditional play-based learning. This shift reflects the growing importance of digital literacy for academic and career success. Historically, ECE has relied on theories from Piaget and Vygotsky, emphasizing social interaction, physical play, and hands-on learning to foster knowledge construction [5]. Approaches like Montessori and Reggio Emilia prioritize experiential learning, but digital tools offer interactive experiences that can complement these methods [8].

The COVID-19 pandemic accelerated digital adoption in ECE, as school closures in Pakistan and globally necessitated remote learning [2]. Digital tools ensured educational continuity, offering accessible and individualized content, but highlighted the need to balance screen time with developmental activities. Excessive screen time is linked to reduced attention, lower physical activity, and delayed language skills [1]. Conversely, well-designed educational apps, e-books, and games can enhance literacy, numeracy, and problem-solving when used appropriately [4]. However, unstructured screen time risks displacing critical social and physical activities.

Socio-economic disparities, particularly in Pakistan, raise equity concerns, as access to devices and the internet varies between urban and rural areas [3]. Integrating digital tools requires alignment with developmentally appropriate practices (DAP), which prioritize learning environments tailored to children's cognitive, social, and emotional stages [9]. This study explores how digital tools can support ECE while preserving DAP, examining their benefits and risks, and addressing challenges in managing screen time and selecting appropriate content. It aims to guide educators and parents in fostering digital literacy without compromising holistic child development.

2. Literature Review

The integration of digital tools in early childhood education (ECE) has transformed learning environments, with educational apps, interactive games, and multimedia platforms becoming central to modern classrooms. This review explores the benefits and risks of digital tools, the impact of screen time on young children's development, and the role of developmentally appropriate practices in ensuring effective technology use.

Research highlights the potential of digital tools to enhance learning. Well-designed apps and games engage young learners through multimedia elements, supporting foundational literacy and numeracy skills via interactive storybooks, phonics games, and puzzles [10]. These tools provide immediate feedback, fostering self-paced learning and a sense of achievement [4]. Digital tools also promote cognitive skills like problem-solving and creativity, with touchscreen games allowing children to explore scenarios and simulate real-world activities [6]. Digital storytelling aids language development and early literacy [11], while collaborative platforms encourage social learning [12]. For children from low-income families, digital tools can bridge gaps in access to educational resources.

However, concerns about excessive screen time persist. The American Academy of Pediatrics advises limited screen exposure for children under five, citing risks like reduced attention spans, delayed language acquisition, and behavioral issues [1]. Unregulated screen use may displace critical play-based learning, social interaction, and physical activity. Additionally, many educational apps lack robust design, prioritizing rote memorization over higher-order thinking [4]. Physical health risks, including obesity and poor sleep quality, are also associated with prolonged screen time [13].

Developmentally appropriate practices (DAP), as defined by the National Association for the Education of Young Children [9], are central to early childhood education (ECE), focusing on teaching that aligns with children's developmental stages and individual needs. DAP prioritizes hands-on learning, social interaction, and physical activity to support holistic development.

Integrating digital tools into ECE must adhere to DAP principles to complement, not replace, traditional learning. Piaget's constructivist theory and Vygotsky's socio-cultural theory emphasize active, experiential learning for cognitive and social-emotional growth [5]. Digital tools, while engaging, should not overshadow real-world exploration, problem-solving, or peer interaction.

Research reported that using tools like touchscreens to supplement hands-on activities, ensuring time for play and movement to meet developmental needs [14].

Parents and educators play vital roles in managing screen time. Parents struggle to regulate children's device use, often unsure which digital content is educational [7]. Clear guidelines and parent-educator collaboration are essential for balanced screen time management. Educators, meanwhile, need training to select curriculum-aligned digital tools. Professional development enhances teachers' ability to use technology effectively, tailoring resources to learners' needs [15].

Literature stresses balance in digital integration. limiting screen time while promoting active learning and social interaction through a mix of traditional and digital methods [16]. Children benefit most when digital tools are used alongside hands-on activities, creative play, and group work, serving as a valuable supplement to support learning without compromising development [8].

2.1. Theoretical Framework

The integration of digital tools in early childhood education (ECE) is best understood through a framework combining Piaget's constructivist theory, Vygotsky's sociocultural theory, and the Technology Acceptance Model (TAM).

This framework explores how digital tools support children's cognitive and social development while aligning with developmentally appropriate practices (DAP).

Piaget's constructivist theory posits that children build knowledge through active engagement with their environment, particularly during the preoperational stage (ages 2–7).

Digital tools, such as interactive storytelling apps or manipulable interfaces, support hands-on exploration, fostering cognitive growth. However, excessive screen time must be avoided to preserve essential physical activities critical for development.

Vygotsky's sociocultural theory emphasizes social interaction in learning, with the Zone of Proximal Development (ZPD) highlighting the role of guidance from educators or peers. Digital tools can mediate collaborative learning, enabling children to engage with others. Effective use requires adult scaffolding to maximize educational benefits, ensuring tools align with social learning goals.

The Technology Acceptance Model (TAM) explains technology adoption through Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). For digital tools to be effective in ECE, educators and parents must view them as valuable for learning and user-friendly. This integrated framework guides the selection of digital tools that promote active learning, social interaction, and scaffolding, aligning with DAP to support cognitive, social, and emotional development, as shown in Figure 1.

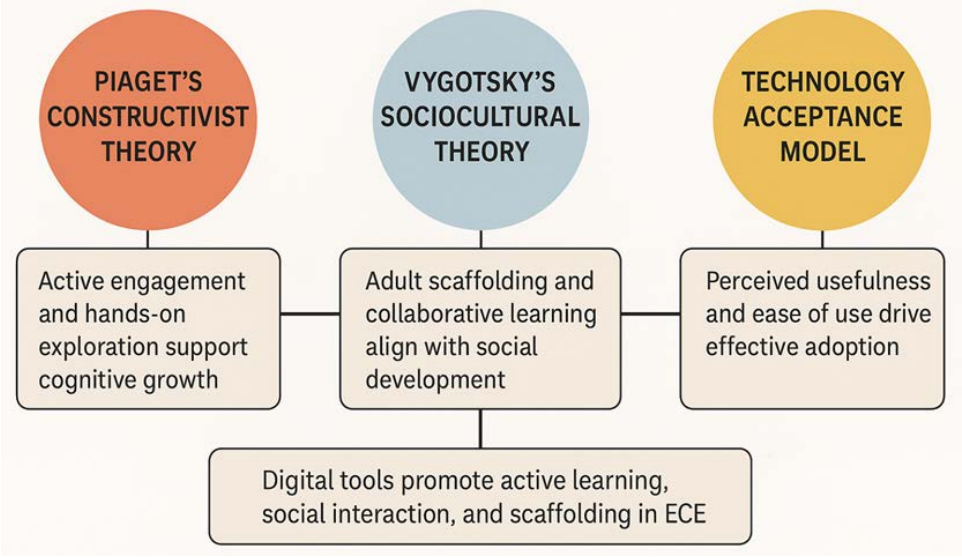

Figure 1. Theoretical framework

3. Methodology

This study employed a qualitative research design to explore the integration of digital tools in early childhood education (ECE) in Lahore, Pakistan, focusing on the perspectives and experiences of educators and parents.

Qualitative methods are well-suited for capturing nuanced insights into complex educational phenomena, such as technology integration [17].

The approach involved in-depth, semi-structured interviews with 25 early childhood educators and 25 parents of children aged 4–6 years, purposively selected from public and private ECE institutions to capture diverse teaching experiences and parental insights.

Purposive sampling ensured a range of perspectives, aligning with recommendations for qualitative research in educational settings [18].

Interviews were conducted face-to-face during parent-teacher meetings, facilitating detailed discussions about participants' experiences with digital tool integration, including the types of tools used (e.g., educational apps, interactive videos), their perceived impacts on children's cognitive and social development, and strategies for managing screen time, as emphasized in studies on digital media in ECE [8].

A semi-structured interview guide was developed to ensure consistency while allowing flexibility for participants to elaborate, following best practices for qualitative interviewing [19]. Key topics included the benefits and challenges of digital tool use, such as access to technology, training needs, and concerns about excessive screen time, as well as strategies for balancing digital engagement with developmentally appropriate practices (DAP) as outlined by [9]. The conversational format encouraged participants to share personal anecdotes, enriching the data with nuanced perspectives on how digital tools align with children's developmental needs [14]. All interviews were audio-recorded with participants' consent, transcribed verbatim, and analyzed thematically to identify patterns related to digital tool integration and screen time management.

Participants were selected purposively to ensure diversity. Educators varied in years of teaching experience and institutional context (public vs. private), while parents represented diverse socio-economic backgrounds, reflecting varying access to digital resources, a critical factor in technology adoption [7]. Conducting interviews during parent-teacher meetings maximized convenience and fostered open dialogue in a familiar setting, enhancing participant comfort and response depth [18].

Data analysis followed a thematic approach, as described by [20]. Transcripts were coded to identify recurring themes, such as the perceived educational value of digital tools, barriers to effective integration, and approaches to screen time management.

Initial codes were organized into broader themes through iterative review, ensuring alignment with participants' narratives. This process provided a comprehensive understanding of how digital tools are used in ECE and the factors shaping their effectiveness, consistent with qualitative research principles [17].

The study acknowledged limitations, including potential biases from self-reported data, as participants may provide socially desirable responses [17]. The focus on Lahore may limit the transferability of findings to other regions with different technological or educational contexts [18]. While the sample size of 50 participants (25 educators and 25 parents) supported in-depth qualitative exploration, it may not capture all perspectives within ECE settings.

Ethical considerations were rigorously upheld. Ethical approval was obtained from the Deanship of Scientific Research at North Border University, ensuring compliance with the Declaration of Helsinki and institutional policies. Participation was voluntary, and informed consent was obtained from all participants, who were fully informed about the study's objectives, methods, and confidentiality measures, following ethical guidelines for educational research [21]. No personally identifiable information was collected, and all data was anonymized and securely stored, accessible only to authorized researchers. The findings are intended for academic research, publications, and educational purposes, with ethical documentation available upon request.

4. Data Analysis and Results

Thematic analysis of the qualitative data from in-depth, semi-structured interviews with 25 early childhood educators and 25 parents in Lahore, Pakistan, revealed key themes and subthemes related to the integration of digital tools in early childhood education (ECE). The analysis followed a [20] thematic analysis framework, identifying patterns in participants' experiences and perspectives on digital tool use, their benefits, challenges, and management strategies. Table 1 presents a set of themes, incorporating dimensions such as digital equity, cultural relevance, and parental involvement, alongside revised versions of the original themes. Each theme includes subthemes with representative quotations from educators and parents, reflecting their insights on how digital tools impact children's learning and development.

Table 1. Thematic analysis

Theme	Subtheme	Source	Representative Quotations
Educational Enhancement	**Increased Engagement**	Parent	"My son gets so excited using interactive apps; they keep his attention much longer than books alone."
		Educator	"Digital tools like interactive games boost class participation, especially for quieter students."
	Skill Development	Parent	"Using math apps, my daughter has improved her counting skills and enjoys practicing at home."
		Educator	"Apps targeting literacy and numeracy help children grasp concepts faster, with clear progress in their skills."
	Motivation and Interest	Parent	"My child looks forward to lessons with tablets; it makes learning feel like a fun game."
		Educator	"Students are more eager to learn when we use digital tools, especially for interactive storytelling."
Access and Equity Challenges	**Technology Access Gaps**	Parent	"Not all families here can afford tablets or internet, so my child misses out on some digital learning at home."
		Educator	"We see a clear divide; students without home devices struggle to keep up with digital assignments."
	Digital Divide in Schools	Parent	"Some schools have better tech than others, and it feels unfair for kids in public institutions."
		Educator	"Our school lacks enough devices for all students, which limits how often we can use digital tools."
Developmental Concerns	**Screen Time Overuse**	Parent	"I'm worried my son spends too much time on screens; it might affect his focus on physical play."
		Educator	"We need to limit screen time to avoid children becoming too reliant on digital devices for learning."
	Content Suitability	Parent	"Not all apps are good for kids; some are just games disguised as educational tools."
		Educator	"Choosing age-appropriate apps is tough; many don't align with our curriculum or developmental goals."
Teacher Preparedness	**Need for Professional Training**	Parent	"I feel teachers could use digital tools better if they had more training on how to integrate them."
		Educator	"I've had little training on educational technology; workshops would help me use tools more effectively."
	Confidence in Technology Use	Parent	"Some teachers seem hesitant with digital tools, which affects how they teach with them."
		Educator	"I'm not always confident using new apps; without support, it's hard to incorporate them well."
Screen Time Regulation Strategies	**Time Restrictions**	Parent	"We allow 30 minutes of educational app time daily to balance it with other activities like reading."
		Educator	"In class, we cap screen time at 20 minutes per session to keep kids engaged in hands-on tasks."
	Guided Interaction	Parent	"I sit with my daughter during app use to ensure she's learning and not just playing games."
		Educator	"We guide students during digital activities to ensure they're engaging with educational content properly."
	Reward-Based Use	Parent	"We let our child use learning apps after finishing homework; it motivates her and controls screen time."
		Educator	"Using tablets as a reward for completing tasks encourages students while keeping digital use limited."
Cultural and Contextual Relevance	**Alignment with Local Values**	Parent	"Some apps don't reflect our culture or language, which makes it harder for my child to connect."
		Educator	"We need digital tools that include local stories and languages to make learning more relevant."
	Parental Expectations	Parent	"I want apps that teach values alongside academics, but many focus only on Western content."
		Educator	"Parents often ask for tools that align with our cultural context, but such resources are hard to find."
Parental Involvement	**Active Participation**	Parent	"I try to learn about the apps my child uses so I can support her learning at home."
		Educator	"When parents engage with digital tools alongside their kids, it really enhances the learning process."
	Communication with Educators	Parent	"Talking to teachers about digital tools helps me understand how to support my child's learning."
		Educator	"Regular discussions with parents about digital tool use help us align home and school strategies."

Table 1 highlights the multifaceted nature of digital tool integration in ECE, drawing on thematic analysis as described by [20]. The expanded themes, Educational Enhancement, Access and Equity Challenges, Developmental Concerns, Teacher Preparedness, Screen Time Regulation Strategies, Cultural and Contextual Relevance, and Parental Involvement, reflect the benefits, challenges, and strategies identified by participants. Educators and parents noted that digital tools enhance engagement, skill development, and motivation, aligning with findings on technology's educational potential [4].

However, challenges such as limited technology access, developmental risks from overuse, and insufficient teacher training underscore equity and implementation barriers [7], [8]. Strategies like time restrictions, guided interaction, and reward-based use help balance digital engagement with developmentally appropriate practices [9]. New themes, such as Cultural and Contextual Relevance and Parental Involvement, highlight the importance of aligning digital tools with local values and fostering parent-educator collaboration to enhance learning outcomes [14], as shown in Figure 2.

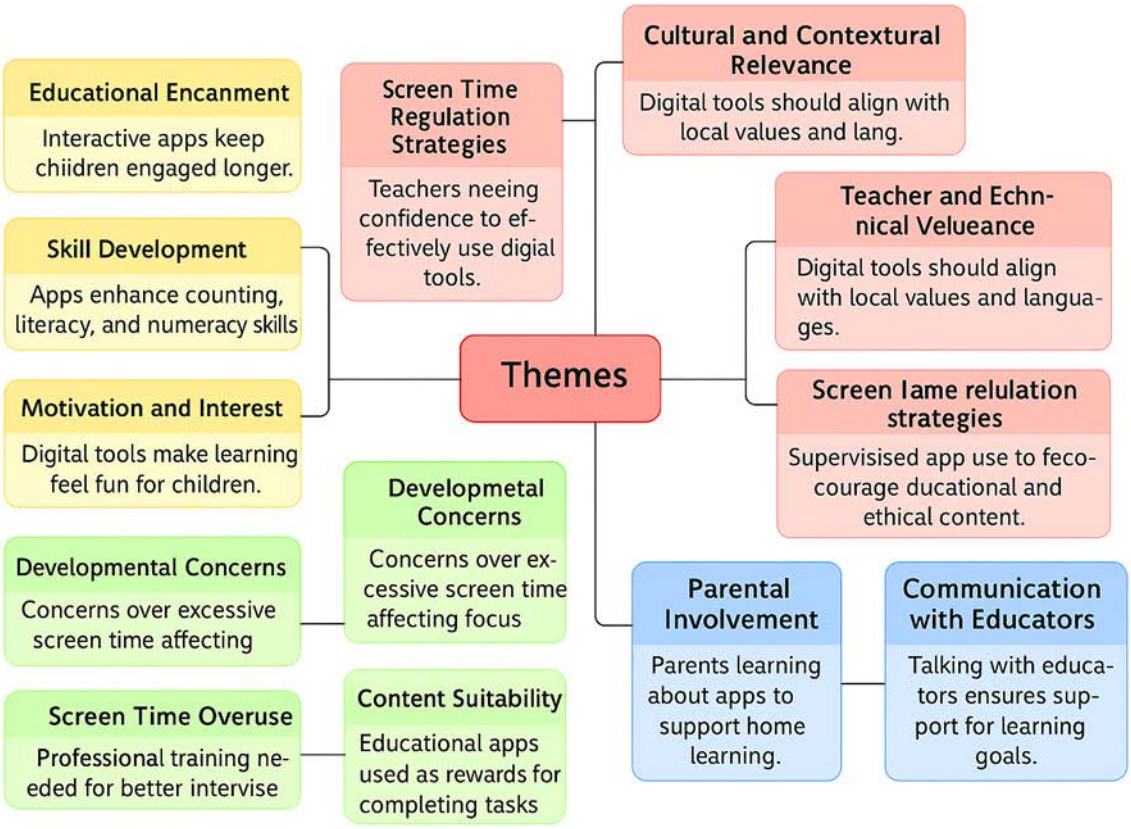

Figure 2. Themes extracted through thematic analysis

4.1. Educational Enhancement

The theme of Educational Enhancement reflects the notable benefits that parents and educators identified in integrating digital tools into early childhood education in Lahore, Pakistan. Both groups observed that children displayed increased attention and engagement during lessons that incorporated digital tools. Educators highlighted that interactive apps and educational videos significantly boosted student participation in classroom activities. Parents reported that their children demonstrated improved comprehension of academic concepts, with digital tools effectively reinforcing learning. Likewise, educators noted that children retained information more clearly when using digital content.

The use of these tools also sparked motivation, with children showing greater enthusiasm for lessons involving technology. Parents and educators agreed that digital tools fostered a sense of excitement, encouraging active involvement in the learning process.

4.2. Access and Equity Challenges

The theme of Access and Equity Challenges reveals critical obstacles in integrating digital tools into early childhood education in Lahore, Pakistan. Parents and educators highlighted significant disparities in technology access, with many families unable to afford devices or stable internet, restricting children's engagement with digital learning resources outside school.

Educators noted that students without home access struggle to keep up with peers who have devices, creating an uneven learning experience. Similarly, differences between schools were evident, as public institutions often lack adequate technology compared to private ones, further widening the gap in educational opportunities. Parents expressed concern that this divide unfairly limits their children's potential to benefit from digital tools. Educators also emphasized that the lack of resources in some schools hinders their ability to incorporate technology effectively into lessons.

This theme underscores the urgent need for solutions to bridge these gaps, ensuring all children have equal opportunities to engage with digital learning tools. Addressing these inequities is essential to creating an inclusive educational environment where every child can thrive in technology-enhanced learning settings.

4.3. Developmental Concerns

The theme of Developmental Concerns captures the apprehensions expressed by parents and educators regarding the integration of digital tools in early childhood education in Lahore, Pakistan. Both groups worried that excessive screen time could negatively impact children's attention spans, reducing their focus on non-digital activities like outdoor play. Educators noted that prolonged use of digital devices might lead to over-reliance, diminishing interest in hands-on learning critical for young learners. Parents voiced concerns about the suitability of digital content, observing that some apps prioritize entertainment over educational value, potentially hindering cognitive development. Educators echoed this, emphasizing the challenge of selecting age-appropriate tools that align with curriculum goals. These concerns highlight the risk of digital tools displacing essential developmental activities, such as social interaction and physical play, which are vital for holistic growth. Both parents and educators stressed the need for careful monitoring to ensure digital tools support, rather than undermine, children's developmental needs. Balancing technology use with traditional learning methods remains a key challenge in maintaining healthy development in early childhood education settings.

4.4. Teacher Preparedness

The theme of Teacher Preparedness highlights significant gaps in the readiness of educators to integrate digital tools effectively in early childhood education in Lahore, Pakistan.

Parents observed that some teachers appear hesitant or unsure when using digital tools, suggesting a lack of confidence that impacts their teaching effectiveness. Educators themselves admitted to receiving minimal training on incorporating technology into lessons, expressing a strong desire for more professional development opportunities. Many felt ill-equipped to select and use digital tools that align with curriculum goals or meet the developmental needs of young learners. Parents noted that untrained teachers often rely on familiar methods, limiting the potential benefits of digital resources for their children.

Educators emphasized that without ongoing support, such as workshops or hands-on training, they struggle to keep pace with evolving educational technologies. This lack of preparedness creates a barrier to fully leveraging digital tools to enhance learning experiences. Both parents and educators agreed that targeted training programs are essential to build confidence and competence in using technology. Strengthening Teacher Preparedness is critical to ensuring digital tools are used effectively, supporting engaging and developmentally appropriate learning environments for young children. Addressing these training needs would empower educators to integrate technology seamlessly into their teaching practices.

4.5. Screen Time Regulation Strategies

The theme of Screen Time Regulation Strategies reflects the proactive approaches parents and educators in Lahore, Pakistan, employ to manage digital tool use in early childhood education. Parents emphasized setting strict time limits, typically allowing 30 minutes of educational app use daily to balance digital engagement with activities like reading or playing. Educators similarly restricted screen time to 20-minute sessions in class, ensuring children remain focused on hands-on tasks. Both groups highlighted the importance of guided interaction, with parents sitting alongside children during app use to ensure content is educational, while educators actively monitored digital activities in the classroom. Additionally, using digital tools as rewards was a common strategy; parents permitted app access after homework completion, and educators allowed tablet use for students who finished tasks, fostering motivation while controlling usage. These strategies demonstrate a shared commitment to preventing overexposure to screens, which could disrupt developmental activities like social interaction or physical play. By implementing time restrictions, guided use, and reward-based approaches, parents and educators aim to harness the benefits of digital tools while safeguarding children's holistic development in early learning environments.

4.6. Cultural and Contextual Relevance

The theme of Cultural and Contextual Relevance underscores the importance of aligning digital tools with local values and educational needs in early childhood education in Lahore, Pakistan. Parents expressed concern that many digital apps feature Western content, making it difficult for children to connect with material that reflects their cultural or linguistic background. Educators noted a lack of digital resources incorporating local stories, traditions, or languages, which limits their relevance and effectiveness in the classroom.

Parents emphasized a desire for tools that teach cultural values alongside academics, fostering a sense of identity in young learners. Educators echoed this, highlighting the challenge of finding apps that resonate with Pakistan's cultural context, as many are designed for global audiences. This disconnect can reduce engagement and hinder meaningful learning experiences. Both groups stressed the need for culturally relevant digital tools to make lessons more relatable and impactful for children. Developing or adapting resources to include local languages, stories, and values is essential for enhancing educational outcomes. Addressing cultural relevance ensures digital tools support holistic development while respecting the unique socio-cultural context of early learners in Pakistan.

4.7. Parental Involvement

The theme of Parental Involvement highlights the critical role parents play in supporting digital tool integration in early childhood education in Lahore, Pakistan. Parents emphasized actively engaging with the digital tools their children use, such as exploring educational apps together to reinforce learning at home. Educators noted that children benefit significantly when parents participate in digital activities, as it strengthens the connection between home and school learning environments. Parents reported communicating regularly with teachers about digital tool use, seeking guidance on selecting appropriate apps, and managing screen time effectively. Educators valued these discussions, as they help align home and school strategies to ensure consistent educational support.

Many parents expressed a desire to better understand digital tools to guide their children's learning, but some faced challenges due to limited technological familiarity. Educators observed that involved parents enhance the effectiveness of digital tools by reinforcing classroom lessons at home.

This collaboration fosters a cohesive approach to integrating technology, ensuring it supports children's cognitive and social development. Both groups agreed that stronger parent-educator partnerships are essential for maximizing the benefits of digital tools. Encouraging active parental involvement through communication and education is key to creating a supportive learning ecosystem for young children.

The thematic analysis of qualitative data from interviews with 25 educators and 25 parents in Lahore, Pakistan, revealed seven key themes regarding digital tool integration in early childhood education. Educational Enhancement highlighted increased engagement, skill development, and motivation, as digital tools like apps and videos captivated children and improved learning outcomes. Access and Equity Challenges underscored disparities, with limited device access and school resources creating divides in learning opportunities. Developmental Concerns focused on risks of excessive screen time and unsuitable content, potentially affecting attention and holistic growth. Teacher Preparedness revealed educators' lack of training and confidence, hindering effective technology use. Screen Time Regulation Strategies included time limits, guided interaction, and reward-based use to balance digital engagement with developmental needs. Cultural and Contextual Relevance emphasized the need for tools reflecting local values and languages to enhance relatability. Parental Involvement showcased parents' active participation and collaboration with educators, strengthening digital learning support. These themes collectively illustrate the benefits, challenges, and strategies for integrating digital tools, emphasizing the need for equitable access, teacher training, and culturally relevant resources to support children's development in ECE settings, as shown in Figure 3.

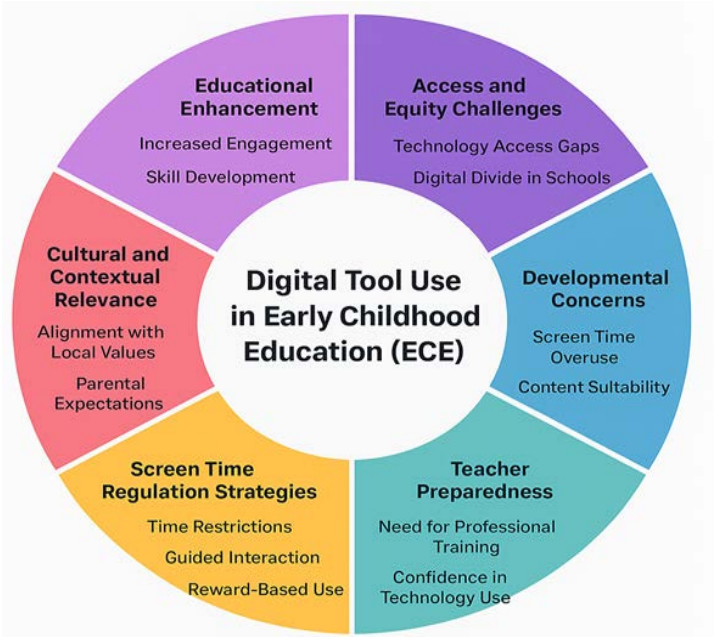

Figure 3. Thematic Wheel

5. Discussion

This study's thematic analysis of interviews with 25 early childhood educators and 25 parents in Lahore, Pakistan, provides a nuanced understanding of the integration of digital tools in early childhood education (ECE), revealing both opportunities and challenges. The seven identified themes, Educational Enhancement, Access and Equity Challenges, Developmental Concerns, Teacher Preparedness, Screen Time Regulation Strategies, Cultural and Contextual Relevance, and Parental Involvement, offer insights into how digital tools are perceived and implemented in ECE settings, aligning with and expanding upon prior research. These findings underscore the need for a balanced approach to technology integration, guided by developmentally appropriate practices (DAP) as outlined by the National Association for the Education of Young Children [9], and highlight the importance of addressing local contextual factors to ensure equitable and effective use of digital tools.

The theme of Educational Enhancement confirms that digital tools significantly boost engagement, skill development, and motivation in young learners, resonating with prior studies. Parents and educators reported that interactive apps and educational videos captivate children's attention, fostering enthusiasm for learning. This aligns with [4], who found that well-designed digital tools promote literacy and numeracy through interactive elements that provide immediate feedback and encourage self-paced learning.

Similarly, [10] emphasized that digital storytelling and phonics-based games enhance early literacy skills, a finding echoed in parents' observations of improved comprehension and educators' reports of better concept retention.

The motivational aspect, where children eagerly participate in lessons involving technology, supports [8], the assertion that digital tools make learning playful and engaging, aligning with Piaget's constructivist theory, which emphasizes active exploration for cognitive growth [5]. However, these benefits are contingent on thoughtful integration, ensuring digital tools complement hands-on activities rather than dominate the learning environment, as advocated by [9].

Access and Equity Challenges emerged as a critical barrier, highlighting disparities in technology access that exacerbate educational inequalities. Parents noted that many families cannot afford devices or reliable internet, limiting home-based digital learning, while educators pointed to resource shortages in public schools compared to private institutions. These findings corroborate [3] report on the digital divide in low-resource settings, which underscores how socio-economic disparities restrict access to educational technology. Similarly, [12] noted that children from lower-income families benefit from digital tools when access is provided, but without it, they fall behind peers with greater resources. This theme aligns with the study's theoretical framework, particularly the Technology Acceptance Model (TAM), which suggests that perceived usefulness is diminished when access is unequal, hindering technological adoption (Davis, 1989, as cited in previous studies).

Addressing these inequities requires targeted interventions, such as providing devices in schools or community centres, to ensure all children benefit from digital tools, as recommended by [2].

Developmental Concerns revealed apprehensions about excessive screen time and inappropriate content, reflecting broader research on technology's impact on young learners. Parents and educators worried that prolonged screen exposure could reduce focus on physical play and social interaction, critical for holistic development. This aligns with [22], which links excessive screen time to attention issues and language delays in children under five. Unregulated digital use may displace play-based learning, a concern echoed by educators who emphasized balancing digital tools with hands-on activities. The issue of content suitability, raised by parents, resonates with [8] finding that many educational apps lack robust pedagogical design, focusing on rote learning rather than fostering critical thinking. These concerns underscore the importance of aligning digital tool use with DAP, ensuring that technology supports, rather than hinders, cognitive and social-emotional development [9].

Teacher Preparedness highlighted a significant gap in educators' readiness to integrate digital tools effectively. Educators reported limited training, leading to low confidence in using technology, while parents noted that this hesitancy affects teaching quality. Professional development enhances teachers' ability to use digital tools in ways that align with curriculum goals, a finding supported by this study's call for workshops to build competence [15]. The lack of training aligns with TAM's emphasis on perceived ease of use as a determinant of technology adoption, suggesting that without adequate support, educators may resist or misuse digital tools. Ongoing professional development to help teachers select age-appropriate resources, a need strongly voiced by participants [16]. Strengthening Teacher Preparedness is essential to maximize the educational potential of digital tools while adhering to DAP principles.

Screen Time Regulation Strategies demonstrated proactive efforts by parents and educators to balance digital tool use with developmental needs. Strategies like setting time limits (e.g., 30 minutes daily for parents, 20-minute sessions for educators), guided interaction, and using digital tools as rewards align with recommendations by [7], who emphasize structured screen time to mitigate overuse risks. These strategies reflect Vygotsky's sociocultural theory, which highlights the role of adult scaffolding in guiding children's learning [5]. By co-viewing or monitoring digital activities, parents and educators ensure content is educational, supporting [14], an assertion that guided technology use enhances learning outcomes.

These findings suggest that structured strategies are critical for integrating digital tools in ways that complement traditional learning methods, maintaining a balance that supports holistic development.

Cultural and Contextual Relevance emerged as a pivotal theme, emphasizing the need for digital tools to reflect local languages, stories, and values. Parents and educators expressed frustration with the prevalence of Western-centric content, which limits children's ability to connect with digital resources. This aligns with [8], which calls for culturally relevant educational technology to enhance engagement and relevance. The lack of localized content highlights a gap in the global digital education market, as noted by [2], which advocates for resources tailored to regional contexts. This theme underscores the importance of aligning digital tools with the socio-cultural environment of learners, ensuring they resonate with children's identities and experiences, a principle central to DAP [9].

Parental Involvement proved crucial in enhancing the effectiveness of digital tools. Parents who actively engaged with their children's digital learning and communicated with educators reported stronger learning outcomes, aligning with [7] findings on the benefits of parent-educator collaboration. Educators noted that it involved parents reinforcing classroom learning, creating a cohesive educational ecosystem. This supports Vygotsky's emphasis on social interaction in learning, where parents act as co-learners or facilitators [5]. However, some parents faced challenges due to limited technological familiarity, highlighting the need for parental education programs, as suggested by [16]. Strengthening parental involvement through workshops or guidelines can bridge this gap, ensuring technology use is consistent across home and school settings.

6. Conclusion

This study investigated the integration of digital tools in early childhood education (ECE) through in-depth interviews with 25 early childhood educators and 25 parents of children aged 4–6 years. The thematic analysis yielded seven key themes providing a comprehensive understanding of the role of digital tools in ECE. These findings illuminate both the transformative potential of technology and the barriers that must be addressed to ensure its effective and equitable use in early learning environments.

The study revealed that digital tools, such as interactive apps and educational videos, significantly enhance educational experiences by increasing children's engagement, fostering skill development in literacy and numeracy, and boosting motivation to learn.

However, these benefits are constrained by significant challenges. Access and Equity Challenges highlighted stark disparities, with many families unable to afford devices or reliable internet and public schools lacking adequate technological resources compared to private institutions, creating an uneven learning landscape. Developmental Concerns underscore the risks of excessive screen time, which could reduce focus on essential activities like physical play and social interaction, as well as the challenge of ensuring content is age-appropriate and educationally valuable. Teacher Preparedness exposed educators' limited training, which undermines their confidence and ability to integrate digital tools effectively, a barrier also noted by parents.

Screen Time Regulation Strategies demonstrated proactive efforts to balance digital engagement with developmental needs, with parents set 30-minute daily limits and educators capping classroom use at 20-minute sessions, alongside guided interaction and reward-based approaches to ensure educational focus. Cultural and Contextual Relevance emphasized the need for digital tools to incorporate local languages, stories, and values, as Western-centric content often fails to resonate with children, reducing engagement. Parental Involvement proved critical, with parents' active participation and collaboration with educators enhancing learning outcomes, though some faced challenges due to limited technological familiarity.

This study underscores the potential of digital tools to enrich ECE in Lahore while highlighting critical barriers that must be addressed. Equitable access to technology, comprehensive teacher training, culturally relevant digital content, and strengthened parent-educator partnerships are essential to ensure digital tools support holistic development. By addressing these challenges, stakeholders can create inclusive, balanced learning environments that harness technology's benefits while preserving the foundational elements of early childhood education, enabling young learners to thrive in a digital world.

These findings offer practical implications for enhancing technology use in ECE. The Educational Enhancement theme suggests educators should integrate interactive apps and videos to boost engagement, literacy, and motivation, ensuring tools align with developmentally appropriate practices to complement hands-on learning. Access and Equity Challenges highlight the need for policymakers to address disparities by providing devices and internet in public schools and underserved areas, reducing the digital divide and ensuring equitable learning opportunities.

Developmental Concerns underscore the importance of monitoring screen time to protect children's focus, social skills, and physical play, with schools and parents selecting age-appropriate content that fosters critical thinking. Teacher Preparedness calls for comprehensive professional development, including workshops to build educators' confidence and skills in using digital tools effectively, enhancing teaching quality. Screen Time Regulation Strategies recommend structured approaches, such as 20-minute classroom sessions and 30-minute home limits, with guided interaction to ensure educational value, which schools can promote through parent guidance. Cultural and Contextual Relevance emphasizes developing digital content with local languages and values to increase engagement, urging stakeholders to create culturally responsive resources. Parental Involvement highlights the need for parent-educator collaboration, with schools offering digital literacy workshops to empower parents, particularly those less tech-savvy, to support learning. These implications advocate for a balanced, equitable approach to digital tool integration, ensuring technology enriches ECE while supporting holistic development.

References:

[1]. Lieber, C. (2024). Effects of screen time on cognitive development in early childhood: A systematic review. *Research Journal in Psychology and Behavioral Studies*, *1*(1), 1-9. Doi: 10.61424/rjpbs.v1i1.80

[2]. UNESCO. (2020). *Education in a post-COVID world: Nine ideas for public action. International Commission on the Futures of Education.* UNESCO.

[3]. UNICEF. (2023). *Regional Digital Learning and Transformation of Education Strategy for Europe and Central Asia.* UNICEF. Retrieved from: https://www.unicef.org/eca/media/33221/file/Digital%20Learning%20and%20Transformation%20of%20Education%20Strategy.pdf [accessed: 15 February 2025]

[4]. Hirsh-Pasek, K., et al. (2015). Putting education in "educational" apps: Lessons from the science of learning. *Psychological science in the public interest*, *16*(1), 3-34. Doi: 10.1177/1529100615569721

[5]. Berk, L. E. (2022). *Development through the lifespan* (7th ed.). Pearson.

[6]. Bers, M. U. (2020). *Coding as a playground: Programming and computational thinking in the early childhood classroom* (2nd ed.). Routledge.

[7]. Jang, Y., & Ko, B. (2023). Online safety for children and youth under the 4Cs framework—A focus on digital policies in Australia, Canada, and the UK. *Children*, *10*(8), 1415. Doi: 10.3390/children10081415

[8]. Scott, F. L. (2022). Family mediation of preschool children's digital media practices at home. *Learning, Media and Technology*, *47*(2), 235-250. Doi: 10.1080/17439884.2021.1960859

[9]. Guerrero, A. L. (2022). *Early Childhood Leaderships' Perceptions of Developmentally Appropriate Instruction*. [Doctoral dissertation, The University of Texas at San Antonio].

[10]. Kucirkova, N., & Rodriguez-Leon, L. (2023). Multisensory Reading in Early Childhood: Systematic Review with Theoretical Guidance for Human Development Studies. *Human Development*, *67*(4), 193-210. Doi: 10.1159/000531633

[11]. Rai, P., Fleer, M., & Fragkiadaki, G. (2022). Theorising digital tools: Mutual constitution of the person and digital in a conceptual PlayWorld. *Human Arenas*, *5*(4), 654-671. Doi: 10.1007/s42087-020-00178-8

[12]. Chiong, C., & Shuler, C. (2010). Learning: Is there an app for that. In *Investigations of young children's usage and learning with mobile devices and apps. New York: The Joan Ganz Cooney Center at Sesame Workshop*, 13-20.

[13]. Duch, H., et al. (2013). Screen time use in children under 3 years old: a systematic review of correlates. *International journal of behavioral nutrition and physical activity*, *10*(1), 102. Doi: 10.1186/1479-5868-10-102

[14]. Veresov, N., Kewalramani, S., & Ma, J. (2024). Setting the Scene: Contexts and Development in Early Childhood. *Child Development Within Contexts: Cultural-Historical Research and Educational Practice*, 13-42. Doi: 10.1007/978-981-97-0692-1_2

[15]. Rad, D., et al. (2023). On the technology acceptance behavior of Romanian preschool teachers. *Behavioral Sciences*, *13*(2), 133. Doi: 10.3390/bs13020133

[16]. Nafiu, H. A., & Olaitan, A. O. (2025). Enhancing Early Childhood Education through Technology Integration in US Classrooms. *International Journal of Research and Innovation in Social Science*, *9*(3s), 3427-3452. Doi: 10.47772/IJRISS.2025.903SEDU0253.

[17]. Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.

[18]. Tisdell, E. J., Merriam, S. B., & Stuckey-Peyrot, H. L. (2025). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

[19]. Rubin, H. J., & Rubin, I. S. (2011). *Qualitative interviewing: The art of hearing data* (3rd ed.). Sage Publications.

[20]. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101. Doi: 10.1191/1478088706qp063oa

[21]. Zwozdiak-Myers, P. (2020). Ethics in educational research. In *Completing Your EdD: The Essential Guide to the Doctor of Education* (pp. 61-89). Emerald Publishing Limited.

[22]. Wolfers, L. N., Nabi, R. L., & Walter, N. (2025). Too much screen time or too much guilt? How child screen time and parental screen guilt affect parental stress and relationship satisfaction. *Media Psychology*, *28*(1), 102-133. Doi: 10.1080//15213269.2024.2310839