DOI: 10.52131/pjhss.2024.v12i3.2424

Pakistan Journal of Humanities and Social Sciences

Volume 12, Number 03, 2024, Pages 2417-2428
Journal Homepage:
https://journals.internationalrasd.org/index.php/pjhss

Impact of Integrating Information and Communication Technology (ICTs) on Students' Learning at Early Childhood Education: An Analysis

Zameer Hussain Bhayo[1], M. Anwar Farooq[2], Jam Muhammad Zafar[3], Naeem Ullah[4]

[1] Ph.D. Scholar, Department of Education, Khwaja Fareed UEIT, Rahim Yar Khan, Punjab, Pakistan.
Email: bhayozameerhussain4@gmail.com
[2] Assistant Professor, Institute of Humanities and Arts, Khwaja Fareed UEIT, Rahim Yar Khan, Punjab, Pakistan.
Email: anwar.farooq@kfueit.edu.pk
[3] Assistant Professor, Department of Education, Khwaja Fareed UEIT, Rahim Yar Khan, Punjab, Pakistan.
Email: dr.zafar@kfueit.edu.pk
[4] Assistant Professor, Department of Education, Khwaja Fareed UEIT, Rahim Yar Khan, Punjab, Pakistan.
Email: dr.naeemullah@kfueit.edu.pk

ARTICLE INFO

Article History:
Received: May 13, 2024
Revised: August 14, 2024
Accepted: August 15, 2024
Available Online: August 16, 2024

Keywords:
Information and Communication Technology (ICT)
Early Childhood Education (ECE)
Student Learning Outcomes
ICT Integration Challenges
Educational Technology

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

This study investigates how the integration of ICT into student learning in ECE provides an insight into key concerns, challenges, and possible measures to effectively implement ICT in ECE institutions. The study employs a mixed-method approach, integrating quantitative and qualitative data, and utilizes explanatory research methods in order to comprehensively analyze the role of ICT in enhancing effective student learning outcomes. The population was all head teachers and ECE teachers from the public sector primary schools within Larkana Region, Sindh. In this study, a stratified random sampling strategy was adopted. This involved drawing a sample of 30 head teachers and 60 ECE teachers. Two separate questionnaires were used to collect perceptions from head teachers and teachers. The TEOs provided insight on the integration of ICT and its implications on students' learning. These instruments were validated by experts in the field of education and refined with a pilot study to ensure reliability and consistency. Data analysis isolated themes and information prevalent in the data regarding barriers and advantages of the use of ICT in ECE classrooms. Conclusions are expected to be drawn from the findings and provide recommendations for improving ICT implementation in ECE, addressing the challenges, and thereby enhancing learning outcomes in students. The paper provides critical information that informs policy development and educator practices toward the integration of ICT in early settings.

Corresponding Author's Email: bhayozameerhussain4@gmail.com

1. Introduction

Pakistan is struggling with significant educational challenges and is far from meeting the millennium development goal of universal primary education. Currently, there are over 22.5 million kids who are not in school, and those who do go to school regularly struggle to meet even the most basic academic standards. Their literacy and numeracy levels are declining (Abbas, Nadeem, & Majoka, 2021). According to the ASER research, Pakistan needs more effective instructors to improve student learning. Due to the fact that the young age is seen as the crucial time for the growth of the verbal, physical, conceptual, and emotional structures, early intervention helps children enhance their reading and math skills. Contrary to popular belief, kids are learning more than we thought. Not only are they taught numbers and letters, but also social skills like sharing and making friends (Diamond, Lee, Senften, Lam, & Abbott, 2019). In response to this requirement, the Pakistani government created a new curriculum and included early childhood education as a separate topic in its 2017 educational plan. The ASER study from 2018 shows that there are more students enrolled in ECE in public schools than in private ones (Ramanujan & Dave, 2019).

Education in Pakistan has been devolved to the provinces/regions since the passage of the 18th amendment in 2010. Through the article 25(A), the Pakistani government incorporated the right to education (RTE) into its constitution "All children aged 5 to 16 must receive free and required education from the State in accordance with any applicable laws." The federal and provincial governments are in charge of educating the general public in their respective regions. ECE was included in the Education Sector Reforms program for the first time in Pakistani history, and financing was given to the provincial and district governments. The National Plan of Action for Education for All included includes ECE (Sohil, Niaz, Rahmani, & Sohail, 2022). The first objective of the Dakar Framework of Action seems to be extended, enhance ECE that is informative for any and all youngsters, particularly for the weakest and also most disadvantaged. Pakistan is dedicated to this goal. Children between the ages of 3 and 6 are absolutely dependent on the ECE. By doing and playing, they pick up new abilities, attitudes, and knowledge. Since levels of learning, learning methods fluctuate according to base on both their physical and mental ages; their classrooms are completely different from those of children in primary schools. They require educational toys so they can have fun while learning (Ansari, Pianta, Whittaker, Vitiello, & Ruzek, 2019). Their classrooms are separated into various areas, such as a doctor's corner, a kitchen corner, a reading corner, a part for household items, and a story-telling circle. Without instructional resources, their learning cannot be effective. Young children can learn while they play with things, interact with other kids their age, and share experiences with their parents and other adults thanks to early childhood education (Kritchevsky, Prescott, & Walling, 2023). Early education should be in a welcoming setting since children learn best through play, and it is important for their physical, linguistic, social, cognitive, and educational development during their first five years of life (Ardoin & Bowers, 2020). ICT is said to stand for "Information and communication technology". This term is currently widely used in research, policy, and practice in education. I.T (Information Technology) seemed to be a term frequently refers to the Internet and Computers. More than simply computers are included in the definition of "Information and Communication Technology." ICT tools used for ECE are as:

- Smart whiteboard, Projectors and, The Internet
- Computer Software, Computer Hardware and Computer Applications
- P.C(Personal Computer, Tablet PCs and Laptops), Digital Video Cameras, Printers, Scanners, Android Mobile Phones, Digital games, Video Conferencing Technology, and more other digital devices.

Information and Communication Technology (ICT) has a crucial impact on how well young children learn (Chien, Anwar, Hsu, Sharif, Razzaq, & Sinha, 2021). It is an extremely effective tool for both educating and communicating. Because it is interactive, it can answer the requirement for practical strategies to support students in constructively regulating their own educational pursuits and finishing assignments in a way that suits their own interests and needs (Maitlo, Shah, & Ahmed, 2024). ECE educators play a crucial role in the development of kids in all spheres of society. ECE instructors assist students in honing their communication, reading, listening, and writing skills (Ahmad, Iqbal, & Rao, 2023). Effective teacher development, pedagogical knowledge, and pedagogical skills are necessary for student success (Neat, 2023). According to the ECEC National Curriculum, teachers with ECE training are crucial for children's development (2017). However, the use of Information and Communication Technology at Early Childhood Education gives teachers the chance to learn about and experiment with new working methods in their own early childhood education environment (B. Rasheed, Zafar, & Shaheen, 2024). The term "ICT" refers to the broad category of technological tools and resources used for communication. They are also used to produce, transfer, gather, and manage information. ICT has significantly altered several facets of how we live (Naz, Zafar, & Ullah, 2024). Information and communication technologies include the networks, media, hardware, software, and related services that are used to gather, store, process, transmit, and present information (voice, data, text, and images) (Paul & Jeyaraj, 2019). Information and communication technologies (ICTs) can be divided into two groups: information and communication infrastructure (ICI), which describes actual telecommunications networks and systems (such as cellular, broadcast, cable, satellite, and postal) and the services that depend on them (such as Internet, voice, mail, radio, and television), and information technology (IT), which describes the hardware and software used for information gathering, storing, processing, and presenting (Rao, Jeevan, & Ahmad, 2023; Sadaf, Rasheed, & Ahmad, 2024).

Literature indicated that during the twenty-first century, ECE was a new field. As early as in ancient times, there were philosophers of education who researched and wrote about the value of early childhood education (Matthews, 2021). The seventeenth-century ECE was attributed to John Locke, Jean-Jacques Rousseau, and Pestalozzi. They advocated differing pedagogical and parenting approaches. They believed that early education for young children should be in a naturalistic manner. Since it is the child's developmental milestones, it will be effective in customized teaching. The literature postulated that ECE, which this article will review or cover was earlier perceived to students learning and kids attending school from the age of three to six. The early childhood education is being advocated by many Asian nations provided that current advancements are properly accomplished (Kim & Park, 2020). Basically, that shall weed out few of the indicators from the overall perspective of E.C.E. distribution. The history of E.C.E. at country Pakistan including its current situation was discussed earlier (Rehman, John, & Latif, 2022). International studies have concluded that early childhood influences a child's later development and potential to achieve academically more than any other period in life. The early years of a child represent the time of both fastest and widest times of brain development; the ability of thinking logically follows next (H. R. Rasheed, Zafar, & Munawar, 2024). The brain's neural connections harden over the first three years of life (Nolvi, Merz, Kataja, & Parsons, 2023). In this literature it is stated that Education for young children used to be a contentious issue. ICT was considered as a danger by some authors to children's growth and enjoyable learning (Gjelaj, Buza, Shatri, & Zabeli, 2020). They refer to the growing body of evidence in support of ICTs for young children. ICT "introduces a new domain of investigation and exploration for young children, provides challenging activities, and responds to children's interest," they state. Information and communication technologies are pervasive in children's daily life; children's learning is influenced by surrounded people and environments shaped by ICTs, according to Akram, Zafar, Aziz, and Asghar (2022). Even though there is still disagreement about whether computers and ICT are acceptable in early childhood education (ECE), the majority of studies support the benefits of ICT for young children's social and cognitive development (Arnott, 2020). Currently, early childhood educators are moving beyond the rate simple question of whether technology is age-appropriate or not for young children. Educators are keen to know how to use ICT effectively as a means of supporting children in their learning and development.

According to the literature, these new forms of ICT have the potential to reshape our world and ensure a technological paradigm shift influential in many facets of everyday life. One of the variables influencing daily life is technological aspects (Vargo, Zhu, Benwell, & Yan, 2021). Approach to the use of information and communication technology in the classroom significantly affects the way ICT is used and managed within the school. Generally speaking, there is a belief among the teachers that computers are helpful assistants and confidence in their students' competence for acquiring computing knowledge and skills. ECE school educators should be fully aware that the information and communication technology is a big concern, and thus they have to make use of it in all teaching processes to enhance further learning among students (Dong & Mertala, 2021). This transformative scope is evident in different ways relating to the educational landscape. The integration of ICT in education enhances learning experiences as rich multimedia content, interactive simulations, and virtual environments for learning become available. In this regard, personalization of learning experiences is rich in digital platforms; each meets diverse learning styles and preferences. Indeed, this is the case, as Hassan, Zafar, and Ullah (2024) note. One of the most important benefits of ICT in education pertains to the continuous professional development of educators. The online courses, webinars, and collaboration platforms provide the teachers with enhanced pedagogical skills and update them about state-of-the-art teaching methodologies. Online courses, webinars, and collaboration platforms empower the teachers in their pursuit to enhance pedagogical competencies and to update themselves with new teaching methodologies which are at par with state of the art. The role of ICT within educational institutions goes as far as developing appropriate technological infrastructure, including high-speed internet connectivity, updated hardware, and secured data storage systems to support seamless integration of ICT.

Literary evidence indicated that ICT had emerged as a force for transformation, which was changing the face of education in terms of teaching by educators and learning by students (Mazhar, Muhammad Zafar, Ullah, & Meharunisa, 2024). Commonly, ICT in education is generally linked to a broad array of technologies and tools enabled in creating, disseminating, and consuming information (Zafar & Ullah, 2020). This transformative scope is evident in different ways relating to the educational landscape. The integration of ICT in education enhances learning

experiences as rich multimedia content, interactive simulations, and virtual environments for learning become available. In this regard, personalization of learning experiences is rich in digital platforms; each meets diverse learning styles and preferences (Alsobhi & Alyoubi, 2019). One of the most important benefits of ICT in education pertains to the continuous professional development of educators. The online courses, webinars, and collaboration platforms provide the teachers with enhanced pedagogical skills and update them about state-of-the-art teaching methodologies. Online courses, webinars, and collaboration platforms empower the teachers in their pursuit to enhance pedagogical competencies and to update themselves with new teaching methodologies which are at par with state of the art (Aithal & Aithal, 2023). The role of ICT within educational institutions goes as far as developing appropriate technological infrastructure, including high-speed internet connectivity, updated hardware, and secured data storage systems to support seamless integration of ICT (Zafar & Ullah, 2020). Literature has suggested that integration of ICT in ECE has elicited considerable interest and debate on the said process of application or effect on young learners. Research has been shown such that judicious use of ICT can positively impress changes in many areas of formative early childhood cognitive, social, and emotional growth of a child (Ogegbo & Aina, 2020). One of the notable influences of ICT in ECE is that it contributes to the cognitive development of a child. The interactive educational apps and games, designed for young children, can trigger their cognitive ability in memory, problem-solving skills, and logical reasoning. Many of the ICT tools in ECE often have applications contributing toward language development and literacy skills. Digital storytelling, phonics applications, and interactive e-books can enhance language acquisition and instill the love for reading in them (Savva, Higgins, & Beckmann, 2022). ICT has immense potential to enhance students' motivation and engagement in learning. Through interactive and visually appealing learning content, memorial learners may be easily attracted, thus making the stay in school a more enjoyable experience (Ha & Im, 2020).

1.1. Research Objectives

Objective of the study were:

- To analyze the impact of integrating information and communication technology (ICTs) on students' learning at early childhood education
- To determine key concerns and challenges faced by educators and institutions in integrating ICT into ECE classrooms.
- To recommend certain measures for ICTs implementation in ECE to enhance student learning outcomes.

1.2. Research Questions

Research questions of the study were:

1. What is the impact of integrating information and communication technology (ICTs) on students' learning at early childhood education?
2. What are key concerns and challenges faced by educators and institutions in integrating ICT into ECE classrooms?
3. Which measures should be taken for ICTs implementation in ECE to enhance student learning outcomes?

2. Research Methodology

The research methodology is process that is used by the researcher for data collection to solve the stated problem; the main purpose of review of the literature is to offer structured arrangement for the existing research work. Moreover, it gives explanation of the approaches employed in directing the research (Ahmad, Farhat, & Abbas, 2024). The study was survey and descriptive in nature. The mixed approach quantitative as well as qualitative (QUAN-qual.) method was adopted. The explanatory research methods were used. This approach was chosen because the study aimed to analyze the impact of information and communication technologies (ICTs) on students' learning in early childhood education comprehensively. Population of the study comprised Head teachers and teachers ECE classes in public sector primary schools of Larkana Region, Sindh. A stratified random sampling technique was used from the four regions of schools in Larkana Region. The data was thirty (30) head teachers and sixty (60) ECE teachers. The questionnaires for head teachers and ECE teachers were made separately to analyze their respective points of view regarding the impact of ICT on learning outcomes. This questionnaire

is developed to take inputs from Taluka Education Officers regarding the implementation and impact of information and communication technology in Early Childhood Education. First of all, the research tools had to be validated through experts in the field to make sure of relevance, clarity, and effectiveness in providing measurements of the variables they are meant for; procedures which necessarily had to be done so that expert feedback fine-tunes the tools to make them more valid. The researcher conducted a pilot study as a way of testing the reliability of the research instruments. From the preponderance activity, there was the incorporation of feedback to enhance the tools for consistency and accuracy in data collection. Overview This section focuses on the analysis and interpretation of data.

3. Data Analysis

Table 1: Teachers use ICT tools in their ECE classroom regularly

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of ICT tools	F	6	9	7	61	7	90	1.00	3.60
	%	6.7%	10.0%	7.8%	67.8%	7.8%	100%		
	Teacher Response								
	F	8	11	3	60	8	90	1.10	3.54
	%	8.9%	12.2%	3.3%	66.7%	8.9%	100%		

Table 1 shows data from head teachers and teachers in Sindh, Pakistan, on the use of ICT in early childhood education (ECE). Among head teachers, 61 agreed and 16 strongly agreed on the regular use of ICT, with only 6 strongly disagreeing. The mean was 3.60 with an SD of 1.00. Similarly, 60 teachers agreed and 8 strongly agreed, while 8 strongly disagreed, resulting in a mean of 3.54 and an SD of 1.10. These low SDs indicate consistent support for ICT's role in enhancing early learning.

Table 2: Teachers use computers or laptops in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of computers or laptops	F	11	18	39	11	11	90	1.14	2.92
	%	12.2%	20.0%	43.3%	12.2%	12.2%	100.0%		
	Teacher Response								
	F	14	28	32	8	8	90	1.12	2.64
	%	15.6%	31.1%	35.6%	8.9%	8.9%	100%		

Table 2 shows mixed views on using computers or laptops in ECE classrooms in Sindh, Pakistan. Among head teachers, 11 strongly disagreed, 18 disagreed, 39 were undecided, 11 agreed, and 11 strongly agreed, resulting in a mean of 2.92 and an SD of 1.14. Teachers' responses were similar, with a mean of 2.64 and an SD of 1.12. The high proportion of disagreement and undecided responses indicates reservations or uncertainty about incorporating computers in ECE, suggesting the need for further exploration and support for technology integration.

Table 3: Teachers use tablets in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of tablets	F	2	14	42	27	5	90	0.85	3.21
	%	2.2%	15.6%	46.7%	30.0%	5.6%	100.0%		
	Teacher Response								
	F	8	17	37	25	3	90	0.98	2.98
	%	8.9%	18.9%	41.1%	27.8%	3.3%	100%		

Table 3 shows mixed views on using computers or laptops in ECE classrooms in Sindh, Pakistan. Among head teachers, 11 strongly disagreed, 18 disagreed, 39 were undecided, 11 agreed, and 11 strongly agreed, resulting in a mean of 2.92 and an SD of 1.14. Teachers' responses were similar, with a mean of 2.64 and an SD of 1.12. The high proportion of disagreement and undecided responses indicates reservations or uncertainty about incorporating computers in ECE, suggesting the need for further exploration and support for technology integration.

Table 4: Teachers use smart-phones for educational purposes in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of smart-phones	F	10	2	10	33	35	90	1.26	3.90
	%	11.1%	2.2%	11.1%	36.7%	38.9%	100.0%		
	Teacher Response								
	F	14	7	13	43	13	90	1.28	3.38
	%	15.6%	7.8%	14.4%	47.8%	14.4%	100%		

Table 4 reveals strong acceptance of smartphones for educational use in ECE classrooms in Sindh, Pakistan. Among head teachers, 33 agreed and 35 strongly agreed, with only 12 disagreeing, resulting in a mean of 3.90 and an SD of 1.26. Teachers showed similar support, with 43 agreeing, 13 strongly agreeing, and 21 disagreeing, leading to a mean of 3.38 and an SD of 1.28. This data reflects a positive attitude towards using smartphones to enhance early childhood education in the region.

Table 5: Teachers use educational software in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of educational software	F	6	11	47	23	3	90	0.88	3.07
	%	6.7%	12.2%	52.2%	25.6%	3.3%	100.0%		
	Teacher Response								
	F	7	16	40	25	2	90	0.93	2.99
	%	7.8%	17.8%	44.4%	27.8%	2.2%	100%		

Table 5 shows significant acceptance of smartphones for educational use in ECE classrooms in Sindh, Pakistan. Among head teachers, 33 agreed and 35 strongly agreed, with only 12 disagreeing, resulting in a mean of 3.90 and an SD of 1.26. Teachers' responses were similar, with 43 agreeing, 13 strongly agreeing, and 21 disagreeing, leading to a mean of 3.38 and an SD of 1.28. These results indicate strong support for using smartphones in ECE, reflecting a positive outlook on mobile technology in early childhood education.

Table 6: Teachers use educational apps into ECE lessons

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of educational apps	F	2	12	13	31	32	90	1.11	3.88
	%	2.2%	13.3%	14.4%	34.4%	35.6%	100.0%		
	Teacher Response								
	F	8	10	17	38	17	90	1.18	3.51
	%	8.9%	11.1%	18.9%	42.2%	18.9%	100%		

Table 6 shows strong support for using educational apps in ECE lessons in Sindh, Pakistan. Among head teachers, 31 agreed and 32 strongly agreed, with only 14 disagreeing, resulting in a mean of 3.88 and an SD of 1.11. Teachers had similar views, with 38 agreeing and 17 strongly agreeing, while 18 disagreed, leading to a mean of 3.51 and an SD of 1.18. This data reflects a positive attitude towards integrating educational apps into early childhood education, suggesting a broad acceptance of digital tools for enhancing learning.

Table 7: Teachers use educational websites in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Use of educational websites	F	3	20	27	10	30	90	1.26	3.49
	%	3.3%	22.2%	30.0%	11.1%	33.3%	100.0%		
	Teacher Response								
	F	6	12	29	29	14	90	1.11	3.37
	%	6.7%	13.3%	32.2%	23.2%	15.6%	100%		

Table 7 reveals a generally positive view on using educational websites in ECE classrooms in Sindh, Pakistan. Among head teachers, 10 agreed and 30 strongly agreed, with 23 disagreeing, resulting in a mean of 3.49 and an SD of 1.26. Teachers showed similar support, with 29 agreeing and 14 strongly agreeing, while 18 disagreed, leading to a mean of 3.37 and an SD of 1.11.

These results indicate a favorable attitude towards integrating educational websites, suggesting a strong inclination to utilize digital resources in early childhood education.

Table 8: Teachers utilize digital storytelling techniques in teaching ECE students

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Utilizing digital storytelling	F	1	10	1	45	33	90	0.96	4.10
	%	1.1%	11.1%	1.1%	50.0%	36.7%	100.0%		
	Teacher Response								
	F	5	5	6	56	18	90	0.99	3.86
	%	5.6%	5.6%	6.7%	62.2%	20.0%	100%		

Table 8 demonstrates strong support for using digital storytelling techniques in ECE classrooms in Sindh, Pakistan. Among head teachers, 45 agreed and 33 strongly agreed, with only 11 disagreeing, resulting in a mean of 4.10 and an SD of 0.96. Similarly, teachers had 56 agreements and 18 strong agreements, with 11 disagreeing, leading to a mean of 3.86 and an SD of 0.99. These results reflect a high level of endorsement for digital storytelling, indicating a robust positive inclination towards this engaging and interactive approach in early childhood education.

Table 9: Teachers employ online resources for exploration in the ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Using online resources	F	5	6	30	46	3	90	0.88	3.40
	%	5.6%	6.7%	33.3%	51.1%	3.3%	100.0%		
	Teacher Response								
	F	1	15	15	52	7	90	0.90	3.54
	%	1.1%	16.7%	16.7%	57.8%	7.8%	100%		

Table 9 shows strong support for using online resources in ECE classrooms in Sindh, Pakistan. Among head teachers, 46 agreed and 3 strongly agreed, with only 11 disagreeing, resulting in a mean of 3.40 and an SD of 0.88. Teachers' responses were similarly positive, with 52 agreeing and 7 strongly agreeing, while 16 disagreed, leading to a mean of 3.54 and an SD of 0.90. These results reflect a significant endorsement of employing online resources, highlighting a positive attitude towards using digital tools to enhance exploration and learning in early childhood education.

Table 10: Teachers sometimes face technical difficulties when using ICT in the classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Facing technical difficulties	F	6	2	23	55	4	90	0.89	3.54
	%	6.7%	2.2%	25.6%	61.1%	4.4%	100.0%		
	Teacher Response								
	F	6	2	13	52	17	90	1.00	3.80
	%	6.7%	2.2%	14.4%	57.8%	18.9%	100%		

Table 10 highlights the challenges of using ICT in classrooms in Sindh, Pakistan. Among head teachers, 55 agreed and 4 strongly agreed that technical difficulties are encountered, with a mean of 3.54 and an SD of 0.89. Teachers reported similar challenges, with 52 agreeing and 17 strongly agreeing, resulting in a mean of 3.80 and an SD of 1.00. These findings underscore a notable recognition of technical difficulties faced when integrating ICT, reflecting a realistic view of the challenges in incorporating technology into educational practices.

Table 11: I worry about the security and privacy of ECE students when using ICT

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Worried about security and privacy	F	7	26	16	39	2	90	1.06	3.03
	%	7.8%	28.9%	17.8%	43.3%	2.2%	100.0%		
	Teacher Response								
	F	3	14	38	23	12	90	1.00	3.30
	%	3.3%	15.6%	42.2%	25.6%	13.3%	100%		

Table 11 reveals significant concerns about security and privacy in ICT use in ECE classrooms in Sindh, Pakistan. Among head teachers, 39 agreed and 2 strongly agreed about worries regarding security and privacy, with a mean of 3.03 and an SD of 1.06. Teachers showed similar concerns, with 23 agreeing and 12 strongly agreeing, resulting in a mean of 3.30 and an SD of 1.00. These results highlight a notable awareness of potential security and privacy risks, emphasizing the need for effective measures to ensure a secure digital environment for early childhood education.

Table 12: Balancing screen time with other activities is a challenge

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Balancing screen time	F	3	22	8	51	6	90	1.04	3.39
	%	3.3%	24.4%	8.9%	56.7%	6.7%	100.0%		
	Teacher Response								
	F	3	15	26	36	10	90	1.00	3.39
	%	3.3%	16.7%	28.9%	40.0%	11.1%	100%		

Table 12 shows a strong consensus on the challenge of balancing screen time with other activities in ECE settings in Sindh, Pakistan. Both head teachers and teachers expressed similar concerns, with 51 head teachers and 36 teachers agreeing that managing screen time is difficult. Conversely, 25 head teachers and 18 teachers disagreed. The mean values of 3.39 and SDs around 1.00 for both groups indicate moderate agreement and consistent views on the issue.

Table 13: Limited access to ICT resources is a barrier in ECE classroom

Theme	Stat.	Head Teacher Response							
		SDA	DA	UD	A	SA	Total	SD	Mean
Limited access of ICT	F	3	0	6	40	41	90	0.86	4.29
	%	3.3%	0%	6.7%	44.4%	45.6%	100%		
	Teacher Response								
	F	2	5	10	34	39	90	0.98	4.14
	%	2.2%	5.6%	11.1%	37.8%	43.3%	100%		

Table 13 highlights that limited access to ICT resources is widely recognized as a significant barrier in ECE classrooms in Sindh, Pakistan. Among head teachers, 81 agreed or strongly agreed, with a mean of 4.29 and an SD of 0.86. Among teachers, 73 agreed or strongly agreed, with a mean of 4.14 and an SD of 0.98. Only a small number disagreed, underscoring a strong consensus on this issue. The low variability in responses and high mean values reflect a critical need to address the lack of ICT resources.

Table 14: ECE students' limited fine motor skills may affect ICT use

No.	Theme	Stat.	Head Teacher Response							
			SDA	DA	UD	A	SA	Total	SD	Mean
1	Students' limited fine motor skills	F	1	10	31	43	5	90	0.81	3.46
		%	1.1%	11.1%	34.4%	47.8%	5.6%	100%		
		Teacher Response								
		F	0	3	27	46	14	90	0.74	3.79
		%	0%	3.3%	30.0%	51.1%	15.6%	100%		

Table 14 shows that both head teachers and teachers in Sindh, Pakistan, recognize that limited fine motor skills can affect ECE students' use of ICT. Among head teachers, 48 agreed or strongly agreed, with a mean of 3.46 and an SD of 0.81. Among teachers, 60 agreed or strongly agreed, with a mean of 3.79 and an SD of 0.74. Only a few disagreed, indicating a strong consensus. The low variability in responses and high mean values emphasize the need to address fine motor skill development to enhance students' effective use of ICT tools.

Table 15: Teachers find it challenging to stay updated on new ICT tools and resources

No.	Theme	Stat.	Head Teacher Response							
			SDA	DA	UD	A	SA	Total	SD	Mean
1	Updated on new ICT tools	F	0	12	23	27	28	90	1.03	3.79
		%	0%	13.3%	25.6%	30.0%	31.1%	100%		

	Teacher Response							
	F	1	24	31	20	14	90	1.05	3.24
	%	1.1%	26.7%	34.4%	22.2%	15.6%	100%		

Table 15 indicates that both head teachers and teachers in Sindh, Pakistan, find it challenging to stay updated on new ICT tools and resources. Among head teachers, 55 agreed or strongly agreed, with a mean of 3.79 and an SD of 1.03. Among teachers, 34 agreed or strongly agreed, with a mean of 3.24 and an SD of 1.05. While some disagreed, there is a notable consensus on the difficulty of keeping up with new ICT developments.

4. Findings

Findings of the study were:

- The study found that data from Sindh, Pakistan, provides a comprehensive overview of the use and perceptions of ICT in early childhood education (ECE). The head teachers and teachers strongly support the use of ICT on a regular basis, as indicated from high mean scores with low standard deviations that highly support the thoughts of technology enhancing early learning. Integration of computers or laptops in ECE classrooms is perceived differently; thus, both groups have shown uncertainty and reservations hence trigger further exploration and support.
- Most of the head teachers and teachers have considerable approval for smartphones and educational apps, represented by high mean scores, testifying to a positive attitude. Similarly, there is high support regarding digital storytelling and online resources, hence indicating that there is good disposition towards recent development on these tools through ECE. Despite such a promising outlook, technical problems, security and privacy issues, and screen time management have been identified as major obstacles. This points to the need for an address of issues such as the difficulties in balancing screen time, as shown by the moderate agreement, and security and privacy concerns.
- Most of the concerns involve limited access to ICT resources and the challenge of keeping up with new technologies. The largest consensus involves improving resource availability and ongoing professional development. Limitations in fine motor skills may impede students in the use of ICT effectively; hence, targeted interventions should be in place, as identified by both head teachers and teachers. The parental concerns about screen time are noted, a reflection of a larger trend prompted by awareness regarding the imperative for prudent management of digital exposure.

5. Conclusions

Indeed, the data from Sindh, Pakistan shows nuances in ICT integration into ECE. While there is strong support on the part of head teachers and teachers for the regular integration of ICT, smartphones, educational apps, and digital storytelling in ECE, there are also some outstanding barriers and misgivings that do need attention. Added to these are mixed views about the use of computers or laptops, concerns about technical difficulties, security, privacy, and screen time management, which further complicate technology integration in the early education setting. Clearly emerging was better access to resources in ICT, continuous professional development, and policies and guidelines, which foregrounded a unified recognition of barriers and necessary supports toward effective integration of technology. Beyond this, the recognition of the limitations in fine motor skills and parents being worried about screen time, underlines the need for a balanced, informed approach toward technology usage in early childhood education.

6. Discussion

Strong support of frequent using of ICT and delight about smartphones, educational apps, and digital storytelling reveal a pretty optimistic approach to the potential of technology contribution to the enhancement of early learning experience. The obtained response would correspond with global trends, which in its turn would mean that ICT is welcomed as a helpful tool within modern education and hence neither threatens nor runs against general principles of acceptance as an integral part of educational support and enrichment. Ambiguous feelings about including computers or laptops in ECE and, further, problems concerning technical issues, security, and privacy . Mean = 4.87,High mean scores and low standard deviations supporting smartphones and digital tools indicate that educators are optimistic for the benefits of technology. However, practical and logistical concerns temper this enthusiasm. As such, these challenges

point toward a requirement for targeted solutions and support mechanisms that would make this integration not only effective but also safe. These data emphasize the critical aspect of poor utilization of ICT resources, which is admitted as a major obstacle. The very strong consensus on the need for improved resource and professional development access suggests a shared understanding that, sans adequate tools and training, the potential benefits of ICT in ECE may not be realized. This also supports earlier research signaling that successful technology integration requires both adequate resources and continuous educator support. While these issues are arising, there is a dire need for a balanced approach, where the usage of technology is handled with care to avoid its potential negative effects, and the building up of skills goes side by side with technology integration. Parents' concerns about screen time gave birth to a general societal insight into having implications associated with increased digital exposure in young learners. It follows, therefore, that there is a need to involve parents in the discussion of the use of technology and in developing strategies for managing screen time effectively. These issues, when addressed through targeted interventions and clear guidelines, ensure that the potential benefits of ICT can be better realized and effective, enriching educational experiences are achieved among young learners.

6.1. Recommendations

- Invest in the scaling up of ICT resources in early childhood education institutions, with a proportionate increase so that every classroom is suitably equipped to accommodate effective integration of technology.
- Develop and deliver comprehensive professional development programs for educators in technical skills and in the pedagogical strategies of technology use, with updating about technology tools and resources.
- Clearly establish policies and guidelines as to opportunities for ICT use relevant to screen time management, security, and privacy that align with responsible and effective integration of technology within the settings of early learning.
- Develop security and privacy policies to protect students' digital information by creating a safe online learning environment through training with educators and parental involvement about online safety.
- Devise plans for balancing the time that is spent on screens with other learning activities, along with focused interventions to help fine motor skills develop appropriately, so technology complements and does not detract from early learning.

References

Abbas, S., Nadeem, M. A., & Majoka, M. I. (2021). The United Nations sustainable development goal-4: a case study of Pakistan. *Pakistan Journal of International Affairs, 4*(4).

Ahmad, A., Farhat, P. A., & Abbas, T. (2024). Critical Discourse Analysis of Bulleh Shah's Poetry. *Remittances Review, 9*(3), 299-312.

Ahmad, A., Iqbal, B., & Rao, I. S. (2023). Efficacy Of Blended Learning Technique in Enhancing ESL Students' Linguistic Skills. *Global Language Review, VIII*(II), 9-21. doi:10.31703/glr.2023(VIII-II).02

Aithal, P. S., & Aithal, S. (2023). How to Empower Educators through Digital Pedagogies and Faculty Development Strategies. *International Journal of Applied Engineering and Management Letters*, 139-183. doi:10.47992/IJAEML.2581.7000.0198

Akram, M., Zafar, J. M., Aziz, S., & Asghar, M. (2022). Elementary School Students' Conceptual Difficulties in the Subject of General Science: A Descriptive Study. *Pakistan Journal of Humanities and Social Sciences, 10*(1), 43-49. doi:10.52131/pjhss.2022.1001.0172

Alsobhi, A. Y., & Alyoubi, K. H. (2019). Adaptation algorithms for selecting personalised learning experience based on learning style and dyslexia type. *Data Technologies and Applications, 53*(2), 189-200. doi:10.1108/DTA-10-2018-0092

Ansari, A., Pianta, R. C., Whittaker, J. V., Vitiello, V. E., & Ruzek, E. A. (2019). Starting Early: The Benefits of Attending Early Childhood Education Programs at Age 3. *American Educational Research Journal, 56*(4), 1495-1523. doi:10.3102/0002831218817737

Ardoin, N. M., & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review, 31*, 100353. doi:10.1016/j.edurev.2020.100353

Arnott, L. (2020). An ecological exploration of young children's digital play: framing children's social experiences with technologies in early childhood. In C. Stephen, L. Brooker, P.

Oberhuemer, & R. Parker-Rees (Eds.), *Digital Play and Technologies in the Early Years* (1 ed., pp. 49-66): Routledge.

Chien, F., Anwar, A., Hsu, C.-C., Sharif, A., Razzaq, A., & Sinha, A. (2021). The role of information and communication technology in encountering environmental degradation: Proposing an SDG framework for the BRICS countries. *Technology in Society, 65*, 101587. doi:10.1016/j.techsoc.2021.101587

Diamond, A., Lee, C., Senften, P., Lam, A., & Abbott, D. (2019). Randomized control trial of Tools of the Mind: Marked benefits to kindergarten children and their teachers. *PloS one, 14*(9), e0222447. doi:https://doi.org/10.1371/journal.pone.0222447

Dong, C., & Mertala, P. (2021). It is a tool, but not a 'must': early childhood preservice teachers' perceptions of ICT and its affordances. *Early Years, 41*(5), 540-555. doi:10.1080/09575146.2019.1627293

Gjelaj, M., Buza, K., Shatri, K., & Zabeli, N. J. I. J. o. I. (2020). Digital Technologies in Early Childhood: Attitudes and Practices of Parents and Teachers in Kosovo. *13*(1), 165-184.

Ha, Y., & Im, H. (2020). The Role of an Interactive Visual Learning Tool and Its Personalizability in Online Learning: Flow Experience. *Online Learning, 24*(1). doi:10.24059/olj.v24i1.1620

Hassan, S., Zafar, J. M., & Ullah, N. (2024). Effect of Using Problem Solving Technique of 5Es Instructional Model on Student' Learning at Secondary Level: An Analysis. *Pakistan Journal of Humanities and Social Sciences, 12*(2), 2279-2289. doi:10.52131/pjhss.2024.v12i2.2409

Kim, J., & Park, C. Y. (2020). Education, skill training, and lifelong learning in the era of technological revolution: a review. *Asian-Pacific Economic Literature, 34*(2), 3-19. doi:10.1111/apel.12299

Kritchevsky, S., Prescott, E., & Walling, L. (2023). Planning Environments for Young Children: Physical Space *. In *Alternative Learning Environments* (1 ed., pp. 311-320). London: Routledge.

Maitlo, S. K., Shah, S. A. A., & Ahmed, A. (2024). Use of Information and Communication Technology (ICT) In Teaching English as a Second Language (ESL). *Journal of Arts and Linguistics Studies, 2*(1), 27-51.

Matthews, G. B. (2021). A philosophy of childhood. In *Gareth B. Matthews, The Child's Philosopher* (1 ed., pp. 232-247). London: Routledge.

Mazhar, A., Muhammad Zafar, J., Ullah, N., & Meharunisa. (2024). Role of Information and Communication Technologies (ICTs) in Students' Knowledge at University Level: An Analysis. *Journal of Asian Development Studies, 13*(2), 1520-1532. doi:10.62345/jads.2024.13.2.120

Naz, L. H., Zafar, J. M., & Ullah, N. (2024). Effectiveness of Monitoring and Evaluation System in Improving Educational Facilities at Secondary School Level in Punjab (Pakistan). *Journal of Asian Development Studies, 13*(3), 175-191. doi:10.62345/jads.2024.13.3.15

Neat, K. J. (2023). *Supporting High Quality Reading Instruction in Early Childhood Education: A Collaboration Between Instructional Leaders and Teachers*: American University.

Nolvi, S., Merz, E. C., Kataja, E.-L., & Parsons, C. E. (2023). Prenatal Stress and the Developing Brain: Postnatal Environments Promoting Resilience. *Biological Psychiatry, 93*(10), 942-952. doi:10.1016/j.biopsych.2022.11.023

Ogegbo, A. A., & Aina, A. (2020). Early childhood development teachers' perceptions on the use of technology in teaching young children. *South African Journal of Childhood Education, 10*(1). doi:10.4102/sajce.v10i1.880

Paul, A., & Jeyaraj, R. (2019). Internet of Things: A primer. *Human Behavior and Emerging Technologies, 1*(1), 37-47. doi:10.1002/hbe2.133

Ramanujan, P., & Dave, N. (2019). Where do young children go? Provisioning in early childhood education. *Early Childhood Education and School Readiness in India: Quality and Diversity*, 109-124. doi:https://doi.org/10.1007/978-981-13-7006-9_6

Rao, I. S., Jeevan, S., & Ahmad, A. (2023). Impact of Metacognitive Strategies on Creative Writing of ESL Students at College Level in District Lahore. *Global Language Review, VIII*(I), 315-324. doi:10.31703/glr.2023(VIII-I).29

Rasheed, B., Zafar, J. M., & Shaheen, R. (2024). Measuring the Cognitive Learning of Graduate Students about Zero Conditional Sentences in English at KFUEIT: The Descriptive and Explanatory Analysis. *Pakistan Languages and Humanities Review, 8*(2), 52-65. doi:https://doi.org/10.47205/plhr.2024(8-II-S)06

Rasheed, H. R., Zafar, J. M., & Munawar, N. (2024). Emerging Trends of Assessment and Evaluation toward Students' Learning in Early Childhood Education: An Analysis. *Remittances Review, 9*(3), 442-456.

Rehman, M. A., John, S., & Latif, Q. (2022). Early Childhood Program for Pre-Primary Teachers of Karachi: Challenges and Opportunities. *Human Nature Journal of Social Sciences, 3*(3), 346-360.

Sadaf, H., Rasheed, B., & Ahmad, A. (2024). Exploring the Role of YouTube Lectures, Vlogs, and Videos in Enhancing ESL Learning. *Journal of Asian Development Studies, 13*(2), 657-670. doi:10.62345/jads.2024.13.2.52

Savva, M., Higgins, S., & Beckmann, N. (2022). Meta-analysis examining the effects of electronic storybooks on language and literacy outcomes for children in grades Pre-K to grade 2. *Journal of Computer Assisted Learning, 38*(2), 526-564. doi:10.1111/jcal.12623

Sohil, F., Niaz, U., Rahmani, E. K., & Sohail, M. U. (2022). Early Childhood Education: The Social and Cultural Consequences. *Journal of Positive School Psychology, 6*(11), 2370-2379.

Vargo, D., Zhu, L., Benwell, B., & Yan, Z. (2021). Digital technology use during COVID -19 pandemic: A rapid review. *Human Behavior and Emerging Technologies, 3*(1), 13-24. doi:10.1002/hbe2.242

Zafar, J. M., & Ullah, N. (2020). Role of ICT in Teachers' Motivation, Professional Skills and Performance at Public Sector Universities in Pakistan. *Journal of Research in Social Sciences, 8*(2), 18-32.