EFFECTIVENESS AND ASSESSMENT OF ICT INTEGRATION IN PRIMARY EDUCATION

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CERTIFICATE

This is to certify that this thesis entitled: **"Effectiveness and Assessment of ICT Integration in Primary Education."** submitted by Nasreen is accepted in its present form by the PIDE School of Social Sciences, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Public Policy.

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Author's Declaration

I, Nasreen Sahito, hereby declare that my MPhil thesis titled Effectiveness and Assessment of ICT Integration in Primary Education is my original work and has not been submitted previously by me for any degree at the Pakistan Institute of Development Economics, Islamabad, or any other institution worldwide.

If at any time my statement is found to be incorrect, even after my graduation, the university reserves the right to revoke my MPhil degree.

Date: 09-10-2024

Signature of the Student

Nasreen

Dedication

This dissertation is dedicated to my beloved parents, whose unwavering support and prayers have been my guiding light. Their belief in me has been my greatest strength.

I also extend this dedication to the School Education and Literacy Department (SELD), Government of Sindh, with the hope that this policy framework will contribute to the advancement of education and literacy in the province. May it serve as a guiding map for ICT integration and help transform primary education in Sindh.

Acknowledgement

At the outset, I bow in gratitude to the divine force, Allah Almighty. His endless blessings, guidance, and grace have been the cornerstone of my journey, illuminating every step of my academic pursuit.

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Furthermore, I would like to acknowledge the significant role played by my dear friends. Their unwavering support and stimulating discussions have enriched my academic journey. Their intellectual engagement and constructive feedback have fostered a vibrant environment conducive to learning and growth.

Moreover, I am deeply thankful to all the individuals who have contributed to this thesis in various ways. Their support, encouragement, and insightful discussions have been invaluable. I am sincerely grateful for their presence in my academic endeavors and for helping me achieve this significant milestone.

Abstract

Information and Communication Technology (ICT) became the fundamental pillar of the society in a short span of time and became integral part of every field of life. Education stands as a key area for leveraging ICT, which has the potential to transform teaching methods, and learning processes. To successfully integrate the ICT in education, it's essential to conduct a research and assessments, to determine the various factors including infrastructure, funding, teacher training, and policy support. The aim of this study is to conduct an environmental scan to assess the effectiveness and assessment of ICT integration in primary education within the public sector schools of School Education & Literacy Department, Govt. of Sindh. A mixed methods approach was employed in this study to gather comprehensive data. This study centered on four objectives: the first three objectives are quantitative in nature, whereas the last objective is qualitative. The 1st objective assesses the effect of ICT integration on Grade V students' academic performance. Pretests and posttests were used to collect the data from 310 students, while the Difference in Differences model was used to analyze it. Contrary to expectations, the results indicated a negative effect of the intervention. This prompts further investigation into the availability of ICT infrastructure and teachers' competencies. The 2nd objective evaluates the existing ICT infrastructure using a survey method to collect data from head teachers of 24 schools in the Hyderabad district. Cross-tab analysis reveals significant gaps, such as only 5 out of 24 schools having computer labs. The 3rd objective examines the ICT-related knowledge and competencies of teachers. To address this objective, a survey method was used to collect data from 172 government teachers. Descriptive statistical analysis techniques were then used for analysis. The findings reveal significant gaps in teachers' ICT knowledge and highlight the necessity for targeted professional development programs. The fourth objective explores stakeholders' perspectives on ICT integration through thematic analysis of in-depth interviews. Thematic analysis identified potential benefits, challenges, and policy recommendations for effective ICT integration.

In light of the review of existing policies and findings, this study proposes a policy framework for the successful integration of ICT in primary education in Sindh. This framework suggests establishing a Provincial Program Implementation Unit (PPIU) within the SELD, Government of Sindh, as stakeholder involvement is essential for sustainability.

The findings of the study reveal that successful ICT integration requires ongoing support and resources, emphasizing the importance of stakeholder involvement for sustainable educational improvements.

Key Words: ICT in Education, ICT integration, ICT infrastructure, Digital Learning

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LIST OF ABBREVIATIONS

CFT	Competency Framework for Teachers
ICTs	Information and Communication Technologies
IT	Information Technology
KA	Knowledge Acquisition
OERs	Open Educational Resources
PPIU	Provincial Program Implementation Unit
SEF	Sindh Education Foundation
SELD	School Education and Literacy Department
SLO	Student Learning Outcome
STBB	Sindh Textbook Board
TNA	Training Need Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Fund

Chapter 1

Introduction

1.1. Introduction to the Chapter

Chapter 1 presents the background to the research area, the problem discussion, explanation of the key concepts used in the research, research question & objectives, conceptual framework of the study, context of the research, significance of the study, and the study's outline or structure of thesis.

1.2. Background

Information and communication technology (ICT) has become the integral part of every field of life and made revolutionary changes in every sector. ICT became the fundamental pillar of the society in a short span of time and completely transformed our society, reformed the way people think, work and live. Nowadays, it is considered as one of the most important driving forces for promoting economic growth and social development. Progress in technology has frequently been vital in causing shifts in society and business. Many experts and supporters in the technology field believe that these changes will greatly affect how we should change education (Schols & Bottema, 2014). Education is among the most promising areas for applying ICT. ICT is often seen as a tool that can bring changes in how teachers' teach, how students learn, and how information is accessed (Danner & Pessu, 2013). The transition from learning about ICT to utilizing ICT for learning is essential. For this shift, it is necessary to train the existing teaching force. Governments should design different capacity building programs for improving the teachers' ICT skills which enable them to transform the classrooms from traditional to a 21st century classroom.

Using ICT in education is a key way to adapt to the globalized world and meet the needs of 21st-century society. But ICTs alone don't make students' learning better, in fact when teachers' use ICTs carefully, they can improve learning opportunities. The effectiveness of using ICTs in education depends on how they are used and their intended purpose. The way ICTs are used varies in different parts of the world due to differences in affordability, availability, and access to technology. Just like any other tools used in education, ICTs does not work for everyone in the same way (Mbodila, 2013). Therefore, there is not a single perfect formula for deciding how much ICT integration is best for education. Instead, we can draw lessons from successful practices worldwide, specially from developing world. Because the problems associated with ICT integration are different in developed and developing

world. As Shaikh & Khoja (2011), posits that the frequent use of ICT in higher education institutions in developed countries has led to various ICT problems in both developed and developing nations. further added that, HIEs in developed nations deal with challenges such managing various departments and technology, taking on global obligations, and sustainability. The difficulties are more severe in developing nations and include a rapid increase in enrollment, institutional development issues, bad governance, high prices, unequal access to ICT resources, and a mindset that sees ICT as a problem rather than a way to improve the organization.

A review of existing literature reveals that the feasibility and success of ICT integration can vary depending on various factors, including infrastructure, funding, teacher training, and policy support. Therefore, it's essential to conduct a research and assessments, to determine the feasibility, challenges, and potential solutions for ICT integration in primary education. The findings of research can help provide insights into whether and how ICT integration can be effectively implemented. Therefore, this study is designed to investigate the possibility of integrating ICT into primary education in Sindh, with a specific focus on the Hyderabad district. The aim of this study is to conduct an environmental scan to assess the integration of ICT in primary grades. Based on the research findings, this study aims to develop a comprehensive policy framework that will facilitate the unified integration of ICT into primary education throughout Sindh. In order to prepare a baseline information for suggesting a policy this study is going to measure the effectiveness of ICT integration in achievement of learning outcomes, check availability of ICT infrastructure in schools, identify teachers' ICT skills. To offer a more effective solution for integrating ICT in the province, this policy framework aims to provide guidance and strategies for the seamless incorporation of ICT tools and resources into the educational system. This will ultimately enrich the learning experience for students and drive educational progress in the region. Additionally, the policy framework outlines the roles and responsibilities of various stakeholders within SELD, Government of Sindh to ensure the successful integration of ICT in primary education throughout the province.

1.3. Problem Discussion: Analyzing the Core Issues in ICT Integration

The primary education sector in Sindh faces a myriad of challenges like disparities in access to quality education, limited infrastructure in certain areas, varying levels of teacher preparedness, and curriculum alignment with international standards. According to SELD Planning Development and Finance Wing (2023), The development budget of SELD for

Financial Year FY 2022-23 was 15.31 billion, and for the current FY 2023-24, the government has increased the budget allocation for the development portfolio to 16.50 billion rupees. But the government's main focus is on school infrastructure development, due to this department's huge portion of development budget is spend on construction, rehabilitation of schools and provision of missing facilities. While human resource development, provision of ICT infrastructure in schools and ICT integration are not to be taken as serious.

Research conducted globally indicates that information and communication technology (ICT) has the potential to enhance students' learning outcomes and promote more effective teaching practices. Utilizing ICT can equip students with the skills required for success in the modern globalized world. ICT possess the capacity to equip students with the 21st century skills and enabling them to confront future challenges with a solid foundation of essential skills and comprehension (Ghavifekr et al., 2014).

During the search for various government policy documents supporting ICT integration in education, only a single policy document was identified which purely emphasized on ICT in Education that is National Information and Communications Technology (NICT) Strategy for Education in Pakistan. The NICT strategy for education in Pakistan was introduced in 2004 by the Ministry of Education (MoE) in partnership with the Education Sector Reform Assistance (ESRA) program, supported by the United States Agency for International Development (USAID), the Ministry of Information Technology (IT), and the provincial education departments. The NICT Strategy encompasses six components along with their associated action recommendations. The six elements include using ICTs to expand access to educational opportunities, applying ICTs to improve the quality of teaching and educational management, employing ICTs to enhance student learning, developing complementary approaches for using ICT in education, building on the successes of existing ICT programs, and developing capacity at both federal and provincial departments ((MoE) Ministry of Education, 2004). Another document the National Education Policy (NEP) 2009 also discuss about the implications of globalization and need for technology. These both documents were before 18th amendment in the constitution, but after the 18th amendment the scenario is different and education become the provincial subject. There are two policy documents of Sindh government launched after the 18th amendment also highlight the ICT integration in teaching learning process. These documents include:

i. Sindh Education Sector Plan (SESP), 2014-18 and
ii. School Education Sector Plan and Roadmap for Sindh (2019-24)

Both documents highlight the ICT integration in teaching learning process. As outlined in the (SESP&R) for Sindh (2019 – 2024), the way we teach and assess students in public schools across the province will be modernized by introducing the usage of technology in teaching learning process and assessment of students learning. While the digitization of curriculum content, e-assessment were discussed in the SESP&R 2019-24 plan. (School Education & Literacy Department, 2020). However, being outlined in the SESP&R 2019-24 for Sindh, regrettably, as of 2023, the government has yet not taken substantial measures for its implementation. This lack of action underscores a concerning lack of commitment toward ICT integration. Furthermore, the document in question lacks a clear policy action framework or model detailing its implementation within the province. It does not define the involvement of relevant stakeholders or responsibilities of different directorates of the SELD in implementation process. Despite global recognition of ICT's transformative potential in education, the ICT integration remains a formidable challenge in the province.

The existing literature underlines a noticeable gap for understanding of the effectiveness and assessment of ICT integration in the public sector primary schools of Sindh. The absence of comprehensive research on the challenges and opportunities related to the lack of ICT integration in primary education, and absence of a clear policy action framework which works like a blueprint for the implementation of ICT in primary education of province became a rationale to conduct this study.

In light of the findings, this study aims to address the important issue of incorporating ICT into the classroom teaching of primary grades in government schools of the Sindh where it hasn't been used much before. By looking at the difficulties, chances, and ways to make it happen, this research tried to propose a policy model for integration of ICT in primary education of province. These policy solutions will work to narrow the gap in access to technology and prepare students to thrive in an increasingly technology-driven world.

1.4. Unpacking the Key Concepts Used in this Study

The purpose of this section is to provide a comprehensive and clear explanation of the important terms used in this research study. The primary intention is to provide readers with a thorough understanding of these terms, enabling them to navigate the study with clear and precise comprehension of the concepts utilized within this study. This clarification is crucial for creating a shared understanding and enabling coherent and meaningful communication of the research findings, analyses, and discussions.

1.4.1. Information and Communication Technology (ICT)

Information and communication technology or technologies (ICTs) refers to a broad array of technological tools and infrastructure employed for the transmission, storage, generation, sharing, or exchange of information. This encompasses a variety of technological tools and resources, including computers, the Internet (websites, blogs, and email services, social media platforms), live communication technologies (like radio, television, and webcasting), recorded communication tools (such as podcasting, audio and video players, and storage devices), and telecommunication methods both fixed and mobile, satellite, video-conferencing, and more (UNESCO, 2017).

1.4.2. ICT Integration in Education

Integration of Information and communication technology in education simply refers to the use of technology to enhance the student learning experience(Drexel, 2023). It simply refers to the purposeful incorporation of ICTs into classroom teaching and curriculum, with the primary goal of enhancing student learning and transforming educational practices. It involves the seamless integration of digital tools, internet resources, software applications, and digital content to empower educators and students, fostering innovative and interactive learning experiences, and equipping learners with essential digital skills (21st-century skills) and competencies for the modern world. While integrating ICT in education, it is essential to consider local relevance and context. It is necessary to ensure that integration of ICT in relevant to the needs and challenges of the specific region. It should be integrated in a way that aligns with the local culture, language, and educational goals. Customized content and applications can be developed to address specific educational needs and challenges.

1.4.3. ICT Competency

According to Danner & Pessu (2013) competence is defined as the ability to combine and apply relevant attributes to particular tasks in particular contexts. An ICT competency describes what a person should know to be able to use technology in his/her professional practice.

1.4.4. ICT Competency Framework for Teachers

In a book titled " Handbook of Research on Innovative Pedagogies and Best Practices in Teacher Education" Mtebe (2020) defined ICT Competency Framework for Teachers (CFT) as a structure that describes the specific set of skills and knowledge

that teachers must have in order to successfully use information and communication technologies in their work as educators. The ICT CFT serves as a roadmap that outlines the essential skills and knowledge teachers need to use technology in their teaching practice. It helps teachers get ready for the modern age of digital learning and teaches them how to use technology to teach well.

1.4.5. UNESCO ICT Competency Framework for Teachers

Globally, United Nations Educational, Scientific and Cultural Organization (UNESCO) has developed an ICT Competency Framework for Teachers (ICT-CFT). This framework acts as a tool to help with the training of both pre-service and in-service teachers. It focuses on how to use digital technologies effectively in education, whether it's in traditional classrooms or more informal learning settings (Danner & Pessu, 2013). The UNESCO ICT Competency Framework for Teachers (ICT-CFT) is designed to help people who make decisions about education, policy makers, those who teach teachers' (teacher-educators), and teachers' themselves. It gives guidance on how technology can improve education. It also helps countries create their own standards for what teachers' should know about technology in education, using a systematic plan (UNESCO, 2018a).

UNESCO and its private working partners continuously work on the ICT CFT to make it a more effective and updated document that fulfills the diverse needs of policymakers and educators around the globe. Since its initial launch in 2008, UNESCO has published three versions of the ICT CFT up to the present day, which are as follow:

1. UNESCO ICT Competency Standards for Teachers (CST) Framework Version 1, was published in year 2008 with the cooperation of Cisco, Intel and Microsoft.
2. UNESCO ICT Competency Framework for Teachers (CFT) Version 2 was published in 2011, following the release of the initial version in 2008. This updated version builds upon the foundation established by the first version and reflects the evolving landscape of technology in education.
3. UNESCO ICT Competency Framework for Teachers (CFT) Version 3 was published in 2018, succeeding the previous versions, Version 1 in 2008 and Version 2 in 2011. Each subsequent version builds upon the earlier ones, incorporating advancements in technology and insights into teaching practices

to provide a more comprehensive and up-to-date resource for educators and policymakers.

In order to identify the teacher's ICT related competencies this study utilized the third version of UNESCO ICT-CFT. The ICT CFT comprises 18 competencies, categorized based on six aspects of teachers' professional practice and distributed across three levels (Knowledge Acquisition, Knowledge Deepening and Knowledge Creation) that correspond to teachers' pedagogical utilization of ICT. The six aspects of the framework are understanding ICT in education, curriculum & assessment, pedagogy, application of digital skills, organization & administration, and teacher professional learning (UNESCO, 2018a).

1.4.6. Student Learning Outcome (SLO)

Student Learning Outcomes (SLO's) are descriptions that outline what students will understand, achieve, or display after they have finished or taken part in a class, course, or program. SLO's articulate a student's action that should be visible, measurable, and demonstrable (Oxnard College, 2021).

In straightforward terms, SLO's should clearly and briefly describe the specific abilities students should be capable of demonstrating, creating, and understanding as a result of the program's curriculum. They should be precise and specific, leaving little room for interpretation, to ensure they can be effectively measured. For instance, an outcome like "Students who complete the BS in Computer Science should be proficient in the essential skills of the field" is too vague. In this case, it's unclear what those essential skills in computer science are. This lack of clarity can pose difficulties in assessing the desired behavior and deriving valid conclusions about the program's effectiveness (Boston University, 2017).

1.4.7. Lesson Plan

A lesson plan acts as a teacher's navigational guide for guiding a particular instructional session. It outlines both what students are expected to grasp and how this comprehension will be effectively conveyed during the session. A proficient lesson plan revolves around the three fundamental elements: learning outcomes, instructional activities, and assessment methods designed to gauge student comprehension(Singapore Management University, 2023). In simple terms, a lesson plan is like a roadmap for teachers. It lays out what they want to teach, what students

should learn, and how to do it. This helps teachers be better in the classroom because it gives them a clear plan to follow for each class.

1.4.8. ICT Infrastructure

ICT infrastructure refers to the comprehensive set of components and systems within information and communications technology. It encompasses devices, software, networks, protocols, telecommunications, automation, and various IT processes that facilitate and oversee information and communication interactions among diverse parties(Greentek Solutions, 2020).

1.4.9. Blended Learning

Blended learning is an approach to learning that integrates traditional face to face instruction with online learning (TeachThought, 2020). In blended learning, students get a mix of in-person and online lessons. They can often choose when and where they do the online part. This way, learning can be more personalized and flexible for each student.

1.4.10. ICT Integration Vs Blended Learning

Following are some key differences between ICT integration and blended learning:

- ICT integration is a broader concept that encompasses the usage of technology in education in various ways whereas, blended learning is a specific instructional or pedagogical approach that combines traditional and online learning.
- ICT integration enhances traditional teaching methods with technology, on the other hand blended learning restructures the learning experience by combining face to face and online elements.
- ICT integration can be applied to different instructional models while blended learning is a specific instructional model.
- Blended learning is one way to implement ICT integration in education, but there are other approaches as well.

1.5. Research Question

Is it feasible to integrate ICT in primary education in Sindh?

Explanation: A well-defined research question is a critical starting point for building a conceptual framework of a research study. This research question is really important because it forms the foundation for developing the conceptual framework of the dissertation. Because

it will guide how to structure and understand the various features of research on ICT integration in primary education.

The research question, "is it feasible to integrate ICT in primary education in Sindh?" serves as the cornerstone of study, which revolves around understanding the effectiveness and assessment of ICT integration in primary education. This question delves into the capability and possibility of introducing ICT and suggest a blueprint which helps how to integrate ICT into the primary education system of Sindh. It seeks to explore whether the infrastructure, resources, and educational environment in Sindh are conducive to integrating ICT effectively. The research question is closely tied to the study's focus on effectiveness. By investigating the possibility of ICT integration, the aim is to determine how this integration aligns with the goal of enhancing learning outcomes and overall effectiveness in primary education in Sindh.

1.6. Research Objectives

This study was designed as a mixed-method research study, with the first three objectives being approached quantitatively. The fourth objective, which is to gather the perspectives of managers, decision-makers, and implementers regarding the integration of ICT in primary schools, utilized a qualitative research method. Effectiveness and assessment of ICT integration in primary education" suggests that this study first observed the effectiveness of ICT integration on students' performance and then assessed the possibility of ICT integration in public sector primary schools. UNESCO's ICT implementation survey and other documents recommend assessing the capabilities of human resources and the availability of relevant infrastructure before integrating ICT in education. Simultaneously, it is crucial to seek the perspectives of relevant stakeholders to recommend or suggest any policy guidelines. This study aimed to address the following objectives:

i. To determine the effect of ICT integration on performance of grade V student.
ii. To assess the existing ICT related infrastructure in public sector schools.
iii. To identify the ICT related knowledge and competencies of teachers.
iv. To seek the decision makers, managers, and implementers perspective for integrating ICT in primary education.

1.7. Conceptual Framework of the Research Study

The conceptual framework of the research is illustrated below in Figure 1.1.

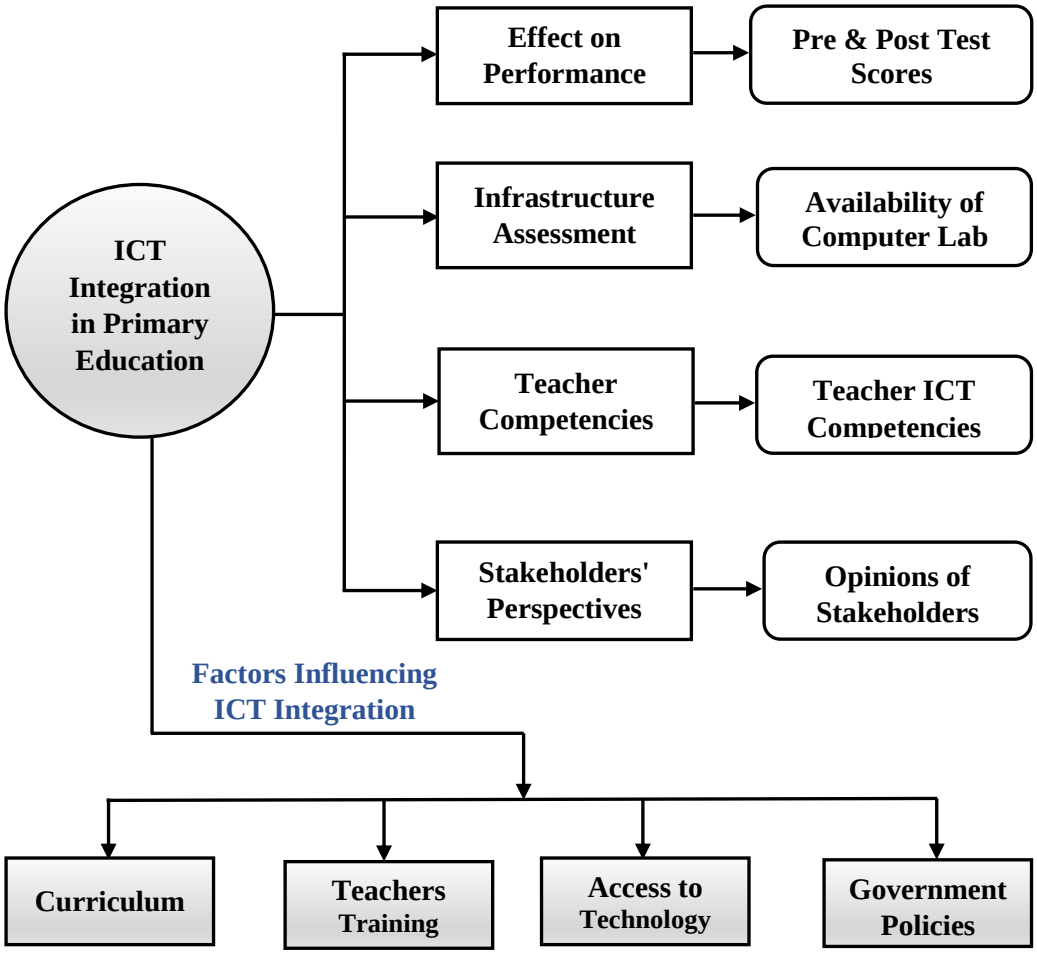

Figure 1.1: Conceptual Framework of the Study

Source: Author (2024)

1.7.1. Developing an Understanding of the Conceptual Framework

In this section, the various elements comprising the conceptual framework will be explored to understand how these components are interconnected and interrelated. This study seeks to offer a thorough insight into the organization and process of the framework.

- **ICT Integration in Primary Education:** The central theme of the conceptual framework revolves around investigating the feasibility of implementing ICT integration in primary education. Four sub-themes, corresponding to the study's objectives, have been identified and are presented in Figure 1.1 followed by their respective outcome variables, pre & post test scores, availability of computer lab, teachers ICT competencies and opinion of stakeholders. These objectives include assessing the impact on performance, evaluating infrastructure, gauging

teacher competencies, and considering stakeholders' perspectives. These objectives have been chosen to thoroughly examine the influence of ICT usage on students' performance. Additionally, when assessing the possibility of ICT integration in education, it becomes imperative to ascertain the availability of ICT infrastructure and the ICT-related competencies of teachers.

- **Effect on Student Performance:** This objective focuses on assessing how the use of ICT tools and resources impacts students' academic score, particularly in the context of primary education. It aims to determine whether the use of ICT enhances or influences students' learning outcomes, which is essential for evaluating the overall effectiveness of ICT integration.
- **Availability of Infrastructure:** This objective involves evaluating the existing ICT infrastructure in public sector schools. It assesses the presence and functionality of essential ICT resources, such as computer labs, internet access, and other technological tools. Understanding the availability of infrastructure is crucial in identifying potential barriers and opportunities for ICT integration.
- **Teachers' ICT Competencies:** This objective aims to identify and measure the ICT skills of teachers involved in primary education. It examines whether educators possess the necessary competencies to effectively integrate ICT into their teaching methods. Teachers play a pivotal role in successful ICT integration, making this objective pivotal for assessing readiness.
- **Stakeholders' Perspective about ICT Integration:** This objective involves seeking the views and opinions of various stakeholders, including decision-makers, managers, and implementers, regarding the integration of ICT in primary education. The aim of this objective is to collect opinions from those involved in the policy formulation and implementation process regarding challenges and potential strategies for ICT integration in primary education of Sindh.
- **Factors Influencing ICT integration:** The effective and successful integration of ICT into education depends on several key factors. First and foremost, the curriculum plays a pivotal role, as it must be designed to incorporate ICT seamlessly into the learning process. Additionally, teachers' training and competencies are crucial, ensuring that educators possess the necessary skills to effectively leverage ICT tools for teaching. Access to technology, including reliable infrastructure and devices, is equally vital, as it determines students' and

teachers' ability to engage with ICT resources. Lastly, government policies and initiatives play a substantial role in facilitating the use of ICT in primary schools, as they set the framework for investments, regulations, and strategies aimed at enhancing educational technology adoption. These factors collectively influence the framework of ICT integration in education, affecting its efficiency and scope.

These objectives collectively contribute to understanding the feasibility and effectiveness of ICT integration in primary education. These provide a comprehensive view of the various aspects involved, including the impact on students' performance, the required infrastructure, teacher preparedness, and the perspectives of key stakeholders. By addressing these objectives, this study will shed light on the pros and cons of ICT integration, aiding in the development of informed policies and strategies. Additionally, this study recognizes that integration of ICT can be impacted by numerous key aspects, including curriculum alignment, teacher training, technology access, and government policies. Exploring these factors in conjunction with the research objectives will offer a holistic perspective on ICT integration in primary education, ultimately guiding evidence-based decision-making and policy formulation.

1.8. Research Context

The research context offers a background to the study, detailing the environment and conditions of District Hyderabad. This section provides an overview of Hyderabad's general characteristics and demographics. Additionally, it examines the district's educational profile, highlighting the state of educational institutions, particularly public sector schools.

1.8.1. Overview of District Hyderabad

Hyderabad, situated within the Sindh province of Pakistan, is both a city and a district. It ranks as the second-largest urban center in Sindh, Pakistan, following Karachi. According to Hyderabad Chamber of Commrce (2019); Wikipedia (2023), Hyderabad ranks as the eighth largest city in Pakistan and holds the distinction of being one of the most ancient cities in the Indian subcontinent. Hyderabad is notably significant as a hub for culture, economy, and administration within the region. Hyderabad is situated in the south-eastern region of the Sindh province. It is roughly 150 kilometers to the east of Karachi, which serves as the capital of the province.

The city of Hyderabad has a rich history that stretches back to ancient times. Mian Ghulam Shah Kalhoro established the Hyderabad city in 1768 on a limestone ridge situated on the eastern side of the Indus River, commonly referred to as Ganjo Takkar

or Bald Hill (Hyderabad Chamber of Commrce, 2019). The old name of the city was Neroon Kot. It served as the capital of Sindh during the rule of the Talpur dynasty, who came after the Kalhora dynasty, until the year 1843.

In Hyderabad, just like in many parts of the Sindh, the primary language spoken is Sindhi and Urdu. The district has a rich cultural history, with different traditional celebrations, music, and handmade crafts.

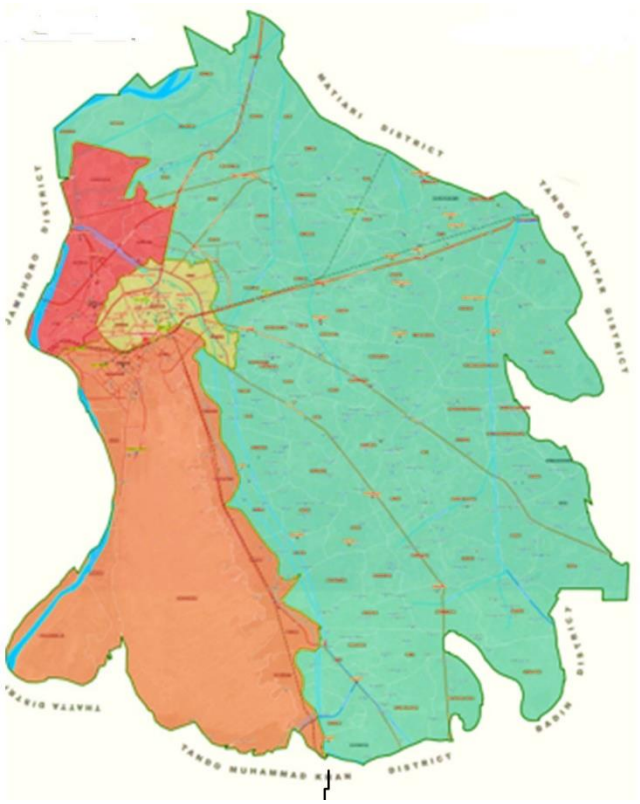

Figure 1.2: Map of District Hyderabad

Source: Board of Revenue, Government of Sindh

Hyderabad, Pakistan, is home to various significant historical sites, such as the renowned Mian Ghulam Shah Kalhoro Bridge, also recognized as the Jamshoro Bridge, the Rani Bagh botanical garden, and the historic Pacco Qillo Fort. One notable attraction for tourists in the city is the Sindh Museum. It beautifully showcases the rich culture of Sindh and the Indus Civilization, often leaving visitors amazed.

According to the 7th Population and Housing Census-2023, the country's first-ever digital census, the population of Hyderabad district is 2,432,54, with a yearly growth rate of 1.69%. The number of households in the district are 448,479. (Bureau of Statistics, 2023). Hyderabad District is administratively structured into the four talukas. Hyderabad City (Urban) taluka, this taluka is an administrative subdivision of the

district, Hyderabad Rural taluka, Latifabad named after the noted Sindhi Sufi poet, Shah Abdul Latif Bhittai and Qasimabad taluka is named after the Arab conqueror who conquered Sindh, Muhammad Bin Qasim. It was formed as an extension to the city of Hyderabad and was mostly attracted population during 1980s.

1.8.2. Educational Profile of the Hyderabad District

Hyderabad, like other districts in Sindh, typically follows the national education system of Pakistan, which consists of primary, middle, high, and higher secondary schools. The district has a mix of government-run and private schools. Government schools are typically funded and managed by the government, while private schools are operated by private entities.

The medium of instruction is usually Urdu or Sindhi (regional language), however, English is also taught as a subject in government schools of the district like rest of the province. Recently few government schools in the district have started to use English as a medium of instruction. The primary education curriculum in Hyderabad district, is set by the relevant education authority that is Directorate of Curriculum Assessment and Research (DCAR) as in the rest of provinces of Pakistan. It generally includes subjects such as Mathematics, Science, Social Studies, Urdu, English, and Islamic Studies or Ethics, depending on the type of school.

Similar to numerous other areas in Pakistan, Hyderabad district also faces many educational challenges such as overcrowded classrooms, inadequate infrastructure, and a need for improved quality of education.

A quick statistical view of public sector schools of district Hyderabad run under the authority of School Education and Literacy Department (SELD), Government of Sindh is shown here in Table no. 1.1.

Table 1.1: Total Number of Schools by Gender and Enrolment

Schools				Enrolment		
Girls	**Boys**	**Mixed**	**Total**	**Enrolment (Girls)**	**Enrolment (Boys)**	**Total**
144	143	620	907	84,902	100,229	185,131

Source: Profiling of Government Schools (PGS), 2019

Table no. 1.1 shows the number of schools on the basis of gender, 144 out of 907 schools are specified for only girls, 143 for boys whereas 620 schools are mixed means

for both girls and boys, it is also graphically represented in Figure 1.2. According to latest available statistics that is profiling of government schools 2019 total enrollment of district Hyderabad is 185,131 with 84,902 (46%) girls' enrollment and 100,29 (54%) of boy's enrolment as shown in Figure 1.3.

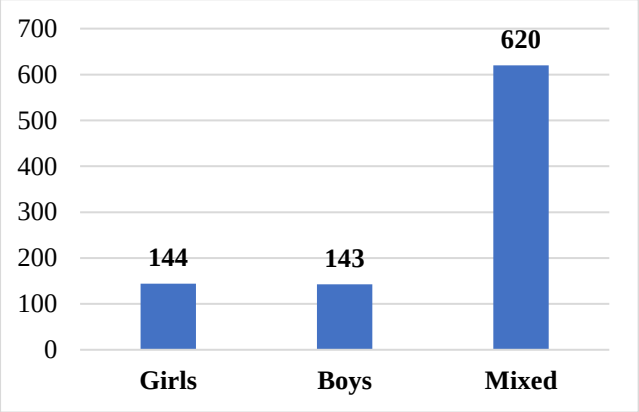

***Figure 1.3*: Number of Schools by Gender**

Source: Profiling of Government Schools 2019

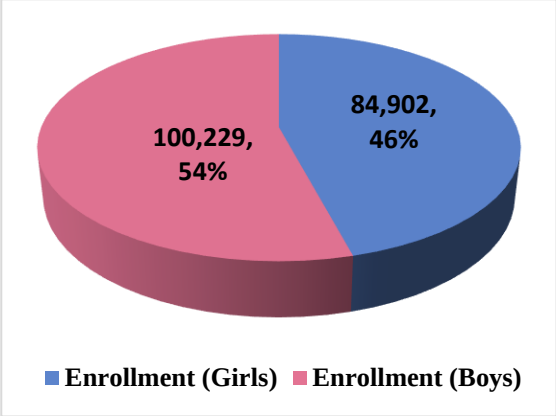

***Figure 1.4:* Enrolment by Gender**

Source: Profiling of Government Schools

Table 1.2: Number of Schools by Level

Primary	Middle	Elementary	Secondary	Hhigher Secondary	Total
739	72	9	70	17	907

Source: Profiling of Government Schools 2019

According to Profiling of Government Schools 2019 there are 907 government schools in the district as shown in Table no. 1.2, these 907 schools include 739 primary schools, 72 middle schools, 9 elementary schools, 70 secondary schools and 17 higher secondary schools.

Table 1.3: Taluka-wise Statistics of the District

Name of Taluka	No. of Schools	Total Enrolment
Hyderabad Rural	508	56,308
Hyderabad City	167	62,478
Latifabad	159	47,396
Qasimabad	73	18,949

Source: Profiling of Government Schools 2019

As per taluka wise statistics of the school education sector of district Hyderabad as shown in Table no. 1.3, taluka Hyderabad Rural have 508 schools with 56,308 enrolment, Hyderabad City have 167 schools with 62,478 enrollment, 159 schools are in Latifabad with 47,396 enrollment and taluka Qasimabad have 73 schools with 18,949 enrolment.

1.9. Significance of the Study

In the era of rapid technological advancement, the ICT integration into primary education has emerged as a crucial topic of interest and importance. It becomes the paramount for preparing students to thrive in a modern, technology-driven world. Equipping young learners with digital literacy and ICT skills at an early age is essential to ensure their future success in higher education and the workforce. This study, titled "Effectiveness and Assessment of ICT Integration in Primary Education," holds significant relevance for several key reasons, like to understand how ICT integration affects academic performance is vital for educational policymakers, teachers, and parents. This study seeks to explore whether the utilization of ICT tools and resources enhances student learning outcomes.

This research study works like an environmental scan for the SELD, Government of Sindh. The findings of this research can inform educational policy decisions at both the district and provincial levels. By assessing the current state of ICT integration, policymakers can make data-driven decisions to improve primary education in Sindh.

On the basis of findings, this study will suggest a unified policy model for the integration of ICT in public sector schools, which works like a blueprint for ICT integration in the province. Not only this, it will help the following directorates and wings of SELD:

- **Teacher Training Institutes:** This research study titled "Effectiveness and Assessment of ICT Integration in Primary Education" can offer valuable support and guidance to Teacher Training Institutes (TTIs) operated by the SELD, government of Sindh in several ways. The study identifies specific ICT competencies that teachers need, TTIs can incorporate these competencies into their training programs. Not only this, TTIs can use the study's insights to customize their training programs to better prepare teachers for ICT integration in primary education. This includes designing workshops, courses, and resources that address specific in-service teacher needs.

  Furthermore, this study can help the TTIs in evaluation of teachers ICT competencies. These institutes may use the study's assessment methods as a model for evaluating teachers ICT related competencies. This ensures that teacher training programs are producing desired outcomes.
- **Directorate of Curriculum Assessment & Research:** The results of this study can inform curriculum developers about the impact of ICT integration on student learning outcomes. In the light of findings of the study curriculum can be designed or adjusted to incorporate ICT tools and resources effectively, ensuring alignment with

educational goals. It helps curriculum developers of various subjects of primary grades to incorporate the use of ICT in student learning outcomes.

- **Sindh Textbook Board:** This study can serve as a valuable resource for Sindh Textbook Board (STBB), helping them adapt to the changing educational landscape and integrate ICT effectively into their textbooks and other educational materials. Based on the study's findings, STBB can invest in the creation of digital resources and materials that enhance the educational experience. This might include interactive e-textbooks, multimedia content, or online learning platforms aligned with the goals of primary education in Sindh.
- **Directorate of Planning Development and Research:** The findings of this study hold significant relevance for the Directorate of Planning, Development, and Research within the Sindh Education and Literacy Department (PDR). They will provide meaningful insights into the feasibility and effectiveness of ICT integration in primary education across the province. These insights can serve as a foundation for evidence-based policy formulation and strategic planning within SELD. By understanding the impact on student performance, assessing infrastructure needs, identifying teacher competencies, and gauging stakeholders' perspectives, SELD can tailor its initiatives to align with the specific challenges and opportunities of ICT integration. Ultimately, this study's findings will empower SELD to make informed decisions, allocate resources efficiently, and contribute to the enhancement of primary education in Sindh.

1.10. Thesis Roadmap

The subsequent chapters of this thesis are structured to present a comprehensive exploration of the study's findings.

In Chapter 2, an in-depth analysis of existing literature is provided, focusing on ICT integration in education. The chapter synthesizes the current body of knowledge into four primary themes: the impact of ICT integration on students' academic performance, the availability and usage of ICT infrastructure in schools, teachers' ICT competencies, and the perspectives of policymakers and other stakeholders in education.

Chapter 3, highlights Pakistan's policies related to ICT in education. It traces the changes in these policies before and after the 18th Amendment to the Constitution, which made education a provincial matter. This analysis helps to understand how ICT integration in education has evolved over time in the country.

Chapter 4 serves as a methodological guide, detailing the approaches employed in this research, including data collection methods and tools, participant demographics, and sampling techniques. It also outlines the roadmap and operationalization of the study's conceptual framework. Additionally, the chapter discusses the various data analysis methods used to analyze the study's data, followed by a presentation of ethical considerations.

Chapter 5 delves into the study's findings, organized into six sections. It begins with an exploration of the socio-demographic characteristics of the participants, followed by an in-depth discussion of the intervention's results. Subsequent sections present outcomes from surveys on ICT infrastructure availability, teachers' ICT competencies, and relevant stakeholders' perspectives on ICT integration in primary education. The chapter ends with a recap of the main findings.

The 6 chapter, 'Paving the Path Forward: Proposed Policy Guidelines for ICT Integration in Primary Education,' outlines the proposed policy model based on the study's findings.

Chapter 2

Thematic Literature Review

2.1 Introduction to the Chapter

This chapter aims to synthesize the existing research on ICT integration in education, highlighting both the advancements and the ongoing challenges. It discusses scholarly work on ICT integration in education and also provides a thorough review of the major challenges faced by various nations in integrating ICT into their education sectors. The chapter also highlights the impact of ICT on students' academic performance based on the literature. Further, it presents a review of the existing body of knowledge on teachers' competencies for integrating ICT in education. Additionally, this chapter delves into the review of existing policies and various initiatives taken by different countries for the implementation of ICT in education. The second to last section identifies lacunae in the current body of knowledge, while the final section discusses how this study will contribute to the body of knowledge.

2.2 ICT integration in Education

ICT plays a crucial role in every dimension of life, bringing revolutionary changes to various sectors. ICT has quickly become a fundamental pillar of society, completely transforming the way of life and reshaping how people think, work, and live. As Ghavifekr et al. (2014) discussed in a study, these technologies are now essential in modern societies. Whether making a phone call, sending an email, visiting the bank, using a library, listening to sports on the radio, watching the news on TV, working in an office or outdoors, visiting the doctor, driving a car, or catching a plane, ICTs are being used. In the 21st century, technology has become essential in every aspect of life, including education, profoundly transforming teaching and learning methods. In this digital era, where ICT serves as a knowledge transfer highway, educational institutions such as schools play a crucial role in preparing students for life in an information society. To achieve this, they must incorporate ICT integration into their teaching-learning processes to enhance students' digital literacy and prepare them for the challenges of the modern world (Ghavifekr et al., 2012). According to Rosnaini & Arif (2008), ICT integration is the process of identifying the appropriate role and placement of technology within the teaching and learning environment. The objective of integrating ICT is to enhance the quality, accessibility, and cost-effectiveness of instruction delivery to students, it also involves leveraging networking opportunities within learning communities to address the challenges posed by globalization (Albirini, 2006). As previously stated, the integration of ICT in education involves utilizing technology based teaching and learning

methods closely associated with technology use in schools. It can be argued that nearly all subjects, including mathematics, science, languages, arts, humanities, and other major fields, can be more effectively learned through the use of technology based tools and equipment. Moreover, ICT is considered an additional supplement that supports teachers' in the teaching learning process. Hermans et al. (2008) identified three key stages: integration, enhancement, and complementarity, for ICT to gain significant acceptance and utilization by teachers. The integration stage aims to improve student achievement by incorporating suitable ICT use into subject areas with advanced topics and competencies. A curriculum review is essential to ensure only relevant ICT resources and software are installed to achieve the curriculum's primary goals. The enhancement approach emphasizes using ICT to provide a strong emphasis on the introduced topic. For example, Microsoft PowerPoint can be used to present subjects in a highly original and creative way, encouraging conversation and idea sharing. The complementary approach involves using ICT to assist and support students' learning. This enables students to be more organized and efficient, as they can take notes on their computers, submit work by email from home (provided they meet deadlines), and search the internet for material from various sources to complete assigned tasks.

Morever, Titus (2020) highlighted in a study that ICT serves as both a catalyst and a tool for driving educational reforms, transforming students from mere job seekers into knowledge and technology driven individuals who can become employers themselves observed that building trust in technology is essential for both student (Ghavifekr & Rosdy, 2015) and teachers to improve technological performance and increase acceptance while reducing resistance to technology. This study further added a wide array of subjects, including mathematics, science, languages, and other major fields, can be more effectively learned through the use of technology based tools and equipment. Furthermore, ICT offers valuable assistance and supplementary support for both teachers and students, facilitating effective learning through the use of computers as learning aids. Digital Learning Network (2020) reported that ICT benefits schools by enhancing classroom learning, improving management tasks, increasing accountability and efficiency, and introducing various ICT tools for learning. The literature suggests that effective use of ICT in schools can enhance the teaching and learning process in multiple ways. ICT focuses on the learner, promoting active student participation. Students are more motivated when learning activities are challenging, authentic, engaging, and multidisciplinary.

Despite the numerous advantages of ICT in the teaching-learning process highlighted in the literature, its integration faces several challenges, including inadequate ICT infrastructure in schools, insufficient teacher capacity, improper implementation of ICT policies, and funding issues. This situation is particularly noticeable in developing countries, where the lack of resources creates hurdles in the effective integration of ICT. However, it is crucial for every nation to cultivate a workforce with advanced skills and education, proficient in applying ICT to thrive in a globally competitive environment. These challenges are discussed in detail in Section 2.2 of this chapter, where the focus is on understanding the specific obstacles that hinder the successful integration of ICT in education systems, especially in developing countries.

2.3 Key Challenges in Integrating ICT in Education

According to researchers like Sherry & Gibson, (2002), multiple factors influence the use of ICT in the teaching and learning process. They suggest that the integration of ICT should take into account technological, personal, managerial, and organizational factors. Moreover, Rogers et al. (2014) identified three technological characteristics that influence the decision to adopt innovation, including content characteristics, technological reflexivity, and professional aptitude, all of which influence the use of ICT in instructional practices.

Study conducted by Mbodila (2013) highlighted that policy makers, educators, educational administrators, and higher education students face substantial hurdles in using ICTs into education, stemming from contextual, cultural, and pedagogical factors. According to him availability of appropriate building or rooms to house the technology, availability of electricity and Internet are contextual challenges. Whereas, contextual challenges include diversities in different part of world which creates challenges to integrate ICT in education. Research indicates that approximately 80% of online content is in English, creating a significant cultural barrier to integrating ICT use in classroom teaching, particularly in countries where English is not the primary language. Mbodila (2013) further emphasized that inadequate funding and a deficit in trained human resources are two major educational challenges in integrating ICT in education. Balancing educational goals with economic realities is one of the greatest challenges in integrating ICT into education. Due to financial constraints, governments in developing countries prioritize the rehabilitation of school buildings over investing in ICT for education.

Integrating ICT in education poses several challenges for developing countries, as identified in the existing literature. These challenges vary across countries and regions, reflecting a complex interplay of factors that impact the successful adoption and implementation of ICT in educational settings. In Nigeria, many secondary schools have not fully implemented the recommended curriculum due to several obstacles. These include a lack of computer facilities, frequent power outages, security concerns, the need for conducive learning environments, and a lack of trained and skilled computer teachers (Titus, 2020).

A study conducted by Ghavifekr & Rosdy (2015) in Malaysian public sector secondary schools, revealed that technical difficulties have emerged as a significant challenge in many schools across the country. These difficulties cause frustration for both students and teachers, leading to disruptions in instructional activities. Without sufficient technical support and maintenance services, teachers may be temporarily unable to use computers.

Liberia, situated along the West African coast, lags behind in the use of ICT in instructional activities. Statistics from a study conducted by Kennedy (2023) indicate that the lack of ICT infrastructure, such as computers and internet facilities, combined with inadequate teacher support in utilizing ICT, deficiencies in teaching methods involving ICT, and insufficient training are major challenges that hinder the integration of ICT in teacher training.

A study conducted in Algeria, aiming to explore teachers' views about barriers and challenges affecting the integration of ICTs in the instructional activities, by Souheyla (2019), highlighted that technical problems can hinder teachers from using ICT in their teaching and learning processes. These problems include a lack of technical support, a lack of awareness of challenges, as well as age and gender differences.

A study conducted in India by Prakash (2022) identified cultural challenges, particularly the fact that English is not the first language of the country. This language barrier poses a significant challenge to the use of ICTs in the country's education system.

Similarly, several studies conducted in Pakistan have highlighted various challenges for the integration of ICT in education. These challenges include the lack of ICT infrastructure, insufficient numbers of qualified ICT teachers, teachers lacking ICT competencies, and a lack of funding for implementing ICT in schools. A study conducted by Shah (2016) with the main to investigate the actual implementation of ICT projects at the secondary school level in Sindh province, with district Ghotki selected as a case study. The study results indicated that, out of 40 secondary schools, only 13 had ICT laboratories. Among these 13

schools, 7 did not have any students enrolled in ICT courses, and 3 did not have an ICT teacher.

Another research study was conducted in the Khyber Pakhtunkhwa (KPK) and Punjab provinces of Pakistan by Majoka et al. (2013), the study aimed to investigate the incorporation of ICTs in pre-service teacher education programs. It marked the first instance in history where the course "ICTs in Education" was introduced in the pre-service teacher education program B.Ed. (Elementary) during the session 2010-11. The study's results revealed that the course was not effectively implemented according to the requirements outlined in its course guide. This shortfall was linked to problems like unreliable electricity, insufficient ICT equipment, and limited training and skills in using ICT among the educators. Furthermore, the degree to which teachers followed the course guide was also seen as a factor affecting the implementation process.

The study conducted by Ghazi et al. (2013) focused on the barriers and complications associated with the proficient use of ICTs in teacher training for distance education. The results of the study identified the top 10 barriers to successfully integrate ICT in teacher training programs. These obstacles encompass inadequate training, power outages, insufficient technical assistance, lack of peer encouragement, slow internet speeds, poor-quality software and hardware, insufficient software, limited knowledge, and low confidence.

As reflected from the existing literature, developing countries encounter substantial hurdles in integrating ICT into education due to insufficient infrastructure, such as unreliable electricity and limited internet connectivity, which impede the effective utilization of ICT tools in schools. Additionally, limited funding for education often leads to a lack of resources for ICT integration. Another challenge is the shortage of trained human resources, particularly teachers proficient in ICT skills, which hinders the successful implementation of ICT in teaching and learning.

2.4 Impact of ICT integration on students' performance

Throughout the globe, numerous studies have been carried out to evaluate the success of incorporating ICT into educational environments and its influence on students' academic achievements. The body of research consistently suggests a positive influence, indicating that the integration of ICTs in education can lead to improved learning outcomes and enhanced academic performance among students. According to Anderson (2009), the

integration of ICT has the potential to enhance educational experiences and results for all students, including those with intellectual disabilities. To explore the most effective approach in designing programs that utilize ICT to enhance English learning, Bai et al. (2016) conducted a clustered randomized controlled trial (RCT) involving 6304 grade fifth students studying English in 127 rural schools in China. The RCT involved schools receiving ICT integrated into their teaching program, schools receiving ICT without integration into the teaching program, and schools serving as controls. The findings suggest that integrating the program into the teaching curriculum effectively improves student test scores compared to control schools.

Teachers must comprehend the conditions under which students enhance their academic performance. Both operational efficiency and strategy play crucial roles in achieving superior performance, with the execution of strategy being particularly critical for attaining high-quality and improved academic outcomes for students (Mbugua, Mbugua, et al., 2015). This study by Mbugua, Mbugua, et al. (2015) was conducted in public secondary schools in Nakuru County, Kenya, where teachers were integrating ICT into the teaching learning process. Despite these efforts, students' academic performance remained low, as indicated by the test scores from the Kenya National Examination Council, with only a few students qualifying to join various universities.

Using a quantitative research approach and a sample of 1000 students from four universities in Saudi Arabia, Basri et al. (2018) conducted a study to examine the implementation of ICT in these universities and its effects on students' academic outcomes. The study also looked at how gender, GPA, and student majors influenced the association between ICT use and academic achievement. The findings show a link between ICT use and academic performance in a conservative setting. Additionally, the study found that ICT use had a more positive effect on female students' academic performance compared to male students. However, the students' IT majors did not have a significant impact on their academic achievement.

Karamti (2016) conducted a study in the North African country of Tunisia, the focus of the study was to assess the impact of ICTs on students' academic performance. Numerous studies that demonstrate the positive effects of ICT on academic achievement are predominantly based on research conducted in developed countries. This study examines higher education in Tunisia to address the knowledge gap about ICTs' impact on education

in developing countries. Evidence from 377 students and teachers was analyzed. A multilevel analysis assessed the effects of ICT access and use, alongside other attributes, on academic performance. The results showed a significant but negative impact of ICTs on performance.

The research study by Ishaq et al. (2020) aims to identify the various effects of ICT on tertiary education. The study investigates the relationship between the use of ICT and students' academic achievement in both public and private universities in Pakistan. The goal of this study is to elucidate the association between the use of ICT and students' academic performance. The study was conducted on 300 students using a questionnaire in various public and private sector universities in Pakistan. The results indicate that the effective use of ICTs has a significant and positive impact on students' performance.

The research from various countries indicates a positive impact of integrating ICT into educational settings on students' academic performance. Studies show that incorporating ICT can result in better learning outcomes and enhanced academic performance, especially in developing countries like Tunisia and Pakistan. Despite challenges, such as low academic performance in some cases, the overall consensus suggests that effective use of ICTs in education can significantly benefit students. Strategies that focus on integrating ICT into teaching programs and curriculum design can further enhance these positive effects.

2.5 Fostering Excellence: Teacher Competencies for Integrating ICT in Education

This section discusses the pivotal role of teacher competencies in integrating ICT into education, as highlighted in existing literature. Educational change hinges on the actions and beliefs of teachers; it is both straightforward and intricate in this regard. This emphasizes that teachers play a crucial role in determining how they adopt educational changes in their teaching methods. Relevant literature examines ICT-related courses and pedagogical training in teacher education programs, along with theories, models, and frameworks aimed at understanding teachers' intentions and actual use of ICT in teaching (Aslan & Zhu, 2016). For example the study by Suárez Rodríguez et al. (2018) suggested that teachers' competencies in ICT play a crucial role in transforming their teaching practices, making them a vital aspect of integrating ICT into classrooms. ICT competencies, defined as the knowledge and skills teachers need to acquire to effectively incorporate technology into their teaching practices, have garnered significant attention in ICT literature. According to Wong & Daud (2018) teachers act as intermediaries between students and technology, serving as the catalysts for creating an ICT

literate society. As educators, it is imperative for teachers to continually prepare and update the content they present in subjects using the available ICT facilities in schools. The integration of ICT in teaching and learning can transform a subject into an enjoyable experience for all students. Moreover, teachers themselves gain valuable experience and knowledge through their interactions with students.

Bate (2010) conducted a mixed-methods study in Western Australia to explore the role of ICT in the evolving pedagogical practices of beginning teachers. This longitudinal study examined the ICT use of 35 novice teachers during their initial three years of teaching. The findings revealed that these teachers expressed pedagogical beliefs focused on engaging students in active meaning-making. While the teachers showed proficiency in using basic ICT software, their teaching beliefs aligned with modern learning theories did not consistently result in practices that integrated pedagogical, content, and technological knowledge effectively. The study highlighted a gap between teachers' expressed teaching beliefs and their practical use of ICT in classrooms.

Syahid et al. (2019) employed a survey method to assess the use of ICT in classroom teaching among primary school teachers in Indonesia. The study revealed that less than half (32%) of the primary school teachers demonstrated good pedagogic competence. These teachers primarily relied on conventional classroom management techniques and had not fully utilized ICT for learning activities in primary schools. Another study conducted by Ghavifekr et al. (2014) in public sector primary schools in the Klang Valley, Malaysia, utilizing a survey method with 61 teachers from 10 different primary schools. The findings revealed that most teachers were categorized as normal users of ICT. Interestingly, many teachers tended to use ICT more frequently in the teachers' room for administrative tasks rather than in the classroom for teaching and learning purposes. The study highlighted the need for teachers to be well prepared and equipped with ICT skills and a positive mindset to offer ICT based learning opportunities, thereby improving the quality of student learning.

The research study conducted by Aslan & Zhu (2016) in Turkey aimed to investigate the integration of ICT into teaching practices among both pre-service and in-service teachers. The study involved 200 pre-service teachers and 105 beginner teachers with three years of teaching experience. The findings indicated that their integration of ICT was limited to a basic level. Significant contributions have been made by Lubuva et al. (2022) in assessing tutors' levels of ICT competencies and the factors influencing the application of ICT-pedagogical competencies

in teaching at two Teachers' Colleges. The study adopted the two levels of ICT competencies, knowledge acquisition, and knowledge deepening, from the UNESCO ICT-Competence Framework for Teachers. The findings indicated a high level of knowledge acquisition, suggesting confidence in basic ICT skills. However, knowledge deepening was found to be low, indicating a limited application of ICT-pedagogical competencies across subjects. Regression results revealed that practice had a positive and unique influence on predicting tutors' competencies in knowledge deepening. These findings suggest a need for more hands-on training for tutors in applying ICT-pedagogical competencies in their classroom practices.

The advent of advanced digital technologies is significantly impacting the improvement of learning outcomes and the enhancement of education quality. However, merely introducing these technologies into schools for the purpose of change and innovation is insufficient. It is essential to have digitally competent teachers who can effectively facilitate the use of ICT in education (M. M. Hassan et al., 2021). The literature reviewed underscores the critical role of teacher competencies in integrating ICT into education. Studies consistently highlight that teachers are pivotal in driving educational change and that their beliefs and actions significantly influence the extent to which ICT is effectively utilized in teaching practices. While many teachers demonstrate confidence in basic ICT skills, there is a gap in applying ICT pedagogical competencies across subjects. This highlights the need for ongoing training and support to enhance teachers' ICT competencies and their capability to effectively incorporate technology into their instructional methods. The findings suggest that to fully realize the benefits of ICT in education, teachers must be equipped with the necessary skills and mindset to effectively leverage technology for improved learning outcomes.

2.6 Global Trends in ICT Integration: Policies and Planning in Education

In an era characterized by rapid technological advancements, nations across the globe are recognizing the indispensability of ICT in fostering innovation, critical thinking, and preparing students for the challenges of the 21st century. Using technology in teaching and learning can bring about many changes in schools. However, it's important to plan carefully and create effective policies. Both researchers and policymakers need to have a shared vision for the future direction of technology in education (Ghavifekr & Rosdy, 2015). Jhurree (2005) explained in his study that Information and Communication Technology (ICT) is a potent catalyst for propelling economic, social, political, and educational progress. Developing countries, in particular, cannot afford to disregard ICT if they aim to remain competitive and flourish in the global economy. As highlighted by Dudeney (2007), planning and policy play crucial roles in

the successful integration of ICT in education. National ICT policies offer a structured plan detailing the objectives and vision for incorporating ICT in education. These policies benefit students, teachers, parents, and the broader community. This section aims to discuss the policies, strategic plans, and measures implemented by various countries to effectively integrate ICT into their education sectors. These initiatives are designed to equip learners to become 21st-century learners capable of global competitiveness. Through a thorough review of these policies and strategies, insights into best practices and challenges faced by nations in leveraging ICT for educational advancement can be gained.

2.6.1 Malaysia's ICT in Education Policies and Initiatives

The government of Malaysia implemented the integration of ICT in the early 1970s, reflecting its awareness of the importance of technology. The government understood that timely decisions about ICT integration in education could help prepare their students for future global competitiveness. In a study conducted by (Ghavifekr & Rosdy, 2015), it was noted that the Malaysian Ministry of Education has developed three key policies for ICT integration in education. The first policy aims to give all students access to ICT, reducing the digital gap between schools. The second policy outlines the importance and role of ICT in education. Additionally, another policy emphasizes the use of ICT for accessing information, communication, and as a productivity tool. The following are a few projects and policy initiatives of the Malaysian government relevant to ICT integration in the education sector:

- **Smart School Project (1997):** The project has been launched in 1997. This project aimed to integrate ICT into the mainstream curriculum of Malaysian schools to enhance the teaching and learning process. In 1999, a group of approximately ninety pilot schools was established to lay the groundwork for the nationwide implementation of Smart School concepts, materials, skills, and technologies. The purpose of these Smart Schools is to help the nation meet the goals of the National Philosophy of Education and to prepare a workforce capable of addressing 21st century challenges, thus reforming the educational system (Chan, 2002).
- **The Computerisation Programme in Schools (2000):** The Chan (2002) discussed in his study titled “ICT in Malaysian Schools: Policy and Strategies” that the Ministry of Education launched "The Computerization Program in Schools" in 2000. The aim of this program was to promote ICT literacy in as many schools as possible and to lessen the digital divide. The program was implemented in three stages. In the first stage, computer labs were established in 18 schools across six selected states from March to

June 2000. The second stage, launched in November 2000, involved the selection of 2400 schools for the construction of buildings. Further, Chan (2002) reported that by February 2002, 43% of school buildings had been completed.

- **The Electronic Book Project (2001):** According to Chan (2002) the Ministry of Education in 2001 launched a pilot project to investigate the use of electronic books in classrooms. The purpose of this project was to assess how digital content could enhance the teaching learning process. Additionally, the Ministry aimed to investigate the feasibility of using e-books to replace traditional textbooks, thus addressing the issue of heavy school bags. The pilot project involved 35 schools and lasted for five months. Initial findings suggest that the project helped improve students' digital skills and engaged them more in reading and learning.
- **Policy on ICT in Education (2010):** The Ministry of Education (MoE) in Malaysia has formulated a policy to guide the implementation of ICT in education, aiming to ensure uniformity and equal opportunity for all. The MoE believes that integrating ICT into teaching, learning, and school administration is essential for Malaysia's transition to a high-income nation (Malaysia Ministry of Education, 2010). This policy is rooted in the government's recognition of knowledge as a crucial foundation for sustainable human capital development. It is driven by the significant potential of ICT to enhance educational depth and overall quality. The Malaysia Ministry of Education (2010) policy aims to unify all ICT initiatives, both current and future, towards the goal of integrating ICT into education. This policy is based on four key pillars: human capital, budget, digital learning resources, and infrastructure (Malaysia Ministry of Education, 2010).
- **1BestariNet (2011):** In 2011, the Malaysian government launched the 1BestariNet project to deliver high speed internet access to schools across the country, thereby improving ICT integration in education. Zainal & Zainuddin (2020) discussed in their study titled “Technology Adoption in Malaysian Schools: An Analysis of National ICT in Education Policy Initiatives,” it was discussed that through the 1BestariNet initiative, the government made significant investments in infrastructure to connect the 10,000 primary and secondary schools in Malaysia. Additionally, teachers were provided with smartphones as part of this project. Zainal & Zainuddin (2020) mentioned that a UK company introduced a Learning Management System (LMS) under the 1BestariNet initiative. They also highlighted the differences between the

1BestariNet project and the Smart School project. One significant difference is the Frog VLE, a cloud-based platform that offers extensive storage for learning materials.

- **Malaysian Education Blueprint (2013-2025):** To improve education standards, the government created the Education Blueprint 2013-2025, which details a plan for the sustainable transformation of Malaysia's education system through 2025. According to Ghavifekr & Rosdy (2015), the Education Blueprint 2013-2025 outlines strategies to elevate the role of ICT within the education system. To achieve this, the Blueprint proposes 11 strategic and operational shifts. ICT is emphasized in the 7th shift, which aims to improve the quality of learning by providing internet access and a virtual learning environment to all schools through 1BestariNet by 2013. This initiative focuses on maximizing ICT implementation for self-directed learning.

2.6.2 ICT in education: Case of Mauritius

Mauritius has transitioned from a low-income, mono-crop economy at independence to a middle-income economy. To stay competitive globally, the government now focuses on developing the ICT sector. The aim is to turn Mauritius into a regional hub and an IT exporter, making ICT the fifth pillar of its economy (Soyjaudah et al., 2002). Further, Soyjaudah et al. (2002) added that to achieve this goal, the country has implemented strategies for establishing e-government and enhancing e-education and training.

Jhurree (2005) noted in his study that, as part of its educational reforms, Mauritius included ICT as a subject in primary schools in 2003 through the School IT Project (SITP). He further mentioned that in 2003, ICT teachers received their initial training at the Mauritius Institute of Education before being assigned to primary schools nationwide. However, insufficient funding and poor planning were major obstacles to the successful implementation of the SITP project. Funding has consistently presented a persistent challenge in various projects. However, as suggested by the study conducted by Kenny et al. (2001), the project is likely to encounter setbacks due to a combination of The project is likely to encounter setbacks due to a combination of election-driven pledges, insufficient political will, and underestimation of the project's scale and complexity by policymakers.

The government has revived the project by adopting a phased implementation approach, as explained by Jhurree (2005) in the study titled "Technology Integration in Education in Developing Countries: Guidelines to Policymakers." According to this strategy, about 50 computer labs were to be set up annually in 50 primary schools, rather than outfitting all

284 primary schools simultaneously. This approach is viewed as more practical and attainable. By setting realistic targets and securing strong commitment from authorities, the technology integration project is likely to move closer to success.

2.6.3 ICT in education: Case of Kenya

Kenya utilizes an 8-4-4 education system, which includes eight years of primary school, four years of secondary school, and four years of university for a first degree (Farrell, 2007). Further, Farrell (2007) noted that in 2003, the country introduced universal, free, and non-compulsory primary education, leading to an immediate enrollment increase of 1.3 million students. This surge in enrollment has generated a growing demand for access to secondary and tertiary education.

According to Kisirkoi (2015) ensuring quality education is a fundamental priority for preparing learners for the knowledge economy. The utilization of Information Communication Technologies (ICTs) in education has been shown to yield numerous learning benefits, despite being resource intensive (Bingimlas & education, 2009). Several initiatives have been undertaken over the past fifteen years to develop an ICT policy for Kenya. After years of effort, Kenya established a National ICT Policy in January 2006 with the goal of "improving the quality of life for Kenyans by ensuring the provision of accessible, efficient, reliable, and affordable ICT services." (Farrell, 2007). The Farrell (2007) further explained that the national policy comprises various sections, including information technology, broadcasting, telecommunications, and postal services. However, it is the information technology section that delineates the objectives and strategies regarding ICT and education. One relevant objective in this section is that the government will promote the utilization of ICT in schools, colleges, universities, and other educational institutions in the country to enhance the quality of teaching and learning. Farrell (2007), details several strategies within the policy's e-learning section, such as encouraging the creation of e-learning resources, fostering public-private collaborations to back e-learning projects, and advancing the formation of a unified e-learning curriculum to bolster ICT in education.

In 2021, Kenya's Ministry of Education introduced a policy on ICT in education and training. The aim of this policy is to establish a framework for utilizing ICT to enhance learning outcomes at all levels within an inclusive environment (Ministry of Education, 2021). The primary objectives of this policy are to foster an inclusive environment

conducive to ICT in education, improve curriculum development, implementation, assessment, and quality assurance through ICT, and encourage the acquisition of relevant skills that support the integration of ICT in education and training (Ministry of Education, 2021).

2.6.4 ICT in Education: Kingdom of Saudi Arabia (KSA)

The Saudi 2030 Vision launched in 2016, the Saudi Vision 2030 aims to reduce the country's reliance on oil as the primary source of income and diversify into other economic sectors. This vision outlines a series of goals and programs intended to reform various sectors, including education (Kingdom of Saudi Arabia, 2016). In the strategies aligned with Saudi Arabia's 2030 vision, including the National Transformation Program 2016–2020, technology is consistently emphasized as a critical catalyst for driving progress (Kingdom of Saudi Arabia, 2016). According to Alghamdi & Holland (2020) education plays a crucial role in equipping Saudi citizens with various new competencies, including digital skills, closely aligning with Saudi Arabia's new economic vision. The study conducted by Alghamdi & Holland (2020) points out that, the Kingdom of Saudi Arabia (KSA) is relatively new to integrating ICT in education, it is proactive in improving education quality and transitioning to a knowledge economy. This is evident through various initiatives, such as curriculum reform, providing teachers with professional development in ICT integration, and supplying computer technologies and infrastructure.

In the 1990s, the Ministry of Education (MoE) in KSA initiated extensive reforms and developed coherent plans to overhaul the educational system, with the goal of improving student learning and educational outcomes through the integration of ICTs in the curriculum and pedagogic processes. The 5th Saudi National Development Plan (1990–1995) and the 6th Saudi National Development Plan (1996–2000), guided by the Ministry of Planning (MoP, Kingdom of Saudi Arabia), both highlighted the importance of integrating ICT. For instance, computer science was introduced as an elective course in primary education and as a compulsory course in secondary education (MoP, Kingdom of Saudi Arabia, 1990, 1996) (Alghamdi & Holland, 2020). Further, Alghamdi & Holland (2020) added that the General Project for Curriculum Development (GPCD), launched by the Ministry of Education in 1998, aimed to enhance education through ICT integration, focusing on aspects such as curricula, teachers' skills, teaching strategies, and the learning environment. In 7th, 8th, and 9th Saudi National Development Plans (2000–2014), the Ministry of Planning (MoP), Kingdom of Saudi Arabia took additional steps to offer ICT

skills development for teachers and students, along with encouraging the integration of ICT in the classroom (Alghamdi & Holland, 2020).

Developing countries encounter many difficulties when trying to integrate ICT into education. One of the main problems is poor infrastructure, such as unreliable electricity and limited internet access, which makes it hard to use ICT tools effectively in schools. Additionally, there is often not enough funding for education, leading to a lack of resources for ICT. Another issue is the shortage of trained teachers with ICT skills, which makes it difficult to implement ICT in teaching and learning. To address these challenges, comprehensive strategies are needed to improve infrastructure, increase funding, and provide training and support for teachers. Therefore, a single formula or replicating the policies or practices of any one country may not be effective. Each country has its own unique circumstances and challenges. However, reviewing best practices from different countries facing similar challenges can provide valuable insights. These adapted strategies can be tailored to fit the current academic situation, ultimately improving learning outcomes and enhancing access to quality education.

2.7 Uncovering the Literature Gaps

In the context of the literature reviewed, a notable gap emerges regarding the absence of interventions in many studies. While existing research often explores teacher competencies, conducts qualitative interviews with stakeholders, or examines ICT infrastructure, few studies actively engage in interventions aimed at improving ICT integration in education. This gap is critical because it limits our understanding of how various interventions can impact the effective integration of ICT in teaching and learning processes. By focusing solely on competencies, qualitative assessments, or infrastructure, the literature overlooks the practical implementation and outcomes of interventions, which are crucial for informing policy and practice in the field. Future research should thus aim to bridge this gap by incorporating intervention-based studies to provide a more comprehensive understanding of the challenges and opportunities in ICT integration in education.

2.8 Contribution of the Study

This study makes significant contributions to the literature on ICT integration in education by addressing the identified research gaps through a multifaceted approach. First, the study employs an intervention to observe the effects of ICT on student learning outcomes, providing empirical evidence on the impact of ICT in a real-world educational setting. This intervention-based approach fills a critical gap in the existing literature, which

predominantly focuses on theoretical competencies or qualitative or quantitaive assessments without practical implementation.

Following the intervention, a quantitative survey was conducted among teachers to evaluate their ICT competencies and training needs. This dual approach not only assesses the current state of teacher preparedness but also identifies specific areas where further training and support are required, thereby contributing valuable insights into teacher development in the context of ICT integration.

Additionally, the study conducted in-depth interviews with a broad spectrum of stakeholders, including district and taluka education officers, the Chief Program Manager (CPM) of Reform Support Unit, SELD, the Additional Secretary of Planning, Development & Research at SELD, Government of Sindh, head teachers, and teachers themselves. These interviews provide a comprehensive understanding of policy and implementation gaps from multiple perspectives, enriching the discourse on ICT integration with practical, policy-relevant insights.

The study also undertakes a thorough review of existing ICT-related studies in Pakistan and compares them with policies and initiatives from other countries. This comparative analysis not only situates the findings within a broader international context but also identifies best practices and potential strategies that could be adapted to the local context of Sindh.

In the way forward, this study proposes policy guidelines for the implementation of ICT in primary education in Sindh. These guidelines are informed by empirical data from the intervention, teacher surveys, stakeholder interviews, and comprehensive literature reviews, making them robust and actionable. By integrating these diverse methodologies and perspectives, this study offers a holistic and practical contribution to the field of ICT in education, particularly in the context of developing regions like Sindh.

Chapter 3

Policy Landscape Review

3.1 Introduction to the Chapter

Chapter 2 elaborates on the existing body of knowledge about ICT integration in education. Expanding on the findings from Chapter 2 about technology in education, this chapter delves into the multifaceted landscape of ICT integration within Pakistan's education sector, aligning our exploration with the country's broader educational objectives and sustainable development goals. We begin with an overview of the existing ICT-related education policies in Pakistan, highlighting their alignment with global and national sustainability agendas. This contextual framework sets the stage for a thorough analysis of the evolution and impact of these policies. We then explore the dynamic changes in ICT education policies before and after the 18th Amendment to the Constitution, offering a comprehensive understanding of the shifts and advancements in the policy landscape. This review aims to provide conclusive insights that underscore the significance of ICT integration in shaping the future of education in Pakistan.

3.2 Integration of ICT in Education: A Contextual Overview

ICTs are like powerful tools that help spread knowledge and information. They have quickly become widespread all around the world. Using ICTs in education has a big impact on many aspects of the education process. This includes things like investing money, using technology to solve important issues like access to education, fairness, how schools are managed, making education more effective, improving teaching methods, ensuring quality, supporting research, and encouraging new ideas and improvements (Mbodila[1] et al., 2013).

The significance of integrating ICT in education is complicated. It goes beyond the introduction of gadgets in classrooms; it is a paradigm shift that seeks to empower students, equip educators, and bridge the digital divide. As technology increasingly integrates into daily lives, grasping its potential to enrich learning experiences is crucial for educational policymakers, practitioners, and stakeholders. The importance of integrating ICT in education goes beyond technological adaptation; it is a transformative journey that has the potential to enhance learning outcomes, facilitate collaboration, and prepare students for a globally connected future. In today's world, students need to use technology (ICT) for their studies. This is because various technological tools are now centralized, making it so that students aren't only dependent on teachers for learning. They can also use these tools to learn outside the traditional classroom setting (Mustafa et al., 2021). Centralizing technological tools has transformed learning,

reducing the traditional reliance on teachers as the main source of knowledge. Now, with various educational resources centralized in technology, students can independently explore and engage with academic content. This shift encourages independent learning and changes the role of teachers into facilitators who guide and support students through the wealth of information on digital platforms. Additionally, technology integration lets students go beyond regular classrooms, providing opportunities for learning and collaboration outside traditional confines. In essence, the centralization of tech tools not only empowers students with self-directed learning capabilities but also opens avenues for a more flexible and personalized educational experience.

3.2.1 The Landscape of ICT Related Education Policies in Pakistan

ICT has emerged as an indispensable component across various spheres of life, instigating revolutionary transformations in every sector. In a remarkably brief period, it has evolved into the foundational pillar of society, fundamentally reshaping societal dynamics and revolutionizing the way individuals think, work, and live. Presently, ICT is recognized as a paramount driving force fostering the economic growth of nations. Frequently indicated as a catalyst for global economic expansion and social progress, information and communication technology play a pivotal role in shaping the trajectory of nations. In pursuit of leveraging ICT for the socio-economic advancement of their populace, developing nations are actively formulating and implementing policies tailored to foster the growth of ICT. This strategic approach underscores the recognition of ICT as a key enabler for progress, affirming its role in propelling both economic development and societal well-being (Palvia et al., 2015).

Recently, ICT has emerged as a crucial factor in enhancing efficiency across various global domains. In the education sector, the integration of ICT signifies a transformative shift, marking one of the most significant changes in educational systems worldwide Over the past two decades, nations have allocated substantial funds to integrate ICT into their education systems. This strategic investment is fueled by international research findings that underscore ICT's capacity to enrich students' learning experiences, providing a dynamic and conducive learning environment. Such an environment supports the cultivation of critical thinking, problem-solving, and other vital competencies essential for navigating the demands of this modern era of education. For this reason, similar to developed nations, developing countries are also designing and attempting to implement various ICT policies in education.

Like other developing nations, Pakistan is grappling with typical ICT issues such as ICT infrastructure, internet access, availability of trained human resources, and content in local languages. Despite these challenges, Pakistan, with its diverse educational landscape, is actively striving to adopt ICT in education policies. The country recognizes the importance of global trends in education and has been formulating policies to bridge the digital divide. These policies aim to equip the youth with the skills necessary for an increasingly digital future. The enactment of the 18th Amendment to the Pakistan's Constitution in 2010 led to a notable shift in the nation's policy-making process concerning education. Prior to this constitutional amendment, education was a concurrent subject, with both the federal and provincial governments sharing responsibilities. However, the 18th amendment brought a pivotal shift by devolving education to the provinces, making it a provincial subject. Before delving further into the particular aims of this research study, it is essential to recognize the broader context within which these policies are conceived and implemented, shaping the educational landscape of Pakistan. Here are brief highlights of some policies that enforced the use of ICT in education:

- **The IT Policy and Action Plan 2000**: It is the first-ever Information Technology policy of the country launched by Ministry of Science & Technology, Government of Pakistan. This policy recommended including computer literacy as a compulsory subject in the matriculation curriculum.
- **NICT Strategy for Education in Pakistan 2004:** In 2004, the Federal Ministry of Education (MoE) and the Education Sector Reform Assistance (ESRA) program jointly developed and introduced the National Information and Communication Technology (NICT) Strategy for Education in Pakistan (Hina, 2016). This educational strategy prompted ministries and education departments to enhance ICT infrastructure, foster professional development for teachers, and gather Open Educational Resources (Wilson et al., 2022b).
- **National Education Policy 2009:** The National Education Policy (NEP) of 2009, launched by the Ministry of Education, Government of Pakistan, aligns with the 2004 National ICT Strategy for Education in its promotion of ICT in education. This policy document emphasizes the promotion of ICT in education, drawing inspiration and direction from the NICT Strategy of 2004 for this specific area (Ministry of Education, 2009).

Specific policies in Pakistan that focus on the integration of ICT in education are briefly discussed here. In Section 3.3, 'A Dive into Pakistan's Dynamic ICT in Education Policies,' the

details of both national and provincial policies are thoroughly reviewed, with a specific focus on policies within Sindh Province for this study. The review encompasses periods both before and after the 18th amendment in the constitution.

3.2.2 Alignment with Sustainable Development Goals

The Sustainable Development Goals (SDGs), also known as the Global Goals, build upon the successes of the Millennium Development Goals (MDGs). In a momentous UN Summit in September 2015, world leaders made a historic commitment to safeguard the rights and welfare of all individuals on a flourishing planet (Friedman & Gostin, 2016). This commitment materialized through the adoption of the 2030 Agenda for Sustainable Development, encompassing 17 goals known as the Sustainable Development Goals (Nations, 2018). Notably, SDG4 is centered on the theme of Quality Education. SDG4 highlights the significance of education as outlined by UNESCO, emphasizing its role in fostering global sustainability and equity. According to Elfert (2019), SDG4 represents a dedicated commitment to guarantee inclusive and equitable quality education and advance lifelong learning opportunities for all. Positioned as a pivotal catalyst for positive transformation, this goal underscores the transformative influence of education in cultivating a sustainable and fair world (UNESCO, 2023).

To fulfill the United Nations' SDG 4 goal related to education, countries globally are formulating and executing diverse ICT policies for education. ICT policies play a key role in advancing SDG 4 objectives by fostering quality education, inclusivity, and technological literacy. These policies facilitate the integration of digital tools and resources in education, enhancing educational access and quality. Additionally, they promote inclusivity by addressing diverse learning needs and contribute to technological literacy, equipping individuals with the skills required in a rapidly advancing digital era.

Pakistan's commitment to achieving the United Nations' SDG 4 is evident in its policies emphasizing the integration of digital technologies in the education sector. The incorporation of ICT aligns with SDG 4 (Quality Education), emphasizing the importance of providing accessible and high quality education to everyone. Aligned with the United Nations' SDGs, the Government of Pakistan introduced two policies: Digital Pakistan 2018 and the National Education Policy Framework 2018. These policies explicitly highlight the integration of ICT in education as part of Pakistan's commitment to achieving SDG 4.

The Federal Ministry of Education and Professional Training (FMoEPT), Government of Pakistan, introduced the National Education Policy (NEP) Framework in 2018. Recognizing the need for prompt improvements in learning outcomes, the FMoEPT recommended in the policy document that the adoption of computers driven by internet technologies presented itself as a clear solution. The FMoEPT wanted to leverage the capabilities of computers, mobile applications, and internet tools to swiftly enhance both quality and access (Federal Ministry of Education and Professional Training, 2018). According to Ministry of IT & Telecom (2018) The purpose of the Digital Pakistan Policy 2018 is to bridge the digital divide. It recommends promoting the use of ICT among women and girls for empowerment and to narrow the digital gap. This policy also advocates for the creation of digital content in regional/local languages. This policy document also recommends promoting the integration of ICT in public schools, ensuring their online presence and fostering a meaningful impact on the existing education ecosystem through a phased approach (Ministry of IT & Telecom, 2018).

3.2.3 Unveiling ICT Integration Challenges in Pakistan's Education Sector

The adoption of ICTs encounters many challenges in both developed and developing countries. Challenges in developing countries encompass issues like inadequate governance, limited education budgets, overcrowded classrooms, language of instruction, and a lack of action plans for policy implementation. Unfortunately, Pakistan, as a developing nation contending with multifaceted challenges across various sectors, including education, finds itself trailing in the pursuit of progress. In the realm of use of digital technologies in educational institutions, particularly in developing countries like Pakistan, the situation is disheartening for several reasons. Steering the integration of ICT in education presents challenges for Pakistan, such as disparities in technology access, limitations in infrastructure, and the imperative need for comprehensive teacher training. This section highlights the challenges that pose hurdles to the integration of ICT in the education sector of Pakistan.

A study conducted by T. Hassan & Sajid (2013) argues that the lack of a unified government-level policy impedes the seamless integration of technology into the educational landscape. Further research indicates that while the global community adopts contemporary tools and methods for education, Pakistan persists in adhering to traditional approaches that have become obsolete in more advanced regions. Furthermore, Akhtar & Roshan (2022) have suggested that technology can be seen as a "key instrument in building knowledge societies," particularly as a fundamental tool with the potential to reshape and

modernize instructional practices and methodologies. This, in turn, could enhance the quality of education for elementary-level students.

Teachers are central to the education system, playing a pivotal role in steering the integration of ICT into the learning environment. They shape a vibrant learning space where innovation and knowledge thrive. In the digital age, teachers have the power to tap into the full potential of technology, guiding students toward better learning and future success. As per a study conducted by Iqbal (2017) in Gilgit Baltistan, the findings indicate a positive outlook from individuals aged 30-39 regarding the use of ICT. Over 90% of participants across all age groups expressed a belief in the significance of integrating ICT in classrooms. However, some female teachers mentioned perceiving social, cultural, or ethical values as barriers to incorporating ICT in their courses. Arbab et al. (2014) found that schools initially lack proper and sufficient ICT resources, and teachers have inadequate or no skills in utilizing them for teaching and learning purposes. They argue that these issues impede the effective implementation of ICT integration. According to their study's findings, teacher inefficiency and the unavailability of ICT resources are crucial factors hindering the integration of ICT. Another study by Qadir & Hameed (2014) in Punjab, Pakistan, found that limited time for teachers, lack of confidence, and insufficient resources affected ICT use in secondary schools. The study showed that in schools with ICT facilities, only ICT teachers used computers for teaching, as other subject teachers were not trained and thus unable to integrate them into their lessons. Interestingly, the study also found that only students enrolled in computer science classes were using the computers in the IT lab. This highlights that ICT is still perceived as a separate subject rather than a learning tool due to teachers' unawareness of ICT integration in teaching and learning.

Sajid (2013) identify access to ICT resources as a significant challenge. However, their findings emphasize that the lack of ICT resources serves as an obstacle. The majority of public sector schools lack ICT infrastructure. On the other hand, in cases where infrastructure is available, it is not being utilized. Findings from a study conducted by Akhtar & Roshan (2022) revealed that despite certain schools being adequately equipped with technical resources, challenges persist, including teachers' hesitancy to embrace technology integration.

In a systematic review conducted by Ismail et al. (2020) analyzing research studies in Pakistan over the past decade on ICT integration, the results highlight the most prevalent

hindering factors. The findings reveal that the shortage of ICT resources and teachers' inability to utilize these tools are the predominant challenges, reported by 73% of the studies. Access to ICT resources is identified as a hindering factor in 64% of the studies. Additionally, 27% of the studies mention the absence of ICT policy in schools, while 18% report insufficient support and resistance from teachers to using ICT. To address these challenges, 73% of the studies recommend supplying technology resources and improving teachers' skills for utilizing ICT as critical enabling factors for ICT integration in schools in the country.

The provision of ICT-related infrastructure and trained human resources are not the only factors that need to be considered during the design of various policies and programs for ICT integration in schools. Previous research consistently shows that, besides providing ICT resources, it is essential to integrate ICT into the curriculum. This involves focusing on both theoretical and practical uses of ICTs by examining elements like the current curriculum, teaching methods, infrastructure, teacher training, language, educational content, and funding in schools. To successfully support the introduction of ICT, it is imperative to provide teachers with rigorous training to enhance their proficiency in this area (Majoka et al., 2013).

The absence of technology integration in classrooms may negatively impact children aged 4 to 12. Without access to technology, they miss out on developing essential contemporary skills, hindering their ability to become global learners (Akhtar & Roshan, 2022). While the significance of ICT is acknowledged by education policymakers in Pakistan, the government's initiatives for ICT integration are evident in various policy documents. These include the NICT Strategy for Education in Pakistan 2004, the National Education Policy 2009, the National Professional Standard for Teachers in Pakistan (NPSTP), and Digital Pakistan 2018. However, nationwide, these policies are falling short of achieving the desired educational goals and have largely failed to integrate ICT in public sector schools. According to findings from various studies conducted in Pakistan on ICT integration, untrained teachers emerge as the primary reason. Whereas, in today's world, incorporating technology in education is not just unavoidable but also essential for teachers, crucial for their own survival. The lack of ICT infrastructure or poor infrastructure in schools, energy crises, and funding issues are also recognized as obstacles to integrating ICT in schools. Additionally, many of these policies lack implementation plans, providing no guidance to

stakeholders for the proper integration of technology in the instructional activities. To successfully implement ICT integration in public sector schools, the government needs a holistic approach. This should involve launching a policy with a proper implementation plan and timeframe, prioritizing curriculum reforms, followed by teacher training, provision of ICT infrastructure, and funding for maintenance. Furthermore, for successful implementation, political will and strong commitment from all relevant stakeholders are essential. As Shaikh & Khoja (2011), recommend that creating a systematic and politically committed strategy for implementing a strong and effective ICT policy is essential for promoting the use of ICT in teaching, learning, and the entire education system.

3.3 Rationale for the Review

The one aspect in formulating evidence based policy is conducting an environmental scan of the context. This involves identifying the relevant skills among implementers and assessing the availability of infrastructure and financial resources required for successful policy implementation, ensuring its sustained impact in the long term. Moreover, developing countries are actively formulating and implementing policies to foster the growth of ICT for the betterment of their society and economy. However, the gap between the design of ICT policies and their actual results is a topic of debate in studies on information systems in many developing countries (Ngololo et al., 2012). Therefore, merely creating policies is insufficient; to have a significant impact on ICT development in a nation, policies must undergo assessment for both their achievements and shortcomings. To identify gaps between policy design and implementation, it is crucial to review the existing policies of the country, coupled with contextual analysis. This study also conducted a contextual analysis, and an intervention was performed to observe how ICT influenced students' performance within the study's selected geographical area. The study also identified teachers' ICT-related competencies through a survey and assessed the availability of ICT infrastructure in schools. In order to propose a more effective evidence-based policy model, various stakeholders of the School Education and Literacy Department, Government of Sindh, were engaged. They shared their opinions about ICT integration in primary education in the province, contributing valuable insights to the study.

As discussed above, contextual analysis alone is insufficient to propose an evidence-based policy model. To achieve this, it is crucial to review the government's previous ICT in education-related policies. This comprehensive review serves as a valuable input, aiding in the identification of gaps between policy design and outcomes. Therefore, this study

simultaneously conducted a critical examination of different policies from both the federal and provincial governments, emphasizing ICT in education. This policy review was indispensable for understanding the historical context, identifying gaps, and learning from past experiences. By considering the successes and challenges of these prior policies, the policy model proposed in this study is strategically positioned to make a positive contribution to ICT integration in primary education within the province. It serves as a roadmap for policymakers, leveraging the insights gained from past endeavors to inform and enhance future policy decisions.

3.4 A Dive into Pakistan's Dynamic ICT in Education Policies

The landscape of ICT related education policies in Pakistan has undergone significant transformations, particularly in the aftermath of the 18th amendment to the constitution. Prior to this constitutional amendment, education was a concurrent subject, with both the federal and provincial governments sharing responsibilities. However, the 18th amendment, enacted in 2010, brought about a pivotal shift by devolving education to the provinces, making it a provincial subject. This decentralization marked a fundamental change in governance, empowering provincial authorities to tailor educational policies to their unique needs and challenges. The Figure 3.1 presents the policies that emphasize the use of ICT in education introduced by the federal government both before and after the 18th amendment, as well as the policies introduced by Sindh government after the 18th amendment.

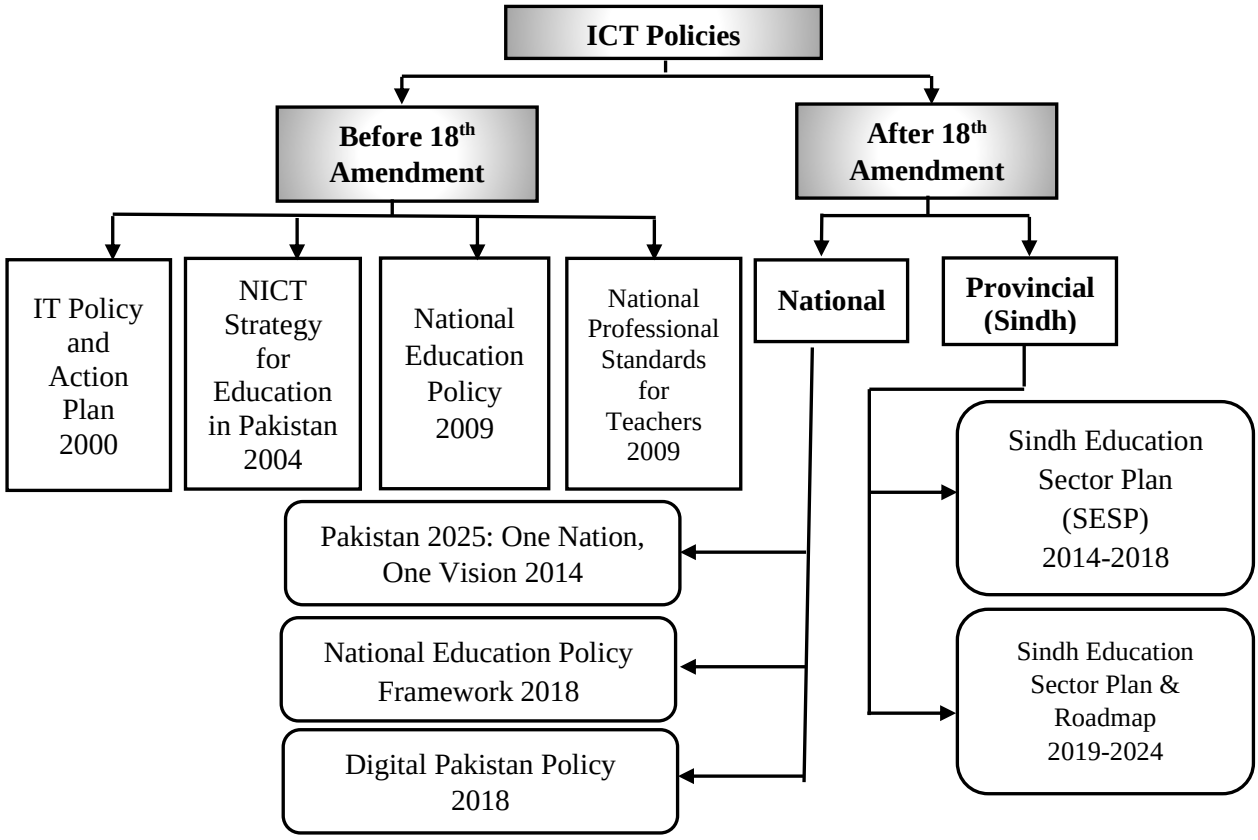

Figure 3.1: ICT in Education Related Policies of Pakistan
Source: Author (2024)

3.4.1 ICT Policies Before 18th Amendment in Constitution

This section presents a comprehensive review of the policies implemented by various ministries and departments before the 18th amendment to the constitution of Pakistan, specifically concentrating on the integration of ICT in the education sector. The objective of this thorough policy review is to unveil the strategies employed by these policies in integrating ICT within the education sector during that era. Table 3.1 illustrates the key points of ICT in education policies from various ministries prior to the 18th amendment in the constitution.

1. IT Policy and Action Plan 2000

The IT Policy and Action Plan 2000 was launched by the IT & Telecommunications Division, Ministry of Science & Technology, Government of Pakistan, on 18th August 2000. This signifies the inaugural Information Technology policy of the country. The Policy aims to harness Information Technology's potential as a significant driver of Pakistan's development, stressing the essential involvement of key stakeholders to ensure its long-term growth. The policy encourages both the private and public sectors to collaborate in meeting the increasing demand for IT education. It is the country's first ever policy that recommends including computer literacy as a compulsory subject in the matriculation curriculum. In addition to this, another policy recommendation that also targets school education involves providing ICT related infrastructure to universities, colleges, and schools at a reduced cost. These are the sole policy recommendations concentrating on schools; the remaining policy strategies related to the education sector are outlined in Table 3.1.

2. NICT Strategy for Education in Pakistan 2004

Four years after the launch of IT policy and Action Plan, in the year 2004, the Federal Ministry of Education (MoE), in collaboration with the Education Sector Reform Assistance (ESRA) program, designed and launched a new policy titled the NICT Strategy for Education in Pakistan. Recognizing the need for a flexible approach in adopting ICT, the MoE opted to discover and record various ICT "bridges to excellence." Through collaboration with a team of strategic planning experts, the MoE crafted a set of six elements along with corresponding action recommendations, allowing leaders to customize them according to the unique requirements of their provinces((MoE) Ministry of Education, 2004). This educational strategy prompted ministries and education departments to improve ICT infrastructure, support professional growth for teachers, and gather Open Educational Resources (Wilson et al., 2022b). The NICT strategy comprises six key

elements focused on enhancing ICT integration in education and encompasses several key initiatives. Moreover, there's a crucial emphasis on maximizing professional development opportunities for educators through various ICT platforms such as interactive radio instruction (IRI), television, open distance learning, and context-specific online resources. Aligning with international ICT standards is also deemed essential to meet educational requirements effectively. Lastly, expanding access to distance learning is vital, necessitating the establishment of virtual classroom education programs utilizing online, internet, and/or video facilities to reach a broader audience (Wilson et al., 2022a).

3. National Education Policy 2009

National Education Policy (NEP) 2009 was introduced by the MoE, Government of Pakistan. The aim of the policy was to outline a national plan for guiding the advancement of education in Pakistan. NEP 2009 emphasized the promotion of ICTs in Education, aligning with the Ministry of Education's National Information and Communication Technology Strategy for Education in Pakistan (Ministry of Education, 2009). Policy Action No. 7 & 8 of Section 6.2, Curriculum Reform, in the above-mentioned policy underscore the significance by stating that ICTs shall be creatively utilized to support teachers and students with diverse abilities and socio-economic backgrounds, and ICTs shall improve the standards of instruction and administration (Iqbal, 2017).

4. National Professional Standards for Teachers in Pakistan 2009

According to Khizar et al. (2019), in 2009 the Ministry of Education (MoE) in Pakistan, with financial support from the United States Agency for International Development (USAID) through the Strengthening Teacher Education in Pakistan (STEP) project, developed the National Professional Standards for Teachers (NPST). The NPST in Pakistan delineate the requisite competencies, skills, and professional conduct expected from educators across various educational tiers in the country. Serving as a reference point, these standards are integral to teacher training curricula, initiatives for professional growth, and assessments, all geared toward fostering exemplary teaching practices and enriching educational environments in Pakistan's schools and institutions (M. Ministry of Education, 2009). According to Fazal et al. (2014), among the ten standards, Standard No. 7, "Effective Communication and Proficient Use of Information and Communication Technologies," highlights the importance of teachers incorporating ICT into their classroom teaching to enhance the curriculum, assess, and evaluate learning outcomes.

Table 3.1: A Look Back at ICT in Education Policies Before the 18th Amendment

Policy Name and Year	Initiating Ministry/Department	Priority Areas	Relevant Institutions	Target audience
IT Policy and Action Plan 2000	Ministry of Science & Technology, Government of Pakistan	• Provision of computers & Internet connectivity to universities, colleges and schools at low price through public- private initiative. • Set up electronic libraries • Include a complete computer literacy course in matriculation curriculum. • Revise the computer science curriculum for intermediate level. • Make Use of IT applications compulsory for all degree courses within the upcoming three years. • Develop world-class Bachelors, Masters, and Ph.D. programs in Computer Science (CS) and related areas of IT.	• MoE • Provincial Education Departments • Universities	Students and teachers of these relevant institutes
NICT Strategy for Education in Pakistan 2004	Ministry of Education (MoE), Government of Pakistan	• Leverage ICT to broaden access to educational opportunities. • Utilize ICT to enhance the quality of teaching and educational administration. • Utilize ICT to improve student learning.	• MoE • Provincial Education Departments	Students, teachers & administrative staff of the MoE and Provincial Education Departments.

		• Create alternative methods for integrating ICT in education. • Utilize the achievements and successes of current ICT programs as a foundation for further development. • Enhance capacity at both federal and provincial levels of education departments.		
National Education Policy 2009	Ministry of Education (MoE), Government of Pakistan	• Utilize ICTs to creatively assist teachers and students of diverse abilities and socio-economic backgrounds. • Utilize ICTs to enhance the quality of teaching and educational management. • Faculty at all levels require training in pedagogical, communication, and ICT skills to enhance teaching efficiency in higher education.	• MoE • Provincial Education Departments • Universities	Students, teachers and administrative staff of these relevant institutes.
National Professional Standards for Teachers in Pakistan 2009	Ministry of Education (MoE), Government of Pakistan	• Teachers integrate ICTs into the teaching-learning process for enriching the curriculum and assessing and evaluating learning outcomes.	• MoE • Provincial Education Departments	Teachers in public sector schools under the Federal Ministry of Education and provincial education departments.

Source: Author (2024)

3.4.2 ICT Policies After 18th Amendment in Constitution

The 18th constitutional amendment has brought about several changes to the constitution of Pakistan, notably reshaping the dynamic between the federation and its federating units. Besides revising several constitutional articles, the amendment has transferred forty-seven subjects solely to the legislative and executive authority of the provinces. Notably, education, a crucial subject, is among those devolved to provincial jurisdiction (ASER Pakistan, 2015). Given that the 18th amendment devolved education to the provinces, making it a provincial subject, this section represents a review of policies from both the federal and provincial governments regarding ICT integration in education. But as far as the review of provincial policies is concerned, this study only touches on the relevant policies of the Sindh province for review, as it focuses solely on proposing a working policy model for Sindh (ASER Pakistan, 2015). The key priority areas of all policies introduced after the 18th amendment are presented in Table no. 3.2.

1. Pakistan 2025: One Nation, One Vision 2014

The policy "Pakistan 2025: One Nation. One Vision 2014" was introduced by the Planning Commission, Ministry of Planning, Development & Reform, Government of Pakistan, in 2014. This document serves as a critical tool for outlining the grand vision for Pakistan. The policy document consists of seven pillars: People First, Growth, Governance, Security, Entrepreneurship, Knowledge Economy, and Connectivity (Minstry of Planning Development and Reform, 2014). The first pillar, "People First," emphasizes social and human capital development and the empowerment of women. This includes poverty eradication (MDG 1), access to health and education services (MDGs 2, 4, 5, and 6), and gender empowerment (MDG 3). When linked with the Sustainable Development Goals (SDGs), it aligns with SDG 1 (poverty), SDG 3 (health), SDG 4 (education), and SDG 5 (gender equality). The ultimate goal is to position Pakistan among the world's ten largest economies by 2047, the centennial year of independence. As per Wilson et al. (2022a) comprehensive reforms in the education system are required to improve the quality of public schooling. These reforms should encompass detailed actions in curriculum, pedagogy, technology, governance, assessment, as well as social and economic relevance. In this regard, modernized teaching methods will be adopted, including the use of emerging technologies for educational purposes such as e-education, mobile education, and online distance learning. The purpose of these reforms is to foster 21st-century learning competencies like critical thinking and problem-solving in students, thus reshaping the

educational focus from rote memorization to analytical thinking. This policy document ensures the development of smart campus systems to facilitate instant networking among campuses, thereby enhancing the learning environment. This initiative enables the sharing of information and knowledge among higher education institutions. The policy also emphasizes the establishment of world-class technology and engineering universities, as well as enhancing the quality of existing ones. This involves establishing new universities, particularly focusing on world-class technology and engineering institutes, while simultaneously improving the standards of existing technology and engineering universities (Planning Commission, 2014).

2. National Education Policy Framework 2018

The MoFEPT Pakistan (2018) introduced National Education Policy (NEP) Framework. To integrate ICT in education, the National Education Policy Framework 2018 recommended the following steps:

- To achieve better learning outcomes in a shorter span of time, NEP 2018 recommends the use of ICT as an obvious solution.
- Introduce ICT-driven training initiatives for educators to enhance their capabilities and knowledge, facilitating improved student engagement and academic performance in classrooms.
- Ensure access to educational materials in remote areas by offering offline content solutions and alternatives
- The incorporation of ICT in classrooms is recommended as an effective strategy to equip the new generation with essential skills for thriving in a workforce that is predominantly reliant on ICT.

3. Digital Pakistan 2018

The Ministry of IT & Telecom, Government of Pakistan (GoP), developed and launched this policy document in 2018. The government is committed to promoting the extensive adoption of new digital technologies and inventive applications to foster socio-economic advancement across various sectors. This policy aims to improve citizens' quality of life and economic prosperity by ensuring accessible, affordable, reliable, universal, and high-quality ICT services (Ministry of IT & Telecom, 2018). This is the first policy in the country to highlight the digital divide between genders and recommend strategies to address this gap. Ministry of IT & Telecom (2018) suggested encouraging and supporting the utilization of ICT technology among women and girls to promote their empowerment and bridge the

digital divide. To facilitate and assist the FMoEPT in integrating ICT in education, this policy recommends to:

- Set up computer labs in girls' schools in underserved areas of the country to offer computing skills training for girls, in partnership with the private sector.
- Advocate for the inclusion of computing courses in the curriculum from elementary school through high school and into higher education.
- Promote the adoption of next-generation computing and analytical curricula, along with ICT tools, to enhance critical thinking, problem-solving, and collaboration skills among primary and secondary school students.

4. Sindh Education Sector Plan (2014-2018)

After the 18th amendment to the constitution of Pakistan, the SELD, Government of Sindh, made efforts and introduced its first five-year plan titled the Sindh Education Sector Plan (SESP) 2014-18. In terms of ICT integration, the document does not propose strategies for embedding ICT into the school curriculum to enhance learning outcomes. Instead, it highlights ICT's role in nonformal education. It suggests using creative, tech-driven methods for non-formal education (NFE), in collaboration with the private sector, to tackle the issues of illiteracy and limited access to formal education in the province.

5. Sindh Education Sector Plan & Roadmap (2019-2024)

The Sindh Education Sector Plan & Roadmap, another five-year plan launched by SELD, Government of Sindh, reflects the government's intention towards ICT integration in education to achieve learning outcomes. The policy recommends ensuring active participation in the rapidly evolving global environment through steps to digitize teaching/learning resources and assessment practices in public schools. This initiative aims to empower students and teachers through technology and enhance academic achievement. Efforts have been made to introduce innovative assessment practices and systems using technology, known as 'e-assessment.' This initiative will be implemented gradually, starting with the six Regional Headquarters in the first phase.

Table 3.2: A Look Back at ICT in Education Policies After the 18th Amendment

Policy Name and Year	Initiating Ministry/Department	Priority Areas	Relevant Institutions	Target audience
Pakistan 2025: One Nation, One Vision 2014	Ministry of Planning, Development & Reform, Government of Pakistan	• Implement modernized teaching methods, including the use of emerging technologies for educational purposes. • Shift the literacy paradigm from traditional methods to digital devices, such as computers and tablets.	• FMoETP, Government of Pakistan	Students and teachers in various institutes under administrative control of the FMoEPT.
National Education Policy Framework 2018	Federal Ministry of Education and Professional Training, Government of Pakistan	• Utilize ICT to accelerate the achievement of learning outcomes. • Enhance access to free educational content in remote areas through the provision of offline content solutions. • Establish ICT-based training programs for teachers to enhance their digital skills and knowledge.	• FMoETP, Government of Pakistan	Students, teachers & administrative staff of the FMoEPT.
Digital Pakistan 2018	Ministry of IT & Telecom, Government of Pakistan	• Set up computer labs in girls' schools in underserved areas of the country. • Promote the integration of computing courses across all levels of the curriculum.	• MoE • Provincial Education Departments • Universities	Students, teachers and administrative staff of these relevant institutes.
Sindh Education Sector Plan (2014-2018)	School Education and Literacy Department, Govt. of Sindh	• Implement technology-based approaches for non-formal education to mitigate illiteracy.	• SELD, Government of Sindh	Students and teachers of School Education and Literacy Department, Govt. of Sindh
Sindh Education Sector Plan & Roadmap (2019-2024)	School Education and Literacy Department, Govt. of Sindh	• Implement the digitization of teaching/learning resources in public sector schools. • Efforts have been initiated to implement e-assessment practices.	• SELD, Government of Sindh	Students and teachers of School Education and Literacy Department, Government of Sindh.

Source: Author (2024)

3.5 Policy Landscape: Conclusive Insights

In reviewing the policies related to ICT integration in education before and after the 18th amendment to the constitution of Pakistan, several key findings and insights have emerged. These policies reflect a growing recognition of the importance of ICT in improving educational outcomes and addressing the digital divide.

The IT Policy and Action Plan 2000 initiated efforts to leverage ICT for Pakistan's development. Later policies, including the NICT Strategy for Education in Pakistan 2004 and the National Education Policy 2009, highlighted the importance of ICT in education and proposed strategies for integrating it into the curriculum.

The introduction of the Sindh Education Sector Plan (SESP) 2014-18 and the Sindh Education Sector Plan & Roadmap (2019-2024) demonstrates the continued commitment to ICT integration in education, particularly in the province of Sindh. These plans highlight the need to digitize teaching/learning resources and assessment practices to empower students and teachers through technology.

Overall, the review underscores the significance of ICT in improving educational quality and accessibility. It highlights the importance of innovative approaches, such as e-assessment and non-formal education programs, in addressing the challenges of illiteracy and limited access to formal education.

Moving forward, there is a clear need for a new approach that builds on the foundation laid by these policies. This approach should focus on enhancing ICT infrastructure, providing professional development opportunities for teachers, and expanding access to digital learning resources. By prioritizing these areas, Pakistan can ensure that its education system is equipped to meet the demands of the 21st century.

Chapter 4

Research Methodology

4.1 Introduction to the Chapter

This chapter explains how the research was carried out. Building on the thorough discussion of ICT integration in Chapters 2 and 3, this chapter explains the methods and approaches used in this research. By grounding the methodologies in the established understanding of ICT integration, Chapter 3 aims to reinforce the study's framework and direction. This chapter covers methodological approaches used in this research, data collection methods and tools used for data collection, followed by participants and sampling techniques used. Additionally, it provides a complete roadmap and operationalization of the study's conceptual framework. It further explores various data analysis method used to analyze the data of the study. Finally, this chapter explains the ethical considerations and issues pertinent to the study.

4.2 Methodological Approach

This study is blend of both qualitative and quantitative methods. It's set to take place within the public sector schools of Hyderabad district, which fall under the administrative jurisdiction of SELD, Government of Sindh. Utilizing a mixed-method approach is paramount due to the intended formulation of a comprehensive policy model for SELD. The incorporation of both qualitative and quantitative methodologies enables a holistic understanding by engaging various stakeholders at the district level, including key decision-makers within the department. This approach ensures a comprehensive exploration of perspectives and data, facilitating a robust and informed policy recommendation process that aligns with the diverse needs and insights of involved stakeholders.

This study encompasses four objectives. The first objective focuses on assessing the effectiveness of ICT integration on the academic scores of Grade V students, while the second objective aims to evaluate the availability of ICT infrastructure in schools. The third objective is directed at identifying the ICT competencies of teachers, and all these objectives utilize a quantitative approach. In contrast, the fourth and final objective, which seeks the perspective of relevant stakeholders regarding ICT integration in primary education in public sector schools, employs a qualitative data approach, as illustrated in Figure 4.1 below.

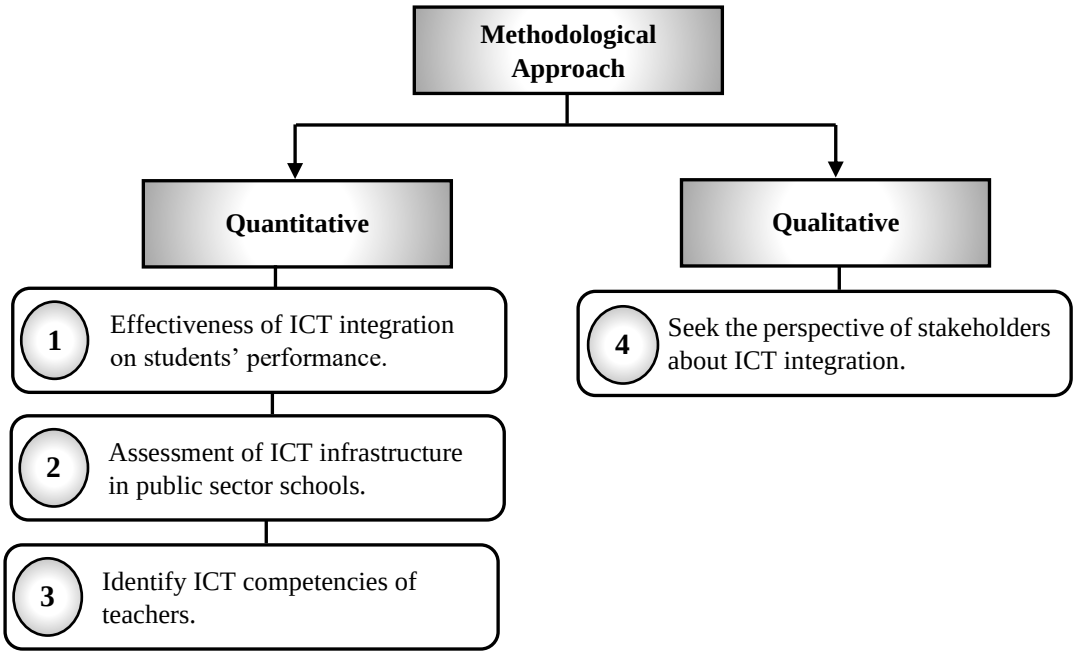

Figure 4.1: Methodological Approach of the Study
Source: Author (2024)

4.2.1 Quantitative Method

Numerous authors offer various definitions of quantitative research, Creswell (2017) defines quantitative research as a method used to test objective theories by exploring connections between different factors that can be measured. These measurable factors are usually assessed using specific tools, allowing for the analysis of numerical data through statistical methods. Similarly, Williams et al. (2022) offer a straightforward definition of quantitative research, describing it as s studies where the data collected and coded are numerical, whereas qualitative research involves data gathered and coded in textual form.

In this study, the quantitative method was employed to address the first three objectives. Objective no. 1 aimed to evaluate how ICT influences the academic performance of grade five students. Objective no. 2 focused on examining the presence and accessibility of ICT infrastructure in public schools across the Hyderabad district, while objective no. 3 centered on assessing the technological proficiency of teachers in using ICT for teaching.

In simpler terms, this study utilized numerical data and statistical analysis to comprehend how ICT affects students' academic performance, investigate the availability of ICT tools in schools, and gauge teachers' proficiency in using technology for teaching, along with identifying their training needs.

4.2.2 Qualitative Method

Qualitative research focuses on collecting non-numeric data, to gain valuable insights. It focuses on emotions, concepts, or personal experiences, aiming to derive testable hypotheses from the gathered insights, often presented in narrative formats (Ugwu & Eze, 2023). According to The University of Texas (2016) qualitative research involves a naturalistic approach aiming to deeply comprehend social phenomena in their natural context. Its emphasis lies in understanding the "why" behind social occurrences, prioritizing human experiences as individuals attribute meaning in their daily lives.

In the initial stages of a research study, educators utilize qualitative research to uncover patterns or different perspectives. Therefore, in order to tackle the final objective of gathering perspectives from managers, decision-makers, and implementers about integrating ICT in primary schools, this study used a qualitative method.

In clarifying the study's focus, the key stakeholders within SELD, such as managers and decision-makers were actively engaged, to grasp their insights regarding the utilization of technology in public sector primary schools.

4.3 Data Collection Methods, Tools & Techniques

Data collection involves gathering and analyzing information from various sources to evaluate results, predict trends, and find solutions to research problems. This step is essential in many types of analysis, research, and decision-making, including business, social sciences, and medical sciences (Simplelearn, 2023). Whereas, methods or procedures Whereas, techniques or approaches employed to gather data for research are known as data collection methods or research procedures or research procedures. These methods can be either quantitative or qualitative, ranging from simple self-reported surveys to intricate experiments (Bhat, 2019).

According to Cleave (2023) the choice of data collection method holds significant importance, impacting the quality and accuracy of collected data. Specific reasons underline this importance: ensuring data relevance, validity, and reliability; minimizing bias; enhancing sample representativeness; and enabling well-informed decisions and accurate conclusions.

The chosen data collection method is crucial to the success and validity of the research, highlighting the need to select the most suitable type for the research requirements. As a result, great effort was taken in selecting the data collection techniques for each objective of the study. As previously discussed, this study comprises four objectives. The first objective, concentrating on the effectiveness of ICT integration on students' academic scores, employed an intervention method. On the other hand, the second objective aimed to assess the availability

of ICT infrastructure in schools, utilizing a survey method. The third objective, which aimed to identify teachers' ICT competencies, also utilized a survey method for data collection. Furthermore, in-depth interviews were conducted to gather diverse stakeholder perspectives about ICT integration.

4.3.1 Intervention

Intervention studies constitute research activities crafted to evaluate the impact of distinct interventions or treatments on a specific population. These studies are undertaken to assess the efficacy of interventions in accomplishing desired outcomes, thereby contributing to the development of evidence-based practices (Aransiola, 2023). According to Melnyk et al. (2012) intervention research focuses on understanding the most effective treatments or strategies to enhance outcomes and create a meaningful impact on critical areas. Interventions, alternatively termed as experimental research, uniquely enable researchers to infer cause-and-effect relationships between a specific intervention or treatment and its resulting outcomes. Further in interventional studies, alterations or interventions are implemented to investigate the subsequent outcomes. For this reason, the study incorporated an intervention method to examine the effect of the treatment on the academic scores of Grade V students. This approach facilitates the exploration of cause-and-effect relationships between the treatment and the resulting outcome or dependent variable, specifically the academic scores of Grade V students in this study. A thorough discussion of the steps taken to implement the intervention in public sector schools of District Hyderabad is provided in Section 3.4.2, titled "Roadmap of the Study.

4.3.2 Survey

Survey research represents a quantitative research approach used to collect data from a specific group of participants. It involves conducting research through surveys distributed to survey participants. Following the survey administration, the collected data is subjected to statistical analysis to derive meaningful research insights and conclusions (Bhaskaran, n.d.). Survey research serves as a widely utilized and influential approach for examining individuals and organizations within society. Rasinski (2005) defines a survey as a research method that includes various techniques to collect information on individual attitudes, values, behaviors, opinions, knowledge, and circumstances. Surveys are also useful for studying organizations and institutions, enabling the evaluation of aspects like culture, policies, and financial dynamics. The second objective, which involves assessing the ICT infrastructure in schools, and the third objective, aiming to identify teachers' ICT competencies, utilized the survey method to collect data from both headteachers and

teachers. The details of how the surveys were conducted in the field are discussed in section "Roadmap of the Study".

4.3.3 In-depth Interviews

In-depth interviewing stands as a qualitative research method, characterized by the in-depth exploration of individual perspectives through intensive one-on-one interviews with a limited number of respondents. This technique aims to delve deeply into their viewpoints on a specific concept, program, or situation (Boyce & Neale, 2005). An in-depth interview represents a form of individual interview designed to gather comprehensive information that goes beyond initial and superficial responses. An in-depth interview is characterized by its loosely structured format, providing flexibility for both the interviewer and the interviewee to delve into additional points and alter the course of the conversation, if required. This approach offers a valuable chance to capture detailed, descriptive data concerning individuals' thoughts, behaviors, and the intricate unfolding of complex processes (B2BInternantional, 2013). The final objective of this study, which is qualitative in nature, employed in-depth interviews to gather opinions and perspectives from various stakeholders within SELD, Government of Sindh. Section 3.4.2, the roadmap of the study, details how stakeholders were engaged for in-depth interviews in the field.

4.4 Research Instruments for Data Collection

The research instruments are tools used by researchers to collect data for their studies are known as research instruments. The research instrument, also known as a data collection tool, includes various methods such as paper surveys or computer-based interview systems. These tools encompass a range of techniques, such as checklists, interviews, observations, and surveys/questionnaires, all employed in the data collection process (Busayo.longe, 2019). The definition provided by PubGenius (2023) states that research instruments are methods used to measure and gather data about specific variables. This helps in evaluating outcomes or finding answers to research questions. The research utilizing these tools can be qualitative as well as quantitative in nature. Data collection tools aim to gather information from the field and arrange it in an organized way, either by numbers (quantitatively) or descriptions (qualitatively). Researchers then use this information to find answers or test ideas they have.

Selecting the appropriate research instrument is crucial as it may reduce the duration of data collection and produce more precise findings for the stated objective of the study (StudySmarter, 2023). Therefore, this study's four objectives were carefully taken into account when selecting the data collection instruments. Therefore, this study's four objectives were

carefully taken into account while selecting the data collection instruments. The selection process was designed to yield more accurate and exact findings that aligned with each objective of the study.

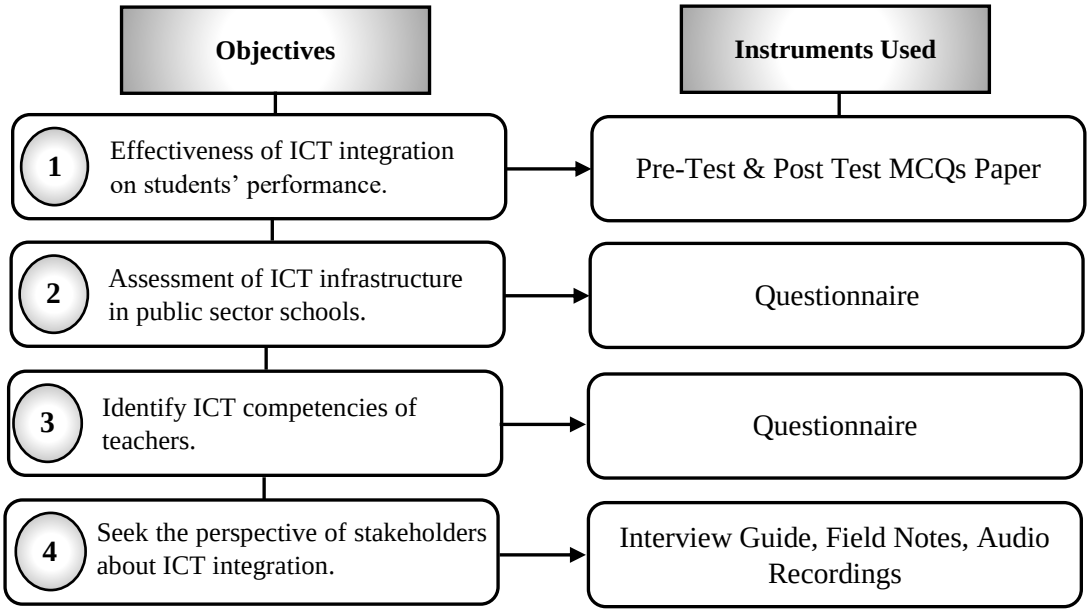

Figure 4.2: Research Instruments Used for Data Collection

Source: Author (2024)

Figure 4.2 presents all four objectives along with the instruments utilized for data collection corresponding to each of these objectives. The first objective, focused on assessing the effectiveness of ICT integration on students' academic scores, utilized a pre-test and posttest Multiple Choice Questions (MCQs) paper to gather data relevant to intervention outcomes. For the second objective, which aimed to evaluate the availability of ICT infrastructure in schools, a questionnaire comprising closed-ended multiple-choice questions was utilized as a research instrument. Whereas, the third objective, centered on identifying teachers' ICT competencies, utilized a questionnaire based on a five-point Likert scale. The fourth and final objective of the study is to gather diverse stakeholder perspectives about ICT integration, utilizing qualitative methods through in-depth interviews for data collection. It employed an interview guide as an instrument.

4.4.1 Instrument for Implementing Intervention

As previously discussed, an MCQs paper was employed as a data collection tool to gather information relevant to intervention outcomes, specifically the academic scores of students. The MCQs paper consists of fifteen multiple-choice questions sourced from Chapter Ten, titled "Our Solar System," found in the Grade V science book published by the Sindh Textbook Board. The same MCQs paper (attached in Appendix- A) served as both the pre-test (before treatment) and post-test (after treatment) data collection tool.

- **Pre-Test:** The pretest definition provided by (Merriam-Webster) online dictionary pre-test is as an assessment conducted to gauge students' readiness for subsequent studies is referred to as a pretest.
- **Post-Test:** According to (Merriam-Webster) online dictionary, a post-test is an assessment administered after completing a lesson or teaching section; typically used in conjunction with a pre-test to measure students' progress.

A pre-test assesses participants before any treatment in a research study, while a post-test evaluates them after treatment. In a pre-test and post-test research design, using identical assessment measures before and after treatment aids in identifying treatment-related changes. This approach aims to establish cause-and-effect relationships in interventions. (Tiffany Budert, 2023). This study followed a similar approach: a pre-test was administered to students before the treatment, and following the intervention, a post-test was conducted using the same MCQs paper initially used as the pre-test tool.

4.4.2 Instrument for Assessing ICT Infrastructure Availability

Making decisions can be challenging, whether it involves identifying the most influential factor affecting social behaviour or determining the primary motivators for community engagement. However, having a variety of options can significantly simplify decision-making processes. A properly constructed multiple-choice survey question has a defined framework and gives respondents concise, understandable answer options faciltate the respondent to select appropriate option from the given choice. An accurately constructed multiple-choice questionnaire adopts a structured layout, offering respondents straightforward and precise answer options. This approach guarantees uniformity in collecting responses, facilitating easier data analysis and interpretation (proprofssurvey, 2023).

The research instrument used for the second objective of the study was a questionnaire comprising closed-ended multiple-choice questions specifically designed to assess the presence of ICT infrastructure within schools. Respondents can select one or more replies from a list of possibilities in multiple choice closed-ended questions. This questionnaire (Attached in Appendix B) includes demographic information about the school and is divided into six comprehensive sections.The initial section primarily addresses inquiries concerning the availability of infrastructure or computer labs in schools. Following this, the second segment of the questionnaire is focused on closed-ended questions regarding Internet connectivity. The subsequent section emphasizes gathering information about repair and

maintenance. Moving forward, the "financial resources" section of the questionnaire asks about the funds allocated for the repair and maintenance of the computer lab. The fifth section is centered on ICT usage, probing into activities performed within the computer lab and who had access. Lastly, the questionnaire's final section focuses on Human Resources, encompassing questions related to the availability of IT teachers and teachers who have received IT-related training.

4.4.3 Instrument for Teachers ICT Competencies

The definition of ICT competency, as outlined by Hwa (2016) in the UN Asian and Pacific Training Centre for Information and Communication Technology for Development's briefing on ICT competency standards, describes it as the "competent and discerning use of electronic media for work, leisure, and communication purposes. Further added by Hwa (2016) that Through the use of ICT competency standards, a nation can gradually reform its workforce to make greater use of ICT technologies. It's essential that teachers possess strong ICT competencies in order to build a workforce that is skilled with ICT tools. According to Fatma Kübra Çelen (2020) teachers' ICT competencies refer to possessing sufficient knowledge in both technology and the teaching field, enabling the creation of suitable technology-based materials for facilitating the teaching and learning processes.

For effective integration of ICT in the curriculum and teaching-learning process, human resources form a crucial pillar. Teachers, as a significant part of this workforce, play a pivotal role in incorporating ICT effectively. This study aimed to assess the existing ICT skills of teachers in public sector schools of the Hyderabad district, recognizing their importance in this integration process. This study not only assesses their existing ICT skills but also endeavours to identify the training needs assessment of teachers in the district. Two different tools were utilized for this purpose, and every teacher who took part in the survey filled them out. The knowledge acquisition and training need assessment tools are structured into three parts. The initial section gathers sociodemographic information about teachers, followed by a segment that assesses whether teachers have attended any computer or ICT-related courses. The final part encompasses questions regarding either knowledge acquisition or training needs assessment, depending on the tool.

1. Techers ICT Knowledge Acquisition Tool

The instrument employed in this study (provided in Appendix C) to evaluate teachers' ICT-related knowledge and competencies consists of fifteen items focused on knowledge acquisition. These items utilize a five-point Likert scale for responses.

The instrument was developed based on the UNESCO ICT Competency Framework for Teachers, version 3, released by the United Nations Educational, Scientific, and Cultural Organization in 2018. The ICT CFT aims to train educators in utilizing ICT for educational purposes. It targets educators involved in training, educational specialists, policymakers, teacher support personnel, and professional development providers. It assumes familiarity with the advantages of ICT in education and promotes customization and adjustment for teacher professional growth (UNESCO, 2018b). The UNESCO ICT-CFT consists of three levels: knowledge acquistion, knowledge deepening and knowledge creation (Ogundolire 2020). The UNESCO ICT-CFT divides the eighteen competencies related to ICT in Education into three tiers, each tier covering six aspects, offering a detailed breakdown of skills and knowledge as shown in Figure 4.3.

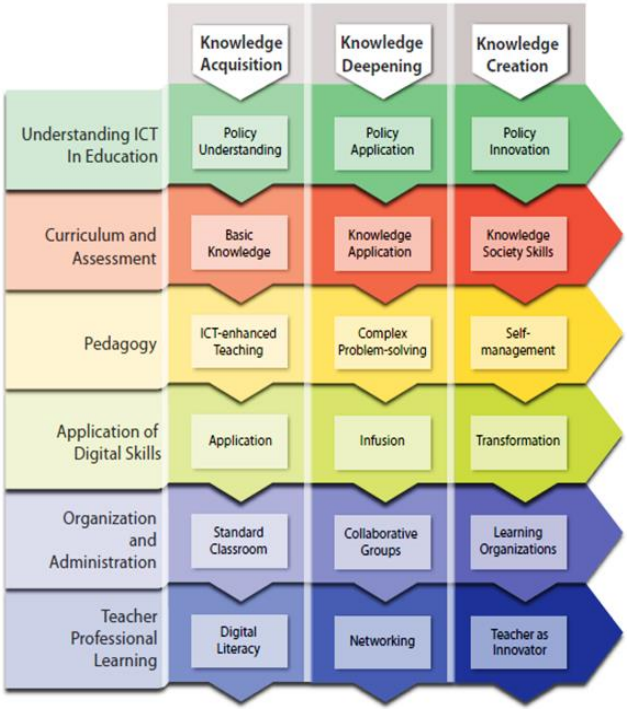

Figure 4.3: UNESCO ICT CFT

Source: UNESCO's ICT-CFT, Version 3, 2018

This study used only Knowledge Acqusition (KA) level and its relevant aspects in order to develop the tool for identifying the teachers ICT related skills. According to UNESCO (2018b) the aim of the KA level is to empower teachers to assist students from diverse backgrounds in utilizing ICT effectively for learning and societal contribution. Teachers

should comprehend national development objectives and their link to education, understanding their part in realizing these goals. Ideally, teachers should gain foundational digital literacy skills to align with the curriculum's requirements.

2. Training Need Teachers Assessment Tool

The same tool used to identify teachers' ICT competencies was also used as a training needs assessment tool, with slight modifications in the question structure and the five-point scale indicators. In the modified scale, "Not Confident" in the knowledge acquisition tool has been replaced with "Strongly Disagree," "Slightly Confident" with "Disagree," "Somewhat Confident" with "Neutral," "Quite Confident" with "Agree," and "Highly Confident" with "Strongly Agree.". The tool is attacched in Appendix C.

This tool also functioned as a safeguard against the inclusion of inaccurate or misleading information provided by respondents. For example, if a respondent selected "Highly Confident" in the knowledge acquisition tool and "Strongly Agree" in the training need assessment tool for the same question, it could indicate an inconsistency in their responses rather than solely a lack of understanding regarding that particular ICT competency.

4.4.4 Instrument for Gathering Stakeholders' Perspectives on ICT Integration

To capture diverse stakeholder opinions, this study employed an interview guide (refer Appendix D) for conducting in-depth interviews. The guide comprises of four sections: the first section contains common questions addressed to all participants; the second section entails questions tailored for policy-makers at SELD; the third section includes specific questions directed to district-level managers such as DEO and TEOs in district Hyderabad. The final section encompasses questions designed for implementers, namely teachers, participating in the in-depth interviews. The fields notes and audio recordings of participants were source of collecting the responses of respondents during in-depth interviews.

4.5 Operationalization of Conceptual Framework and Step by Step Roadmap of the Study

This section explores both the implementation of the conceptual framework and the detailed plan of the study. Operationalization is the vital process of translating conceptual elements into tangible actions, essentially explaining how the ideas in the research plan become measurable actions. This involves detailing the procedures and methods employed to address the study's objectives. The roadmap of the study serves as a step-by-step guide, offering a comprehensive plan that functions as a blueprint for the research. It outlines how the research will be conducted, providing a clear sequence of actions and informing

researchers about the subsequent steps in the study. In essence, this section aims to elucidate the practical implementation of theoretical concepts and offer a detailed guide for the systematic progression of the research.

4.5.1 Operationalizing The Conceptual Framework

The process of turning theoretical concepts into quantifiable facts is known as operationalization. DeCarlo (2018) defines operationalization as the process of precisely defining measurements for concepts in research. It entails outlining the exact research procedures utilized to collect data related to the concepts discussed within the study's conceptual framework. In research, operationalization is the process by which the researcher outlines how an idea under study can be measured, observed, or modified. It converts conceptual or ideological elements into tangible actions that represent the meaning of the variable (Study.com, 2013).

The definition provided above describes operationalization of the conceptual framework in a thesis. The process involves transforming abstract thoughts and ideas into precise, quantifiable actions or variables. It requires establishing and converting the essential components of the theoretical framework into workable procedures, techniques, or indicators that the research study can observe, measure, and analyze. Table 4.1 shows how the ideas in the research plan are put into action. In this research endeavour, a structured framework guides the operationalization of research strategies aiming to understand the influence and infrastructure of ICT in the educational context. Among the four objectives of the study, the first three are quantitative in nature, while only one employs a qualitative approach.

Table 4.1: Operationalizing the Research

Objective	Research Approach	Units of Data Collection	Research Procedures	Instrument	Sampling Technique	Sample Size	Timeframe
1. To determine the effect of ICT integration on performance of grade V students.	Quantitative	Grade V Students	Intervention	Pre-test/post-test MCQs paper	Random Sampling	310 Students	6 Weeks
2. To assess the existing ICT related infrastructure in public sector schools.	Quantitative	Public Sector Schools in District Hyderabad	Survey	Questionnaire	Stratified Sampling	24 Schools	2 Weeks
3. To identify the ICT related knowledge and competencies of teachers	Quantitative	Teachers in public sector schools of the District Hyderabad.	Survey	Questionnaire	Convenient Sampling	172 Teachers	3 Weeks
4. To seek the managers', decision makers' and implementers' perspective for integrating ICT in primary school	Qualitative	District level managers, policymakers, teachers	In-depth Interviews	Interview Guide (Field notes & audio recordings)	Convenient Sampling	8 Participants	2 Weeks

Source: Author (2024)

Further below, the procedures used for data collection, instrument, sampling techniques, timeframe, and the number of participants chosen into the sample for each objective are discussed in detail.

1. Firstly, employing a quantitative approach, the study aims to evaluate how ICT integration affects the academic performance (measured by academic scores) of Grade V students. The research involves an intervention-based method, utilizing pre- and post-test assessments through multiple-choice question papers. The data collection process spans six weeks, employing a random sampling technique to select a total of 310 Grade V students for participation in the intervention. The 310 students were split into two groups. Among them, 158 students were assigned to the treatment group (who received instruction with ICT), while the remaining 152 students were designated to the control group (taught through traditional teaching methods).
2. The second objective of the study, also employing quantitative techniques. This phase of the research concentrates on evaluating the current state of ICT infrastructure in public sector schools within Hyderabad District. The data collection utilizes a survey-based approach with questionnaires, employing stratified sampling to ensure representation from various schools. A total of 24 schools are included in the study, and the data collection process is expected to span a concise two-week duration.
3. Additionally, the third objective of the study delves into the ICT knowledge and competencies of teachers within the same district, employing a quantitative approach with survey and questionnaire Convenient sampling was employed to select a diverse sample of teachers, ensuring a broad representation. A total of 172 teachers participated in the study, and the data collection spanned a three-week period.
4. The last objective of the study study aims to capture perspectives from managerial and implementer roles through a qualitative approach. In-depth interviews, guided by an interview guide, are conducted with district-level managers, policymakers, and teachers. Convenient sampling is employed to ensure a diverse range of perspectives. A total of 8 participants were interviewed, and the data collection process for interviews took almost two weeks.

4.5.2 Roadmap of The Research Study

The step-by-step roadmap, or research plan represented in Figure 4.4, guides this study as a blueprint. This comprehensive research plan is meticulously outlined in the different sections, offering a detailed, stage-by-stage explanation of the study's progression.

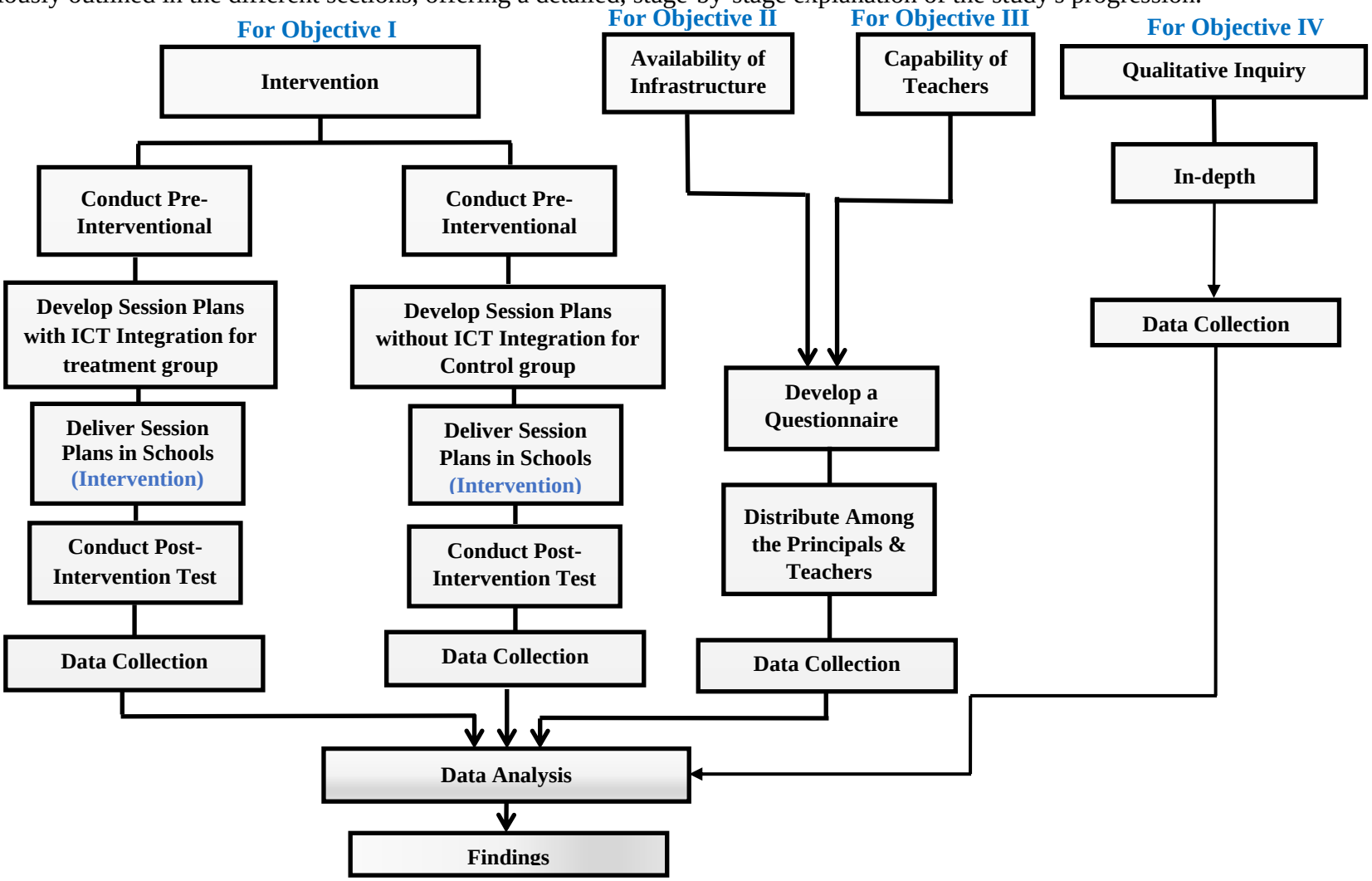

Figure 4.4: Roadmap of Research Study

Source: Author (2024)

Each stage in Figure 4.4 explains the specific actions and methodologies undertaken, providing a thorough understanding of how the research objectives are addressed throughout the study. The roadmap serves as a navigational guide, ensuring a systematic and well-structured approach to exploring the effectiveness of ICT integration on students' performance, identifying teachers' ICT-related competencies, assessing ICT infrastructure in public sector schools, and capturing insights from key stakeholders about ICT integration in the public sector primary schools of SELD, Government of Sindh. Steps taken to address each objective of the study are as follows:

1. **Effectiveness of ICT integration on students' performance**

   The intervention research design was employed to address the first objective, which aims to determine the effectiveness of ICT integration on students' academic performance. A total of 310 Grade V students from public sector schools participated in the intervention. The intervention was conducted in 16 schools (refer Appendix E for the Schools List) within the Hyderabad district. Additionally, two teachers from primary schools in the Hyderabad district were involved in the intervention.

   - **Formation of Groups:** Before the intervention, students were divided into two groups: the treatment group, which received instruction with ICT, and the control group, which was taught using traditional teaching methods. Before implementing the intervention in the schools, school headteachers were briefed on the formation of two groups through a phone call. The emphasis of the request was to ensure comparability between the groups. This process involved incorporating a mix of exceptional and average students, ensuring similarity in parental backgrounds (educated or not), residing in comparable geographical locations (city or village), and sharing common family structures (nuclear or joint families).
   - **Lesson/Session Planning:** Two distinct lesson plans were designed for the same chapter, Chapter 10, from the Grade V science book published by the Sindh Textbook Board, titled "Our Solar System." One lesson plan was devised for the treatment group, utilizing ICT, while the other was customized for the control group, employing traditional teaching methods. The lesson plan for the treatment group integrated an animated video from YouTube the URL of the source is here: (https://www.youtube.com/watch?v=w6VuQ7fbWww&list=PLGuPyytrB67bHnO5EPkaPkip9SFxDet2j&index=25) , centered around the same chapter from the science book and developed by the Sindh Education Foundation (SEF).

- **Pre-Test:** Before the intervention, a pre-test was administered to the students. The purpose of the pre-test was to evaluate the students' prior knowledge, establishing a baseline for comparison after the intervention. The same set of MCQs was distributed among both the treatment and control groups.
- **Intervention:** During this stage, the intervention was implemented. The treatment group received instruction with ICT, while the control group students were taught using traditional teaching methods. Both teachers delivered the same lesson plans in all sixteen schools of the district that participated in the intervention.
- **Post-Intervention Test:** To evaluate the impact of the intervention on students' academic performance, a post-test using the same set of multiple-choice questions (MCQs) as the pre-test was administered to both groups of students.
- **Data Collection:** The completed multiple-choice question (MCQ) papers for both the pre-test and post-test were collected by the teachers on the spot. This involved the immediate retrieval of the filled-out MCQ papers from students in both the treatment and control groups after the respective tests were conducted.

2. Assessment of the existing ICT related infrastructure

This objective of the study centers on assessing the existing state of ICT infrastructure in public sector schools within Hyderabad District. Headteachers from a total of 24 schools (refer to the Schools List attached in Appendix E) were engaged to complete the tool. The data collection process for this objective is expected to span a two-week duration. The headteachers were provided with the tool and instructions for completion during this specified timeframe.

- **Develop a Questionnaire:** For the second objective of the study, a questionnaire was used as the research tool. This questionnaire included closed-ended multiple-choice questions designed to assess the presence of ICT infrastructure in schools. Respondents (Head teachers) were given the option to choose one or more responses from a list of possibilities provided in these closed-ended multiple-choice questions.
- **Distribute Questionnaire:** During the school visits for intervention purposes, a tool was employed to assess the availability of ICT infrastructure in public sector schools of the Hyderabad district. Each headteacher was provided with the tool for completion, designed to gather essential information about the school's infrastructure. Headteachers were given instructions to fill out the tool during the visit.

- **Data Collection:** The tool was collected from the headteachers on the same day by the researcher. After the completion, the researcher gathered the tools from each head teacher during the visit.

3. Identification of Teachers ICT Competencies

The third objective of the study, outlined in the roadmap, investigates the ICT knowledge and competencies of teachers within the district. A total of 172 teachers from public sector schools in Hyderabad, under the administrative control of SELD, Government of Sindh, actively participated in the study.

- **Develop a Questionnaire:** The tool designed to assess the ICT-related knowledge and competencies of teachers comprises fifteen items specifically crafted to gauge teachers' knowledge acquisition. Respondents provide their feedback using a five-point Likert scale for each item.
- **Distribute Questionnaire:** Once again, the same schools were revisited to distribute the survey questionnaire among the teachers. During this phase, researchers returned to the schools previously engaged in the intervention to distribute the survey questionnaire to the teachers. This step was crucial for collecting data on the ICT-related knowledge and competencies of teachers, addressing the third objective of the study. The second tool, a survey questionnaire used to assess teachers' ICT training need assessment, was distributed among the teachers after they completed the knowledge acquisition tool, which was employed to measure their existing ICT-related knowledge and competencies. Detailed discussion about the Teacher Needs Assessment (TNA) tool is provided in the subsection titled "Instrument for Teachers' ICT Competencies" in section 3.3.3.
- **Data Collection:** The data from both tools were collected from teachers on the same day after they had completed both instruments. The data collection process for this objective spanned three weeks. Once teachers filled out both the knowledge acquisition tool and the ICT training survey questionnaire, the collected data was prepared for subsequent stages of the study.

4. Gathering Stakeholders' Perspectives on ICT Integration

The final objective involved capturing perspectives from managerial and implementer roles using a qualitative approach. In-depth interviews, guided by an interview guide, were conducted with district-level managers, policymakers, and teachers. A total of 8 participants were interviewed, and the data collection process for interviews took almost two weeks.

- **Develop Interview Guide:** For the in-depth interviews with relevant stakeholders, an interview guide was crafted. It consists of four sections: the first includes general questions for all participants, the second contains queries customized for SELD policy-makers, the third entails specific questions for district-level managers, and the last section comprises questions tailored for implementers, specifically teachers involved in the in-depth interviews.
- **Conduct In-depth Interviews:** After obtaining permission from the relevant authorities, in-depth interviews were conducted with all participants in their respective offices during the office hours. All these in-depth interviews were recorded with the consent of the participants.
- **Data Collection:** For the data collection of in-depth interviews, field notes and audio recordings were employed. During the in-depth interviews conducted to gather perspectives from district-level managers, policymakers, and teachers, detailed field notes were taken, capturing nuanced insights and observations. Additionally, the interviews were audio-recorded to ensure accurate representation and aid in later analysis.

5. Data Analysis

The quantitative data of the study were analyzed using IBM SPSS Statistics version 25. Various statistical methods were employed on the quantitative data, and detailed discussions on these methods can be found in Section 4.6, dedicated to Data Analysis. On the other hand, thematic analysis was utilized for the qualitative data, extracting themes and patterns from the in-depth interviews conducted with district-level managers, policymakers, and teachers, as outlined in the same Data Analysis section.

6. Findings

Based on the analyzed data, this study presents several important findings discussed in Chapter 5 titled "Results and Analysis." In this chapter, the results of the data analysis are thoroughly explored and presented, offering insights into the study's objectives and contributing to a comprehensive understanding of the research question.

4.6 Data Analysis Methods

Data analysis includes the methodical review, refinement, transformation, and interpretation of data to reveal valuable insights, draw informed conclusions, and support decision making (Kelley, 2023). Calzon (2023) defines data analysis as the process of collecting, modeling, and examining data using various statistical and logical methods. Within the business context, analytics processes and tools are essential for deriving insights that inform both strategic and operational decision-making. According to Kelley (2023) this process employs a range of techniques and tools to scrutinize extensive datasets, extracting significant patterns, trends, correlations, and relationships embedded within the data. These methods mainly belong to two fundamental categories: quantitative and qualitative research.

This study utilized both quantitative and qualitative methods to address four objectives. The first three objectives employed quantitative data analysis methods, while the fourth objective used a qualitative data analysis method. The corresponding data analysis methods are outlined in Table 4.2 below.

Table 4.2 Methods of Data Analysis Used in the Research Study

Sr.	Objective	Research Approach	Analysis Method Used
1	To determine the effect of ICT integration on performance of grade V students.	Quantitative	Differences in Differences (DiD) Model
2	To assess the existing ICT related infrastructure in public sector schools.	Quantitative	Cross-Tab Analysis
3	To identify the ICT related knowledge and competencies of teachers.	Quantitative	Descriptive Statistical Analysis
4	To seek the managers', decision makers' and implementers' perspective for integrating ICT in primary schools.	Qualitative	Thematic Analysis

As presented in Table 4.2, this study employed the Difference in Differences (DiD) Model to analyze the impact of ICT integration on Grade V students' performance. Cross-Tab analysis was utilized to examine data on existing ICT infrastructure in public sector schools. Descriptive analysis was applied to assess teachers' ICT competencies and training needs. The final objective, a qualitative study on stakeholders' perspectives, utilized thematic analysis for data analysis.

4.6.1 Quantitative Data Analysis

Quantitative data analysis involves examining and interpreting numerical data. It helps make sense of information by identifying patterns, trends, and relationships between variables through mathematical calculations and statistical tests (Sharma, 2023). This section presents the quantitative data analysis methods employed to address the study's first three objectives. The first objective focuses on determining the effect of ICT integration on the performance of Grade V students. The second objective assesses the existing ICT-related infrastructure in public sector schools. The third objective aims to identify the ICT-related knowledge and competencies of teachers.

1. Data Analysis Method: Determining the Effect of ICT Integration

To assess the effect of ICT integration on the academic scores of Grade V students, this research study employed a statistical technique known as the Difference in Difference (DiD) Model. The DiD Model is a frequently used method in impact evaluations, enabling researchers to compare changes in outcomes over time between a treatment group exposed to an intervention (in this instance, ICT integration) and a control group that was not exposed.

- **Difference In Differences Model**

  Difference-in-differences estimation aims to assess the impact of an abrupt shift in economic conditions, policy, or overall treatment on a specific group of individuals. The DiD model is employed to scrutinize the consequences of a change, such as the introduction of a new law or policy intervention, aiming to comprehend the impact of the specific change or policy implementation on distinct outcomes. DiD is a robust model that enables the examination of the impact of a policy intervention by considering the changes in the mean of a treated group before and after the intervention. This change is then compared with the mean over time of a comparable group, referred to as the control group, that did not undergo the treatment (ds4ps.org, 2015).

  - **Structure of the DiD Model**

    The DiD model can be expressed as a linear regression model, typically estimated using Ordinary Least Squares (OLS). The general form of the DiD regression model can be expressed as:

$$\mathbf{Y=\beta_0+\beta_1*Treatment+\beta_2*Post+\beta_3*Treatment*Post+e}$$

    The above equation is the mathematical representation of DiD model. Where:

Y: Y represents the outcome or dependent variable, specifically the academic scores of grade V students in both the pre-test and post-test in this study.

Treatment: The treatment variable is a dummy variable that identifies the group as either the treatment or control, with 1 indicating the treatment group and 0 indicating the control group.

Post: The 'Post' variable is also a dummy variable indicating the time periods before and after the intervention. A value of 0 indicates the pre-intervention period, whereas a value of 1 indicates the post intervention period.

Treatment*Post: The ' Treatment*Post' is a dummy variable that shows whether the outcome occurred in the treatment group after the intervention (equals 1) or in any other case (equals 0).

E: The variable E serves as the error term, capturing unobserved factors that influence the dependent variable Y, which corresponds to the academic scores of grade V students in both the pretest and post-test.

β_0: The term β_0 functions as the intercept in the regression model, signifying the estimated value of the dependent variable (Y) when no treatment is present, specifically during the pre intervention period. It represents the expected value of the dependent variable (Y) when all predictors are zero or inactive, establishing the initial point or starting baseline for the analysis. In this study, β0 specifically indicates the estimated average academic score of the control group during the pre-test period. This is because β_0 serves as the intercept term, estimating the baseline or starting level of the dependent variable (academic score of grade V students) when there is no treatment (Treatment=0) and during the pre-intervention period (Post=0). It provides an estimate of the baseline or initial level of the dependent variable, which, in this case, is the academic score of grade V students. If the value of this coefficient is statistically significant and positive

The coefficients β_1, β_2, and β_3 relate to the independent variables, indicating the change in the expected value of the dependent variable (academic score of students) for a one-unit shift in the corresponding independent variable (like parents' qualification, students previous academic result, etc.), while holding other variables constant. These coefficients play a crucial role in estimating when fitting a regression model to your data.

β_1: The coefficient β1 reflects the disparity in the average outcomes between the treatment group and control group before any intervention occurs. In the context of this study, β1 signifies the average difference between the pre-test results of both the treatment and control groups. If β1 is statistically significant and positive, it indicates that the treatment group had a higher baseline academic score before the intervention.

β_2: The coefficient β_2 signifies the average change in the outcome of the control variable from the pre-intervention to the post-intervention time period. Applying the same logic to this study, β_2 indicates the average change in the dependent variable (academic score) from the pre-test to post-test results.

β_3: The β_3 is the coefficient of interest because it captures the intervention effect. It indicates how much the average outcome of the treatment group has changed in the post-treatment period, compared to what would have happened if the intervention had not been implemented. In the context of this study, β3 specifically signifies the estimated effect of the ICT intervention on students' scores, which is the dependent or outcome variable in this study. A positive coefficient value would suggest that the intervention had a positive impact.

2. Data Analysis Method: Evaluating ICT Infrastructure Availability

For the second objective of this study, which aims to evaluate the presence of ICT-related infrastructure in schools, cross-tabulation analysis was employed. A crosstab is a tabular representation illustrating the connection between two or more variables (Bock, 2018). When analyzing survey data and comparing results across different variables, cross-tabulation emerges as a crucial tool. Also known as crosstab or cross-tab, it is a highly useful analytical method widely employed in various fields. Cross-tabulation, commonly known as contingency table analysis, is highly effective for evaluating categorical data (nominal measurement scale). Essentially, cross-tabulations are simple data tables that present results for the entire respondent group and specific subgroups within the survey. They provide a method to examine relationships within the data that may not be immediately evident when reviewing overall survey responses (Carpenter, 2018).

As discussed above the second objective of this study, which aims to assess the availability of ICT infrastructure in schools, used cross-tab analysis. The cross-tabulation specifically focused on the availability of computer labs in schools, offering insights into the distribution based on the type of school, including girls, boys, or mixed schools. Through this cross-tab analysis, the availability of ICT infrastructure, indicating whether schools

have computer labs, internet connectivity, and access to computer labs and the internet, was observed in relation to the school type.

3. Data Analysis Method: Analyzing Teachers' ICT Competencies

Descriptive analysis was employed to analyze the survey data collected from teachers, aiming to identify their ICT competencies. The descriptive analysis involves statistically presenting, summarizing, and aggregating the constructs of interest or relationships between these constructs. According to Bhandari (2020) descriptive statistical analysis summarizes and organizes the characteristics of a data set, which comprises responses or observations from a sample or the entire population. It is used to represent the fundamental features of the data in a study. In quantitative research, the first step in statistical analysis, following data collection, is to characterize the characteristics of the responses. For example, this could involve calculating the mean of a single variable such as age or exploring the relationship between two variables (e.g., age and creativity). Descriptive statistics provide straightforward summaries about the sample and its measures, focusing on what the data reveals (Trochim, 2022).

For the analysis of data related to the third objective, namely, identifying ICT-related competencies among teachers in public sector schools in the Hyderabad district, this study employed descriptive statistical analysis. The responses from participants were represented using frequency counts and percentages, considering a 5-point Likert scale for all questions.

4.6.2 Qualitative Data Analysis

Qualitative data is non-numerical and unstructured, often encompassing text from open-ended survey responses or user interviews, as well as audio, photos, and video. Qualitative data analysis involves the process of collecting, organizing, and interpreting this data to gain insights and understand its underlying meanings and patterns (Getthematic, 2021). The fourth objective of this study, which is qualitative in nature, is to gather stakeholders' perspectives on ICT integration in primary education.

1. Data Analysis Method: Stakeholders' Perspectives on ICT Integration

To analyze the data from in-depth interviews conducted with various stakeholders of SELD, Government of Sindh, about ICT integration in public sector schools which is the last objective, this study utilized thematic analysis. Thematic analysis stands out as a widely used method for analyzing qualitative data, typically applied to a set of texts, such as interviews or transcripts. Thematic analysis serves as a qualitative data analysis method that involves examining a dataset to identify patterns and themes in the meaning of the

data. This active process emphasizes the researcher's subjective experience in making sense of the information. The data analysis was conducted using Braun & Clarke's six-step thematic analysis approach: (1) Familiarizing with the data, (2) Generating initial codes, (3) Developing themes, (4) Reviewing themes, (5) Defining and naming themes, and (6) Writing up the results (Naeem et al., 2023). The researcher carefully reviews the data to identify common themes, including repeated ideas, topics, or expressions (Villegas, 2022). In the first step of Braun and Clarke's data analysis method, the interview transcripts were thoroughly read multiple times aloud to ensure familiarity with the data. This procedure keeps going until the researcher is familiar working with the dataset. The second step was looking for reoccurring patterns in the raw data to find the initial codes. A total of 42 different codes were identified in this study from the dataset. The third step is developing themes involved grouping codes under common subthemes based on coherent patterns. At this stage, the researcher formulates themes in order to shift from a more in-depth analysis of codes and categories to a more abstract interpretation. In this study three themes were identified which are potential benefits of ICT, challenges in ICT integration, and solutions: ICT policies. In the fourth step of Braun and Clarke's thematic analysis method, the researcher initiated the process of matching codes with subthemes and then subthemes with themes. A total of 11 subthemes were identified in this study. Theme 1 contains 2 subthemes, Theme 2 contains 5 subthemes, and Theme 3 contains 4 subthemes. The details of these themes, subthemes, and their respective codes are presented in Table 5.5 of Chapter 5. The themes used in this study are predominantly found in the ICT integration literature. In step five of this method, the researcher named the themes, mostly using similar names from previous research studies on ICT integration in the education sector. The final step involved reporting and visualizing the emergent themes using a thematic map. The thematic map of all three themes is illustrated in Chapter 5, with details of each theme and its analysis.

4.7 Ethical Considerations

According to George (2023) research relies on new ideas, trust, and being clear and open. But it's also important for scientists and academics to follow specific rules about what's right and wrong when doing research. As per Bhandari (2021) in research, ethical guidelines dictate the principles guiding study designs and practices. Scientists and researchers are obliged to uphold specific codes of conduct when gathering data from individuals. Further Rana et al. (2023)

added that, research ethics are the rules researchers follow to protect rights while planning studies and creating trust between the people being studied and the researcher.

Social studies usually involve gathering information from people. Hence, social researchers need to think about what's morally right when gathering information. This helps avoid problems when collecting data and sharing their findings. (Chen, 2010). According to (The Kirklees Council's Research and Intelligence Team) ethical considerations in social research prioritize fostering a trustworthy relationship between researchers and those being studied. This involves thoughtful and strategic planning of communication, minimizing potential risks, and maximizing the benefits for all involved parties. Due to ethical considerations, this study implemented specific measures to ensure compliance with the appropriate ethical guidelines.

Considering the need to obtain permission from the relevant authority for access to the research field, the research proposal was first submitted to the District Education Officer (DEO) Hyderabad's office, along with a list of schools selected randomly. Two days later, a call came from the DEO office, prompting a visit to discuss the research's purpose and methods in detail. During this meeting, the concerned authorities were provided with a concise overview of the research, including its purpose and methods. Afterward, the respective office issued a letter (refer Appendix F) which was sent to all head teachers of the schools included in the sample via WhatsApp.

Following the authorization granted by the DEO permission letter, all headteachers of the schools were contacted to explain the research activity to them. During the phone call, they were briefed about the study's aim to involve both teachers and students from their respective schools. Regarding teacher participation, the headteachers were informed about aiming to involve a maximum of eight to ten teachers from each school in a survey focused on assessing ICT skills. The headteachers were also notified that their involvement in a survey assessing the availability of ICT infrastructure was needed. They were asked to complete a survey form related to the assessment of ICT infrastructure.

The head teachers were informed about the necessity for student involvement in the intervention. They were informed that the study required fifteen to twenty grade five students from each school. During the call, the head teachers were briefed about forming two groups. They were asked to divide the students into two groups—one taught by ICT and the other by traditional teaching methods—for the intervention. The request emphasized ensuring similarities between the groups. This included having a mix of exceptional and average students, similar parental backgrounds (educated or not), residing in similar geographical locations (city or village), and sharing similar family structures (nuclear or joint families). After

comprehending the research goals and methods, the selected schools' headteachers granted access for the conduction of this study within their premises.

To understand the perspective on ICT integration in public sector primary schools under the administrative control of SELD, government of Sindh, interviews were conducted with the Taluka Education Officers (TEOs) and two primary school teachers involved in the intervention, with permission from the DEO of Hyderabad district. Additionally, via phone calls, requests were made to the Chief Program Manager (CPM), RSU, Additional Secretary of SELD, Government of Sindh for interview appointments.

The University of Virginia (2023) mentioned on their official website that participating in a study can led to different kinds of harm, like psychological, physical, legal, social, and economic harm. Therefore, the researchers have a responsibility to identify and, wherever possible, manage the risks that are reasonably expected in their research. To prevent potential harm, whether mental, physical, social, or economic, to participants, this study meticulously managed all research activities. Precautions and safeguards were implemented to ensure the well-being and safety of those involved. Careful measures were taken to avoid including questions that could be sensitive or distressing, aiming to prevent any offense or discomfort among the headteachers, teachers, and participating students in the research. To safeguard the participants' privacy and encourage open expression of their opinions and ideas, they were assured that their personal information and thoughts would be kept confidential and solely used for the purpose of this study. This assurance aimed to make them feel comfortable and confident in sharing their perspectives without worry.

Chapter 5

Results and Analysis

5.1 Introduction to the Chapter

This chapter presents the findings and conducts an analysis, illustrated in several graphics and table, and discuss the results of the analyzed data in connection to the reviewed literature. This chapter comprises six sections describing various aspects of the study's findings. Commencing with an exploration of the socio-demographic characteristics, the first section sheds light on the participants' key attributes. Subsequently, the second section delves into the results and findings derived from the implemented intervention. Following this, the third section presents the outcomes of a survey concerning the availability of ICT related infrastructure within schools. Moving forward, the fourth section extensively discusses and analyses the results obtained from a survey among teachers, aiming to assess their current ICT competencies and ascertain their training requirements in the realm of ICT. Finally, the last section encapsulates the perspectives of relevant stakeholders regarding the integration of ICT in primary education. The last section provides a brief conclusion of the study.

The primary aim of this study is to create a practical roadmap or policy model based on its findings, which helps the SELD, Government of Sindh in integrating ICT into primary education. To accomplish this objective, the study aimed to pinpoint the critical factors affecting ICT integration in public sector schools in district Hyderabad. Initially, the study assessed how ICT integration influenced students' learning outcomes, as outlined in Chapter four.

5.2 Socio-Demographic Characteristics of the Study

This section provides a thorough overview of the socio-demographic characteristics of the study participants and institutions. It begins with an overview of the institutional characteristics of the schools involved, detailing the number of schools that participated, categorized by taluka, gender, and whether they are located in rural or urban areas. Following this, it presents the characteristics of the teachers sample with respect to their taluka, gender, and designation. The next section discusses the characteristics of the students with respect to their taluka, gender, participation in ICT (treatment group) or traditional teaching methods (control group), and school type (girls, boys, or mixed). The head teachers' sample characteristics are also discussed in section 5.2.4, and the sample characteristics of various stakeholders who participated in in-depth interviews are presented in section 5.2.5.

5.2.1 Institutional Characteristics of Schools

Table 5.1 presents an overview of the institutional characteristics of the surveyed schools across different talukas within the Hyderabad District are presented in Table 5.1. The table demonstrates the distribution of schools based on various parameters. A total of 24 schools were selected as the sample. All the head teachers from these 24 schools completed the infrastructure availability questionnaire. Out of these 24 schools, students from 16 schools participated in the intervention, and the teachers from these 16 schools completed two questionnaires to assess their existing ICT competencies and their training needs.

The distribution of schools based on taluka reveals varying frequencies, with Hyderabad Rural exhibiting the highest count at 8 schools, accounting for 33.34% of the total surveyed. The reason for selecting the highest number of schools from Hyderabad Rural taluka is that it is the only taluka classified as rural, while the remaining three talukas in the Hyderabad district are urban. Following this, Hyderabad City and Latifabad each encompass 25.00% and 20.83% of the schools, respectively, while Qasimabad mirrors Latifabad's frequency at 20.83%. Examining school types with respect to gender, the data illustrates that 25.0% are designated as girls' schools, 20.8% as boys' schools, and the majority, comprising 54.2%, are mixed-gender institutions. Regarding school area, the distribution indicates that 33.4% of the surveyed schools are situated in rural areas, contrasting with the majority, which constitutes 66.6% in urban regions. Additionally, the table delineates the educational level of these institutions, showcasing that the 83.3%, are primary schools, while 12.5% are categorized as middle schools, and a smaller fraction, constituting 4.2%, are designated as high schools. This comprehensive breakdown provides a detailed overview characteristics of schools in sample based on taluka, type, area, and educational level, offering a comprehensive perspective on the diversity and distribution of schools within the surveyed region.

Table 5.1: Institutional Characteristics of Schools

Name of Taluka	Frequency	Proportion
Hyderabad Rural	8	33.34
Hyderabad City	6	25.00
Latifabad	5	20.83
Qasimabad	5	20.83
Total	24	100

School Type		
Girls	6	25.0
Boys	5	20.8
Mix	13	54.2
Total	24	100
School Area		
Rural	8	33.4
Urban	16	66.6
Total	24	100
School Level		
Primary	20	83.3
Middle	3	12.5
High	1	4.2
Total	24	100

5.2.2 Teachers Sample Characteristics

Table 5.2 outlines the characteristics of teachers involved in the survey. It outlines details regarding their distribution across different geographical areas, gender representation, and their designations within the public sector schools of Hyderabad district.

Table 5.2: Characteristics of Teachers Sample Participated in Survey

Name of Taluka	**Frequency**	**Proportion**
Hyderabad Rural	52	30.23
Hyderabad City	55	31.98
Latifabad	22	12.79
Qasimabad	43	25
Total	172	100
Gender	**Frequency**	**Proportion**
Male	49	28.49
Female	123	71.51
Total	172	100
Designation	**Frequency**	**Proportion**
HST	7	4.07
JST/JEST	17	9.88
PST	144	83.72

ECCE	3	1.74
Other	1	0.58
Total	172	100

Table 5.2 outlines details about teachers who took part in the survey. The table shows the number and percentage of teachers from different talukas. Among the 172 teachers surveyed, 30.23% (52 teachers) were from Hyderabad Rural taluka, 31.98% (55 teachers) from Hyderabad City, 12.79% (22 teachers) from Latifabad, and 25% (43 teachers) belongs to Qasimabad taluka. This demonstrates a varied representation of teachers from different talukas of district Hyderabad.

If we observe the teachers sample size on basis of gender, out of the total 172 teachers participated in survey, 28.49% (49 teachers) were male, and 71.51% (123 teachers) were female. The data illustrates a higher participation of female teachers in the survey compared to male teachers. This is because most of the mixed schools included in the sample were originally girls' schools that were converted to mixed schools, but they still have only female teachers.

The majority, 83.72%, were Primary School Teachers (PST) with 144 individuals. Other designations included Junior School Teachers/Junior Elementary School Teachers (JST/JEST) at 9.88% (17 teachers), High School Teachers (HST) at 4.07% (7 teachers), Early Childhood Care and Education (ECCE) teachers at 1.74% (3 teachers), and a smaller group categorized as 'Other' at 0.58% (1 teacher). This breakdown reveals the prevalence of Primary School Teachers among the surveyed group, with smaller representations from various other designations.

5.2.3 Student Sample Characteristics

Table 5.3 presents an overview of the student sample characteristics involved in the intervention. It outlines details of students' sample regarding their distribution across different geographical areas, the teaching methods employed, gender representation, and the types of schools they attended.

Table 5.3: Characteristics of Students Sample Participated in Intervention

Name of Taluka	Frequency	Proportion
Hyderabad Rural	126	40.65
Hyderabad City	55	17.74
Latifabad	72	23.23
Qasimabad	57	18.39

Total	310	100
Teaching Method	**Frequency**	**Proportion**
ICT	158	50.97
Traditional	152	49.03
Total	310	100
Gender	**Frequency**	**Proportion**
Girls	169	54.52
Boys	141	45.48
Total	310	100
School Type	**Frequency**	**Proportion**
Girls	59	19.03
Boys	31	10
Mix	220	70.97
Total	310	100

The Table 4.3 displays the distribution of students participating in the intervention across various talukas of Hyderabad. Among the 310 students, the highest proportion, 40.65%, hailed from Hyderabad Rural (126 students), followed by Latifabad with 23.23% (72 students), Qasimabad with 18.39% (57 students), and Hyderabad City with 17.74% (55 students). This indicates a varied representation from different geographical locations.

During the intervention, two teaching methods were used. About half of the students, 50.97% (158 students), learned using Information and Communication Technology (ICT). The rest, 49.03% (152 students), were taught using traditional methods. This means there was nearly an equal number of students who learned with ICT and those who used traditional teaching ways during the intervention.

In the intervention sample, more than half of the students, 54.52% (169 students), were girls, while 45.48% (141 students) were boys. This shows that there were slightly more girls than boys among the students who took part in the intervention.

The schools the students attended during the intervention were of different types. The breakdown of school type indicates that around 19.03% (59 students) came from girls' schools, 10% (31 students) were from boys' schools, and the majority, 70.97% (220 students), were enrolled in mixed-gender schools. This shows that more students attended schools with both girls and boys together compared to schools that were only for boys or girls during the intervention.

5.2.4 Head Teachers Sample Characteristics

Table 5.4 describes the attributes of the head teachers involved in the survey. The table shows the details of the head teachers' sample regarding their distribution across different talukas and their gender.

Table 5.4: Characteristics of Head Teachers Sample Participated in Survey

Name of Taluka	**Frequency**	**Proportion**
Hyderabad Rural	8	33.34
Hyderabad City	6	25.00
Latifabad	5	20.83
Qasimabad	5	20.83
Total	24	100
Gender	**Frequency**	**Proportion**
Male	10	42.00
Female	14	58.00
Total	24	100

Table 5.4 illustrates how head teachers participating in the survey are distributed across various talukas. The sample consists of 24 head teachers, from which 8 head teachers, representing 33.34% of the sample, belong to Hyderabad Rural taluka. Six head teachers, representing 25.00% of the sample, are from Hyderabad City taluka. Five head teachers, representing 20.83% of the sample, belong to Latifabad, and another 5 head teachers, also representing 20.83% of the sample, are from Qasimabad taluka.

In summary, Hyderabad Rural has the highest representation of head teachers in the sample, followed by Hyderabad City, with Latifabad and Qasimabad having equal representation. Out of the 24 head teachers in the survey, 10 were male and 14 were female, resulting in a higher percentage of female head teachers (58.00%) compared to males (42.00%).

5.2.5 Different Stakeholders Sample Characteristics

Table 5.5 presents the characteristics of the stakeholders who participated in the in-depth interviews. The table includes information about the gender and designation of each participant.

Table 5.5: Characteristics of Stakeholders Sample for In-Depth Interviews

Participant No.	Gender	Designation
Participant 1	Male	Additional Secretary
Participant 2	Male	Chief Program Manager
Participant 3	Male	District Education Officer
Participant 4	Female	Taluka Education Officer
Participant 5	Male	Taluka Education Officer
Participant 6	Female	Head Teacher
Participant 7	Male	Teacher
Participant 8	Female	Teacher

The participants were chosen on basis of their roles and duties within the education sector, specifically related to the ICT integration initiative in primary education. The table shows that the sample included a diverse group of eight participants, including high-ranking officials such as the Additional Secretary and Chief Program Manager, as well as a district education officer, two taluka education officers, head teachers, and two teachers.

This diverse representation ensured that a wide range of perspectives and experiences were captured during the interviews, providing valuable insights into the implementation of the ICT integration program and its impact on primary education in Sindh.

5.3 Analysis Results of Intervention

The first objective of this study is to examine the impact of digital technology on the academic performance of fifth-grade students. This objective aims to assess whether integrating ICT into the learning process has a positive or negative effect on their academic outcomes. The methodology and implementation of the intervention in schools, designed to address this objective, are discussed in detail in Chapter 4

5.3.1 Results of Combine Difference in Differences (DiD) Model Analysis Results

Table 5.6 displays the results of a Difference-in-Differences (DiD) analysis, examining how ICT intervention impacts student performance. This analysis explores the relationship between student performance (the dependent variable) and the influence of an intervention over time. It takes into account various factors (control variables) like student characteristics such as their previous grade percentage, gender, favorite subject, and whether they take tuition. Other factors include the type of school they attend (girls', boys', or mixed) and their parents' education level. This method helps determine if the ICT intervention caused changes in student performance by comparing results between the groups that received the

intervention and those that didn't, while considering other factors that could affect the outcomes.

The Table 5.6 provides key coefficients and statistics used to evaluate the relationships between variables within the DiD model. Standard errors are included in parentheses, and significance levels are denoted by asterisks (*, **, ***) as indicated below the table. The analysis is based on a sample of 310 observations and aims to understand the effects of ICT integration on academic outcomes.

Table 5.6: Analysis Results of Combine DiD Model for Intervention

Model	**Coefficients**
Dependent Variable: Score	
Constant (β_0)	-0.338 (0.632)
β_1	-0.130 (0.254)
β_2	4.711*** (0.252)
β_3	-2.204*** (0.353)
Tuition	0.009 (0.192)
Percentage	0.090*** (0.008)
Favouritee Subject	0.290 (0.250)
Gender	0.004 (0.213)
Father Educated	0.336 (0.187)
Mother Educated	0.001 (0.176)
Girls School	0.075 (0.254)
Boys School	2.001*** (0.442)
Where Live	-0.193 (0.364)
Family	-0.118 (0.188)
R-Squared	0.538
F Statistics	54.189
No. of Observations	310

Standard errors are reported in parentheses. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Constant β_0: The intercept β_0 signifies the predicted value of the dependent variable when all predictor variables are at their baseline. In this case when all other factors are held constant, the expected value of dependent variable (β_0) is approximately -0.338. However, it is not statistically significant ($p > 0.05$), suggesting that it does not make a substantial contribution to the model.

β_1: The β_1 coefficient represents the difference in the baseline (pre-intervention) scores of the treatment group and control group (traditional teaching method group). The coefficient for β_1 is -0.130 with a standard error of 0.254, suggesting that, on average, students in the treatment group (those who are in Teaching with ICT Group) had scores that were 0.130 units lower than those in the control group before the intervention. However, this difference is not statistically significant ($p > 0.05$), implying that there is no meaningful baseline difference in scores between the two groups prior to the intervention.

β_2: This coefficient represents the change in academic performance over time (pre to post) for the control group (since the 'treatment' and 'treatment after' coefficients are zero). The coefficient for β_2 associated with an increase in the dependent variable by approximately 4.711. This indicates that, on average, there was an increase of 4.711 points in the academic performance from the pre-test to the post-test for the control group This effect is highly statistically significant ($p < 0.001$).

β_3: The coefficient for is -2.204. It implies that the ICT treatment has a significant negative impact on the dependent variable (score) after the intervention. Being in the treatment group after the intervention is associated with a decrease by approximately 2.204. It indicates, on average there is a decrease of 2.204 points in academic score (dependent variable) of students. This effect is highly statistically significant ($p < 0.001$).

Other Covariates: The coefficients for other covariates (Tuition, Percentage, Favorite Subject, Gender, Father Educated, Mother Educated, Girls School, Boys School, Where Live, Family) represent the estimated impact of each variable on the dependent variable score while controlling for other factors. A one-unit change in "Percentage" is associated with an increase in the score by approximately 0.090 units. Covariate variables percentage and Boys school are highly statistically significant in their effect on the dependent variable score with p-values less than 0.01.

R-Square: The R-square value 0.538 indicates that the model explains approximately 53.8% of the variance in the dependent variable (score). This means that the included independent variables collectively account for 53.8% of the variability in the score.

F Statistics: The F statistic is robust at 54.189, signifying the overall model's significance and suggests that the model, as a whole, is a good fit for the data.

No. of Observations: The analysis is based on 310 observations.

This regression analysis suggests that the β_2 "After" variable (representing time) has a significant positive impact on the score. The β_{s3} "Treatment After" variable (interaction between ICT treatment and time) has a significant negative effect on the score. The effects of other covariates may vary, and their significance is indicated by the * in Table 5.6.

5.3.2 Separately Run Difference in Differences (DiD) Model Analysis Results

Table 5.7 provides results of separate run Difference-in-Differences (DiD) models for both control and treatment groups based on various characteristics, such as child characteristics, parental characteristics, school type, family, and where they live

Table 5.7: DiD Model Analysis Results of Separately Run Model

Variable	Coefficients	Student Characteristics	Parental Characteristics	School Type	Family	Student Geographical Location	Combined
(Constant) (β0)	5.513	-0.496	5.084	5.327	5.591	6.617	-0.388
	(0.204)	(0.549)	(0.258)	(0.275)	(0.243)	(0.301)	(0.632)
After (β1)	4.711***	4.711***	4.711***	4.711***	4.711***	4.711***	4.711***
	(0.289)	(0.262)	(0.288)	(0.278)	(0.289)	(0.284)	(0.252)
Treatment (β2)	-.178	-0.175	-0.169	-0.148	-0.200	-0.152	-0.130
	(0.286)	(0.260)	(0.285)	(0.276)	(0.289)	(0.281)	(0.254)
Treatment After (β3)	-2.204***	-2.204***	-2.204***	-2.204***	-2.204***	-2.204***	-2.204***
	(0.405)	(0.366)	(0.403)	(0.389)	(0.405)	(0.397)	(0.353)
Tuition		-0.043					0.009
		(0.191)					(0.192)
Percentage		0.092***					0.090***
		(0.008)					(0.008)
Favourite Subject		0.559*					0.250
		(0.291)					(0.290)
Gender		0.480**					0.004
		(0.186)					(0.213)
Father Educated			0.403				0.336
			(0.211)				(0.187)
Mother Educated			0.256				0.001
			(0.197)				(0.176)
Boys Schools				2.277***			2.001***
				(0.380)			(0.442)
Girls Schools				0.080			0.075
				(0.252)			(0.254)
Where Live						-1.331***	-0.193
						(0.270)	(0.364)
Family Type					-0.123		-0.118
					(0.207)		(0.188)
R-Squared	0.384	0.498	0.537	0.432	0.384	0.408	0.538
F Statistics	128.058	86.879	78.980	93.538	96.031	105.756	54.189

No. of Observations: 310

Standard errors are reported in parentheses. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Here's the interpretation of the coefficients and statistics for each of these separate models represented in Table 5.7.

1. Student Characteristics Model

This section presents an overview of the student characteristics model. In this model, the analysis focuses on how various covariates, including students' previous grade academic scores (percentage), tuition, their preference for science as a favorite subject, and gender, influence the dependent variable, which is the score.

The covariates such as "Tuition" has a coefficient of -0.043, which is not statistically significant. It shows that tuition doesn't seem to have an impact on students score. Another covariate "Percentage" represents the academic scores of students in their previous grade has a coefficient of 0.092, which is statistically significant at the 99% level ($p < 0.01$). This suggests that an increase in "Percentage" is associated with an increase in the dependent variable score. The covariate "Favorite Subject" (preference for science) also has an impact on the dependent variable "score". This suggests that students whose favorite subject is science tend to achieve higher scores. It has a coefficient of 0.559 with a significance level of 90% ($p < 0.1$). Gender has a coefficient of 0.480, which is statistically significant at the 95% level ($p < 0.05$).

The key findings of this model suggest that, over time, there is an improvement in student outcomes, as indicated by the positive coefficient 4.711 for the "After" ($\beta 2$) variable. However, the ICT treatment does not seem to significantly affect students with these specific child characteristics, as shown by the non-significant negative coefficient -0.175 for "Treatment" variable ($\beta 1$). Additionally, "Percentage" (percentage in previous academic grade), favorite Subject (preference for science) and their gender have significant effects on the dependent variable score.

2. Parental Characteristics Model

Parental Characteristics" model, focuses on the impact of parental attributes, such as the educational background of mothers and fathers, on student outcomes. In this model, we examine how the educational levels of both mothers and fathers influence student academic performance.

In this model, parents with the reference characteristics experience a significant positive impact of time on the dependent variable score, signifying improvement over time, as indicated by the highly statistically significant coefficient for "After" ($\beta 2$) at $p < 0.001$. However, the ICT treatment, represented by the "Treatment" variable, does not have a significant impact on these parents ($p = 0.554$). Interestingly, the educational backgrounds of both fathers and mothers appear to play a role in students' scores. While "Father Educated" has a p-value of 0.057, which

is slightly above the common significance threshold of 0.05, indicating a potential impact, it falls just short of statistical significance. Similarly, "Mother Educated" has a p-value of 0.194, suggesting a trend but not reaching statistical significance at the 0.05 level.

In summary, for parents with the reference characteristics, time has a significant positive impact on the dependent variable score, indicating improvement over time. However, the ICT treatment does not significantly affect these parents. The educational backgrounds of both fathers and mothers may influence students' scores, but further analysis is needed to determine the full extent of their impact.

3. School Type Model

The School Type Model examines the influence of school types, specifically "ST_B" (Boys Schools) and ST_G (Girls Schools), on the dependent variable (Score). This model seeks to understand how attending different school types (covariates) affects the academic performance of students. ST_G represents students attending Girls Schools, with a coefficient of 0.080 and a non-significant p-value of 0.751, indicating that the type of school (Girls Schools) is not associated with a statistically significant change in the dependent variable. Whereas, ST_B represents students attending Boys Schools, with a coefficient of 2.357 and a highly significant p-value of < 0.001. This suggests that students attending Boys Schools have significantly higher scores compared to students with Girls Schools, after accounting for other factors.

4. Family Type Model

The Family Type Model explores the potential influence of family structure (nuclear or joint family), on the dependent variable score. Here "Family" variable represents family structure and has a coefficient of -0.123 with a p-value of 0.553, indicating that family structure does not have a statistically significant impact on the student score.

The time has a significant positive impact on the dependent variable, signifying improvement over time. The ICT treatment after the intervention leads to a notable decline in students' academic performance, as indicated by a significant decrease in the dependent variable score. However, the family structure, as represented by the "Family" variable, is not associated with a statistically significant change in students' scores.

5. Student Geographical Location Model

The Student Geographical Location Model investigates how students' place of residence, whether in a city or a village (as represented by the "WhereLive" variable), impacts on dependent variable score. The covariate "WhereLive" represents the students' place of residence (city or village) and has a coefficient of -1.331 with a highly significant p-value of < 0.001. This suggests that the place of residence significantly affects the dependent variable,

with students living in certain areas having lower scores compared to others. Moreover, the place of residence (city or village) has a significant impact on students' scores, with students from different areas showing variations in their academic performance.

The ICT intervention unexpectedly led to a decline in students' academic score. In a Difference in Differences (DiD) model, various control variables showed different effects on student scores. The student characteristic model found that students who favored science tended to achieve higher scores. Additionally, factors such as the percentage from their previous academic grade and their gender significantly influenced the students' scores. In the parental characteristic model, both fathers' and mothers' educational backgrounds seemed to impact students' scores. Regarding school types, attending Boys Schools was associated with significantly higher scores compared to Girls Schools. While family structure did not show a statistically significant impact on student scores, the geographical location of students did influence their scores.

Despite initial positive expectations, the intervention's outcomes did not align with anticipated improvements in students' academic scores. This unexpected effect calls for further investigation into the underlying causes. Going forward, the study aims to explore factors like the availability of ICT infrastructure in district primary schools and the current ICT proficiency of teachers. Understanding these elements will be crucial in addressing shortcomings and enhancing the effectiveness of ICT integration in educational settings.

5.4 Analysis Results of Availability of ICT Infrastructure

The second objective of this study is to evaluate the existing ICT-related infrastructure in public sector schools of Hyderabad district. Understanding this infrastructure is crucial as it forms the backbone of implementing effective ICT interventions. Following our intervention for this study with grade 5 students, which unexpectedly revealed a negative impact of ICT integration on their performance (academic score). The purpose of looking into the ICT infrastructure is to find out why the ICT intervention ended up lowering students' academic scores.

The study further focused on the two main areas to understand the reasons behind the negative impact of the ICT intervention on students' performance: first, assessing the availability of ICT infrastructure in district primary schools, and second, evaluating the current ICT skills of teachers and determining their training needs. However, this section specifically focuses on presenting the results related to the availability of ICT-related infrastructure. Detailed

discussion on the methodology, tools employed, and stakeholder engagement for data collection during this investigation are extensively discussed in Chapter 4.

5.4.1 Availability of Infrastructure

Table 5.8 presents the cross-tabulation results for the availability of computer labs in schools, providing insights into the distribution based on the type of school. The findings reveal that among the 24 schools examined, only 5 have a computer lab. Specifically, 1 of these schools is for girls, 3 are for boys, and 1 is a mixed school, accommodating both girls and boys. The table also indicates that out of the 5 schools with computer labs, 4 have a backup facility. The total number of computers across these 5 schools is 50.

Table 5.8: Availability of Computer Lab

Cross Tabulation Frequency		Type of School			Total
		Girls	Boys	Mix	
Do you have computer lab in your school?	No. of Schools having Lab	1	3	1	5 out of 24 schools
	No. of Computers	12	30	8	50 No. of computers
	Backup Facility Schools Have	1	2	1	4 out of 5 schools

5.4.2 ICT Equipment Usage

In Table 5.9, the cross-tabulation results provide insights into the usage of ICT equipment in schools, categorized by school type. Out of 5 schools, 4 have access to a computer lab, with 1 girls' school, 3 boys' schools, and none in the mix school category. Regarding the frequency of access, 2 out of 4 schools have daily access, while 2 out of 4 have weekly access. The students of 1 out of 4 schools use MS Paint in computer lab, and students of 3 out of 4 schools uses both MS Paint and videos in computer lab.

Table 5.9: ICT Equipment Usage

Cross Tabulation Frequency			Type of School			Total
			Girls	Boys	Mix	
Have Primary students access to computer lab?	Access to computer lab		1	3	0	4 out of 5 schools
	How frequently	Daily	1	1	0	2 out of 4
		Weekly	0	2	0	2 out of 4

	What sort of activities mostly they performed in computer lab?	MS Paint	1	0	0	1 out of 4
		MS Paint & Videos	0	3	0	3 out of 4

5.4.3 Internet Connectivity

Examining Table 5.10 provides insights into the internet connectivity status across various types of schools. Notably, 2 out of 5 surveyed schools, including boys' schools, have computers connected to the internet. Among them, 1 school utilizes internet connectivity for both academic and administrative purposes, showcasing a dual focus. Additionally, 1 out of 5 schools dedicates internet connectivity solely to administrative tasks. Interestingly, the remaining schools do not report utilizing internet connectivity specifically for academic purposes. These findings underscore the diverse approaches and priorities in integrating internet resources within different school types, offering valuable insights into the current landscape of digital connectivity in the surveyed schools.

Table 5.10: Internet Connectivity

Cross Tabulation Frequency			Type of School			Total
			Girls	Boys	Mix	
Are the computers connected to the Internet?	Internet Facility		0	2	0	2 out of 5 Schools
	Purpose	Academic & Administrative	0	1	0	1 out of 5 Schools
		Academic	0	1	0	1 out of 5 Schools

5.4.4 Repair & Maintenance

Analyzing Table. 5.11 provides insightful perspectives into the repair and maintenance practices concerning computers in schools with computer labs. Notably, among the surveyed schools with computer labs, 2 out of 5 schools adopt a half-yearly repair, while 3 out of 5 schools address issues when computers are out of order. It is noteworthy that all 5 schools with computer labs lack in-house technical staff for minor repairs and maintenance; instead, they resort to market-based solutions.

Table 5.11: Repair & Maintenance

Cross Tabulation Frequency			Type of School			Total
			Girls	Boys	Mix	
How often computers are repaired?	Frequency of Repair	Half Yearly	0	1	1	2 out of 5 schools
		When out of order	1	2	0	3 out of 5 schools

	Who Maintains	Market	1	3	1	5 out of 5 schools

5.4.5 Financial Resources

Table 5.12 provides valuable perspectives on the financial resources allocated for the maintenance of computer and other ICT equipment in schools with computer labs. Notably, all 5 schools with computer lab, including girls' and boys' schools, and those with a mix of genders, have funds reserved for this purpose. The source of funding varies, with 2 out of 5 (1 girl's and 1 boy's school) schools relying on the School Management Committee (SMC) budget. Whereas remaining 3 out of 5 schools securing funds from other sources includes support from the community.

Table 5.12: Financial Resources

Cross Tabulation Frequency			Type of School			Total
			Girls	Boys	Mix	
Do you have funds allocated for maintenance of computer and other ICT equipment?	Funds available		1	3	1	5 out of 5 Schools
	Source of Funding	SMC	1	1	0	2 out of 5 Schools
		Other	0	2	1	3 out of 5 Schools

5.4.6 Human Resources

Table 5.13 provides valuable insights into the human resources related to IT in schools. Notably, 1 out of 5 schools, mainly a girl's school, reports having 8 teachers who attended IT training provided by government of Sindh. Furthermore, girls' school also have an IT teacher. Additionally, 1 out of 5 schools, representing the girls' school, has an IT lab attendant.

Table 5.13: Human Resources

Cross Tabulation Frequency			Type of School			Total
			Girls	Boys	Mix	
Did your school teachers attend any IT related training provided by government or any development partner?	Trained Teachers Available	Yes	1	0	0	1 out of 5 Schools
		No. of Teachers	8	0	0	8 Trained Teachers
	IT Teacher	Yes	1	0	0	1 out of 5 Schools

		No. of IT Teachers	1	0	0	Only 1 IT Teacher
	Lab Attendant	Yes	1	0	0	1 out of 5 Schools
		No. of Lab Attendants	1	0	0	1 lab Attendant

The analysis of ICT infrastructure availability in public sector schools of Hyderabad district reveals several key findings. Out of the 24 schools surveyed, only 5 have a computer lab, with 4 of them having backup facilities. These 5 schools collectively house 50 computers. In terms of internet connectivity, 2 out of 5 schools have computers connected to the internet, with one school using it for both academic and administrative purposes. Regarding repair and maintenance, 2 out of 5 schools repair computers half-yearly, while all schools rely on market-based solutions for maintenance. Financially, all 5 schools have funds allocated for maintenance, with 2 schools sourcing funds from the School Management Committee budget. Human resources related to IT are limited, with only 1 school having 8 trained teachers, an IT teacher, and an IT lab attendant. These findings highlight the need for significant improvements in ICT infrastructure and human resource capacity to support effective ICT integration in schools.

5.5 Analysis Results of ICT related Skills & Training Needs of Teachers

The third objective of this study is “to identify the ICT related knowledge and competencies of teachers”. The purpose of this objective is to gauge the level of ICT-related knowledge and competencies among teachers. This analysis aims to delve into the extent of teachers' familiarity with ICT and assess their skill sets in utilizing these tools for educational purposes. Additionally, the investigation involves identifying the gaps in their knowledge acquisition and understanding their specific training needs in relation to ICT integration. This assessment is crucial in comprehending the current landscape of teachers' capabilities and determining areas that require further support and training to effectively incorporate ICT into teaching practices.

5.5.1 Detail of Knowledge Acquisition (KA) Frequency Table

The data in the Table 5.14 displayed the frequency and percentage of teachers who selected each response category for each KA variable. The Likert scale responses of 172 school teachers concerning their digital skills revealed diverse levels of confidence across the 15 KA variables. Notably, in KA1, where teachers were tasked with identifying suitable ICT tools in alignment with professional standards, 15.7% expressed "Quite Confident," while

12.8% marked "Highly Confident." In KA2, which assesses MS Word proficiency, 13.4% of teachers were "Quite Confident," and 11.6% were "Highly Confident," indicating a moderate level of confidence. For KA3, related to MS Excel skills, 11.6% of teachers expressed "Highly Confident." In the case of KA4, focusing on MS PowerPoint proficiency, 16.9% were "Highly Confident," showcasing a significant level of confidence. KA5, which evaluates effective search engine use, saw 26.7% of teachers expressing "Highly Confident," signifying a high level of confidence. In KA6, assessing email proficiency, 23.8% were "Highly Confident," highlighting a significant level of confidence. KA7, centered on social media competence, saw 17.4% of teachers marking "Highly Confident" in using social media platforms effectively. In KA8, concerning the identification of web resources, 14.5% reported "Quite Confident," reflecting a moderate level of confidence.

KA9, which evaluates teachers' capabilities in participating in online meetings, saw 14.5% expressing "Highly Confident." In KA10, pertaining to online meeting scheduling, 11.6% were "Highly Confident." For KA11, focused on ICT troubleshooting, 12.2% marked "Highly Confident." In KA12, assessing the integration of ICT-supported activities into lesson plans, 12.2% expressed "Highly Confident." KA13, centered on the integration of curriculum standards with digital tools, saw 15.1% marking "Quite Confident," signifying a moderate level of confidence. In KA14, evaluating the integration of digital tools with curriculum outcomes, 16.9% reported "Quite Confident," showcasing a moderate level of confidence. Finally, in KA15, which focuses on the identification of e-assessment tools, 11.6% expressed "Highly Confident."

The analysis of teachers' digital skills across 15 Knowledge Areas (KAs) reveals varying levels of confidence and proficiency among educators in public sector schools of Hyderabad district. While some teachers demonstrate strong confidence in certain areas, such as using search engines and sending emails, others exhibit lower confidence levels, particularly in identifying suitable ICT tools and integrating digital tools with curriculum standards.

The prevalence of "Not Confident" and "Slightly Confident" responses in several KAs indicates areas where teachers may benefit from targeted improvement efforts. These findings underscore the importance of tailored training programs to enhance teachers' overall digital competency. By addressing these specific areas of need, educators can be better equipped to integrate ICT effectively in their teaching practices, ultimately improving the quality of education and student outcomes in Hyderabad's public sector schools.

Table 5.14: Frequency Table of Knowledge Acquisition Questions

Knowledge Acquisition						
Variable	**Competency**	**Not Confident**	**Slightly Confident**	**Somewhat confident**	**Quite Confident**	**Highly Confident**
KA1	Identify appropriate ICT tools in order to incorporate national professional standards for teacher's classroom teaching.	59 (34.3%)	43 (25%)	21 (12.2%)	27 (15.7%)	22 (12.8%)
KA2	Create a document with text, tables, pictures, shapes and hyperlinks using word processor (MS Word) software.	86 (50%)	22 (12.8%)	21 (12.2%)	23 (13.4%)	20 (11.6%)
KA3	Maintain the students' attendance, exam results and other official records by using spreadsheet software e.g., MS Excel.	92 (53.5)	22 (12.8%)	21 (12.2%)	17 (9.9%)	20 (11.6%)
KA4	Create a presentation for a lesson of your subject using MS PowerPoint or similar software.	87 (50.6%)	23 (13.4%)	16 (9.3%)	17 (9.9%)	29 (16.9%)
KA5	Use search engine to find out the curriculum related contents from Internet and save on your computer.	51 (29.7%)	31 (18%)	21 (12.2%)	23 (13.4%)	46 (26.7%)
KA6	Send an email with an attachment of document or image.	83 (48.3%)	19 (11%)	12 (7%)	17 (9.9%)	41 (23.8%)
KA7	Use social media like WhatsApp, Facebook and Twitter to engage the students in academic interaction and active learning.	59 (34.3%)	26 (15.1%)	35 (20.3%)	22 (12.8%)	30 (17.4%)
KA8	Identify and evaluate educational software and web resources, and match them to curriculum standards and student needs.	73 (42.4%)	37 (21.5%)	19 (11%)	25 (14.5%)	18 (10.5%)

KA9	Join online meeting on different collaborative tools such as Zoom and MS Teams.	83 (48.3%)	26 (15.1%)	21 (12.2%)	17 (9.9%)	25 (14.5%)
KA10	Schedule an online meeting on Zoom and MS Teams with students.	86 (50%)	25 (14.5%)	27 (15.7%)	14 (8.1%)	20 (11.6%)
KA11	Troubleshoot common ICT problems such as lack of power and internet connectivity issue to ensure the minimal disruption in class.	88 (51.2%)	27 (15.7%)	20 (11.6%)	21 (12.2%)	16 (9.3%)
KA12	Devise lesson plans that incorporate ICT-supported activities to enhance students' acquisition of subject knowledge.	72 (41.9%)	40 (23.3%)	20 (11.6%)	19 (11%)	21 (12.2%)
KA13	Identify various curriculum standards and incorporate them with relevant digital tools to make the teaching-learning process more effective.	65 (37.8%)	44 (25.6%)	22 (12.8%)	26 (15.1%)	15 (8.7%)
KA14	Incorporate relevant digital tools with curriculum standards and learning outcomes to enhance the efficiency of the teaching process.	75 (43.6%)	31 (18.0%)	20 (11.6%)	29 (16.9%)	17 (9.9%)
KA15	Identify various e-assessment tools to assess students learning outcomes in different ways.	81 (47.1%)	33 (19.2%)	20 (11.6%)	18 (10.5%)	20 (11.6%)

5.5.2 Detail of Training Need Assessment (TNA) Frequency Table

Table 5.15 represents the frequency and percentage of responses to 14 questions related to training needs assessment. The provided data reflects the responses of 172 school teachers using a 5-point Likert scale to assess their training needs across 14 TNA variables. Notably, in TNA1, where teachers were asked about the need for help in identifying suitable ICT tools in alignment with professional standards for classroom teaching, 48.3% expressed "Strongly Disagree," while 20.9% disagreed. Moving to TNA2, which assesses the need for assistance in creating documents with text, tables, pictures, shapes, and hyperlinks using word processor software like MS Word, 53.3% expressed "Strongly Disagree," and 13.4% agreed, indicating a high level of need. In TNA3, which focuses on maintaining attendance, grades, and student records using spreadsheet software like MS Excel, 50.6% strongly disagreed, and 18% disagreed, highlighting a significant training need.

For TNA4, concerning the creation of presentations using MS PowerPoint or similar software, 53.3% strongly disagreed, and 12.2% agreed. TNA5, evaluating the need for assistance in using search engines to find curriculum-related content, saw 38.4% strongly disagree, and 16.9% agreed. TNA6, related to sending emails with attachments, revealed a need, with 44.8% strongly disagreeing, and 15.1% agreeing. In TNA7, focusing on using social media for academic engagement, 41.3% strongly disagreed, while 19.8% agreed, indicating a noteworthy need. TNA8, centered on identifying and evaluating educational software and web resources, showed a need, with 43.6% strongly disagreeing and 22.7% disagreeing. For TNA9, pertaining to joining online meetings on collaborative tools, 50% strongly disagreed, and 19.2% agreed. TNA10, focused on scheduling meetings on Zoom and MS Teams, revealed a high need, with 54.7% strongly disagreeing. In TNA11, which assesses the need for help in devising lesson plans incorporating ICT-supported activities, 50% strongly disagreed, emphasizing the training need in this area.

In TNA12, where teachers expressed the need for assistance in identifying curriculum standards and integrating them with digital tools for effective teaching, 43.6% strongly disagreed. For TNA13, related to incorporating digital tools with curriculum standards, 45.3% strongly disagreed, signifying a significant need. TNA14, which evaluates the need for assistance in identifying e-assessment tools, saw 50% strongly disagree, highlighting a pronounced training need.

These findings underline the areas where teachers require substantial training and support to enhance their digital skills and instructional abilities, offering valuable insights for targeted training interventions. he detailed analysis of the Training Needs Assessment (TNA) reveals significant areas where teachers in public sector schools of Hyderabad district require training and support to enhance their digital skills and instructional abilities. Across the 14 TNA variables, a substantial proportion of teachers expressed strong disagreement regarding their proficiency or comfort with various ICT-related tasks. These tasks include identifying suitable ICT tools for classroom teaching, creating documents with word processor software, maintaining records with spreadsheet software, and creating presentations. Teachers also expressed a need for assistance in using search engines, sending emails with attachments, using social media for academic engagement, and evaluating educational software and web resources. Moreover, there is a clear need for training in joining online meetings, scheduling meetings on platforms like Zoom and MS Teams, devising lesson plans with ICT-supported activities, integrating curriculum standards with digital tools, and identifying e-assessment tools. These findings underscore the critical importance of tailored training interventions to equip teachers with the necessary skills to effectively integrate ICT in their teaching practices. Addressing these training needs is essential for ensuring that teachers can leverage ICT tools and resources to enhance the quality of education and student learning outcomes in Hyderabad's public sector schools. please little bit short the text.

Table 5.15: Frequency Table of Training Need Assessment Questions

Training Need Assessment						
Variable	**Competency**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
TNA1	I need help identifying the appropriate ICT tools in order to incorporate national professional standards in classroom teaching.	83 (48.3%)	36 (20.9%)	22 (12.8%)	18 (10.5%)	13 (7.6%)
TNA2	I need help creating a document with text, tables, pictures, shapes, and hyperlinks using word processor (MS Word) software.	92 (53.3%)	22 (12.8%)	17 (9.9%)	23 (13.4%)	18 (10.5%)
TNA3	I need help to maintain attendance, grades, and other record of students by using spreadsheet software e.g., MS Excel.	87 (50.6%)	31 (18%)	19 (11%)	16 (9.3%)	19 (11%)
TNA4	I need help to create a presentation for a lesson of my subject using MS PowerPoint or similar software.	92 (53.3%)	20 (11.6%)	22 (12.8%)	17 (9.9%)	21 (12.2%)
TNA5	I need help using the search engine (google) in order to find out curriculum-related content from the Internet and save it on my computer.	66 (38.4%)	35 (20.3%)	16 (9.3%)	26 (15.1%)	29 (16.9%)
TNA6	I need help for sending an email with an attachment of a document or image.	77 (44.8%)	27 (15.7%)	18 (10.5%)	24 (14%)	26 (15.1%)
TNA7	I need help for using social media like WhatsApp, Facebook, and Twitter to engage the students in academic interaction and active learning.	71 (41.3%)	20 (11.6%)	27 (15.7%)	20 (11.6%)	34 (19.8%)
TNA8	I need help identifying and evaluating educational software and different web resources in order to match them with curriculum standards and student needs.	75 (43.6%)	39 (22.7%)	25 (14.5%)	20 (11.6%)	13 (7.6%)

TNA9	I need help in joining an online meeting on different collaborative tools such as Zoom and MS Teams.	86 (50%)	33 (19.2%)	14 (8.1%)	20 (11.6%)	19 (11%)
TNA10	I need help for scheduling a meeting on Zoom and MS Teams.	94 (54.7%)	28 (16.3%)	16 (9.3%)	15 (8.7%)	19 (11%)
TNA11	I need help to devise lesson plans that incorporate ICT-supported activities to enhance students' acquisition of subject knowledge.	86 (50%)	31 (18%)	21 (12.2%)	23 (13.4%)	11 (6.4%)
TNA12	I need help identifying various curriculum standards and incorporating them with relevant digital tools to make the teaching-learning process more effective.	75 (43.6%)	38 (22.1%)	24 (14%)	25 (14.5%)	10 (5.8%)
TNA13	I need help in incorporating relevant digital tools with curriculum standards and learning outcomes to enhance the efficiency of the teaching process.	78 (45.3%)	43 (25%)	12 (7%)	29 (16.9%)	10 (5.8%)
TNA14	I need help identifying various e-assessment tools to assess students learning outcomes in different ways.	86 (50%)	37 (21.5%)	17 (9.9%)	21 (12.2%)	11 (6.4%)

5.5.3 Description of Knowledge Acquisition and TNA Composite Score

1. Knowledge Acquisition

In this study, the Knowledge Acquisition Composite Score is calculated as the sum of responses from 15 Likert scale questions provided by 172 teachers. The Likert scale uses 5 points, ranging from Not Confident to Highly Confident, with a maximum score of 5 indicating Highly Confident. Each of the 15 questions can contribute a maximum score of 5, resulting in a potential maximum score of 75 for knowledge acquisition. Thus, teachers can score anywhere within the range of 15 reflecting minimum confidence in knowledge acquisition to 75 indicating maximum confidence. On average, the teachers in the sample have a Knowledge Acquisition composite Score of 35.15.

2. Training Need Assessment

In this study, the Training Need Assessment (TNA) Composite Score is derived by aggregating the responses of 172 teachers across 14 Likert scale questions. The Likert scale utilized consists of 5 points, spanning from Strongly Disagree to Strongly Agree, with a maximum rating of 5 denoting a high level of confidence. Each of the 14 questions has the potential to contribute a maximum score of 5, resulting in a potential total score of 70 for the Training Need Assessment. Consequently, teachers' scores within this framework can fall anywhere between 14, representing the minimum TNA score, to 70, indicating the highest possible Training Need Assessment score. The average TNA composite score for the teachers in the sample stands at 53.24.

5.5.4 Boxplot: Teachers' KA Composite Score by Demographic Variables

1. **KA Composite Score with respect to Gender**

Following Figure 5.1 show box and whisker plot knowledge acquisition score with among male and female teachers. Minimum (15) and maximum (75) score was same among both male and females. However Median score was higher among males (35 with interquartile range of 24-62) as compared to females (25 with interquartile range of 18-47).

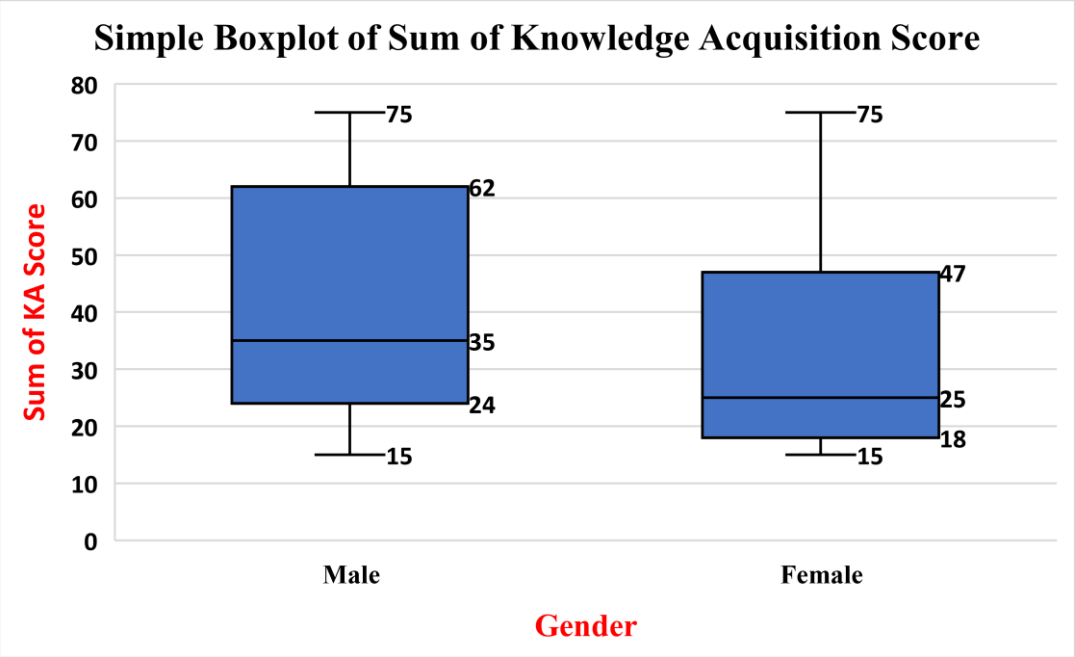

Figure No. 5.1: Knowledge Acquisition Score by Gender

2. **KA Composite Score with respect to Teachers Experience**

The Figure 5.2 shows knowledge acquisition score among teachers at the different level of experience. Teachers with the low experience (1-15 years) had higher knowledge acquisition scores as compared to teachers having more experience. KA scores were almost similar for teachers having 15-30 years of experience as well as teachers having more than 30 years of experience.

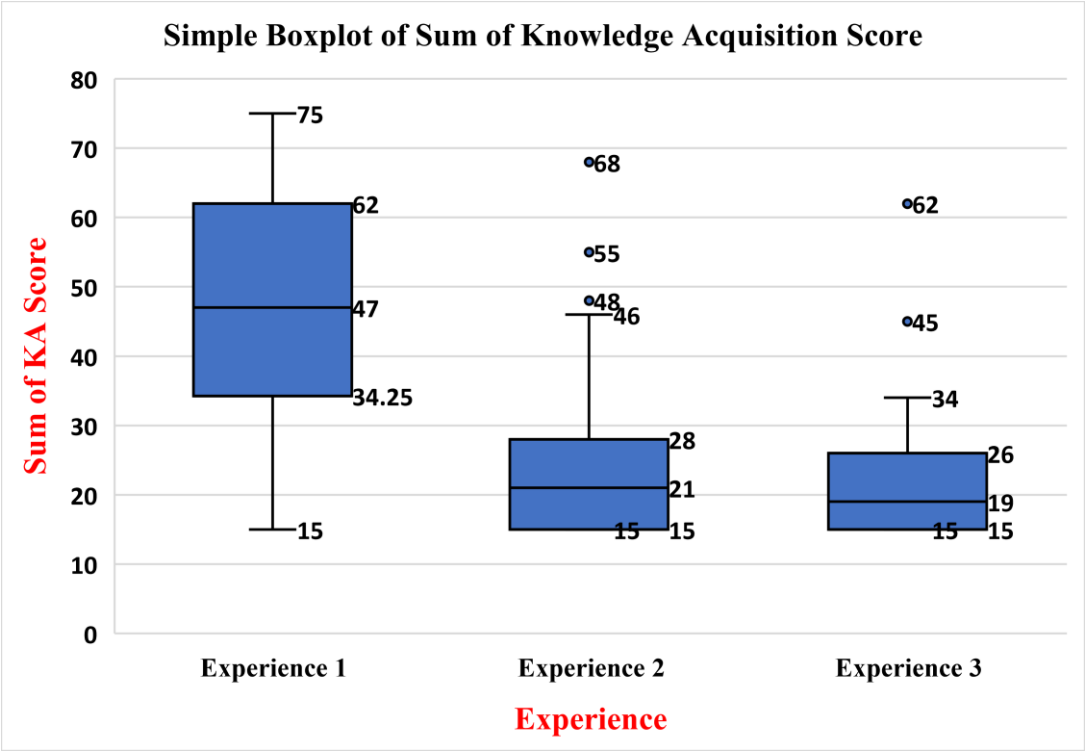

Figure No. 5.2: Knowledge Acquisition Score by Teachers Experience

3. KA Composite Score with respect to Teachers Done Basic Computer Course

Figure 5.3 show the box and whisker plot shows knowledge acquisition (KA) scores among teachers who have or have not done any basic computer course. KA score was higher among teachers who have done basic computer course.

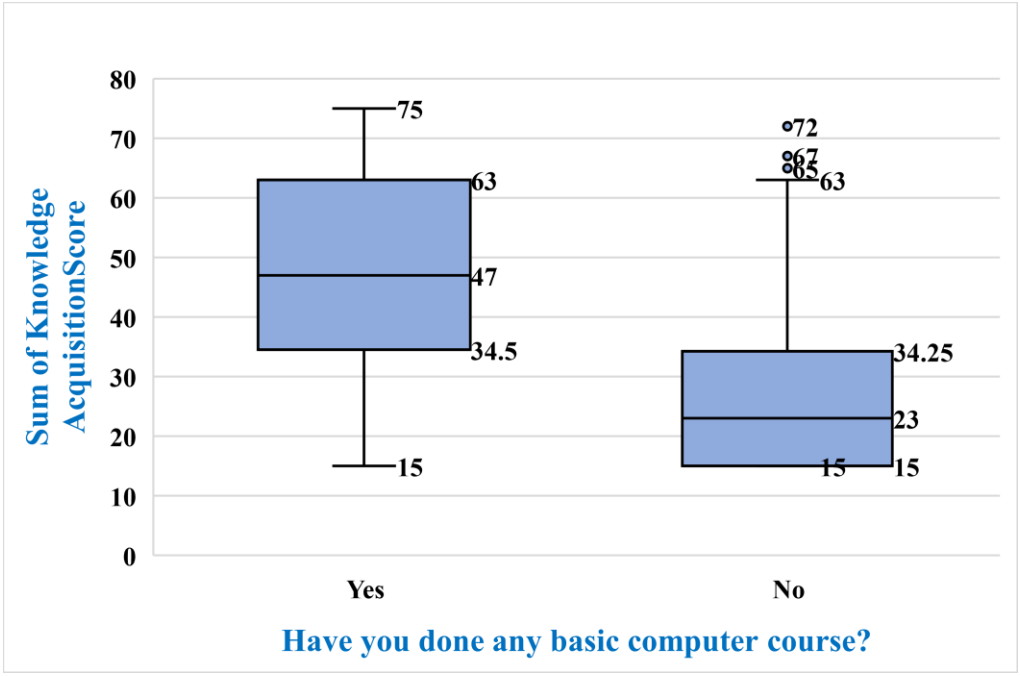

Figure No. 5.3: Knowledge Acquisition Based on Basic Course

5.5.5 Boxplot: Teachers' TNA Composite Score by Demographic Variables

This section presents a boxplot analysis of teachers' TNA (Training Needs Assessment) composite scores in relation to various demographic variables. The analysis includes comparisons based on gender, teaching experience, and completion of a basic computer course. Each demographic factor is discussed in detail in the subsequent subsections.

1. TNA Composite Score with respect to Gender

Figure 5.4 shows the box and whisker plot representing the training need assessment score among male and female teachers. The minimum and the maximum training need assessment score was same for both male and female, 14 and 70 respectively. However median training need assessment score as well as the interquartile range (IQR) was higher among females. This suggests that females identified more need of training as compare to male teachers.

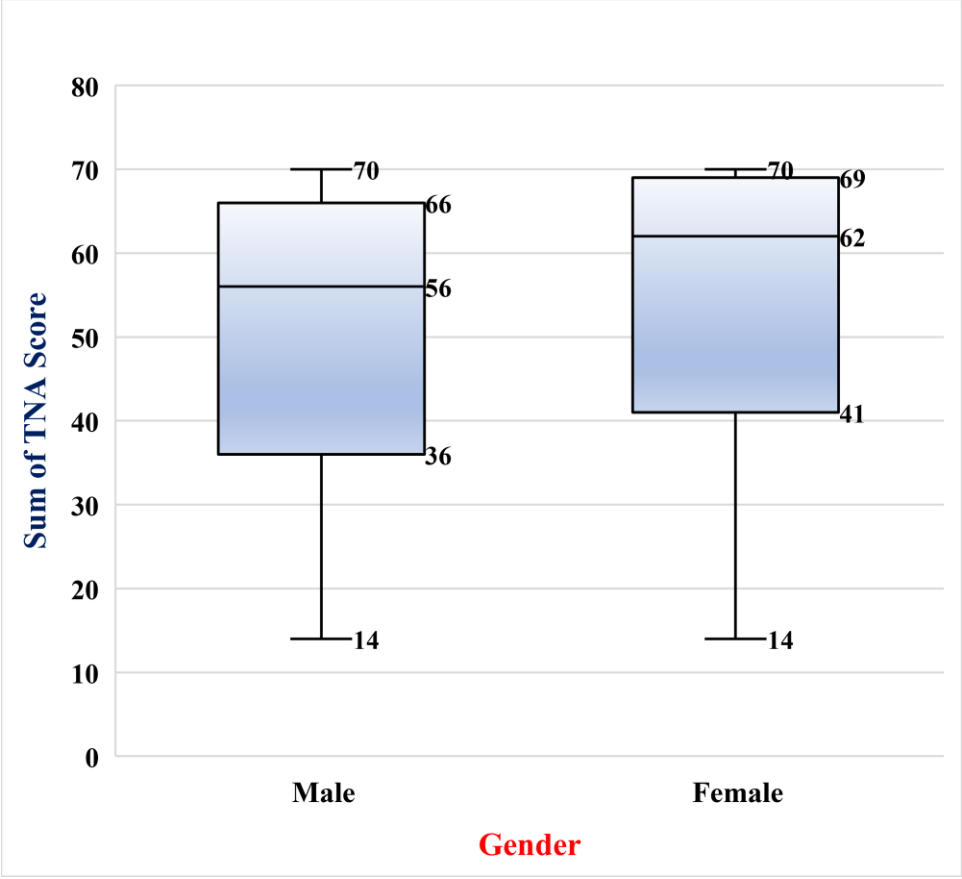

Figure 5.4: Training Need Assessment Score by Gender

2. TNA Composite Score with respect to Experience

This is box and whisker plot showing the training need assessment (TNA) composite among the teachers with different years of experience. The experience of teachers is categorized into three groups: Experience 1, Experience 2, and Experience 3, as illustrated in Figure 5.5. Experience 1 encompasses teachers with experience ranging from 1 to 15 years, Experience 2 includes teachers

with experience ranging from 16 to 30 years, and Experience 3 comprises teachers with experience exceeding 30 years. TNA composite score was the lowest among experience 1 group (Teachers with the lowest experience).

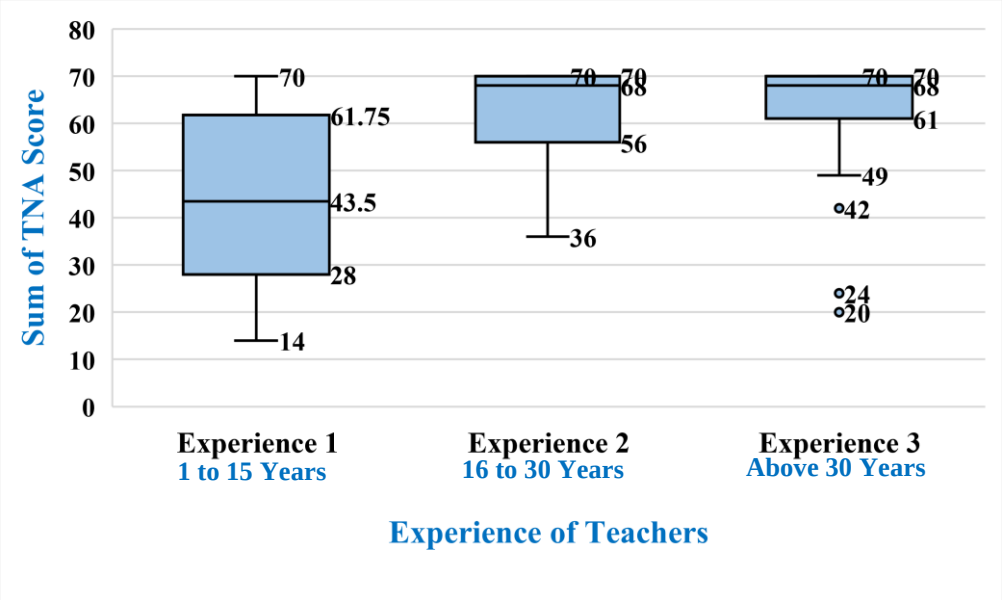

Figure 5.5: TNA Score by Teachers Experience

3. TNA Composite Score with respect to Teacher Done Basic Computer Course

Figure 5.6 represents a box and whisker plot for training need assessment (TNA) score among teachers who have and have not done basic computer course. Teachers who have done the basic computer course had lower TNA composite score as compared to the teachers who have not done basic computer course.

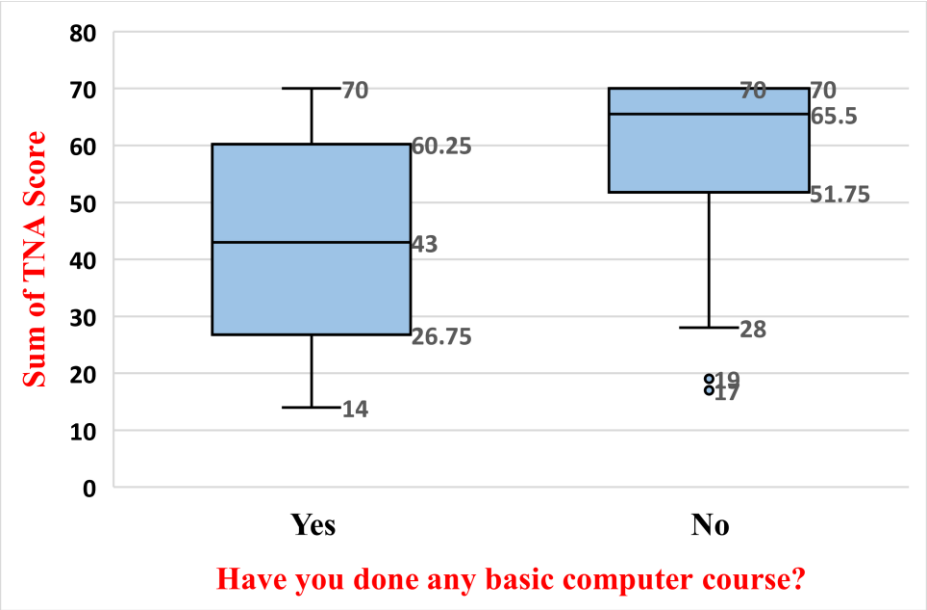

Figure 5.6: TNA Score Based on Computer Course

5.5.6 Scatterplots for Teachers Composite KA Score

In Figure 5.7, a scatter plot illustrates the composite knowledge acquisition scores of male and female teachers. Each data point signifies an individual observation (teacher), distinguished by color: red dots denote male teachers, while black dots represent female teachers. On average, knowledge acquisition composite score across the sample of teachers is 35.15. Specifically, male teachers exhibit an average composite score of 40.43, whereas female teachers demonstrate an average score of 33.05 in knowledge acquisition.

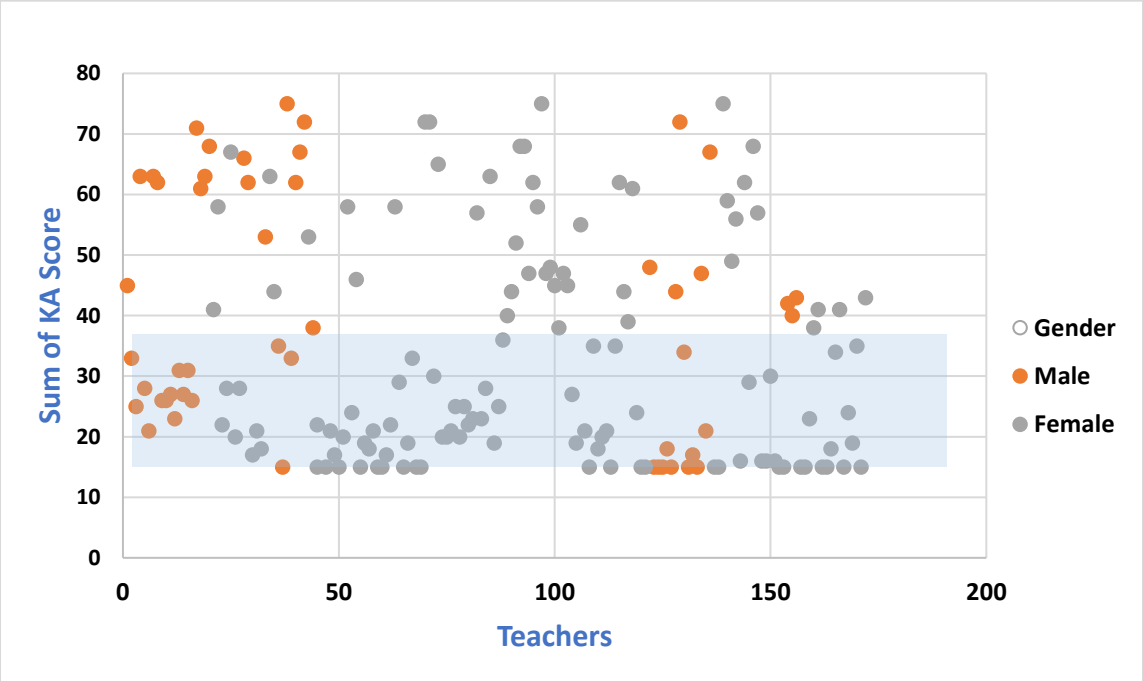

Figure 5.7: Scatterplot for Composite KA Score of Teachers

5.5.7 Scatterplots for Teachers Composite TNA Score

Scatter plot in Figure 5.8 presents the composite training need assessment scores of male and female teachers. Each data point on the graph represents an individual observation, with distinctions based on color: male teachers are indicated by red dots, while female teachers are represented by black dots. The overall average training need assessment score for all teachers in the sample stands at 53.24. When comparing gender groups, male teachers have a slightly lower average score of 50.0, while female teachers exhibit a higher average composite TNA score of 54.35. This suggests that, on average, female teachers demonstrate a relatively higher perceived need for training in various areas related to ICT compared to their male counterparts.

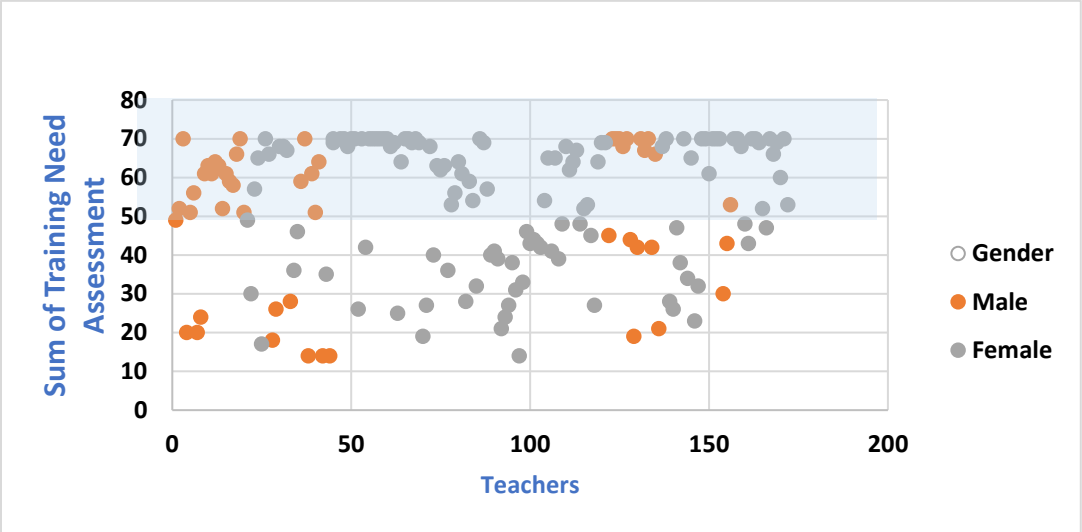

Figure 5.8: Scatterplot for Composite TNA Score of Teachers

5.6 Analysis of Stakeholders' Perspectives on ICT Integration in Primary Education

The fourth and last objective of this study is, "to seek the decision makers' managers', and implementers' perspective for integrating ICT in primary school". This involves seeking insights and opinions from these stakeholders to understand their views, challenges, and potential strategies related to ICT integration in primary education. The aim is to gain valuable insights into their perceptions regarding the use of technology in education and to identify potential hurdles and solutions in implementing ICT initiatives at the primary school level. The details of the stakeholders who participated in the interviews and the procedures related to the data collection process are discussed in detail in Chapter 4. Building on this foundation, Table 5.16 presents the three main themes derived from the analysis: potential benefits of ICT use, challenges in ICT integration, and solutions through ICT policies. From these themes, eleven sub-themes were identified. Table 5.16 below illustrates these three main themes, along with their corresponding sub-themes and respective codes.

Table 5.16: Themes, Sub Themes and Codes of In-depth Interview

Sr.	Theme	Sub Theme and Codes

1	Potential Benefits of Use of ICT	• **Enhanced Learning Experience & Student performance**
		  ○ Enhanced Learning
		  ○ Student Engagement
		  ○ Academic Outcomes
		  ○ Problem Solving & Critical Thinking Skills
		• **Teacher Efficiency and Innovation**
		  ○ Teacher Efficiency
		  ○ Innovative Teaching
		  ○ Learner Centered
		  ○ Resource Utilization

2	Challenges in ICT Integration	• **Infrastructure Issues**
		  o Technical Challenges
		  o Infrastructure Lacking
		  o Connectivity Issues
		  o Hardware Shortages
		• **Financial Constraints**
		  o Financial Barriers
		  o Funding Limitations
		  o Budget Allocations
		  o Resource Allocation
		• **Teacher Training and Competency**
		  o Training Gaps
		  o Training Needs Assessment
		  o Professional Development
		  o ICT Competency
		  o Digital Literacy
		• **Resistance to Change**
		  o Cultural Barriers
		  o Traditional Methods
		  o Attitudinal Barriers
		• **Policy and Administrative Challenges**
		  o Policy Gaps
		  o Administrative Barriers
		  o Policy Implementation Issues
		  o Bureaucratic Hurdles

3	Solutions: ICT Policies	• **Policy Development and Implementation**
		  o Policy Development
		  o Policy Implementation
		  o Strategic Planning
		• **Funding and Resource Allocation**
		  o Funding Strategies
		  o Budget Management
		  o Financial Planning
		• **Stakeholder Involvement**
		  o Stakeholder Engagement
		  o Community Participation
		  o Public Private Partnerships
		  o Collaboration Strategies
		• **Monitoring and Evaluation**
		  o Monitoring Systems
		  o Evaluation Mechanisms
		  o Impact Assessment
		  o Feedback Loops

5.6.1 Theme 1: Potential Benefits of Use of ICT

The potential benefits of using ICT in education are vast and transformative. This theme explores how integrating ICT into teaching and learning processes can enhance educational outcomes, improve student engagement, and foster innovative teaching practices. Specifically, this theme seeks to uncover the advantages of using ICT in primary education in two ways: how it helps students enhance their learning experiences and how it assists teachers in becoming more efficient by incorporating modern teaching tools into their practices. Participants discussed various advantages, including increased access to educational resources, personalized learning experiences, and the development of digital literacy skills. Additionally, ICT can facilitate collaborative learning, streamline administrative tasks, and provide opportunities for remote education, thereby bridging gaps in traditional educational settings.

To further illustrate these findings, Figure 5.9 visualizes the sub-themes and codes related to Theme 4.5.1: Potential Benefits of ICT Use. In this figure, the main theme is represented by a circle shape, sub-themes are shown in rectangular shapes, and codes are displayed in round-cornered rectangles, providing a clear and organized view of the various aspects of this theme.

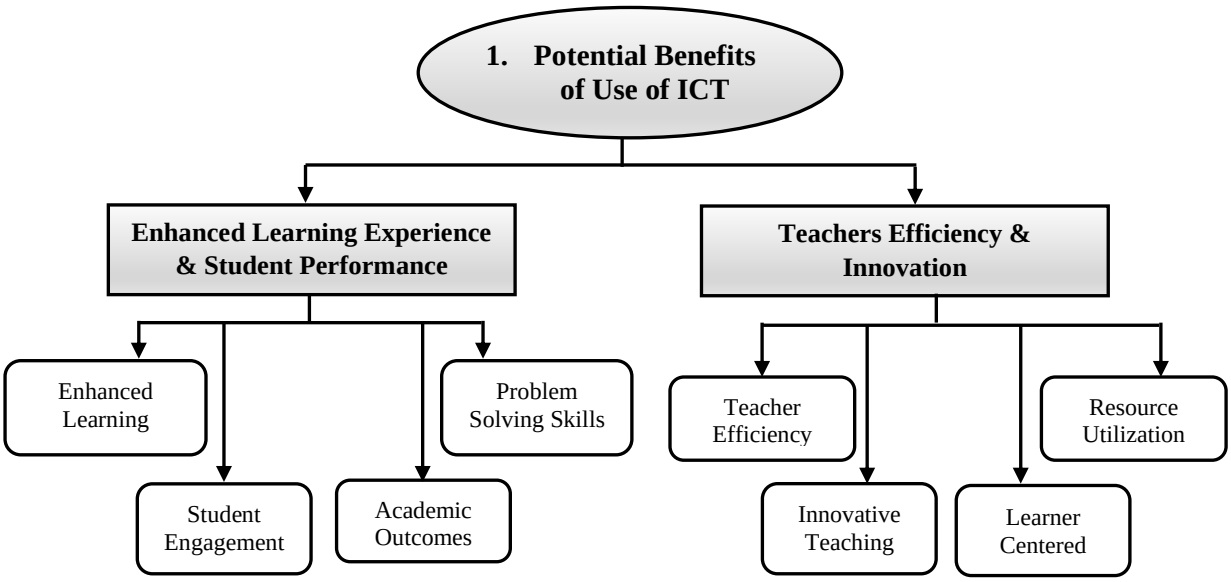

Figure 5.9: Sub Themes & Codes of Theme 1

Source: Author (2024)

1. **Sub-theme 1: Enhanced Learning Experience & Student performance**

The use of ICT in education significantly enhances the learning experience and improves student performance. Participants shared their views on how digital tools and resources create a more engaging and interactive learning environment, leading to better understanding and retention of information. The use of multimedia, interactive simulations, and online assessments was particularly highlighted as beneficial for student learning. One female respondent, who is a teacher, stated that:

"Using ICT in the classroom has significantly improved students' motivation and engagement. They are more interested in interactive lessons that involve digital tools. For instance, once I was teaching a lesson on Mohenjo-Daro to grade 4 students. I used my laptop to show a Mohenjo-Daro documentary on YouTube. The students were so excited and engaged in the class, and I observed that it makes their learning more interactive and easier to understand." (Participant 8).

Most of the participants agreed that technology has had a drastic impact on students' learning, helping them develop a conceptual understanding that is not possible with traditional teaching strategies and learning resources. One male teacher among the eight participants explained that:

"The use of ICT resources in the teaching-learning process helps students to build their digital skills. For example, I used an online puzzle game related to basic arithmetic for assessment in my class, and it helped the students improve their problem-solving and critical thinking skills. Although we don't have ICT tools and gadgets in our school, sometimes I use my own mobile phone in order to provide them with an opportunity to become familiar with digital tools and gadgets." (Participant 7)

The responses from participants underscore the positive impact of ICT on education. By enhancing student engagement and providing diverse resources, ICT supports personalized learning and helps develop critical skills like problem-solving and digital literacy. The use of digital tools, such as an online puzzle game and a Mohenjo-Daro documentary, shows how ICT can make learning more engaging and effective. Additionally, teachers' willingness to use their own devices highlights the importance of ICT in modernizing education. This theme emphasizes ICT's critical role in improving educational outcomes and the need for increased access to digital tools in schools.

2. Sub-theme: Teacher Efficiency and Innovation

ICT integration enhances teacher efficiency and fosters innovation in teaching practices. Participants discussed how digital tools streamline administrative tasks, allowing teachers to devote more time to instructional activities. Moreover, ICT provides teachers with a wealth of resources and tools to create innovative and effective lesson plans, facilitating a more dynamic and interactive classroom environment. Most of the participants agreed that technology has had a drastic impact on students' learning and also helps teachers easily address the diverse needs of their students. An interviewee a head teacher of a school stated:

"Integrating ICT into the teaching-learning process will enhance the efficiency and creativity of our teachers. It will streamline administrative tasks, enabling them to devote more time to teaching. With the digital tools and resources at their disposal, our teachers will be able to develop engaging lesson plans that meet the diverse needs of their students." (Participant 6)

This sub-theme emphasizes how integrating ICT improves teacher efficiency and promotes innovative teaching. Digital tools streamline tasks, enabling more focus on teaching. ICT provides resources for creative lesson planning, creating a dynamic classroom environment for diverse student needs.

5.6.2 Theme 2: Challenges in ICT Integration

Theme 2, "Challenges in ICT Integration," delves into the hurdles faced when incorporating ICT into education. It examines issues such as infrastructure limitations, financial constraints, teacher training gaps, resistance to change, and policy/administrative challenges. These barriers hinder effective ICT integration in education and require strategic solutions for successful implementation. In Figure 5.10, the main theme, represented by a circle shape, sub-themes shown in rectangular shapes, and codes displayed in round-cornered rectangles, offers a clear and organized view of the various aspects of Theme 2, "Challenges in ICT Integration," mirroring the visualization style used in Theme 1.

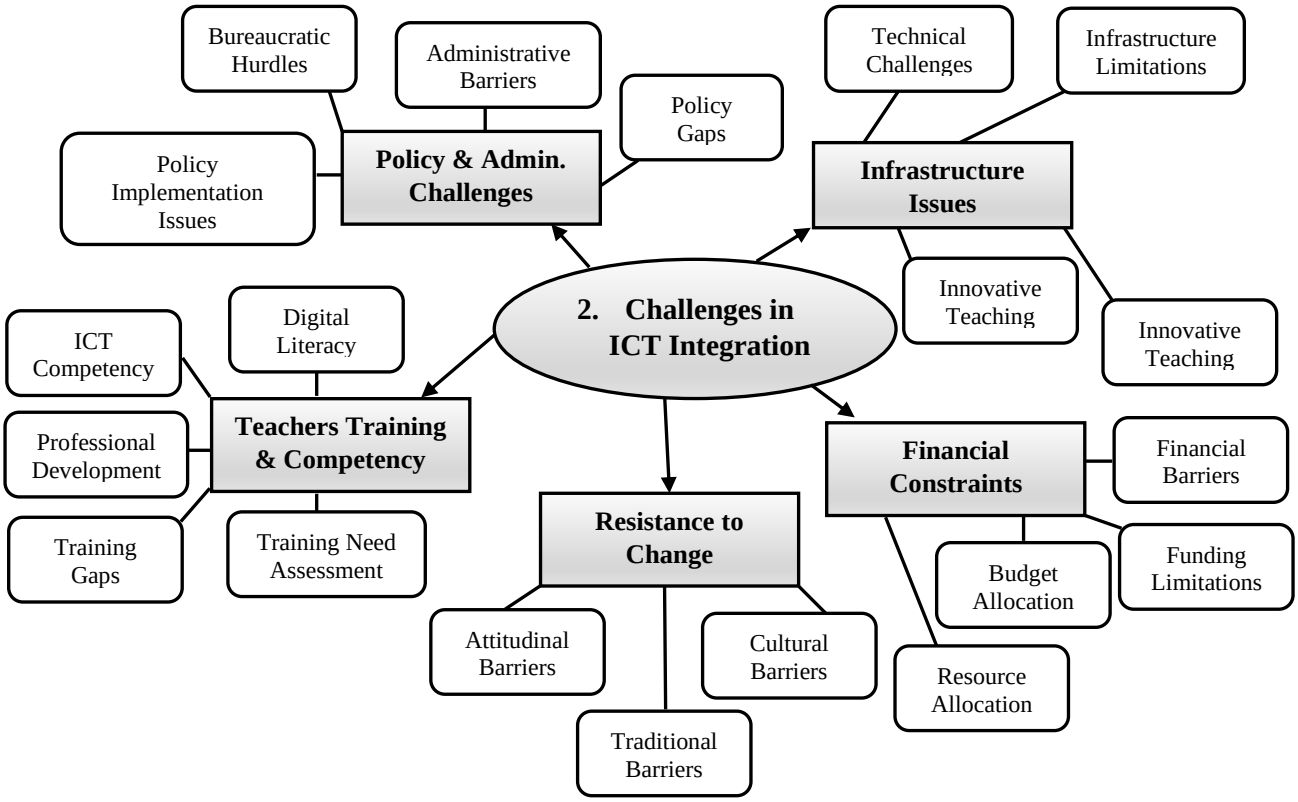

Figure 5.10: Sub Themes & Codes of Theme 2

Source: Author (2024)

1. Sub-theme: Infrastructure Issues

This sub-theme focuses on the challenges related to infrastructure that hinder the integration of ICT in primary education of the province. It includes issues such as the lack of computers, reliable internet connectivity, and sufficient hardware in primary schools. These infrastructure deficiencies create barriers to implementing effective ICT initiatives and must be addressed to ensure successful integration. A recurring theme was the technical and infrastructure challenges faced by schools. One district education officer remarked that:

"Almost all primary schools in the district lack the necessary infrastructure for effective ICT implementation, including computers, reliable internet connectivity, and sufficient hardware. Additionally, many schools face challenges with electricity supply, further hindering ICT integration. Moreover, inappropriate building structures in Hyderabad rural taluka and other talukas of the district pose significant challenges that need to be addressed before adopting ICT solutions." (Participant 3)

Participants highlighted the lack of essential infrastructure such as computers, reliable internet, and adequate hardware, which hinders effective ICT implementation. The challenges also include issues with electricity supply and inappropriate building structures in certain areas, emphasizing the need to address these issues before adopting ICT solutions.

2. Sub-theme: Financial Constraints

This sub-theme explores the financial challenges faced in integrating ICT in education. It includes limitations in budget allocation for ICT infrastructure and resources, which restrict the ability to acquire necessary technology. Financial constraints also impact the capacity for training teachers and implementing support systems for sustainable ICT integration. The three interviewees, DEO, TEO, and head teacher, acknowledged that financial constraints are one of the challenges that should be addressed. They explained in separate in-depth interviews that:

“The lack of adequate funding restricts the procurement of essential technological tools and infrastructure. Moreover, the lack of specific budget allocation for ICT integration hinders the ability to provide comprehensive training programs for teachers, which are crucial for effective ICT integration. Furthermore, the government should allocate a specific budget at the school level for ICT implementation.” (Participant 3, Participant 3, and Participant 6).

Without adequate financial support, establishing and maintaining robust support systems for the sustainable use of ICT in education becomes challenging. All interviewees emphasized the need for increased financial investment to overcome these barriers and ensure the successful integration of ICT in education.

3. Sub-theme: Teacher Training and Competency

This sub-theme addresses the importance of equipping teachers with the necessary skills and knowledge for effective ICT integration in education. It highlights the need for comprehensive training programs that focus on enhancing teachers' technological competencies and pedagogical strategies. To reflect on the importance of training for ICT integration, one of the interviewees, the Additional Secretary, SELD, Government of Sindh stated that:

"Human resources are the key factor for successful ICT integration in primary education. Simply providing the essential infrastructure without proper training is akin to having a car without a driver." (Participant 1).

Further, another interviewee, the Chief Program Manager of the Reform Support Unit, SELD, Government of Sindh, stated that:

"Of course, training is an essential component for ICT integration that cannot be neglected. However, before conducting ICT training, it is necessary to conduct a training needs assessment. The ICT training should be offered at different levels, such as beginner, intermediate, and advanced, and teachers should be enrolled based on their scores in the training needs assessment." (Participant 2).

These two statements emphasize the critical role of human resources and training in the successful integration of ICT in primary education. Participant 1's analogy of a car without a driver highlights that providing infrastructure alone is insufficient without trained personnel to effectively utilize it. Participant 2's emphasis on conducting a training needs assessment and offering training at different levels underscores the importance of tailored and comprehensive training programs for teachers to effectively integrate ICT in their teaching practices.

4. Sub-theme: Resistance to Change

Resistance to change, particularly in the form of teachers' fear of adopting new technologies and their attitudinal problems, is a prominent sub-theme in the interviews. The Taluka Education officer stated that:

"The senior teachers, mostly those with 20 years or more of teaching experience, have a fear of the unknown or a perceived lack of technical skills, which creates attitudinal barriers to incorporating ICT into their teaching practice." (Participant 5).

This suggests that senior teachers may face challenges in adopting ICT due to a fear of the unknown or feeling inadequately skilled, highlighting the importance of targeted support and training programs tailored to address their specific concerns.

5. Sub-theme 5: Policy and Administrative Challenges

Policy and administrative challenges emerged as a significant sub-theme in the interviews, indicating that the integration of ICT in primary education is hindered by various bureaucratic and organizational barriers. These challenges include outdated policies that do not align with the needs of modern era of education, a lack of clear guidelines for implementation, and bureaucratic hurdles that slow down decision-making processes. An interviewee stated that:

"ICT integration in primary education entails a comprehensive transformation of the public sector school system. To achieve this, we need to engage local stakeholders by establishing a separate directorate under the administrative control of the Secretary, SELD, Government of Sindh. This is essential because most donor-funded projects only sustain for the duration of the project completion." (Participant 2).

Participant 2 emphasizes the need for a sustainable approach to ICT integration in primary education, suggesting that engaging local stakeholders through a dedicated directorate can help ensure continuity beyond the lifespan of donor-funded projects. This highlights the importance of long-term planning and local ownership in driving effective and lasting change in the education system.

5.6.3 Theme 3: Solutions: ICT Policies

Addressing the challenges like non availability of required infrastructure, trained teachers, outdated policies, a lack of clear guidelines for implementation, and bureaucratic hurdles requires comprehensive policy reforms, streamlined administrative processes, and strong leadership to drive effective ICT integration in primary education. The theme Solutions: ICT Policies focuses on strategies to address challenges related to ICT integration in primary education. This theme emphasizes the importance of developing and implementing effective ICT policies at the national and local levels. These policies should outline clear guidelines for ICT

integration, including infrastructure development, teacher training, curriculum integration, and monitoring and evaluation mechanisms. Here in Figure 5.11, the main theme is represented by a circle, sub-themes are presented in rectangles, and rounded-corner rectangles illustrate their respective codes.

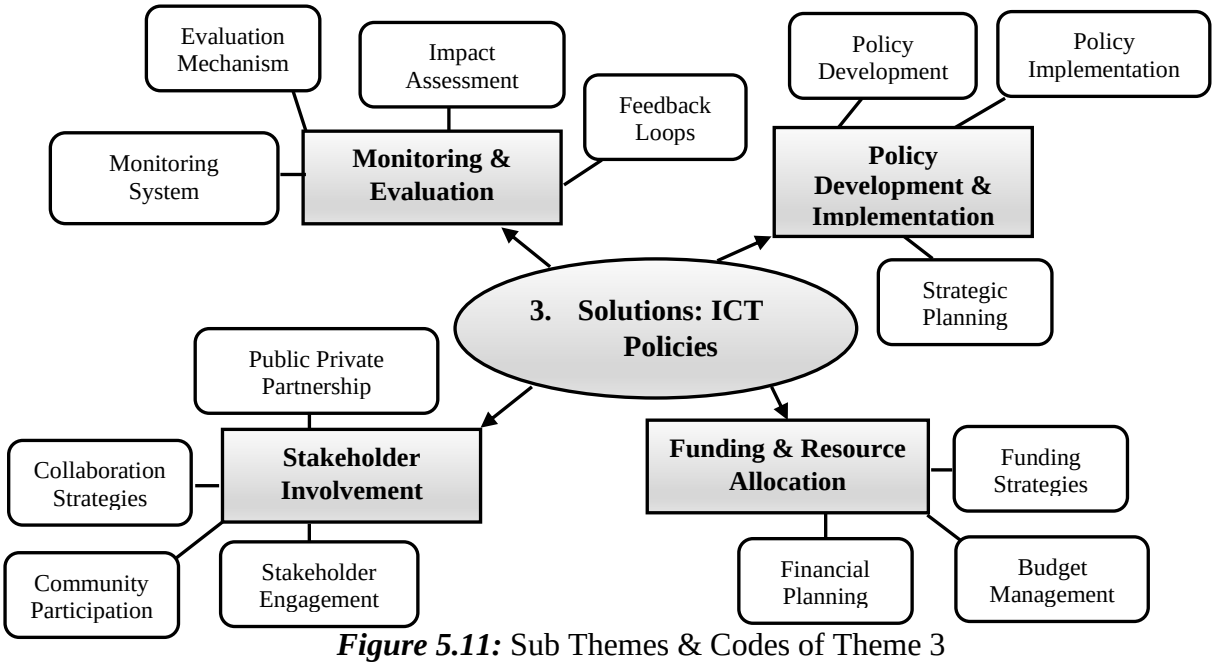

Figure 5.11: Sub Themes & Codes of Theme 3

Source: Author (2024)

1. **Sub-theme: Policy Development and Implementation**

   This sub-theme focuses on the creation and execution of effective ICT policies to facilitate the integration of technology in primary education. It emphasizes the importance of developing comprehensive policies that address the specific needs of the education sector, including infrastructure, teacher training, curriculum integration, and ongoing support. This sub-theme underscores the need for a strategic approach to policy development and robust implementation plans to achieve sustainable ICT integration in education. One of the participants explained that:

   "For ICT integration, we need to adopt a holistic approach and develop an evidence-based policy that includes implementation strategies, a time frame, a proper execution plan, resource allocation, and methods for monitoring activities and ensuring sustainability." (Participant 2).

   During the interview with the District Education Officer (DEO) of Hyderabad, he shared his opinion that:

   "Most of our policies are not properly implemented. I believe this implementation gap is due to policymakers' unawareness of ground realities. Therefore, to develop a policy that

overcomes the implementation gap and delivers the desired outcomes, we need to conduct a contextual analysis prior to policy development." (Participant 3).

These responses underline the importance of a holistic and evidence-based approach to policy development for ICT integration. Effective policies should include detailed implementation strategies, clear timelines, execution plans, resource allocation, and robust monitoring mechanisms to ensure sustainability. Additionally, addressing the implementation gap requires policymakers to conduct a contextual analysis to understand ground realities. This ensures that policies are realistic, achievable, and tailored to local needs, ultimately leading to successful and sustainable ICT integration in education.

2. **Sub-theme: Funding and Resource Allocation**

This sub-theme addresses the critical role of securing adequate funding and effectively allocating resources for the successful integration of ICT in primary education. Ensuring sufficient financial support is essential for acquiring necessary infrastructure, providing ongoing teacher training, and maintaining ICT resources. Participant 1 stated in his interview that:

"A significant portion of the development budget of the School Education and Literacy Department, Government of Sindh, is allocated to civil works. However, a negligible amount is earmarked for soft components like teacher training and ICT integration. It is imperative to make tough decisions now to prioritize ICT integration. This is crucial for reducing the digital divide, preparing children for higher education, and equipping them for today's challenging job market." (Participant 1).

The quote highlights the challenge of funding allocation in education, where a significant portion goes to schools' construction and rehabilitation (civil works) rather than to soft components like teacher training and ICT integration. It emphasizes the need for hard decisions to prioritize ICT integration, recognizing its importance in reducing the digital divide and preparing students for higher education and the job market. This underscores the critical role of funding and resource allocation in shaping the success of ICT integration in education

3. **Sub-theme: Stakeholder Involvement**

This sub-theme emphasizes the importance of engaging various stakeholders of the School Education and Literacy Department (SELD), Government of Sindh, including teachers, head teachers, TEOs, DEOs, policymakers, and other top-level management, in the process of ICT integration in primary education. It highlights the need for collaboration and active participation from all stakeholders to ensure the successful implementation and

sustainability of ICT initiatives. This sub-theme underlines the importance of fostering a sense of ownership among stakeholders to drive meaningful change in the primary education of Sindh. An interviewee explained that:

"For the successful implementation of ICT in public sector schools of Sindh, it is necessary for the School Education and Literacy Department (SELD), Government of Sindh, to take responsibility for implementation rather than relying solely on other working partners and donor agencies. Involving SELD officers in the implementation process is crucial for developing a sense of ownership and ensuring sustainability of the reforms." (Participant 2).

Participant 2's statement emphasizes the importance of the School Education and Literacy Department (SELD), Government of Sindh, taking a leading role in the implementation of ICT initiatives in public sector schools. This approach is seen as essential for ensuring that the department is fully invested in the process, which can lead to greater ownership and sustainability of the reforms.

4. **Sub-theme: Monitoring and Evaluation**

This sub-theme focuses on the importance of establishing robust monitoring and evaluation mechanisms to assess the effectiveness of ICT integration in primary education. It highlights the need for ongoing assessment to track progress, identify challenges, and make informed decisions for improvement.

"For the successful integration of ICT in public sector primary schools of Sindh, it is imperative to establish a comprehensive monitoring and evaluation system within the department. This system should track the progress of ICT initiatives regularly, identify challenges, and provide data-driven insights for improvement. While the SELD, Government of Sindh, already has a separate directorate for monitoring and evaluation purposes, which ensures teacher attendance, a separate, strong M&E mechanism will be required specifically for ICT initiatives." (Participant 3).

Establishing a dedicated monitoring and evaluation (M&E) system is crucial for the successful integration of ICT in Sindh's public primary schools. This system should track progress, identify challenges, and provide data-driven insights for improvement, complementing the existing directorate's efforts focused on teacher attendance.

5.7 Discussion and Conclusion

The findings from the ICT intervention study in primary education of district Hyderabad revealed unexpected outcomes, as the intervention led to a decline in students' academic scores. Factors such as student characteristics, parental background, school types, and geographical locations

were found to significantly affect the student scores. This has also been explored in prior study by Karamti (2016) conducted on tertiary education of Tunisia. This study attempts to highlight the gap in knowledge about the effects of ICT on education in developing countries by providing evidence from this region. The findings of the study show a negative effect of ICT on students' academic performance, which raise a question about the effectiveness of the educational policies in Tunisia. A number of studies show that ICTs improve students' academic performance. For example, Basri et al. (2018) studied how information and communication technology (ICT) was adopted by four Saudi Arabian universities and how it affected students' academic performance. The moderating effects of gender, GPA, and student majors on academic achievement were also investigated in this study. The results show that, in a conservative setting, there is an association between ICT usage and academic achievement. In addition, the study discovered that female students' academic performance benefited more from ICT adoption than did male students. Nonetheless, there was not a noticeable impact of the students' IT majors on their academic performance. Teachers in Kenya's public secondary schools in Nakuru County have been incorporating ICT into their classes, yet the results of the Kenya National assessments Council (KNEC) assessments indicate that the performance of students in the KCSE exams has been poor. Few students get admitted into the different universities (Mbugua, Kiboss, et al., 2015).

These findings call for further investigation into the underlying causes of the unexpected outcomes. Moving forward, the study aims to explore factors such as the availability of ICT infrastructure in district primary schools and the current ICT proficiency of teachers to address shortcomings and enhance the effectiveness of ICT integration in educational settings. The analysis of ICT infrastructure availability in public sector schools of Hyderabad district highlighted significant deficiencies. Few schools have computer labs with internet connectivity, and repair and maintenance rely heavily on market-based solutions. Human resources related to IT are also limited, indicating a need for significant improvements in ICT infrastructure and capacity building to support effective ICT integration in schools. According to earlier research ICT infrastructure is a necessary component for the effective integration of ICT in education. For example, research by Mulwa & Kalyo (2011) have demonstrated how much ICT infrastructure affects secondary schools in Kenya's Kitui district's willingness to use e-learning. The findings demonstrated that institutional elements including infrastructure (e.g., connectivity, energy sources, and ICT gadgets) have a significant influence on readiness to adopt e-learning. However, the majority of Kitui district schools lacked the necessary infrastructure to encourage the use of e-learning. It was suggested that in order to facilitate the adoption of e-learning by educators and

students and accelerate the development and economic expansion of this nation, the government should ensure timely installation of ICT infrastructure in all secondary schools. Like other developing countries Pakistan also having trouble in integrating ICT into public education. The main objective of the study by Salam et al. (2017) was to examine the technological barriers preventing ICT use in Pakistan's public schools in the Khyber Pakhtunkhwa Province. For this purpose, a survey was conducted and questionnaires were filled by the officers of Education Department of KP province. The study's findings show that insufficient funding for the education sector makes it difficult for public schools to successfully integrate ICT. ICT integration in public schools is further hindered by the cost of hardware and software, outdated curricula, unreliable power supplies and internet connections, and a shortage of teachers with training in ICT.

Teachers' knowledge acquisition and training need assessment revealed areas for improvement in teachers' digital competencies. Many teachers expressed a lack of confidence in various ICT-related tasks, indicating a need for targeted training interventions. Tailored training programs are essential to equip teachers with the necessary skills to effectively integrate ICT in their teaching practices and enhance student learning outcomes. A number of authors have recognized that teachers ICT competencies are important for implementation of ICT in schools. In order to evaluate secondary school teachers' knowledge and abilities required for the implementation of Tanzania's Information and Communications Technologies (ICTs) policy for basic education, Kayombo & Mlyakado (2016) conducted research in the Tanga and Mwanza regions of Tanzania. The study discovered a number of inconsistencies between the ICT policy and the actual application of ICT goals in education, including low teacher awareness and training in ICT integration. A survey was conducted by Garba (2014) to investigate the level of ICT literacy skills and competence of Pre-service Teachers in Nigerian Colleges of Education. The goal of the study was to ascertain how the ICT course affected pre-service teachers' development of the ICT literacy and competence necessary for integrating ICT into the classroom. The study's conclusions revealed that the participants' overall ICT literacy competency and skills were judged to be low after taking the course. The findings of this study imply the need for a targeted training course that fulfills the individual needs of pre-service teachers, which is only possible after conducting a needs assessment. Lubuva et al. (2022) evaluated the ICT competencies of instructors in this study, along with the factors that affected how well they applied these competencies. The UNESCO ICT-Competence Framework for Teachers' ICT competency levels were used in the study. Seventy tutors' self-rating questionnaires were used to gather quantitative data. The study's conclusions

imply that in order for teachers to effectively implement ICT-pedagogical abilities in the classroom, they require additional practical training.

Stakeholders' perspectives on ICT integration in primary education of Sindh highlighted the potential benefits, challenges, and solutions associated with this endeavor. While stakeholders acknowledged the transformative impact of ICT on learning experiences and student performance, they also identified challenges such as infrastructure limitations, financial constraints, and resistance to change among teachers. Comprehensive policies, strategic approaches, and robust monitoring and evaluation mechanisms are essential to address these challenges and ensure sustainable ICT integration in education. The study conducted by Uygur et al. (2020) in the Turkish province of Mersin, this study intends to ascertain the opinions of educators regarding the role of educational leadership in promoting sustainable inclusive education, as well as the integration of technology. The results show that all parties involved think that using technology into inclusive, sustainable education improves students' learning. Mwendwa (2017) conducted a survey to find out the opinions of principals and teachers in Kitui County, Kenya, regarding the inclusion of ICT in the public primary school curriculum. The findings demonstrated that ICT was viewed as a crucial instrument for enhancing output, cooperation, learning opportunities, and learning results. Positive opinions were expressed by the principals and teachers who participated in the study on ICT integration in the elementary school curriculum. The study went on to state that one important aspect in the adoption of technology-related innovations is instructors' attitudes towards ICT integration in the classroom.

In conclusion, the findings highlight the critical role of ICT in transforming primary education in Sindh and emphasize the need for concerted efforts from policymakers, educators, and other stakeholders to realize its full potential. By addressing the identified challenges and implementing the proposed solutions, Sindh can create a more inclusive, innovative, and effective education system that meets the needs of 21st century learners.

Chapter 6

Paving the Path Forward: Proposed Policy Guidelines for ICT Integration in Primary Education

6.1 Introduction to the Chapter

This chapter outlines proposed policy guidelines for integrating ICT in primary education in Sindh, drawing on the study's findings to address challenges and opportunities. Section 6.2, "Trajectory to Proposing Policy Guidelines," explains the rationale and process behind developing these guidelines. Section 6.3 highlights the role of the Provincial Program Implementation Unit (PPIU) in ensuring stakeholder involvement for sustainable ICT integration, emphasizing collaboration with government bodies, educators, and the community. Section 6.4, "Implementation Strategies," details the key pillars for effective ICT integration, defining the roles and responsibilities of various stakeholders and the necessary infrastructure and training programs. Finally, Section 6.5 presents strategies for the program's sustainability, focusing on funding, stakeholder engagement, continuous professional development, and regular policy reviews. Together, these sections provide a practical roadmap for enhancing educational outcomes and equipping students with essential digital skills.

6.2 Trajectory to Proposing Policy Guidelines

In this chapter, before proposing the guidelines, it is essential to reflect on the researcher's journey in developing policy guidelines for integrating ICT in primary education in Sindh. This process involves several critical steps, as shown in Figure 6.1.

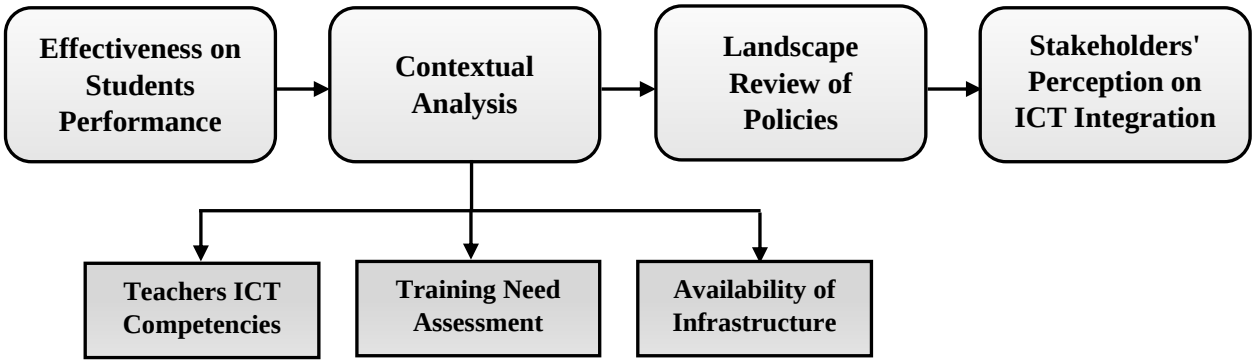

Figure 6.1: Trajectory to Propose Policy Guidelines
Source: Author (2024)

- **Effectiveness on Student Performance:** The study begins by assessing the impact of ICT on student performance. This involves conducting an intervention to observe changes in academic outcomes, providing empirical evidence on the effectiveness of ICT integration.

- **Contextual Analysis:** This step includes evaluating teacher competencies, conducting a training needs assessment, and assessing the availability of ICT infrastructure. Understanding the current capabilities and requirements of teachers, as well as the existing infrastructure, is crucial for formulating relevant and practical policy guidelines.
- **Landscape Review of Policies:** A comprehensive review of existing policies related to ICT in education is conducted. This review helps identify the strengths, weaknesses, and gaps in the current policy framework, providing a foundation for developing improved guidelines.
- **Stakeholders' Perspective/Opinion on ICT Integration:** Gathering insights from various stakeholders, such as district and taluka education officers, chief program manager, head teachers, and teachers, is essential. This step involves conducting the in-depth interviews to understand the practical challenges, and opinions of those directly involved in ICT integration.

By following this structured path, the study ensures that the proposed policy guidelines are well-informed and grounded in both empirical evidence and practical insights. This trajectory highlights the importance of a holistic approach, considering the impact on student performance, contextual factors, existing policies, and stakeholder perspectives, to develop comprehensive and effective guidelines for integrating ICT in primary education in Sindh.

6.3 Ensuring Stakeholder Involvement for Sustainable ICT Integration

In this section, the implementation strategy for ICT integration in primary education in Sindh will be discussed, with a focus on the importance of involving local stakeholders to ensure long-term sustainability. The section will outline the basic structure of the implementation unit or a separate directorate working under the administrative control of SELD, Government of Sindh responsible for overseeing the ICT integration project. By involving stakeholders such as district and taluka education officers, head teachers, and teachers, and others relevant officers of SELD, Government of Sindh the initiative aims to foster ownership and accountability, ensuring that the ICT integration efforts extend beyond the project period and become a sustainable part of the education system.

6.3.1 Building the PPIU: Framework for ICT Integration in Sindh

In light of the reviewed policies and in-depth interviews with various stakeholders, it appears more feasible to establish a separate directorate or Provincial Program Implementation Unit (PPIU) for the sustainable integration of ICT in public sector schools in Sindh. This section

will discuss the structure of PPIU, and emphasizing the importance of involving local stakeholders to ensure long-term sustainability.

1. Structure of the Provincial Program Implementation Unit (PPIU)

The Provincial Program Implementation Unit (PPIU) will be a provincial-level office with four sections: Administration, Training, Technical, and Monitoring & Evaluation (M&E) as shown in Figure 6.2.

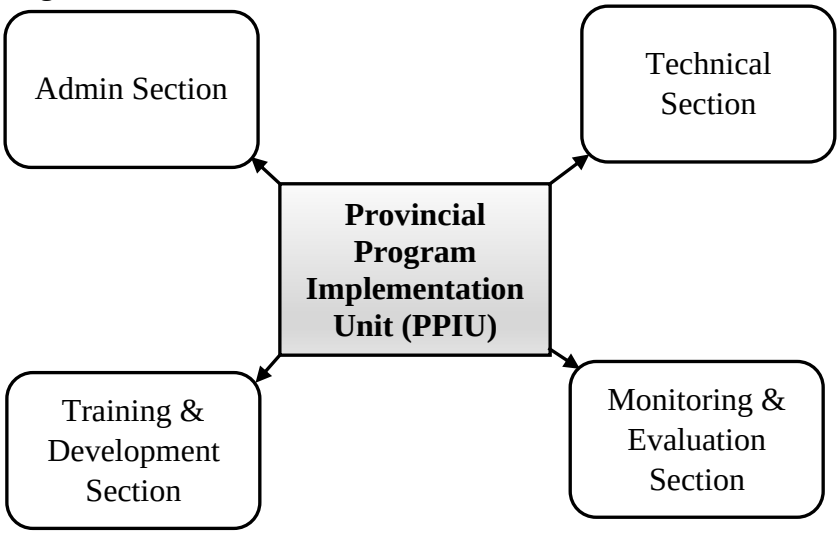

Figure 6.2: Structure of PPIU
Source: Author (2024)

The overall successful implementation and sustainability of ICT in primary education will be the responsibility of the PPIU. As shown in Figure 6.2, the PPIU comprises four sections: the administrative section, the technical section, the training and development section, and the monitoring and evaluation (M&E) section. The following details propose the future roles and responsibilities of each section:

- **Administrative Section:** This section will manage the overall administration and coordination within the PPIU and district offices, ensuring smooth operations and effective communication among all sections and district offices. Further this will deal with the all administrative and financial matters of PPIU.
- **Technical Section:** This section will be responsible for providing technical support and expertise. It will comprise a team that will include software engineers, hardware specialists, and network specialists. The hardware and network specialists will oversee the implementation of ICT systems and ensure their efficient functionality, while the software engineers will be responsible for upgrading and modifying software after deployment. This section will also be responsible for providing technical support to district-level offices when required.

- **Training & Development Section:** This section will focus on designing and delivering training programs for school teachers, enhancing their skills and knowledge in utilizing ICT tools and resources effectively. This section will also be responsible for designing the essential training program for the administrative staff of SELD, Government of Sindh, who will be involved in the ICT integration process. Additionally, the training and development section of the PPIU will be responsible for developing resource materials. This will include creating training modules, establishing a training calendar for all districts, developing training needs assessment tools, monitoring and evaluation tools, and designing master course plans for all primary level subjects.
- **M&E Section:** The M&E will be responsible for assessing the progress and impact of ICT integration initiatives. This section will also be responsible to monitor the progress of district level offices, collect data and progress reports from district offices, monitor outcomes, and provide feedback for continuous improvement. This directorate will be responsible for preparing a consolidated monitoring report based on the M&E reports received from district offices and sharing it with the Directorate General Monitoring & Evaluation, SELD, Government of Sindh.

2. District Level Program Implementation Unit

After discussing the function of each section of the PPIU, it is necessary to outline how this unit will operate across the entire province. Each district within the province will have a district-level PPIU office, ensuring localized oversight and support for ICT integration efforts. This decentralized structure will facilitate effective communication, resource distribution, and tailored interventions to meet the specific needs of each district. Each district-level PPIU office will consist of three sections: the training section, the technical section, and the M&E section, as shown in Figure 6.3.

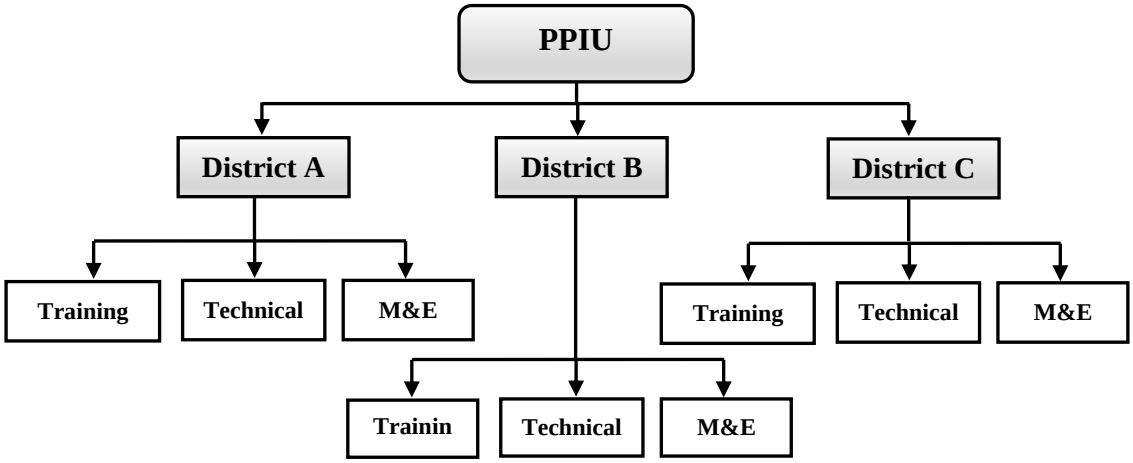

Figure 6.3: Overall Structure of PPIU
Source: Author (2024)

- **Training Section:** The training section of the district-level office will be responsible for conducting ICT-related training for school teachers in their respective districts, following the training calendar provided by the training and development section of the PPIU. This section will also be responsible for conducting training needs assessments and sharing the assessment results and training completion reports with both the training and development section and the M&E section of the PPIU.
- **Technical Section:** The technical section team of the district office will be responsible for providing technical assistance to schools when needed and handling software-related and other technical issues within their own office.
- **M&E Section:** The M&E section of the district office will be responsible for monitoring the implementation of ICT in schools within their respective districts. The M&E team will visit each school at least twice a month to ensure the proper implementation of ICT in the teaching and learning process, following the course guide and master plan provided by the PPIU to all schools. At the end of every month, the M&E section will prepare a consolidated M&E report for their district and share it with the M&E section of the provincial office.

3. Importance of Involving Local Stakeholders

Involving stakeholders such as district education officers, taluka education officers, head teachers, teachers, and other relevant officers from the SELD, Government of Sindh, is crucial for the success of ICT integration. As mentioned previously, most third-party implemented projects often only sustain during the tenure of the project, lacking long-term impact. The purpose of engaging local stakeholders is to set the stage for long-term success and sustainability. The initiative aims to foster ownership and accountability, ensuring that ICT integration efforts extend beyond the project period and become a sustainable part of the education system. This approach helps build a strong, locally-supported foundation that promotes continuous improvement and adaptation to evolving educational needs.

6.4 Implementation Strategies

Research indicates that the presence of technology and gadgets does not automatically enhance the quality of education. As Hinostroza et al. (2014) found that pedagogical practices, resource management, and instructional methods have a greater impact on learning than simply having digital devices. Other important factors include school leadership, the availability of technical and pedagogical support, attitudes and beliefs about ICT in education, and the time teachers spend preparing their lessons. Therefore, Martínez & Jaimes (2020) emphasize in the UNESCO Practical

Guide to Implement Surveys on ICT Use in Primary and Secondary Schools the necessity of robust data to understand the factors influencing effective ICT integration in education and to ensure equal access for both students and teachers. Such data is crucial for supporting policy decisions. Evidence-based policymaking, along with analyzing indicators to monitor policy and program implementation, is essential. Indicators that are politically relevant, robust, timely, accurate, and reliable provide policymakers with valuable information to diagnose baseline and desired scenarios, design and track the development of ICT in education policies, and combine this data with specific evaluations to assess policy outcomes and identify areas for improvement.

In light of the above literature, to successfully implement ICT in primary education in the province, an evidence-based policy is crucial. This requires robust data on various indicators, such as the availability of IT teachers, technical staff, ICT infrastructure, teacher preparation time, and the extent of ICT training provided to teachers by the government, as discussed in the UNESCO Practical Guide to Implement Surveys on ICT Use in Primary and Secondary Schools. The SELD, Government of Sindh, can collect this data through its Annual School Census by adding an additional section to the census form before establishing PPIU and implementing the relevant policy. Furthermore, the effective implementation of ICT in primary education requires the active participation of all relevant stakeholders. This process is supported by several essential pillars: human resources, digital learning resources, infrastructure, and budget. Each of these elements is vital for creating a sustainable and impactful integration of ICT in the province's education sector. The following sections detail the specific components and actions necessary for achieving successful ICT implementation

6.4.1 Key Pillars for Implementing ICT in Education

For successful ICT integration in primary education, certain foundational elements are essential. Below, each key pillar is elaborated to provide a comprehensive understanding of the necessary components for effective and sustainable ICT implementation. These pillars include human resources, digital learning resources, infrastructure, and budget, all of which play a critical role in the seamless integration of ICT into the educational system.

1. Human Resources

Human resources are the backbone of any organization and also play a crucial role in the successful integration of ICT in primary education. The effectiveness of technology in education largely depends on the skills, knowledge, and commitment of the individuals involved. Teachers, administrators, and support staff need to be adequately trained and continuously developed to keep up with technological advancements. By investing in human

resources, SELD, Government of Sindh can ensure that ICT tools are used effectively to enhance teaching and learning processes. A well-prepared workforce is essential for maintaining and troubleshooting ICT infrastructure, developing innovative educational practices, and fostering a culture of continuous improvement. This section discusses some important implementation strategies relevant to human resources (HR) for the successful implementation of ICT in primary education in the SELD, Government of Sindh.

a **Training and Capacity Building:** The training and development section of the Provincial Planning and Implementation Unit (PPIU) will play a pivotal role in enhancing the capacity of teachers and administrative staff for the effective integration of ICT in education, as outlined in the policy guidelines. Recognizing the diverse needs and responsibilities of educators, the training section will design separate modules tailored to the specific roles and requirements of each group. For teachers, a structured approach will be adopted, offering training at three levels: basic, intermediate, and advanced. The selection of training levels will be based on the results of a comprehensive Training Needs Assessment (TNA) to ensure that educators receive the most relevant and impactful training for their professional development. This approach not only addresses the immediate training needs but also provides a clear pathway for continuous learning and skill enhancement, crucial for successful ICT integration in education. To ensure effective capacity building for successful ICT integration in education, several policy actions regarding training and development initiatives are as follows:

- Conduct regular workshops focusing on ICT integration, digital pedagogy, and the use of educational technology tools for school teachers of SELD, Government of Sindh
- Incorporate cutting-edge pedagogical innovations related to ICT integration in teaching and learning.
- Design and implement a comprehensive training program for in-service teachers, initially focusing on primary school teachers, to improve student outcomes through ICT integration
- Train teachers to use ICT to enhance students' creativity, innovation, analytical skills, and problem-solving abilities.
- Support teachers' professional development by encouraging the sharing of best practices, participation in learning circles, conducting action research, and publishing findings related to ICT in teaching and learning.

- District Education Officers and Taluka Education Officers will receive training on incorporating ICT into their work. They will also be trained on various aspects of ICT implementation at the school level.
- School head teachers will play a crucial role in the establishment and optimal utilization of ICT and ICT-enabled educational practices within schools. To ensure their effectiveness, all head teachers will participate in orientation training programs focused on ICT and ICT-enabled education. These programs will also assist them in developing and managing digital resources for their schools.
- School head teachers will be trained to maintain the ICT infrastructure, ensure its safety, and maximize the use of ICT facilities.
- Train administrative staff, including head teachers, Taluka Education Officers, District Education Officers, and other relevant personnel of the SELD, Government of Sindh, on the essential competencies related to ICT in education. This training aims to equip them with the necessary skills to effectively fulfill their responsibilities in the context of ICT implementation in schools.
- Provide orientation training to the employees of PPIU and its district-level offices to enable them to fulfill their responsibilities effectively.
- Provide training to technical staff like computer lab assistants, computer operators in schools and technical team of district office of PPIU.
- If the necessary trainer competencies are not available internally, PPIU, working under the administrative authority of SELD, Government of Sindh, may engage external trainers.

b **Recruitment of ICT Specialists:** The recruitment of ICT specialists plays a pivotal role in the successful integration of ICT in education. These specialists bring a unique skill set and expertise that is essential for leveraging technology effectively in teaching and learning processes. To ensure the effective integration of ICT in education through the recruitment of ICT specialists, several policy actions are proposed:

- Hiring dedicated ICT specialists, such as software engineers, hardware specialists, network administrators, and support staff, is crucial for maintaining and troubleshooting ICT infrastructure, ensuring minimal disruption to the learning process.
- Initially, considering the time constraints, the task of developing software to digitize the entire curriculum and deploying essential ICT infrastructure in schools should be

assigned to a third party. After the successful development of the software and deployment of infrastructure in schools, the PPIU technical section team will be responsible for software upgrades in the future.

- The technical section of district-level offices and lab assistants will be responsible for hardware troubleshooting in schools and ensuring the smooth teaching and learning process.

c Continuous Professional Development

After the completion of basic and orientation training related to program needs, it is essential for the training and development section of PPIU to design training programs for teachers whenever modifications are made to digital content or ongoing training programs. This will ensure that educators are kept updated with the latest ICT tools and pedagogical strategies, enabling them to remain competent and confident in using technology to enhance student learning.

2. Digital Learning Resources

Digital Learning Resources here refer to the development and integration of comprehensive customized software and digital tools to support the curriculum. The purpose of this customized software is to create, curate, and maintain high-quality digital content that aligns with the goals and learning outcomes of the provincial curriculum, thereby enhancing the teaching and learning experience. The primary goal is to ensure that all students have equal access to modern educational resources, fostering a more inclusive and effective learning environment that helps improve 21st-century skills like creative thinking and problem-solving. Additionally, these resources aim to prepare the schools' students for higher education and create a future workforce that is productive and equipped with the skills demanded by today's global job market. The following are a few recommended policy actions for the successful integration of ICT in education in light of the findings:

a. **Development of Customized Digital Contents:** Develop and provide access to digital curriculum materials that align with provincial educational standards and learning outcomes. This customized software will include e-books, interactive lessons, and online assessments. In development process of software following things may be considered:
    - To accommodate the diverse linguistic and social contexts present in primary schools within the School Education and Literacy Department (SELD), Government of Sindh, develop customized software or digital curriculum for all grades in Sindhi, Urdu, and English languages.

- Ensure the customized software has a user-friendly interface. Implement separate logins for students and teachers within the software.
- For quality assurance and monitoring purposes, create separate logins for head teachers, TEOs, DEOs, and PPIU district offices to monitor the progress of their respective schools, talukas, and districts. The PPIU provincial office will have access to all district dashboards, enabling them to monitor and evaluate progress across the entire province.

b. Establishment of Educational Recording Studio: A studio will be established at the PPIU head office to record instructional videos that simulate real classroom environments. These videos will cover all subjects and be aligned with the developed course guides. The purpose of these videos is to support teachers in conducting classes with effective ICT integration. This initiative aims to enhance teacher preparedness and confidence in using ICT tools, thereby improving student engagement and learning outcomes through multimedia resources.

c. Controlled Access to Educational Videos: Access to these instructional videos will be granted exclusively to the concerned subject teachers, according to the scheduled topics in the master plan. This video collection will also serve as a valuable resource in the event of natural disasters or health emergencies, ensuring continuity of education when schools remain closed for extended periods.

3. Infrastructure

Infrastructure is a crucial component for the successful integration of Information and Communication Technology (ICT) in education. It encompasses the physical and technical components necessary to support the use of ICT tools and resources in teaching and learning. A robust ICT infrastructure provides schools and educational institutions with the technological backbone necessary to facilitate seamless communication, access to digital resources, and efficient management of educational processes. It not only enhances the learning experience for students but also supports teachers in delivering high-quality instruction and improving their professional development. Therefore, investing in and maintaining a strong ICT infrastructure is essential for realizing the full benefits of ICT integration in the education sector of the province. The following are a few recommended policy actions to ensure a robust ICT infrastructure for successful integration in education, based on the findings:

- Providing schools with essential hardware, including computers, laptops, tablets, projectors, and other digital devices tailored for ICT integration, along with customized digital content.

- Ensuring robust and high-speed internet connectivity in all schools to support online learning and digital collaboration.
- Creating a strong technical support system to help schools quickly fix any computer or software problems, so they can keep working smoothly.

4. Budget

Budget plays a vital role in the successful integration of Information and Communication Technology (ICT) in education. Adequate financial resources are essential for implementing policies and strategies related to ICT integration, ensuring the availability of necessary infrastructure, human resources, and digital learning resources. Without a well-planned budget, educational institutions may struggle to acquire and maintain the technological tools and resources required for effective ICT integration. Therefore, a carefully allocated budget is fundamental for supporting the various aspects of ICT integration in education, ultimately contributing to improved teaching and learning outcomes. To ensure a robust ICT infrastructure for successful integration in education, several policy actions are recommended regarding budget allocation and management:

- Allocate a specific portion of the provincial education budget exclusively for ICT integration. This dedicated budget should cover the costs of infrastructure development, maintenance, upgrades, and training.
- Implement mechanisms to ensure transparency in budget allocation and expenditure.
- Establish clear guidelines for how the ICT budget should be used and ensure that funds are used efficiently and effectively.
- Conduct regular monitoring and evaluation of the ICT budget to assess its effectiveness in meeting integration goals. Adjust the budget allocation based on the outcomes of these evaluations to ensure optimal resource utilization.
- Allocate funds for the development of ICT infrastructure that is scalable, sustainable, and adaptable to future technological advancements. This includes investing in high-speed internet connectivity, hardware, software, and other ICT equipment.
- Allocate a portion of the budget for training teachers and staff in ICT skills. This includes training on how to effectively integrate ICT into teaching practices and utilize digital learning resources.
- Explore partnerships with the private sector to leverage additional resources for ICT integration. This could include partnering with technology companies to provide discounted hardware or software solutions.

- Allocate funds for research and development in ICT integration in education. This includes funding for pilot projects, studies on best practices, and the development of innovative ICT solutions for education.

By implementing these policy actions, SELD, Government of Sindh can ensure a robust ICT infrastructure that supports successful integration and enhances teaching and learning outcomes.

6.4.2 Roles & Responsibilities of All Relevant Stakeholders

This section will discuss the roles and responsibilities of various stakeholders involved in the process of ICT integration in primary education. It will outline the specific contributions expected from each stakeholder group, including the Secretary of SELD, Government of Sindh, the Head of PPIU, District Offices of PPIU, Chief Monitoring Officers of the concerned districts, District Education Officers, Taluka Education Officers, Head Teachers, and Teachers, who are the real implementers. To ensure the effective integration of ICT in education through defining the roles and responsibilities of stakeholders, several policy actions are recommended.

1. Role of Secretary, SELD, Government of Sindh

The Secretary of the School Education and Literacy Department (SELD) in the Government of Sindh holds a pivotal role at the top of the organizational hierarchy. Responsible for overseeing educational policies and initiatives, the Secretary plays a crucial role in driving the integration of ICT in teaching and learning processes across the province. In this context, the roles and responsibilities of the Secretary, SELD, Government of Sindh, include:

- Provide overall supervision and contribute to the formulation of policies related to ICT integration in the teaching-learning process.
- Ensure alignment of ICT initiatives with provincial educational goals.
- Ensuring adequate resources, such as funding and infrastructure, for ICT integration projects.
- Monitor and evaluate the progress of ICT implementation in schools throughout the province.
- Overseeing the monitoring and evaluation of ICT integration programs to assess their effectiveness and impact.

2. Role of PPIU Head

The Head of the Provincial Program Implementation Unit (PPIU) plays a pivotal role in the successful implementation of education policies and initiatives under the School Education and Literacy Department (SELD) in the Government of Sindh. Reporting to the Secretary, SELD,

Government of Sindh, the PPIU Head is responsible for overseeing the execution of programs, projects, and policies related to ICT integration in the province. The PPIU head serve as a key liaison between its district-level offices, and other stakeholders, ensuring effective coordination and implementation at the grassroots level. The PPIU Head plays a crucial role in translating policy directives into actionable plans, monitoring progress, and ensuring that objectives are met in a timely and efficient manner. The roles and responsibilities of the PPIU Head include:

- Leading the PPIU in planning and executing ICT initiatives.
- Implementing education policies and initiatives related to ICT integration in province
- Overseeing the management and implementation of programs and projects aimed at improving education quality by integrating ICT in public sector schools of the province.
- Managing human, financial, and material resources allocated to the PPIU for effective program implementation
- Engaging with various stakeholders, including government officials, educators, parents, and community members, to ensure their participation and support
- Facilitating training and professional development programs for teachers, administrators, and other stakeholders to enhance their ICT skills and knowledge
- Monitoring the progress of ICT integration programs, evaluating their impact, and reporting findings to the Secretary, SELD
- Coordinating with district-level education offices, schools, and other relevant agencies to ensure the smooth implementation of programs and initiatives.
- Collecting, analyzing, and managing data related to ICT integration and education outcomes to inform decision-making and policy development
- Ensuring that ICT integration efforts meet quality standards and contribute to improved education outcomes.
- Providing regular reports to the Secretary, SELD, and other stakeholders on the progress and impact of ICT integration programs and initiatives.

3. Role of District Offices of PPIU

The District Offices of the Provincial Program Implementation Unit (PPIU) will be essential components in the implementation of education policies and initiatives at the grassroots level. They will operate under the umbrella of the School Education and Literacy Department (SELD), Government of Sindh, and will directly report to the PPIU Head. These offices will play a crucial role in bridging the gap between the PPIU head office and district-level education authorities. They will facilitate communication, coordination, and collaboration to achieve the

set goals of education policies and initiatives. The roles and responsibilities of the PPIU district offices include:

- Implementing ICT integration policies and initiatives at the district level as directed by the PPIU Head and in accordance with provincial guidelines.
- Managing and overseeing the execution of ICT programs and projects aimed at improving education quality and access in their respective district.
- Monitoring the progress of programs and projects, evaluating their impact, and providing regular reports to the PPIU Head.
- Organizing training and professional development programs for teachers and other relevant stakeholders within the district to enhance their skills and knowledge.
- Coordinating with schools, district education offices, and other relevant stakeholders to ensure the smooth implementation of education initiatives.
- Providing technical support and resources to schools.
- Providing regular reports to the PPIU Head and other stakeholders on the progress and impact of ICT integration programs and initiatives in the district.

4. Role of Chief Monitoring Officer (CMO), M&E Directorate

The Chief Monitoring Officer (CMO) works under the Directorate General of Monitoring & Evaluation (M&E) of SELD, Government of Sindh, and directly reports to the DG M&E. Every district has a CMO, whose current role includes monitoring schools to ensure teacher attendance. His responsibilities related to this program will include:

- Overseeing the monitoring and evaluation of ICT projects in the district.
- Collecting and analyzing data on ICT usage and its impact on educational outcomes.
- Ensuring that all schools in the district are adequately equipped with necessary ICT resources.
- Training and supporting teachers in effectively integrating ICT into their teaching practices.
- Identifying and addressing any challenges or barriers to ICT implementation.
- Reporting findings and progress to the relevant authorities to inform decision-making.
- Coordinating with other stakeholders to ensure the successful implementation of ICT initiatives in district.
- Monitoring the maintenance and functionality of ICT infrastructure in schools.

- Collecting and analyzing data on ICT usage and its impact in the respective district, and reporting findings to relevant authorities such as the DEO, DG M&E, and the PPIU Head for informed decision-making.

5. District Education Officer (DEO)

Every district in Sindh has two District Education Officers (DEOs). One DEO oversees primary schools, while the other is responsible for elementary, secondary, and higher secondary schools. The current role of both DEOs includes managing all administrative issues in their respective schools within the district. Coordinating ICT efforts at the district level. As these policy guidelines are prepared for primary education, this section only highlights the responsibilities of the DEO Primary in connection with ICT integration programs, which will include:

- Providing support to schools and encouraging teachers and head teachers to successfully implement ICT in primary education in the district.
- Monitoring the ICT programs in the district and reporting on district-wide ICT integration to other concerned authorities, such as the PPIU head.
- Ensuring that all primary schools in the district have the necessary ICT infrastructure and resources.
- Collaborating with other education officers and stakeholders to continuously improve ICT implementation strategies.
- Evaluating the effectiveness of ICT integration and making recommendations for improvements.
- Promoting digital literacy among students and teachers.

6. Taluka Education Officer (TEO)

The Taluka Education Office (TEO) is responsible for handling administrative and other school-related issues within the taluka and reporting to the concerned District Education Officer. The TEO's responsibilities for ICT integration under the policy include:

- Assisting in the implementation of ICT strategies at the taluka level.
- Ensuring compliance with ICT policies and guidelines.
- Facilitating the integration of ICT in teaching and learning processes.
- Monitoring and evaluating the effectiveness of ICT implementation.
- Collaborating with other stakeholders to promote ICT integration.
- Providing regular updates and reports on ICT integration progress to higher authorities.

7. Teacher

The school teacher plays a crucial role in implementing this policy, which aims to transform the education system from a teacher-centered to a learner-centered approach by utilizing ICT-integrated teaching strategies to enhance students' digital skills. The responsibilities of teachers in light of ICT integration will include:

- Integrating ICT into teaching and learning practices to enhance the learning experience.
- Participating in training programs to improve their ICT skills and proficiency.
- Providing feedback on ICT tools and resources to enhance their effectiveness in the classroom.
- Encouraging students to use ICT for learning and research purposes.
- Creating a conducive environment for ICT use in the classroom.
- Collaborating with other teachers to share best practices for ICT integration.
- Supporting students in developing digital literacy skills.
- Using ICT to differentiate instruction and meet the diverse learning needs of students.

6.5 Strategies for Sustainability of Program

To improve the quality of education and prepare students for the challenges of the digital age, this section will outline strategies to ensure the long-term sustainability of ICT integration in primary education in Sindh. These strategies will focus on funding, stakeholder engagement, continuous professional development, and regular review and updates of ICT policies and practices.

- **Remuneration and Performance**: Provide additional incentives or remuneration for teachers who effectively integrate ICT into their teaching practices. To ensure the sustainability of ICT integration, teachers' performance related to ICT integration should be reflected in their annual performance reports and linked with their promotions.
- **Incentives and Recognition:** Develop incentive structures, such as recognition programs, to motivate stakeholders to actively participate in ICT integration efforts.
- **Accountability for Devices:** Ensure that teachers are responsible for the proper use and safety of ICT devices in their classrooms, promoting accountability and device longevity.
- **Training and Access to Resources:** Access to digitized curriculum will be granted only to schools where teachers have undergone orientation training by PPIU. This measure is aimed at ensuring effective resource utilization and enhancing learning outcomes.
- **Funding Diversity and Partnerships:** Explore various funding sources and foster public-private partnerships to secure sustainable financial support and access to innovative ICT solutions.

- **Community Engagement and Capacity Building:** Engage parents and community leaders to garner support for ICT integration, while providing training programs to enhance stakeholder ICT skills and knowledge.
- **Collaboration and Networking:** Foster collaboration among schools, districts, and institutions to facilitate knowledge-sharing and the exchange of best practices in ICT integration.
- **Regular Updates and Maintenance**: Regularly update and maintain digital resources to ensure relevance and effectiveness, including software updates and device replacements.
- **Monitoring, Evaluation, and Policy Review**: Establish a robust framework for monitoring and evaluating ICT integration, and conduct regular reviews of policies to align with emerging trends and educational needs.
- **Institutionalization and Sustainability**: Embed ICT integration into the institutional culture and practices, ensuring long-term sustainability beyond individual projects.
- **Resource Sharing and Optimization:** Promote the sharing and optimization of ICT resources to maximize impact and minimize costs.

By implementing these strategies, primary education in Sindh can achieve sustainable ICT integration, leading to enhanced learning outcomes and improved educational experiences for students.

6.6 Overall Monitoring and Evaluation (M&E) Mechanism

This section will detail the accountability mechanisms and strategies for monitoring and evaluating the implementation of ICT initiatives. It will include the roles and responsibilities of various stakeholders in the M&E process. A multilayered monitoring mechanism should be adopted for the successful implementation and sustainability of the program. Here are a few proposed strategies for monitoring and evaluating the program. I propose implementing a monitoring mechanism for ICT integration:

- The PPIU will be responsible for designing and developing the M&E web portal for uploading monitoring reports.
- The Technical Section of the PPIU Head Office will assign usernames and passwords to all relevant stakeholders.
- The head teacher will monitor ICT usage in their school, prepare the reports, and upload them to the PPIU web portal.

- The TEO will monitor ICT integration in education, visiting each school at least twice a month within their jurisdiction. They will submit a monthly report on the PPIU web portal and share it with the District Education Officer.
- The monitoring assistants in each district will also gather ICT usage information from schools during their regular monitoring and share it with their respective Chief Monitoring Officer (CMO).
- The CMO of each district will be responsible for preparing and sharing the monthly report with the PPIU head office and the Director General of Monitoring and Evaluation (DG M&E).
- The PPIU head and DG M&E will share and discuss these monitoring reports with the Secretary of SELD for further progress and successful implementation of the ICT policy.

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Appendix A
Pre-Test & Post Test Tool

Socio-demographic Information of Student

Student ID (For Office Use)	
Student Name طالب علم کا نام	
Gender صنف	1. Girl لڑکی 2. Boy لڑکا
School Name اسکول کا نام	
SEMIS Code	
School Type اسکول کی قسم	1. Girls لڑکیاں 2. Boys لڑکے 3. Mix مکس
Percentage in Previous Class	
Tuition ٹیوشن	1. Yes ہاں 2. No نہیں
Favorite Subject پسندیدہ سجیکٹ	
No. of students in your class آپ کی کلاس میں طلباء کی تعداد	
Is your father educated? کیا آپ کے والد تعلیم یافتہ ہیں؟	1. Yes ہاں 2. No نہیں
Please specify his qualification برائے مہربانی یہاں ان کی اہلیت لکھیں۔	
Father Occupation باپ کا پیشہ	
Is your mother educated? کیا آپ کی والدہ تعلیم یافتہ ہیں؟	1. Yes ہاں 2. No نہیں
Please specify her qualification برائے مہربانی یہاں ان کی اہلیت لکھیں۔	
Is your mother employed? کیا آپ کی والدہ ملازمت کرتی ہیں؟	1. Yes ہاں 2. No نہیں
If yes, please specify her occupation. اگر ہاں، تو برائے مہربانی ان کے پیشہ کانام یہاں لکھیں۔	

Family structure فیملی اسٹرکچر	1. Nuclear Family 2. Joint Family	انفرادی خاندان جوائنٹ فیملی
Where do you live? آپ کہاں رہتے ہیں؟	1. City 2. Village	شہر گاؤں
Is school at your walking distance? کیا اسکول آپ کو پیدل فاصلے پر ہے؟	1. Yes 2. No	ہاں نہیں
If no, please specify the mode of transportation need to commute. اگرنہیں، تو براہ کرم سفر کے لیے نقل و حمل کے طریقہ کی وضاحت کریں۔	1. Local Transport 2. Public Transport 3. Personal vehicle 4. Monthly Shift in any vehicle 5. Other	لوکل ٹرانسپورٹ پبلک ٹرانسپورٹ اپنی گاڑی کسی بھی گاڑی میں ماہانہ شفٹ دیگر
Distance to School (Write in Kms) اسکول کا فاصلہ (کلومیٹر میں لکھیں)		
Time Taken to Reach School سکول پہنچنے میں کتنا وقت لگتا ہے۔		
Estimated Cost (monthly or daily basis) تخمینی لاگت (ماہانہ یا روزانہ کی بنیاد پر)		

Availability of ICT Gadgets Information			
1.	Do you have IT gadgets at your home? کیا آپ کے گھر میں آئی ٹی گیجٹس ہیں؟	1. Yes 2. No	ہاں نہیں
2.	If yes, select the device or equipment do you have (You can select more than one option). اگر ہاں، تو اپنے پاس موجود ڈیوائس یا گیجٹ کو منتخب کریں (آپ ایک سے زیادہ آپشن منتخب کر سکتے ہیں)۔	1. Desktop Computer 2. Laptop 3. Tablet 4. Smart Phone	
3.	Do you have Internet connection on your device? کیا آپ کے آلے پر انٹرنیٹ کنیکشن ہے؟	1. Yes 2. No	ہاں نہیں
4.	The device is your own or in sharing ڈیوائس آپ کی اپنی ہے یا شیئرنگ میں ہے۔	1. Your Personal 2. In Sharing with siblings	آپ کی ذاتی بہن بھائیوں کے ساتھ اشتراک میں
5.	For What purpose you use it? آپ زیادہ تر اپنے گیجٹ کس مقصد کے لیے استعمال کرتے ہیں	1. Study 2. Games 3. YouTube 4. Social Media (Facebook & WhatsApp)	اسٹڈی گیمس یوٹیوب سوشل میڈیا (فیس بک، واٹس ایپ)
6.	How many hours a week do you use your digital gadgets for study purpose?		

	مطالعہ کے مقصد کے لیے آپ ہفتے میں کتنے گھنٹے اپنے ڈیجیٹل گیجٹس استعمال کرتے ہیں؟	
7.	How many hours per week do you use your digital gadgets for fun & games? پ اپنے ڈیجیٹل گیجٹس کو تفریح اور گیمز کے لیے ہفتے میں کتنے گھنٹے استعمال کرتے ہیں؟	

Multiple Choice Questions

Sr.	Question	Options
1.	Stars are different from planets because_____ _____ستارے سیاروں سے مختلف ہیں کیونکہ	a. They have their own light ان کی اپنی روشنی ہے۔ b. They are fixed وہ ایک جگہ پر ہوتے ہیں۔ c. Both A & B اے اور بی دونوں d. They move around the sun وہ سورج کے گرد گھومتے ہیں۔
2.	a. The sun is a_____ سورج ایک _____	a. Star ستارہ b. Planet سیارہ c. Both A & B اے اور بی دونوں d. None کوئی نہیں
3.	How many planets are there in the solar system? نظام شمسی میں کتنے سیارے ہیں؟	a. Nine نو b. Eight آٹھ c. Five پانچ d. Four چار
4.	_____is the biggest planet in solar system. _____نظام شمسی کا سب سے بڑا سیارہ ہے۔	a. Mercury عطارد b. Jupiter مشتری c. Mars مریخ d. Saturn زحل
5.	How many moons does the earth have? زمین کے کتنے چاند ہیں؟	a. One ایک b. Zero زیرو c. Two دو d. Many بہت سارے
6.	Which one of the following is the smallest planet in the solar system? مندرجہ ذیل میں سے کون سا سیارہ نظام شمسی کا سب سے چھوٹا سیارہ ہے؟	a. Mars مریخ b. Neptune نیپچون c. Mercury عطارد d. Earth زمین

7.	What is the source of heat and light for earth? زمین کے لیے حرارت اور روشنی کا ذریعہ کیا ہے؟	a. Moon b. Sun c. Both A & B	چاند سورج اے اور بی دونوں
8.	_____hottest planet of solar system. _____نظام شمسی کا گرم ترین سیارہ ہے۔	a. Mercury b. Sun c. Mars d. Venus	عطارد سورج مریخ زھرہ
9.	Which one of the following is the coldest planet of solar system? مندرجہ ذیل میں سے کون سا نظام شمسی کا سرد ترین سیارہ ہے؟	a. Saturn b. Neptune c. Uranus d. Pluto	زحل نیپچون یورینس پلوٹو
10.	Mars is smaller than earth but it has_____ Moon(s). مریخ زمین سے چھوٹا ہے لیکن اس کے _____ چاند ہیں۔	a. One b. Two c. Three d. Many	ایک دو تین بہت سارے
11.	Which of the following planets is no more part of solar system? مندرجہ ذیل میں سے کون سا سیارہ نظام شمسی کا اب حصہ نہیں رہا؟	a. Earth b. Neptune c. Pluto d. Venus	زمین نیپچون پلوٹو زھرہ
12.	_____is the planet closest to the sun. _____سورج کے قریب ترین سیارہ ہے۔	a. Mars b. Uranus c. Jupiter d. Mercury	مریخ یورینس مشتری عطارد
13.	_____ planet is the farthest one from the sun. _____سیارہ سورج سے سب سے دور ہے۔	a. Neptune b. Venus c. Pluto d. Saturn	نیپچون زھرہ پلوٹو زحل

14.	Venus and Earth both are of same size planets but _____ زہرہ اور زمین دونوں ایک ہی سائز کے سیارے ہیں لیکن---	a. Venus moves Faster than Earth زہرہ سیارہ زمین سے زیادہ تیزی سے حرکت کرتا ہے۔ b. Venus moves slower than earth زہرہ سیارہ زمین سے آہستہ حرکت کرتا ہے۔ c. Earth and Venus Move at same speed d. زمین اور زہرہ سیارہ ایک ہی رفتار سے حرکت کرتے ہیں۔
15.	_____ planet is made-up of iron. _____سیارہ لوہے سے بنا ہے۔	a. Uranus یورینس b. Mars مریخ c. Mercury عطارد d. Jupiter مشتری

Appendix B
Infrastructure Availability Tool

Effectiveness and Assessment of ICT Integration in Primary Education

Name of Head Teacher: _____ **Date:**_____

Experience (in years)**:** _____ **Posted in School Since** (Write Year):_____

School Name اسکول کا نام	**SEMIS Code:**
Level (Please specify grades) لیول (برائے مہربانی درجات کی وضاحت کریں)	1. Grade 1 to 5 جماعت 1سے 5 تک 2. Grade 1 to 8 جماعت 1سے 8 تک 3. Grade 1 to 10 جماعت 1سے 10 تک 4. Grade 6 to 10 جماعت 6 سے 10 تک 5. Grade 1 to 12 جماعت 1 سے 12 تک 6. Grade 6 to 12 جماعت 6 سے 12 تک
School Type اسکول کی قسم	1. Girls لڑکیاں 2. Boys لڑکے 3. Mix مکس
Taluka:_____ تعلقہ	1. Rural دیہی 2. Urban شہری

Section A: Availability of Infrastructure		
1.	Do you have computer lab in your school? کیا آ پکے اسکول میں کمپیوٹر لیب ہے؟	1. Yes ہاں 2. No نہیں
2.	please mention the year of establishment of lab in next column. برائے مہربانی اگلے کالم میں لیب کے قیام کا سال لکھیں۔	
3.	Who established the computer lab? کمپیوٹر لیب کس نے تعمیر کروائی؟	1. Government گورنمنٹ 2. Community کمیونٹی 3. Development Partner ترقیاتی پارٹنر 4. Corporate Social Responsibility سماجی ذمیداری کے تعاون سے
4.	Please write down the number of listed equipment in your computer lab or school. Write down zero if you don't have any. برائے مہربانی اپنی کمپیوٹر لیب یا اسکول میں درج آلات کی تعداد لکھیں۔ اگر آپ کے پاس کوئی نہیں ہے تو صفر لکھیں۔	
	4a. Scanner اسکینر	1. Yes ہاں 2. No نہیں
	4b. Printer پرنٹر	1. Yes ہاں 2. No نہیں
	4c. Multimedia ملٹی میڈیا	1. Yes ہاں 2. No نہیں
	4d. Smartboard اسمارٹ بورڈ	1. Yes ہاں 2. No نہیں
	4e. Desktop Computers ڈیسک ٹاپ کمپیوٹر	1. Yes ہاں 2. No نہیں
	4f. Laptops لیپ ٹاپس	1. Yes ہاں 2. No نہیں
5.	Do you have any power Backup Facility in the school? کیا آپ کے اسکول میں پاور بیک اپ کی کوئی سہولت ہے؟	1. Yes ہاں 2. No نہیں
6.	What kind of power backup facility do you have? آپ کے پاس پاور بیک اپ کی کس قسم کی سہولت ہے؟	1.Generator جنریٹر 2.UPS یو پی ایس 3.Solar System سولر سسٹم
7.	Specify the number of computers supported by the backup facility? بیک اپ کی سہولت سے کتنے کمپیوٹرز چلتے ہیں، تعداد بتائیں؟	

Section B: Internet Connectivity			
1.	Are the computers connected to the internet? کیا کمپیوٹرز میں انٹرنیٹ کنیکشن موجود ہے؟	1. Yes ہاں 2. No نہیں	
2.	What type of internet connection your school have? آپ کے اسکول میں کونسا انٹرنیٹ کنیکشن ہے؟	1. Fiberoptics 2. Wireless 3. Cellphone (3G/4G) 4. Other	فائبر آپٹکس وائرلیس سیل فون (تھری جی\فور جی) دیگر
3.	Please specify the name of Internet Service Provider (ISP). برائے مہربانی انٹرنیٹ سروس پرووائیڈر (آئی ایس پی) کا نام بتائیں	1. Ufone 2. Jazz 3. Telenor 4. Zong 5. PTCL 6. StromFiber 7. Other:	یوفون جیز ٹیلی نار زونگ پی ٹی سی ایل اسٹارم فائبر دیگر
4.	How many GBs internet connection your school have? آپ کے اسکول میں کتنے GBs کا انٹرنیٹ کنکشن ہے ؟	1. 1 GBs 2. 4 GBs 3. 5 GBs 4. 10 GBs 5. Other	1 جی بی 4 جی بی 5 جی بی 10 جی بی دیگر

Section C: Repair & Maintenance			
8.	How often computers are repaired? کمپیوٹرز کی کتنی بار مرمت کی جاتی ہے؟	1. Monthly 2. Quarterly 3. Half Yearly 4. Yearly 5. When out of Order 6. Never	ماہانہ سہ ماہی ششماہی سالانہ جب خراب ہو کبھی نہیں
9.	Who repairs and maintains the equipment? سامان کی مرمت اور دیکھ بھال کون کرتا ہے؟	1. Market 2. Vendor 3. IT/Hardware Specialist in your School 4. Other	مارکیٹ ٹھیکیدار موجود آپ کے اسکول میں آئی ٹی /ہارڈ ویئر کا ماہر دیگر

Section D: Financial Resources		
1.	Do you have funds allocated for maintenance of computer and other ICT equipment? کیا آپ کے پاس کمپیوٹر اور دیگرآئی سی ٹی آلات کی دیکھ بھال کے لیے فنڈز مختص ہیں؟	1. Yes ہاں 2. No نہیں
2.	If yes, please specify the source of funding. اگر ہاں، تو براہ کرم فنڈنگ کا ذریعہ بتائیں۔	1. Annual Budget سالانہ بجٹ 2. SMC Fund ایس ایم سی فنڈ 3. School Specific Budget (SSB) اسکول اسپیسیفک بجیٹ 4. Other دیگر
3.	Is there any specific budget for payment of internet connection bill? کیا انٹرنیٹ کنیکشن بل کی ادائیگی کے لیے کوئی مخصوص بجٹ ہے؟	1. Yes ہاں 2. No نہیں
4.	If yes, please specify the source of funding. اگر ہاں، تو برائے مہربانی فنڈنگ کا ذریعہ بتائیں۔	1. Annual Budget سالانہ بجٹ 2. SMC Fund ایس ایم سی فنڈ 3. School Specific Budget (SSB) اسکول اسپیسیفک بجیٹ 4. Other دیگر

Section E: ICT Equipment Usage		
1.	Have Primary students access to computer lab? کیا پرائمری کے طلباء کو کمپیوٹر لیب تک رسائی حاصل ہے؟	1. Yes ہاں 2. No نہیں
2.	If yes, how frequently you take your primary students to computer lab? اگر ہاں، تو آپ اپنے پرائمری کے طلباء کو کمپیوٹر لیب میں کتنی بار لے جاتے ہیں؟	1. Daily روزانہ 2. Weekly ہفتہ وار 3. Monthly ماہانہ 4. Quarterly سہ ماہی 5. Half Yearly ششماہی 6. Yearly سالانہ 7. Never کبھی نہیں
3.	What sort of activities mostly they performed in computer lab? وہ کس قسم کی سرگرمیاں زیادہ تر کمپیوٹر لیب میں انجام دیتے ہیں؟	1. Painting on MS Paint ایم ایس پینٹ پر پیٹنگ 2. Watch Videos related to subject سبق سے متعلق ویڈیوز دیکھنا 3. Both دونوں 4. Other دیگر

4.	For what purpose you are using the internet facility in your school? آپ اپنے اسکول میں انٹرنیٹ کی سہولت کس مقصد کے لیے استعمال کر رہے ہیں؟	1. Academic 2. Administrative 3. Both Academic & Administrative	صرف تعلیمی استعمال میں صرف آفس استعمال میں دونوں استعمال میں
5.	Who have the access to Internet? کس کو انٹرنیٹ پر رسائی حاصل ہے؟	1. Administrative Staff 2. Teachers 3. Both Teachers & Administrative Staff 4. Only Students 5. All students, Teachers & Administrative Staff	صرف ا آفس عملہ صرف اساتذہ آفس عملہ اوراساتذہ دونوں کو صرف طلباء کو آفس عملہ اساتذہ اورطلباء سب کو
6.	If teachers also have access to internet, for What purpose they are using Internet facility in school? اگر اساتذہ کو انٹرنیٹ کی رسائی حاصل ہے تو وہ انٹرنیٹ کس مقصد کے لئے استعمال کرتے ہیں اسکول میں؟	1. Email 2. Preparation of Class 3. Social Media (Facebook, WhatsApp) 4. Professional Development (Online Course or self-learning from various web resources) 5. Other	ای میل کلاس کی تیاری کے لیے سوشل میڈیا (فیس بک، واٹس ایپ) پیشہ ورانہ ترقی (انٹرنیٹ کے مختلف وسائل سے آن لائن کورس یا خود سیکھنا) دیگر
7.	If students also have access to internet, for what purpose they are using the internet in school? اگر طالب علموں کو انٹرنیٹ کی رسائی حاصل ہے تو وہ انٹرنیٹ کس مقصد کے لئے استعمال کرتے ہیں اسکول میں؟	1. Assignments 2. To search subject contents from various websites 3. Social Media 4. (Facebook, WhatsApp) 5. To watch subject related videos on YouTube 6. Other	اسائنمنٹ مختلف ویب سائٹس سے موضوع کے مواد کو تلاش کرنے کے لیے سوشل میڈیا (فیس بک، واٹس ایپ) مضمون متعلق یوٹیوب پر ویڈیوز دیکھنا دیگر
Section F: Human Resources			
8.	Do you have lab attendant in computer lab? کیا آپکے کمپیوٹر لیب میں لیب اٹینڈنٹ ہے؟	1. Yes 2. No	ہاں نہیں
9.	Do you have any IT teacher in your school? کیا آپکے اسکول میں آئی ٹی ٹیچر موجود ہے؟	1. Yes 2. No	ہاں نہیں

10.	If yes, please specify the number of IT teachers working in your school. Please write down zero if you don't have any IT teacher. اگرہاں، تو براہ کرم اپنے اسکول میں کام کرنے والے آئی ٹی اساتذہ کی تعداد بتائیں۔ اگر آپ کے پاس کوئی آئی ٹی ٹیچر نہیں ہے تو براہ کرم صفر لکھ دیں۔	
11.	Did your school teachers attend any IT related training provided by government or any development partner? کیا آپکے اسکول ٹیچرز نے کبھی کوئی سرکار یا ترقیاتی پارٹنر کی طرف سے آئی ٹی ٹریننگ حاصل کی ہے؟	1. Yes ہاں 2. No نہیں
12.	If yes, please specify the number of teachers who attended IT training. اگر ہاں، تو براہ کرم ان اساتذہ کی تعداد بتائیں جنہوں نے آئی ٹی ٹریننگ لی ہے۔	

Appendix C
Teachers Tool

Effectiveness and Assessment of ICT Integration in Primary Education

Note: *We ensure that your Information will never be disclosed, this will only be used for this survey.*

We ensure that your Information will never be disclosed, this will only be used for this survey.

Socio-demographic Information	
Teacher Name استاد کا نام	
Gender صنف	1. Male مرد 2. Female عورت
Designation عہدہ	1. PST پی ایس ٹی 2. JST/JEST جے ایس ٹی\جے ای ایس ٹی 3. HST ایچ ایس ٹی 4. Other دیگر
Qualification قابلیت	
Professional Qualification پیشہ ورانہ اہلیت	1. B.Ed. بی ایڈ 2. M.Ed. ایم ایڈ
Experience (in Years) تجربہ (سالوں میں)	
School Name اسکول کا نام	
SEMIS Code	
School Level (Please specify grades) لیول (برائے مہربانی درجات کی وضاحت کریں)	1. Grade 1 to 5 جماعت 1سے 5 تک 2. Grade 1 to 8 تک 8جماعت 1سے 3. Grade 1 to 10 تک10جماعت 1سے 4. Grade 6 to 10 تک10سے 6 جماعت 5. Grade 1 to 12 تک12سے 1 جماعت 6. Grade 6 to 12 جماعت 6 سے 12 تک
School Type اسکول کی قسم	1. Girls لڑکیاں 2. Boys لڑکے 3. Mix مکس

Note: In this questionnaire the word Information and Communication Technology (ICT) refers to all those technologies which are used in classroom like computers, smart phones, different softwares and online web resources.

Basic ICT Related Information			
10.	Have you done any basic computer course? کیا آپ نے کمپیوٹر کا کوئی بنیادی کورس کیا ہے؟	1. Yes 2. No	ہاں نہیں
11.	If yes, please select the relevant option. اگر ہاں، تو برائے مہربانی متعلقہ آپشن کو منتخب کریں۔	1. CIT 2. DIT 3. MS office Course 4. Online Course 5. Government Training 6. Other	سی آئی ٹی ڈی آئی ٹی ایم ایس آفس کورس آن لائن کورس گورنمنٹ ٹریننگ دیگر
12.	Do you have your own/personal ICT gadget at your home? کیا آپ کے گھر میں آپ کا اپنا/ذاتی آئی سی ٹی گیجٹ ہے؟	1. Yes 2. No	ہاں نہیں
13.	If yes, select the device or gadget you have. (You can select more than one option if applicable). اگر ہاں، تو اپنے پاس موجود ڈیوائس یا گیجٹ کو منتخب کریں۔(آپ ایک سے زیادہ آپشن منتخب کر سکتے ہیں)۔	1. Desktop Computer 2. Laptop 3. Tablet 4. Smart Phone	ڈیسک ٹاپ کمپیوٹر لیپ ٹاپ ٹیبلٹ سمارٹ فون
14.	Do you have Internet connection on your device? کیا آپ کے آلے پر انٹرنیٹ کنیکشن ہے؟	1. Yes 2. No	ہاں نہیں
15.	For what purpose do you mostly use your gadget(s) آپ زیادہ تر اپنے گیجٹ کس مقصد کے لیے استعمال کرتے ہیں	1. Preparation of Class 2. Social Media (WhatsApp, Facebook) 3. Games 4. Email 5. Other	کلاس کی تیاری کے لیے سوشل میڈیا (فیس بک، واٹس ایپ) گیمس ای میل دیگر

Knowledge Acquisition

In this table you are asked about ICT competencies. Kindly write how confident you are while performing following tasks using scale from 1 to 5. In this scale **1**=Not Confident, **2**=Slightly Confident, **3**=Somewhat confident, **4**=Quite Confident, **5**=Highly Confident

Competency	**1**	**2**	**3**	**4**	**5**
Identify appropriate ICT tools in order to incorporate national professional standards in classroom teaching. مناسب آئی کلاس روم کی تدریس میں قومی پیشہ ورانہ معیارات کو شامل کرنے کے لیے سی ٹی ٹولز کی شناخت کریں۔					

Create a document with text, tables, pictures, shapes and hyperlinks using word processor (MS Word) software. ورڈ پروسیسر (ایم ایس ورڈ) سافٹ ویئر کا استعمال کرتے ہوئے ٹیکسٹ، ٹیبل، تصاویر، شکلیں اور ہائپر لنکس کے ساتھ ایک دستاویز بنائیں۔					
Maintain students' attendance, exam results and other official record of s using spreadsheet software e.g., MS Excel. اسپریڈ شیٹ سافٹ ویئر جیسے ایم ایس ایکسل کا استعمال کرتے ہوئے طلباء کی حاضری، امتحان کے نتائج اور دیگر سرکاری ریکارڈز کو برقرار رکھیں۔					
Create a presentation for a lesson of your subject using MS PowerPoint or similar software. ایم ایس پاورپوائنٹ یا اس سے ملتے جلتے سافٹ ویئر کا استعمال کرتے ہوئے اپنے مضمون کے سبق کے لیے ایک پریزنٹیشن بنائیں۔					
Use search engine to find out the curriculum related contents from Internet and save on your computer. انٹرنیٹ سے نصاب سے متعلق مواد تلاش کرنے اور اپنے کمپیوٹر پر محفوظ کرنے کے لیے سرچ انجن کا استعمال کریں۔					
Send an email with an attachment of document or image. دستاویز یا تصویر کے اٹیچمنٹ کے ساتھ ای میل بھیجیں۔					
Use social media like WhatsApp, Facebook and Twitter to engage the students in academic interaction and active learning. طلباء کو تعلیمی تعامل اور فعال سیکھنے میں مشغول کرنے کے لیے سوشل میڈیا جیسے فیس بک، واٹس ایپ اورٹئٹر کا استعمال کریں۔					
Identify and evaluate educational software and web resources, and match them to curriculum standards and student needs. تعلیمی سافٹ ویئر اور ویب وسائل کی شناخت کریں اور ان کا جائزہ لیں، اور انہیں نصاب کے معیارات اور طلباء کی ضروریات سے مماثل کریں۔					
Join online meeting on different collaborative tools such as Zoom and MS Teams. مختلف کولابریٹو ٹولز جیسے زوم اور ایم ایس ٹیمز پر آن لائن میٹنگ میں شامل ہوں۔					
Schedule an online meeting on Zoom and MS Teams with students. طلباء کے ساتھ زوم اور ایم ایس ٹیمس پرآنلائن میٹنگ شیڈول کریں۔					
Troubleshoot common ICT problems such as lack of power and internet connectivity issue to ensure the minimal disruption in class. کلاس میں کم سے کم رکاوٹ کو یقینی بنانے کے لیے عام آئی سی ٹی کے مسائل جیسے کہ بجلی کی کمی اور انٹرنیٹ کنیکٹیویٹی کا مسئلہ حل کریں۔					
Devise lesson plans that incorporate ICT- supported activities to enhance students' acquisition of subject knowledge. اسباق کے منصوبے تیار کریں جن میں طالب علموں کے مضمون کے علم کے حصول کو بڑھانے کے لیے آئی سی ٹی سے تعاون یافتہ سرگرمیاں شامل ہوں۔					
Identify various curriculum standards and incorporate them with relevant digital tools to make the teaching-learning process more effective. نصاب کے مختلف معیارات کی نشاندہی کریں اور تدریسی سیکھنے کے عمل کو سپورٹ کرنے کے لیے متعلقہ ڈیجیٹل ٹولز کے ساتھ شامل کریں۔					
Incorporate relevant digital tools with curriculum standards and learning outcomes to enhance the efficiency of the teaching process.					

تدریسی عمل کی کارکردگی کو بڑھانے کے لیے نصاب کے معیارات اور سیکھنے کے نتائج کے ساتھ متعلقہ ڈیجیٹل ٹولز کو شامل کریں۔					
Identify various e-assessment tools to assess students learning outcomes in different ways. طلباء کے سیکھنے کے نتائج کو مختلف طریقوں سے جانچنے کے لیے مختلف ای-اسسمنٹ ٹولز کی شناخت کریں۔					

Training Need Assessment

In this table you are asked about the training needs for integrating of ICT into teaching learning process. Write your responses on scale of 1 to 5. Where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4= Agree, 5= Strongly Agree

Statement	1	2	3	4	5
I need help identifying the appropriate ICT tools in order to incorporate national professional standards in classroom teaching. مجھے کلاس روم کی تدریس میں قومی پیشہ ورانہ معیارات کو شامل کرنے کے لیے مناسب آئی سی ٹی ٹولز کی شناخت میں مدد کی ضرورت ہے۔					
I need help creating a document with text, tables, pictures, shapes, and hyperlinks using word processor (MS Word) software. مجھے ورڈ پروسیسر (ایم ایس ورڈ) سافٹ ویئر کا استعمال کرتے ہوئے ٹیکسٹ، ٹیبلز، تصویروں، شکلوں اور ہائپر لنکس کے ساتھ دستاویز بنانے میں مدد کی ضرورت ہے۔					
I need help to maintain attendance, grades, and other record of students by using spreadsheet software e.g., MS Excel. مجھے اسپریڈ شیٹ سافٹ ویئر جیسے ایم ایس ایکسل کا استعمال کرتے ہوئے طلباء کی حاضری، درجات اور دیگر ریکارڈ کو برقرار رکھنے میں مدد کی ضرورت ہے۔					
I need help to create a presentation for a lesson of my subject using MS PowerPoint or similar software. مجھے ایم ایس پاورپوائنٹ یا اس سے ملتے جلتے سافٹ ویئر کا استعمال کرتے ہوئے اپنے مضمون کی پریزنٹیشن بنانے کے لے مدد درکار ہے۔					
I need help using the search engine (google) in order to find out curriculum-related content from the Internet and save it on my computer. مجھے انٹرنیٹ سے سرچ انجن (گوگل) کا استعمال کرکے، نصاب سے متعلق مواد تلاش کرنے اور اسے اپنے کمپیوٹر پر محفوظ کرنے کے لیے مدد درکار ہے۔					
I need help for sending an email with an attachment of a document or image. مجھے دستاویز یا تصویر کے ساتھ ایک ای میل بھیجنے کے لیے مدد کی ضرورت ہے۔					
I need help for using social media like WhatsApp, Facebook, and Twitter to engage the students in academic interaction and active learning. جھے سوشل میڈیا جیسے واٹس ایپ، فیس بک، اور ٹویٹر کے استعمال کے لیے مدد کی ضرورت ہے تاکہ طلبہ کو تعلیمی تعامل اور فعال سیکھنے میں مشغول کیا جا سکے۔					
I need help identifying and evaluating educational software and different web resources in order to match them with curriculum standards and student needs. مجھے تعلیمی سافٹ ویئر اور مختلف ویب وسائل کی شناخت اور ان کا جائزہ لینے میں مدد کی ضرورت ہے تاکہ ان کو نصاب کے معیارات اور طلباء کی ضروریات سے ہم آہنگ کر سکوں۔					

I need help in joining an online meeting on different collaborative tools such as Zoom and MS Teams. مجھے مختلف کولابریٹو ٹولز جیسے زوم اور ایم ایس ٹیمز پر آن لائن میٹنگ میں شامل ہونے کے لے مدد کی ضرورت ہے۔					
I need help for scheduling a meeting on Zoom and MS Teams. مجھے زوم اور ایم ایس ٹیمس پر میٹنگ شیڈول کرنے کے لے مدد کی ضرورت ہے۔					
I need help to devise lesson plans that incorporate ICT-supported activities to enhance students' acquisition of subject knowledge. مجھے اسباق کے منصوبے وضع کرنے میں مدد کی ضرورت ہے جس میں طالب علموں کے مضمون کی معلومات کے حصول کو بڑھانے کے لیے آئی سی ٹی سے تعاون یافتہ سرگرمیاں شامل ہوں۔					
I need help identifying various curriculum standards and incorporating them with relevant digital tools to make the teaching-learning process more effective. مجھے مختلف نصابی معیارات کی نشاندہی کرنے اور انہیں متعلقہ ڈیجیٹل ٹولز کے ساتھ شامل کرنے میں مدد کی ضرورت ہے تاکہ تدریس سیکھنے کے عمل کو مزید موثر بنایا جا سکے۔					
I need help incorporating relevant digital tools with curriculum standards and learning outcomes to enhance the efficiency of the teaching process. مجھے تدریسی عمل کی کارکردگی کومزید بہتر کرنے کے کے لیے نصاب کے معیارات اور سیکھنے کے نتائج کے ساتھ متعلقہ ڈیجیٹل ٹولز کو شامل کرنے میں مدد کی ضرورت ہے۔					
I need help identifying various e-assessment tools to assess students learning outcomes in different ways. مجھے طلباء کے سیکھنے کے نتائج کو مختلف طریقوں سے جانچنے کے لیے مختلف ای-اسسمنٹ ٹولز کی شناخت میں مدد کی ضرورت ہے۔					

Appendix D
Interview Guide

Effectiveness and Assessment of ICT Integration in Primary Education

Interview Guide

RESPONDENT INFORMATION

Name:

Organization/institution:_____

Designation:_____

INTERVIEWER INFORMATION

Date of interview
(DD/MM/YY):

Interview Date:_____

Data Collection method:

1. Audio Recording
2. Field Notes
3. Both

Dear Sir/Ma'am,

I am currently engrossed in a research endeavor titled "Effectiveness and Assessment of ICT Integration in Primary Education." This study seeks to unravel the impact of ICT usage on students' performance while also scrutinizing existing infrastructures and identifying the necessary competencies for successful ICT implementation in primary schools. To enrich our understanding and gather diverse perspectives on ICT integration in primary education in Sindh, interviews will be conducted with key stakeholders from the School Education & Literacy Department (SELD), Government of Sindh. Your valuable insights are crucial to comprehensively assessing the landscape of ICT integration.

Common Questions for All Stakeholders

1. How do you see the use of technology in primary education in your area (school, district or province)?
2. What do you see as the potential benefits of ICT integration in primary schools?
3. What challenges or barriers do you believe exist in effectively integrating ICT in primary education?
4. Considering the diversity of schools in your region, are there specific challenges that you think might vary across different types of schools, and how can these be addressed?
5. Are there any specific ICT initiatives or policies that have been implemented in your region or school, and how have they impacted teaching and learning?
6. What are the key resources or support systems that you think are necessary for successful ICT integration in primary schools?
7. How would you gauge the overall readiness of primary schools to embrace ICT integration in your region?
8. In your opinion, what role does ICT play in enhancing the overall learning experience for students?
9. Can you share any successful examples or case studies where ICT integration has positively influenced academic outcomes in primary education?

Questions Specific to Decision Makers of School Education & Literacy Department, Government of Sindh

1. What are the main goals and objectives of ICT integration in primary education, as per your department's perspective?
2. How does your department allocate resources and funding for ICT integration in primary schools?
3. How does the current infrastructure at the district or taluka level facilitate or hinder the implementation of ICT initiatives in primary schools?
4. As a policy maker, how do you perceive the current status of ICT integration in primary education, and what role do policies play in promoting this integration?
5. Are there any ongoing or planned policy initiatives aimed at enhancing ICT integration in primary schools, and if so, can you provide insights into their key objectives?
6. In your opinion, what challenges exist at the policy level in ensuring effective ICT integration, and how can these challenges be addressed?
7. How do you envision the collaboration between policy makers and various stakeholders to foster a conducive environment for ICT integration in primary education?
8. From a policy perspective, what measures are in place to ensure equitable access to ICT resources and opportunities across different schools within the region?

Questions Specific to District Level Managers (District Education Officers and Taluka Education Officers)

1. What role do district-level education officers play in facilitating ICT integration at the local level?
2. How do you assess the readiness and capacity of primary schools within your district to adopt ICT?
3. Can you provide examples of successful ICT integration initiatives or projects in your district, and what factors contributed to their success?
4. From your perspective, what policy-level changes or interventions could further support the effective integration of ICT in primary education?
5. How does the current infrastructure at the district or taluka level facilitate or hinder the implementation of ICT initiatives in primary schools?
6. In your role, what strategies or initiatives have you found to be most effective in promoting teachers' ICT competencies at the district or taluka level?

Questions Specific to Implementers (Teachers)

1. How confident do you feel in using ICT tools and technologies in your teaching practices?
2. Based on your experience, how has ICT integration impacted your teaching methodologies and approaches?
3. Can you share any specific training or professional development programs you have attended to enhance your ICT competencies?
4. Can you share your experiences and challenges in integrating ICT into your teaching, including any successful strategies you have used?
5. What types of training and professional development opportunities would you like to get in the future to enhance your ICT skills (Like Basic ICT Training or How to integrate ICT in classroom teaching)?
6. What resources or support do you feel would better enable you to integrate ICT seamlessly into your classroom activities?
7. Can you share your experiences and challenges in integrating ICT into your teaching, including any successful strategies you have used?
8. Based on your experience, how has ICT integration impacted your teaching methodologies and approaches?

Appendix E
School List

Sr.	SEMIS	School Name	Taluka
1	403010372	GBPS Tando Jam Town Sindhi	Hyderabad Rural
2	403010403	GBPS Tando Jam Farm	Hyderabad Rural
3	403010204	GGPS Tando Jam Colony	Hyderabad Rural
4	403010131	GGPS Jhando Khoso	Hyderabad Rural
5	403010151	GGPS Sahib Khan Mirani	Hyderabad Rural
6	403010349	GBPS Saifal Noodani	Hyderabad Rural
7	403010075	GBPS Moosa Khatian	Hyderabad Rural
8	403010089	GBPS Tando Qaisar	Hyderabad Rural
9	403020199	GGLSS English Teaching @ Barrage Colony	Hyderabad City
10	403020055	GGPS Islamabad Colony	Hyderabad City
11	403020169	GGPS Central Jail	Hyderabad City
12	403020189	GBLSS Qazi Akbar	Hyderabad City
13	403020147	GBPS Liaquat Colony No. 2	Hyderabad City
14	403020229	GGHS Hyderabad Pilot	Hyderabad City
15	403030068	GGPS Hani Latifabad No.7	Latifabad
16	403030055	GGPS M.R. Zubairi	Latifabad
17	403030179	GGLSS Noor Islam	Latifabad
18	403030004	GBPS Latifabad No. 5	Latifabad
19	403030048	GGPS Tawakal Mirjat	Latifabad
20	403040054	GGPS Amna Sehrish Nagar	Qasimabad
21	403040039	GGPS Peon Colony	Qasimabad
22	403040025	GGPS Ismail Soomro	Qasimabad
23	403040004	GBPS Kirir Solangi	Qasimabad
24	403040064	GBLSS Shahbaz Town	Qasimabad

Appendix F
DEO Permission Letter

No. DEO(P)/ Hyd/2023/2023-214

OFFICE OF THE
DISTRICT EDUCATION OFFICER
(PRIMARY), HYDERABAD

Government of Sindh
Phone # 022-9210296 **Dated: 22-04-2023**

To,

Nasreen Sahito,
Pakistan Institute of Development Economics,
Islamabad

Subject: Authorization to Conduct Research on ICT Integration in Primary Education

Dear Mam,

I am writing to confirm that permission has been granted for you to conduct your research study titled "Effectiveness and Assessment of ICT Integration in Primary Education" within the schools under the administrative control of the District Education Office, Hyderabad.

Your research proposal has been reviewed and approved by our office. The study aims to assess ICT skills among teachers, evaluate the availability of ICT infrastructure, and examine the effect of ICT-based teaching methods compared to traditional methods on grade five students. You are authorized to:

1. Involve a maximum of eight to ten teachers from each selected school in a survey focused on assessing ICT skills.
2. Conduct a survey to assess the availability of ICT infrastructure in the selected schools.
3. Involve fifteen to twenty grade five students from each school.

This authorization is granted with the understanding that you will conduct your research ethically and responsibly, ensuring minimal disruption to the regular activities of the schools. You are required to maintain the confidentiality of all participants and use the data solely for the purposes of your study.

The headteachers of the selected schools have been informed about your research and have been requested to provide the necessary support and access to facilitate your work.

We wish you success in your research endeavors and look forward to the valuable insights your study will contribute to the effective integration of ICT in primary education.

Khalid Hussain Babar
District Education Officer (Primary)
Hyderabad