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TEACHERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGY TOOLS TO FACILITATE TEACHING IN EARLY CHILDHOOD CENTRES IN THE GOMOA CENTRAL DISTRICT

EKUA BOSOMEFI ACQUAYE

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A thesis in the Department of Early Childhood Education, Faculty of Applied Behavioural Sciences in Education, submitted to the school of Graduate Studies in partial fulfilment of the requirements for the award of the degree of Master of Philosophy (Early Childhood Education) in the University of Education, Winneba

AUGUST, 2025

DECLARATION

Student's Declaration

I, **Ekua Bosomefi Acquaye**, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: ……..……

Date: ……..……

Supervisors' Declaration

I, hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: **Prof. Hinneh Kusi**

Signature:……..……

Date:……..……

DEDICATION

To my parents, Dr Solomon Acquaye (Late) and Mrs. Lucy Acquaye

ACKNOWLEDGMENTS

I like to convey my sincere appreciation to my supervisor, Prof. Hinneh Kusi, for his indispensable direction, constructive criticism, and support throughout the study process. His proficiency and support has been vital in the successful execution of this research.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Despite growing emphasis on ICT integration in education, limited understanding exists regarding how early childhood teachers view and use ICT tools in their instructional practices in rural Ghanaian contexts, particularly within resource-constrained environments where infrastructural and sociocultural barriers may impede effective adoption. This study explored teachers‘ use of Information and Communication Technology (ICT) tools to support teaching and learning in Early Childhood Centres in the Gomoa Central District. The study employed qualitative research approach with a case study design guided by the Interpretivists‘ paradigm. Data were collected with the help of a semi-structured interview guide and structured observation checklist. The study employed purposive sampling technique to select 20 participants for in-depth interviews. Data from the field were analysed using thematic analysis. The research explored four key objectives: teachers' views on ICT integration, available ICT tools for instruction, implementation challenges, and existing support systems for effective use. Findings revealed that the teachers view the use of ICT for instructional purposes as beneficial, leading to significant improvements in learner engagement, particularly in literacy, numeracy, and science subjects. However, their experiences were complicated by unreliable electricity supply, alongside sociocultural tensions where parents perceived digital learning as mere entertainment. Smartphones and tablet emerged as the most commonly used ICT tools with radio-based learning resources in the local Fantse language. The study identified challenges spanning inadequate ICT infrastructure, unreliable electricity, limited ongoing professional development for teachers, while highlighting teachers' remarkable resourcefulness in creating informal support networks. The study recommends developing practical digital literacy training programmes, prioritising procurement of affordable portable devices, and institutionalising professional development that blends formal training with peer support networks to enhance effective ICT integration in early childhood education.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter presents the background to the study, statement of the problem, purpose of the study, research objectives, research questions, significance of the study, operational definition of terms, delimitation of the study and organisation of the study.

1.1 Background to the Study

Recent years have seen a tremendous pace of advancement in information and communication technology (ICT). The rapid growth of ICT has resulted in enormous changes in our private, social, and professional life (Li, 2013). We live in an _information society' which is dependent on ICT use; it is also a 'knowledge society' with intangible capital and learning, where growth is built on knowledge and creativity, both of which are crucial in early childhood education. Most firms now rely heavily on information and communication technology. Computers first appeared in classrooms in the early 1980s, and numerous academics believe that ICT will play a major role in education for the future generation. Modern technology provides several options for improving educational experiences in classrooms (Ghavifekr et al., 2014).

The educational system in Ghana is structured according to the British model, encompassing primary, secondary, and tertiary levels of education (Arnot et al., 2018). The Ghana Education Service (GES) and the Ministry of Education are responsible for the supervision of the system. Mandatory primary education is prescribed for children between the ages of six and twelve, spanning a duration of six years (Aziabah, 2017; Takyi et al., 2021). Following the completion of primary

education, students transition to junior high education, a three-year program that encompasses a range of subjects, including English, mathematics, science, social studies, and vocational skills. In Ghana, the senior high education program spans a duration of three years and is categorized into two distinct tracks, namely general education and technical education (Takyi et al.) The academic curriculum is designed to equip students with the necessary skills and knowledge required for advanced studies. Conversely, the technical education track is geared towards providing students with the practical skills and expertise needed for vocational careers (Aziabah, 2017), and the institutions of higher learning that specialize in the field of education prioritize the preparation and development of teachers (Mónico et al., 2020).

Despite the various reforms implemented in the Ghanaian education system to enhance the standard of education, the system still grapples with obstacles such as insufficient funding, inadequate infrastructure, and a dearth of teachers (Adu-Gyamfi et al, 2016; Aziabah & Aziabah, 2018; Quainoo et al., 2020). The implementation of this measure underscores the significance of acquiring quality education during the formative years, thereby emphasising the imperative for students to receive enhanced academic instruction during this period (Quainoo et al., 2020). Thus, according to Adu-Gyamfi and Otami (2020) stakeholders involved in Ghana's education system have acknowledged the significance of early childhood education and have consequently integrated it into the system. The incorporation of early childhood education into the educational system is crucial for the advancement of Ghana's human capital, as it serves as the fundamental basis for all subsequent education (Adarkwah, 2021; Atiku & Boateng, 2020). The early childhood educational program in Ghana is specifically designed for children aged between birth and five years, with a primary emphasis on their comprehensive growth and development. The educational

program comprises exercises that foster cognitive, social, emotional, and physical growth, alongside early literacy and numeracy proficiencies.

The incorporation of early childhood education into the Ghanaian education system has been determined to yield numerous benefits. According to Kabay et al. (2017), early childhood education assists in equipping children with the necessary skills for formal education and establishes a robust basis for their future learning. Also, according to Wolf (2020), children who have received early childhood education are more likely to exhibit academic success in primary school and beyond. Abdulai (2016) asserted that early childhood education plays a significant role in the social and economic advancement of a nation. Abdulai continued to argues that early childhood education plays a crucial role in mitigating poverty and inequality by affording children equal opportunities to learn and grow, irrespective of their socio-economic status. According to Neuman and Okeng'o (2019), early childhood education plays a crucial role in fostering lifelong learning and enhancing the growth of a proficient and capable workforce.

In contemporary times, technology and education are inseparably linked. The exponential expansion of Information and Communication Technology (ICT) has transformed the global landscape into a knowledge-based society (Enrique-Hinostroza, 2018; Meyer & Gent, 2016). The utilization of Information and Communication Technology (ICT) tools has gained significant prominence in the realm of education. The prioritization of incorporating Information and Communication Technology (ICT) into the pedagogical process is widely acknowledged by numerous governments and academic establishments across the globe (Dhital, 2018; Enrique-Hinostroza, Gil-Flores et al., 2017; Meyer & Gent, 2016). The integration of technology in the process of teaching and learning is

commonly referred to as Information and Communication Technology (ICT) and educational technology. Dhital, indicated that ICT and educational technology consist of technological tools that can be utilized for educational purposes, including physical devices like computers and tablets, educational software applications and games, and digital repositories and virtual learning environments accessible via the internet.

Within the field of Early Childhood Education, ICTs have the potential to enhance pedagogical practices by offering interactive and captivating learning opportunities, accommodating individualized learning styles, and promoting effective communication and collaboration among teachers, families, and learners (Masoumi, 2021). Kabay et al. (2017) argued that the utilization of ICT tools can furnish young learners with prospects to investigate, generate, and cooperate within a secure and encouraging environment. ICT tools, such as interactive whiteboards, multimedia projectors, and educational software, provide teachers with innovative ways to deliver their lessons, making learning more engaging and interactive for pupils. This can lead to a better understanding of concepts and improved retention of information by students. Furthermore, the use of ICT tools can provide pupils with access to a wealth of educational resources beyond the traditional textbook, which can broaden their knowledge and enhance their learning experience. Students can also develop essential digital skills using ICT tools, which are increasingly becoming necessary in today's job market (Jackman et al., 2021).

The incorporation of technology in educational practices, specifically in the context of early childhood education, has taken place in the Ghanaian educational system. The Ghanaian government has implemented noteworthy initiatives to integrate technology into the educational framework, encompassing the domain of early childhood education (Buabeng-Andoh, 2019; Gaspard-Richards, 2022).

Teachers are under pressure to include computers in their practices. To achieve the aims of this new curriculum, many schools worked hard to equip ICT facilities in their schools, such as computer labs, projectors, and so on. Yet, this chance and experience are not being leveraged on a large scale (Frydenberg & Andone, 2018). Teachers might change their ideas and have a better grasp of how to use technology in their teaching activities.

Many studies have been conducted to explore the use of ICT in the teaching-learning process (Ali et al., 2015; Hennessy et al., 2010). these studies which explored teachers' experiences with integrating ICT tools in early childhood education globally, revealed both opportunities and challenges. For instance, in Hong Kong, preservice teachers used ICT primarily in teacher-directed ways, influenced by school-level factors such as curriculum and infrastructure (Hu & Yelland, 2017). Similarly, in Greece, teachers‘ beliefs and self-confidence significantly shaped how ICT was integrated into preschool play, with many viewing it more as a learning tool than free play (Nikolopoulou & Gialamas, 2015). A study in Shanghai found that teachers valued ICT but lacked the pedagogical strategies for child-centered integration, highlighting a gap in both policy and practice (Dong & Newman, 2016). In Sweden, preservice teachers felt underprepared by teacher education programs, despite efforts by their instructors to promote digital competency (Masoumi, 2020). Moreover, a training intervention study in Qatar revealed that ICT-focused professional development significantly improved teachers‘ practices and reduced integration challenges (Ihmeideh & Al-Maadadi, 2018). Lastly, in Rwanda, rural teachers identified ICT as beneficial but struggled with poor infrastructure and insufficient training (Mpumuje, 2024). Despite these findings, little is known about the specific

context of early childhood teachers using ICT tools in rural districts in Ghana, particularly in the Gomoa Central District.

1.2 Statement of the Problem

The Government of Ghana has implemented noteworthy initiatives to integrate technology into the educational framework, encompassing the domain of early childhood education (Ofosu-Asare, 2024; Gaspard-Richards, 2022; Buabeng-Andoh, 2019). A standards-based curriculum has been introduced in early childhood centres, which encourages the teaching of digital skills to young children (Yulin & Danso, 2025; Dele-Ajayi et al, 2021). As part of this new curriculum, ICT is expected to be used in teaching all subjects, as it is one of the three key areas every school must focus on. The goal is to help children learn in deeper and more independent ways. To achieve this, teachers are encouraged to use tools like radio, television, and mobile phones to find and share useful learning materials in kindergarten classrooms (Ministry of Education, 2019a; 2019b).

Similarly, the Government of Ghana established a digital literacy programme named, ―Ghana Reads" in 2019. The project's goal was to use digital technologies to help primary school pupils improve their reading and writing abilities. Early childhood teachers were taught as part of the project how to use ICT resources such as tablets and educational applications to promote young children's reading development (World Vision International, 2019). Moreover, in 2019, the Ghana Education Service (GES) collaborated with Vodafone Ghana to develop the ―Instant Schools" initiative. The programme sought to offer students and teachers around the country access to digital instructional resources, especially those in early childhood education. Early childhood teachers may utilise the platform to supplement their instruction with digital resources such as video lessons, quizzes, and interactive activities (Vodafone

Ghana Foundations, 2019). Furthermore, the Government of Ghana, through the Ghana Education Service (GES), introduced the "One Teacher One Laptop" initiative as part of efforts to enhance teaching and learning with digital technologies. The programme aimed at promoting ICT-mediated teacher professional development by equipping all public school teachers, from Kindergarten to Senior High School, with laptops to support lesson preparation, instructional delivery, research, and continuous learning (Graphic Online, 2024). According to KA Technologies, the firm responsible for the nationwide distribution, the supply of laptops, training of teachers, and establishment of technical support centres across the country were completed in 2024. The initiative also includes aftercare services through the katcare App and toll-free support, further ensuring sustainability and accessibility of ICT tools for teachers (Graphic Online, 2024).

However, though studies have found that Ghanaian teachers generally recognize the importance of ICT in education, the actual use of digital tools in classroom instruction remains limited (Enu et al., 2018; Loh, 2022). For example, Enu et al. (2018) conducted a study involving basic school teachers and found that while most teachers were familiar with ICT tools such as social media platforms and could perform basic tasks, they rarely applied these tools in teaching and learning activities. The study identified major barriers such as lack of ICT infrastructure, insufficient internet access, and inadequate training in how to effectively integrate ICT into pedagogy. Similarly, Loh (2022) confirmed that although teachers held positive attitudes toward technology use, their classroom practices did not reflect these beliefs, largely due to logistical and capacity-related challenges.

In the context of early childhood education, studies by Abdullai and Dery (2018) and Bondah (2021) revealed that many kindergarten teachers do not use ICT

tools regularly for teaching. Abdullai and Dery found that most kindergarten teachers did not regularly use ICT due to limited access to devices and inadequate skills. Teachers lacked confidence and basic infrastructure to support ICT use. Similarly, Bondah reported that although teachers had positive attitudes toward ICT, they used it rarely because of limited training, poor institutional support, and a lack of clear ICT policies for early childhood education. These teachers reported a lack of access to digital devices such as computers and tablets, as well as limited training opportunities to build their capacity in using technology for instructional purposes. As a result, ICT use in early childhood settings tends to be minimal or nonexistent, despite national efforts to promote digital literacy at the preschool level. These findings highlight the gap between ICT policy intentions and actual classroom implementation.

An informal observation by the researcher in the Gomoa Central District in the Central Region reveals a worrying situation among early childhood teachers in the district. It was observed that, the teachers place prominence on teaching the contents of the curriculum without ICT tools in the early childhood centres. Also, aside the laptops which teachers were supplied with, the researcher observed many other ICT tools, including projectors and smart TVs were found to be lacking in many Early Childhood Centres in the District, which makes it alarming. Without these tools, integration becomes barely impossible. Again, there is still limited information about how teachers in the Gomoa Central District who have access to these tools actually use them in the classroom.

Failure to teach children with ICT tools in the classroom can have several terrible consequences that can negatively impact their academic and future professional lives (Mishra & Koehler, 2021). Children who are not taught with ICT tools in the classroom may miss out on opportunities to develop critical digital skills

that are becoming increasingly necessary in the modern world. As technology continues to advance, proficiency in digital skills such as computer literacy, online research, and digital communication are becoming essential for success in many careers. Without exposure to these skills early on, children may struggle to keep up with the demands of the workforce and may be left behind in the job market. Also, not teaching children with ICT tools in the classroom may hinder their ability to learn and understand complex concepts (Karsenti, 2019). Traditional teaching methods may not be sufficient to engage and challenge children who have grown up in a world where technology is ubiquitous. The integration of ICT tools can provide interactive and engaging learning experiences that can help children better understand and retain information (Kabay et al., 2017). As new technologies emerge and evolve, individuals who lack technological proficiency may struggle to adapt and may be left behind in an increasingly competitive and interconnected world (Jackman et al., 2021).

Although previous studies have examined the use of ICT in kindergarten classrooms in Ghana (Loh, 2022; Bondah, 2021; Enu et al., 2018; Abdullai & Dery, 2018), none of them focused specifically on the Gomoa Central District. For example, Bondah conducted research in public early childhood centres across various regions in Ghana, while Loh focused on kindergarten schools in the North Dayi District of the Volta Region. Similarly, Enu et al. (2018) carried out their study in basic schools located in selected regions across the country. Although Abdullai and Dery conducted their study in the Central Region, it was limited to only one early childhood centre and did not cover the broader context of Gomoa Central District.

Also, the majority of the previous studies employed a descriptive survey design (Loh, 2022; Bondah, 2021; Enu et al., 2018, Abdullai & Dery, 2018). The use of descriptive surveys may not capture the real-life experiences, practices, and

challenges teachers face when using ICT tools unlike a qualitative design which allows for a more in-depth exploration of teachers‘ actual experiences, providing richer, and more detailed data. Lastly, though these studies provided useful insights into ICT use in early childhood education, they did not investigate the support systems available to enhance teachers‘ effective use of ICT tools. Support systems can help stakeholders understand what structures need to be in place to promote the effective use of ICT in early childhood centres, ensuring a successful ICT integration. These gaps identified prompted this qualitative study on teachers use of Information and Communication Technology (ICT) tools in early childhood centres within the Gomoa Central District.

1.3 Purpose of the Study

The purpose of this study was to explore teachers‘ use of Information and Communication Technology (ICT) tools to support teaching and learning in Early Childhood Centres in the Gomoa Central District.

1.4 Objectives of the Study

The objectives of the study were to:

1. Explore teachers‘ views regarding the use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District.
2. Identify the ICT tools available to teachers for instructional purposes in Early Childhood Centres in the Gomoa Central District.
3. Examine the challenges teachers encounter in using ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District.

4. Examine the support systems available for teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District.

1.5 Research Questions

The following research questions were formulated to guide the study:

1. What are teachers‘ views regarding the use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?
2. Which ICT tools are available to teachers for instructional purposes in Early Childhood Centres in the Gomoa Central District?
3. What challenges do teachers encounter when using ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?
4. What support systems are available for teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?

1.6 Significance of the Study

This study holds practical significance for early childhood educators and educational practitioners. The findings would provide valuable insights into the real-world challenges and successes teachers encounter when integrating ICT tools in early childhood settings. Teachers currently struggling with technology implementation can benefit from understanding effective strategies and overcoming common barriers identified through their peers' experiences.

The study‘s findings would also inform policy development of the Gomoa Central District Education Directorate. The district education office can utilise the study's outcomes to formulate evidence-based policies for ICT integration in early

childhood education. Similarly, the findings could offer practical guidance for the development of teacher training programs, helping to organize more targeted professional development initiatives that address specific needs of early childhood teachers in ICT integration. The study would also highlight resource allocation needs, infrastructure requirements, and support systems necessary for successful technology implementation.

This study contributes to theoretical understanding of technology integration in early childhood education by exploring the intersection of pedagogical practice and technological innovation. It adds to the theoretical framework surrounding Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) specifically within the early childhood context. The research extends existing theories about teacher adoption of educational technology by examining unique factors that influence ICT integration when working with young children.

The study addresses significant gaps in the existing literature on ICT integration in early childhood education, particularly within the Ghanaian and broader African context. While extensive research exists on technology in education generally, limited studies focus specifically on teachers‘ use of ICT tools in early childhood settings in developing countries. This research contributes original empirical data to the growing body of literature on educational technology in African educational systems. It expands the international discourse on early childhood education and technology by providing culturally specific insights that can inform comparative studies. It would also become a reference material for other researchers interested in conducting research in this field of study.

1.7 Delimitation of the Study

Research delimitations define the boundaries and parameters that researchers intentionally establish to maintain focus and ensure the study remains manageable and coherent (Creswell & Creswell, 2018). These boundaries help establish the specific context, population, and methodological approach while ensuring the research question can be thoroughly investigated within the defined parameters. The study's scope is limited to certified early childhood educators who have had direct experience using ICT tools in their teaching practice. The study does not extend to primary schools, informal learning centres, or early childhood facilities in neighbouring districts. Also, this study was geographically delimited to early childhood centres within the Gomoa Central District of the Central Region of Ghana. The study focused exclusively on teachers working in formal early childhood education settings, including kindergartens, nurseries, and pre-schools within this specific district.

Again, the study was temporally bounded to examine current practices in terms of ICT integration. It specifically looked at teachers' views, available tools, challenges and existing support systems related to ICT tool usage in early childhood teaching and learning environments. The study concentrates on pedagogical uses of ICT tools. As such, student learning outcomes, parental perspectives, or institutional policy analysis, were not included in this study. Lastly, the study was methodologically delimited to qualitative research approach, specifically employing case study to explore the usage of these ICT tools among early childhood teachers. The research design is bounded by interpretive paradigm assumptions, focusing on understanding subjective experiences rather than measuring quantifiable outcomes or establishing causal relationships.

1.9 Operational Definition of Terms

ICT Tools: In the context of this study, Information and Communication Technology tools refer to the digital technologies and devices used to facilitate teaching and learning. These include but are not limited to laptops, desktop computers, tablets, projectors, smart TVs, radios, mobile phones, educational software, interactive whiteboards, mobile applications, and internet resources.

Teachers: For the purpose of this study, Teachers refer to trained and certified early childhood educators who are currently teaching in public or private early childhood centres in the Gomoa Central District.

Early Childhood Centres (ECE): In this study, these are formal educational institutions (both public and private) located within the Gomoa Central District that provide foundational education to children between the ages of 3 and 8 years, including nurseries, kindergartens, and lower primary classes.

Teachers' Views: In this study, teachers' views refer to the first-hand experiences and practical insights shared by early childhood teachers in the Gomoa Central District regarding their actual use of ICT tools in teaching and learning. This includes what they have done, observed, or encountered while integrating ICT into their instructional practices.

Instructional purposes: In this study, instructional purposes refer to the use of ICT tools to support and enhance teaching and learning activities. It involves teachers' use of ICTs to plan, deliver, and assess learning activities for children aged 3 to 8 years, focusing on cognitive, emotional, and physical development within the early childhood curriculum.

Support Systems: Support systems refer to the available structures, services, and resources that assist teachers in effectively using ICT tools. These may include

teacher training programs, provision of ICT equipment, technical support, administrative encouragement, and educational policies that promote ICT integration.

1.10 Organisation of the Study

This study is organised into five main chapters. Each chapter focuses on a specific aspect of the research to provide a logical flow and structure to the study. Chapter one presents the background to the study, the statement of the problem, the purpose of the study, research objectives, research questions, significance of the study, delimitation, limitations, and the operational definition of key terms. It sets the foundation for understanding the context and rationale of the study. Chapter two dealt with review of related literature. It is organised into theoretical and conceptual frameworks, empirical literature, and a review of related studies. The chapter highlights gaps in the literature that this study sought to address and provides a scholarly basis for the investigation. Chapter three outlines the methodology used in the study. It includes a description of the research philosophy, approach, design, population, sample and sampling techniques, data collection methods and instruments, data analysis procedures, and ethical considerations. This chapter four presents the data collected and provides a detailed analysis and discussion of the findings in relation to the research questions. It integrates participants‘ views with existing literature and the study‘s theoretical framework to provide insights into the teachers' experiences with ICT in early childhood education. The final chapter summarises the key findings of the study, draws relevant conclusions, and offers practical recommendations for policy, practice, and future research. It also highlights the contributions of the study to the field of early childhood education and ICT integration.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter of the study presents information on existing literature. The chapter discusses the theoretical review, conceptual review and empirical review. This chapter throws more light on the variables that are being studied and how these variables or concepts are supported by various empirical and theoretical literature.

2.1 Theoretical Review

This section of the study presents the theoretical review of the study and provides justifications for the importance of the theory to the study. The two theories that are discussed are the Technological Pedagogical Content Knowledge (TPACK) and the Diffusion of Innovation Theory.

2.1.1 Technological Pedagogical Content Knowledge (TPACK)

The Technological Pedagogical Content Knowledge (TPACK) framework was originally proposed by Mishra and Koehler (2006). The Technological Pedagogical Content Knowledge (TPACK) framework is a theoretical framework that describes the interplay between technology, pedagogy, and content knowledge (Chai, et al., 2016; Tondeur, et al., 2020). Akyuz (2018) emphasizes that it‘s important to understanding the unique relationships between these three components in effective teaching with technology. The framework suggests that effective technology integration requires an understanding of how technology, pedagogy, and content knowledge intersect and influence each other. The TPACK framework provides a holistic approach to understanding the challenges and opportunities associated with

the integration of technology in teaching, which can be valuable in identifying effective pedagogical strategies for early childhood education.

The TPACK framework holds significant theoretical value for this study as it underscores the significance of comprehending the convergence of technological, pedagogical, and content knowledge, which is essential for proficient technology-integrated teaching (Akyuz, 2018; Tondeur et al., 2020). The relevance of TPACK is noteworthy in this research, as it aims to examine the teaching experiences of teachers utilizing ICT tools in Early Childhood Centres located in the Gomoa Central District. The Technological Pedagogical Content Knowledge (TPACK) framework offers a valuable perspective for examining the incorporation of technology in teachers' instructional methodologies (Elas, et al., 2019). Utilizing TPACK, the study can differentiate the precise competencies and expertise that teachers require to proficiently incorporate technology into their pedagogical methodologies. Furthermore, the TPACK framework can serve as a means of assessing the efficacy of current support structures and pinpointing areas in need of enhancement (Tondeur et al.). According to Kulaksız and Karaca (2022), the framework offers a comprehensive perspective on the obstacles and prospects linked to the incorporation of technology in instruction, which can be advantageous in recognizing efficacious pedagogical methods for the domain of early childhood education.

The TPACK framework has been implemented in diverse educational contexts across multiple nations and has demonstrated efficacy as a mechanism for comprehending the confluence of technological, pedagogical, and content knowledge. The TPACK framework has been utilized in the United States to guide the creation of teacher education programs and assess the efficacy of professional development endeavours that seek to facilitate the integration of technology in pedagogy (Dewi et

al., 2021; Mouza et al., 2017). Also, the framework has been utilized in Australia to shape the creation of technology-related standards for teacher education and to steer the development of professional development initiatives for teachers (Barac & Prestridge, 2017; Drummond & Sweeney, 2017). The TPACK framework has moreover, been employed in the United Kingdom to assess the efficacy of technology integration in instructional methodologies at the primary and secondary education levels (Khine et al., 2019). The framework was utilized to ascertain the precise knowledge and competencies that teachers require to proficiently incorporate technology into their pedagogical methodologies (Drummond & Sweeney).

Furthermore, the TPACK framework has been implemented in several Asian nations, such as China, Taiwan, and Singapore. According to Xu and Sun (2019), the framework has been implemented in China to provide guidance for the development of teacher education programs that facilitate the integration of technology in teaching practices. The framework has also been employed in Taiwan to investigate the correlation between teacher beliefs and the integration of technology in pedagogical practices (Cheng, 2017). The framework has been utilized in Singapore to guide the creation of digital competency frameworks and assess the efficacy of technology integration in primary and secondary school pedagogies (Chai, et al., 2016; Tondeur, et al., 2020). Also, the TPACK framework, according to Ji and Shin (2020) and Kim and Lee (2017) has been instituted in South Korea to investigate the correlation between teacher beliefs and technology integration in pedagogical practices. The framework was utilised to ascertain the precise knowledge and competencies that teachers require in order to proficiently incorporate technology into their pedagogical methodologies (Lee et al., 2017).

The TPACK framework has been demonstrated to be a valuable instrument for comprehending the intricate interplay among technology, pedagogy, and content knowledge, which is essential for proficient technology-integrated instruction. The TPACK framework was used to understand how early childhood teachers' pedagogical and content knowledge influence their use of ICT tools in classroom instruction. Specifically, it provided a lens to explore teachers‘ views as shaped by their real-life experiences with technology integration in early childhood education (ECE) centres. Rather than focusing on abstract opinions, the framework helped examine how teachers apply their knowledge of pedagogy and content in conjunction with available technological tools. By doing so, the study captured how confident and capable teachers feel in using ICT to enhance teaching and learning, highlighting both strengths and gaps in their integrated knowledge and practice.

2.1.2 Diffusion of Innovation Theory

The Diffusion of Innovation Theory was first proposed by Everett Rogers in 1962 (Rogers, 2010). The Diffusion of Innovation Theory is a theoretical construct that clarifies the mechanisms underlying the adoption and dissemination of novel concepts, commodities, or technologies throughout a given societal structure (Dearing & Cox, 2018). According to the theory, the process of adopting and utilising novel innovations is contingent upon various factors, such as the attributes of the innovation, the characteristics of the adopter, and the societal environment in which the innovation is being introduced (Dearing & Cox,; Goh & Sigala, 2020). According to the theory, the process of adopting and utilising novel innovations adheres to a distinct pattern, referred to as the S-curve, that depicts the pace of adoption across a given period (Goh & Sigala). The Diffusion of Innovation Theory has been extensively applied across diverse domains, such as education (Sasaki, 2018; Scott &

McGuire, 2017), healthcare (Balas & Chapman, 2018; Leggott et al., 2016), and business (Abdalla et al., 2024; Sartipi, 2020) to comprehend the uptake and implementation of novel technologies, practices, or concepts.

The utilization of the Diffusion of Innovation Theory serves as a significant theoretical framework in this research, as it offers valuable insights into the obstacles encountered by teachers when adopting and implementing novel technological advancements. The theoretical framework according to Cirus and Simonova (2020), clarifies the process of technology adoption and utilization, and can be employed to discern the determinants that impact the adoption and utilization of novel technologies. The framework facilitates the identification of obstacles to the utilization of Information and Communication Technology (ICT) tools (Goh & Sigala, 2020).

Additionally, it offers valuable perspectives on enhancing the efficacy of current support systems or devising novel support systems to overcome these obstacles (Cirus & Simonova, 2020; Goh & Sigala, 2020). Through the utilization of the Diffusion of Innovation Theory, this study aims to determine the determinants that impact the assimilation and implementation of novel technologies, as well as the obstructions to the utilization of information and communication technology tools within the educational context under study. The framework can yield significant perspectives regarding the obstacles that teachers encounter when incorporating technology into their pedagogical approaches, and can contribute to the creation of effective tactics to facilitate the integration of information and communication technology (ICT) resources in the educational program (Dearing & Cox, 2018).

Furthermore, the Diffusion of Innovation Theory can be utilized to discern the efficacious support systems that facilitate the adoption and utilization of ICT tools in

Early Childhood Centres situated in the Gomoa Central District. On the other hand, the theory has the potential to pinpoint deficiencies in existing support systems and offer valuable perspectives on the development of novel support systems that can overcome these obstacles (Lawrence & Tar, 2018). The Diffusion of Innovation Theory has been widely utilized in diverse educational contexts to understand the integration and utilization of novel technologies, practices, or concepts. The theory has demonstrated effectiveness in explaining the interplay between diverse factors, including the attributes of the innovation, the characteristics of the adopter, and the sociocultural milieu in which the innovation is being implemented, in shaping the process of innovation adoption and utilization (Dearing & Cox, 2018; Lawrence & Tar).

The Diffusion of Innovation (DIT) theory was employed in this study to examine how various factors influence the adoption and use of ICT tools by early childhood teachers. The theory focuses on three key dimensions: the attributes of the innovation (in this case, ICT tools), the characteristics of the innovator (the teachers), and the social context in which the innovation is introduced (the school environment). DIT guided the investigation of the availability of ICT tools, the challenges teachers face in adopting them, and the support systems that exist to promote their use. It provided a useful framework for analyzing how factors such as perceived usefulness, ease of use, access to training, and administrative support affect teachers‘ willingness and ability to integrate technology into early childhood teaching.

2.2 Conceptual Review

2.2.1 The Use of ICT/Educational Technology in the Education

Information and Communication Technology (ICT) and educational technology have become increasingly important in the Ghanaian educational system

(Banji et al., 2020; Nkansah et al., 2020). Information and Communication Technology (ICT) in education refers to the use of technological tools and systems to support teaching, learning, and school management. ICT plays a vital role in facilitating access to information, enhancing lesson delivery, and promoting learner engagement. According to UNESCO (2021), ICT in education is not just about using computers, but also includes a range of technologies such as radios, televisions, mobile devices, and digital learning platforms to improve educational outcomes. ICT is widely acknowledged as a key driver in transforming traditional teaching into more interactive, learner-centred environments (Buabeng-Andoh, 2019).

ICT tools in education can generally be grouped into two broad categories: hardware and software. Hardware includes physical devices such as computers, laptops, tablets, projectors, smart TVs, radios, and mobile phones. These tools are used to deliver content visually and interactively, support multimedia learning, and enable access to educational resources online and offline (Aydin & Gürol, 2019). For example, projectors and smartboards are often used to present animated educational videos in early childhood classrooms, making learning more engaging for young children (Buabeng-Andoh, 2019). However, the use of such devices depends on the availability of infrastructure and the capacity of teachers to operate them effectively (Adarkwah, 2021).

On the other hand, software tools include educational applications, learning management systems (LMS) such as Google Classroom and Moodle, and subject-specific digital platforms designed to enhance literacy, numeracy, and other skills. These tools allow for interactive learning, personalized instruction, and assessment of student performance. In early childhood settings, software like ABCmouse, Starfall, and ScratchJr are commonly used to introduce basic concepts through games, stories,

and puzzles, promoting cognitive and language development in playful ways (Aydin & Gürol, 2019). The effective use of these tools, however, depends on teachers' knowledge of how to integrate them into the curriculum meaningfully (Buabeng-Andoh, 2019).

The use of ICT has the potential to improve the quality of education, increase access to education, and promote the development of critical skills for the 21st century. The use of ICT in Ghana's educational system has increased access to education (Nkansah et al., 2020). With the rise of online learning, students in remote or rural areas can access education without having to travel to the city. This has helped to reduce educational disparities and increase the number of students who have access to education. Also, according to Laryeafio (2018), ICT has improved the quality of education in Ghana. With the use of digital learning resources, teachers can access up-to-date information and teaching materials, which can enhance their teaching practices.

ICT has also help to make learning more interactive and engaging, which can improve student learning outcomes (Banji et al., 2020). ICT has the potential to promote the development of critical skills for the 21st century. As the world becomes more digital, students need to be equipped with the skills necessary to navigate digital environments. By integrating ICT into the curriculum, students can develop digital literacy skills, problem-solving skills, and critical thinking skills, which are essential for success in the 21st century (Laryeafio, 2018; Nkansah et al., 2020).

However, despite the potential benefits of ICT, there are also challenges that need to be addressed. One significant challenge is the lack of infrastructure and resources (Anaman et al., 2022). Many schools in Ghana do not have access to reliable internet connectivity, which can limit the use of ICT in the classroom.

Additionally, many schools do not have the necessary resources such as computers and tablets, which can limit the use of digital learning resources (Anaman et al., 2022; Banji et al., 2020). Another challenge is the lack of teacher training and support. Also, Yalley (2022) indicates that many teachers in Ghana do not have the necessary training to effectively integrate ICT into their teaching practices. This can lead to substandard teaching practices and a lack of understanding of how to use ICT effectively. To address these challenges, the Ghanaian government has made efforts to improve the use of ICT in the educational system (Anaman et al.; Nyamekye et al., 2021). The government has initiated programs to improve internet connectivity in schools and provide schools with the necessary resources such as computers and tablets. Additionally, the government has introduced teacher training programs to support teachers in using ICT effectively (Adarkwah, 2021).

2.2.2 The Role of Teachers in ICT Integration

The integration of Information and Communication Technology (ICT) in education is a cornerstone of contemporary pedagogy (Ghavifekr et al., 2014). A key player in this integration process is the teacher, who serves as the conduit between the technology and the students' learning (Razak, et al, 2019). The multifaceted role of teachers in ICT integration includes being facilitators, advocates for technological literacy, innovators, lifelong learners, and barrier mitigators. The first concept in the integration of ICT in teaching positions the teacher as a facilitator. In this pivotal role, according to Banji et al., 2020), teachers leverage ICT tools to foster a conducive learning environment that promotes collaboration, engagement, and critical thinking among students. Instead of solely serving as information providers, teachers guide and support students' learning experiences, enabling them to actively construct their knowledge (Banji et al.; Ghavifekr et al., 2014). ICT aids in this transformation from

a teacher-centred approach to a learner-centred model, where teachers guide students towards self-directed learning.

The next facet of a teacher's role in ICT integration is as an advocate for technological literacy (Maru et al., 2021). As digital literacy becomes increasingly crucial in the modern age, teachers help students develop a comprehensive set of skills. These range from navigating diverse software applications, understanding online safety protocols, to learning about digital etiquette (Belo et al., 2016). As role models for suitable technology use, teachers guide students to become responsible digital citizens, a skill integral to navigating the information age successfully. Progressing along the conceptual arc, students encounter teachers in the role of innovators. As technology continuously evolves, so must teaching methodologies. Teachers often find themselves experimenting with diverse ICT tools to discover the most effective ways of enhancing learning outcomes, contributing significantly to pedagogical innovation (Buabeng-Andoh, 2018). By adapting their teaching strategies to align with emerging technologies, teachers ensure their instruction remains relevant and engaging amidst the rapidly changing digital landscape.

The requirement for teachers to be lifelong learners is underscored by the integration of ICT in teaching (Belo et al., 2016). As technologies advance at a relentless pace, teachers must continuously update their skills and knowledge. By engaging in professional development, participating in learning communities, and actively seeking new learning opportunities, teachers stay abreast of the latest trends and best practices in ICT integration (Daguet, 2021). This commitment to continuous learning is critical for teachers to effectively incorporate evolving technologies into their classrooms. Lastly, teachers play an essential role as barrier mitigators in the process of successful ICT integration (Dele-Ajayi et al., 2021). Barriers can be

technical, such as unreliable internet access or insufficient hardware, or pedagogical, such as resistance to transitioning away from traditional teaching methods. By identifying these challenges and working towards solutions, teachers ensure the effective and sustainable integration of ICT into their teaching practice (Belo et al., 2016; Dhital, 2018).

2.2.3 Relevance of ICT Use in Education

According to Das (2019), Information and Communication Technology (ICT) has the potential to revolutionize education in developing countries by providing students with access to high-quality educational resources and connecting them with teachers and experts from around the world. One of the main advantages of ICT in education is that it can help to bridge the digital divide by providing students in remote or underserved areas with access to educational materials and resources that they might not otherwise have access to (Akarowhe, 2017; Hernandez, 2017). This can help to improve educational outcomes and reduce educational disparities. Moreover, the use of ICT in education can enhance the quality of teaching and learning by providing teachers with access to a wide range of educational resources, including digital textbooks, videos, and interactive learning tools (Hernandez). By incorporating ICT into their teaching practices, teachers can create a more interactive and engaging learning environment that can help to improve student motivation and engagement (Meyer & Gent, 2016).

Another advantage of ICT in education is that it can help to develop students' digital literacy skills, which are becoming increasingly important in the modern world (Akarowhe, 2017; Daguet, 2021). By using digital technologies to access and share information, students can develop the critical thinking and problem-solving skills that are necessary for success in the 21st century (Meyer & Gent, 2016). However, the

successful integration of ICT in education requires more than just providing access to technology. Teachers also need to be trained in how to effectively use ICT to enhance their teaching practices, and educational institutions need to have the necessary infrastructure and support systems in place to ensure that the technology is being used effectively (Das, 2019; Pandolfini, 2016).

2.2.3 Early Childhood Education (ECE) in Ghana

Early Childhood Education (ECE) is an essential part of education that aims to cater to the learning and developmental needs of children from birth to age eight (Bakken et al., 2017). In Ghana, ECE is a crucial component of the education system that can significantly impact children's lifelong learning and development (Kabay et al., 2017). The primary goal of ECE according to Oppong Frimpong (2021), is to promote children's cognitive, social, emotional, and physical development. This stage of education is critical because it lays the foundation for children's future learning and development. Wolf (2020) postulated that, ECE can help reduce inequalities in educational outcomes and improve children's chances of success in school and beyond. It can also promote children's social and emotional development and improve their overall well-being. High-quality ECE can provide children with the skills, knowledge, and attitudes they need to succeed in school and beyond (Ackah-Jnr, 2021). Children who attend high-quality ECE programs are more likely to perform better in school, have higher levels of literacy and numeracy, and are more likely to complete their education. Furthermore, ECE can support children's social and emotional development. High-quality ECE programs can help children develop social skills, emotional regulation, and self-control, which are crucial for success in school and later life (Agbenyega, 2018; Haslip & Gullo, 2018).

In Ghana, the government has made efforts to expand access to ECE. However, there are still significant gaps in coverage, quality, and equity (Agbenyega, 2018). According to the Ghana Education Service, only about 50% of children aged 3-5 years have access to ECE. Access is lower in rural areas and among disadvantaged groups such as girls, children with disabilities, and those from poor households (Ackah-Jnr, 2021). The quality of ECE in Ghana is also a concern, with many teachers lacking the necessary qualifications and training to support young children's development (Kabay et al., 2017). One significant challenge facing ECE in Ghana is the lack of funding (Ackah-Jnr.; Kabay et al., 2017).

According to Ackah-Jnr (2021), the government's allocation of resources to ECE is relatively low compared to other levels of education. As a result, many ECE programs lack basic resources such as teaching materials, toys, and books (Kabay et al., 2017). Additionally, ECE teachers in Ghana are often poorly paid, which can lead to low morale and high turnover rates. Another challenge facing ECE in Ghana is the lack of trained teachers (Haslip & Gullo, 2018; Lee & Wolf, 2019). Many ECE teachers in Ghana do not have the necessary qualifications or training to support young children's development effectively. This lack of training can lead to substandard teaching practices and a lack of understanding of children's developmental needs (Lee & Wolf).

In spite of all these challenges, investing in high-quality ECE in Ghana can have numerous benefits. Firstly, it can improve children's school readiness and educational outcomes (Mensah & Badu-Shayar, 2016). Children who attend high-quality ECE programs are more likely to perform better in school, have higher levels of literacy and numeracy, and are more likely to complete their education (Mensah & Badu-Shayar; Neuman & Okeng‘o, 2019). This, in turn, can lead to better job

prospects and increased earning potential. Also, ECE can support children's social and emotional development (Neuman & Okeng'o, 2019). High-quality ECE programs can help children develop social skills, emotional regulation, and self-control, which are crucial for success in school and later life. Furthermore, according to Bago et al. (2020), ECE can promote positive attitudes towards learning and improve children's motivation to learn. Also, by providing equal access to ECE, girls and children from disadvantaged backgrounds can have equal opportunities to succeed in school and beyond (Bago et al., 2020; Neuman & Okeng'o). High-quality ECE programs can also help to break down gender stereotypes and promote the full participation of girls in education and society.

2.2.4 Policy Framework and Curriculum Design for ICT in ECE

Navigating through the intricate landscape of Early Childhood Education (ECE), it is imperative to scrutinize the existing policy frameworks and curriculum designs that govern the integration of Information and Communication Technology (ICT). Huang et al. (2021) and Ng et al. (2017) delineate the advancements and ongoing challenges in places like Hong Kong, where the infusion of innovative technologies like Augmented Reality is meticulously crafted to align with early childhood developmental goals, reflecting a concerted effort to harmonize technological innovation with pedagogical needs. Furthermore, the deliberation over policy frameworks and curriculum designs is not localised but resonates globally. Wiseman and Kumar's (2021) anthology sheds light on the intricate dynamics of policy frameworks in India, offering a lens through which one can discern the varying degrees of successful ICT integration across diverse educational landscapes. Their exploration unravels the subtle nuances of policy implementation and the ensuing ramifications on teacher quality and educational outcomes.

Adding another layer to this discourse, Su, et al. (2024) contemplate the future trajectories of curriculum design, specifically focusing on the incorporation of Artificial Intelligence (AI) in early childhood education. Their work signifies a paradigm shift, emphasising the burgeoning role of AI in shaping pedagogical strategies and curriculum frameworks to cater to the evolving educational needs and preferences of young learners. In a similar context, Martin et al. (2020) investigated the intricacies of course design and its influence on pre-service teachers‘ self-efficacy beliefs pertaining to ICT support for students. Their insights underscore the criticality of adeptly designed courses in bolstering teachers‘ confidence and competence in leveraging ICT tools, thereby facilitating enriched learning experiences for students.

The scope of these discussions extends to varied educational contexts, as demonstrated by Al-Hassan (2019) and Dong and Newman (2016), who delve into the developments and integrations of ICT in early childhood education in Jordan and Shanghai, respectively. Their findings illuminate the multifarious approaches to ICT integration, reflecting diverse pedagogical philosophies and contextual needs, and emphasising the pivotal role of meticulous curriculum design and coherent policy frameworks in fostering effective ICT integration in ECE.

2.2.5 Teachers’ Views on the Use of ICT in Early Childhood Education (ECE)

The use of Information and Communication Technology in Early Childhood Education is still in the early stages of development in Ghana. While there is recognition of the potential benefits of ICT in ECE, such as enhancing learning outcomes and preparing children for the digital age, there are also challenges that need to be addressed to ensure the effective use of ICT in ECE (Aydin & Gürol, 2019). One of the main challenges in the use of ICT in ECE in Ghana is the lack of access to ICT resources and infrastructure (Abdulai & Dery, 2018; Anaman et al.,

2022). Many schools in Ghana, particularly those in rural areas, lack access to computers, tablets, and reliable internet connectivity. This limits the ability of teachers to effectively use ICT in their teaching practices and hinders the potential benefits of ICT in ECE (Anaman et al., 2022). Another challenge is the lack of teacher training and support in the effective use of ICT in ECE. Many teachers in Ghana do not have the necessary training and skills to effectively incorporate ICT into their teaching practices. This can lead to substandard teaching practices and a lack of understanding of how to use ICT effectively in ECE (Adarkwah, 2021).

There are attempts in Ghana to increase the use of ICT in early childhood education. For example, the government has launched the Basic Education Computerisation Project (Wambugu et al., 2017), which intends to provide schools with computers and internet access. Furthermore, non-governmental organisations (NGOs) such as the Ghana Society for Education Technology (GSET) have created programs to educate and support teachers in the efficient use of ICT in early childhood education (Aidoo et al., 2022). While the use of ICT in ECE is still in its early stages in Ghana, there is potential for its effective use to enhance learning outcomes and prepare children for the digital age. However, it is crucial to address the challenges of access to resources and teacher training and support to ensure that the potential benefits of ICT in ECE can be fully realised in Ghana.

The integration of Information and Communication Technology (ICT) within Early Childhood Education (ECE) inherently brings forth substantial impacts on child development, encapsulating cognitive, social, and emotional dimensions. Hammed (2014) extensive research elucidates these impacts, examining how the interjection of ICT within early educational settings can mould and refine developmental trajectories. His work resonates with the theme of dual impacts, wherein the effective

implementation of ICT can yield enriching developmental outcomes, while its mismanagement can lead to detrimental consequences. Similarly, the studies conducted by Dong (2018) echo this sentiment by illuminating preschool teachers‘ perceptions of young children's aptitude in ICT. Dong‘s research underscores the profound influence of ICT on the cognitive development of children, evidenced by their advanced acumen and adaptability to technology from a tender age. However, it also hints at the potential repercussions of premature and unregulated exposure to technology, emphasising the need for balanced and conscientious ICT integration to safeguard the holistic development of young minds.

Alanko et al. (2019) add a nuanced layer to this discourse through their exploration of the implementation of digital portfolios in early childhood education. They demonstrate how such innovative integration of ICT can significantly enhance learning experiences, fostering cognitive and creative development. Nonetheless, they also caution against the unstructured implementation of such tools, advocating for meticulous planning and execution to circumvent any adverse developmental impacts. Reflecting on the role of ICT in ECE, Ukwueze and Ajala (2014) also contributed to the understanding of ICT‘s influence on child development. Their findings reiterate the transformative potential of well-integrated ICT in fostering enriched learning experiences, accentuating its role in shaping developmental pathways. However, their research simultaneously underscores the importance of mitigating the challenges posed by ICT integration to optimize developmental outcomes in early learning environments.

Further, Ford, et al. (2021) exploration of early childhood distance learning during the COVID pandemic sheds light on the newfound challenges and opportunities in leveraging ICT for child development. Their insights reveal the

pivotal role of adaptive and innovative ICT solutions in navigating the complexities of remote learning, underscoring the importance of addressing the multifaceted impacts of technology on child development in such unprecedented times.

In the Ghanaian context, empirical studies consistently confirm that although early childhood teachers acknowledge the benefits of ICT, its actual use in classroom settings remains minimal. Abdullai and Dery (2018) found that most kindergarten teachers seldom used ICT tools in instruction due to limited access to digital devices, lack of confidence, and inadequate infrastructure. Similarly, Bondah (2021) reported that despite teachers‘ positive attitudes toward technology, ICT use in classrooms was infrequent. This was largely attributed to insufficient training, weak institutional support, and the absence of clear ICT policies tailored to early childhood education. These findings reflect a significant gap between policy intentions and practical implementation in ECE settings. Also, Adarkwah (2021) examined the shift to online learning in Ghana during the COVID-19 pandemic and found that limited access to ICT tools, poor infrastructure, and inadequate teacher training hindered effective implementation. The study highlighted deep inequalities between urban and rural schools and stressed the need for stronger support systems to make ICT integration in education more effective and inclusive. Together, these studies highlight that while the intent to integrate ICT exists among teachers and in national education policy, actual usage in early childhood classrooms is often obstructed by systemic and contextual barriers.

2.2.6 Challenges in ICT Integration in ECE

The integration of Information and Communication Technology (ICT) in Early Childhood Education (ECE) brings to the fore numerous challenges and barriers, particularly in the alignment of new technological tools with existing

pedagogical practices. Hammed‘s (2014) work provides insight into these challenges, emphasizing the inherent difficulties educators face due to inadequate training and support, which are pivotal for the effective implementation and integration of ICT in early learning environments. This inadequacy in support and training is particularly detrimental as it leads to a lack of technological proficiency among educators, hindering the realization of ICT‘s full potential in early childhood educational settings.

Dong (2018) lent further perspective to this discussion, exploring preschool teachers' perceptions of ICT use, which also reflect the underlying challenges. The teacher's perceptions, as elucidated by Dong, often highlight a discernible gap between the apparent proficiency of young learners in ICT and the ability of educators to effectively integrate these tools, fostering a milieu of missed educational opportunities and unfulfilled potential. Alanko et al. (2019) delved into the practical aspects of ICT integration by discussing the implementation of digital portfolios in early childhood education. The complexities surrounding such implementations, as conveyed by their study, mirror the larger challenges of ICT integration, where the juxtaposition of digital tools with traditional educational paradigms creates a labyrinth of operational and instructional difficulties.

However, despite the increase in mobile phone usage, there are still challenges in terms of internet connectivity and digital literacy. Many areas, particularly in rural communities, still lack access to reliable internet connectivity, which limits the ability of individuals to take advantage of the benefits of ICT (Anaman et al., 2022). Additionally, many Ghanaians, particularly those in older age groups, lack the necessary digital literacy skills to effectively use ICT (May & Abreh, 2017). This limits their ability to access information, engage in online activities, and take

advantage of the benefits of the digital economy. The Ghanaian government has recognized the importance of improving digital literacy and has implemented several programs to address this issue (Nuhu, 2021). For example, according to Armah (2019), the government has launched the e-Ghana project, which aims to provide digital skills training to young people, women, and disadvantaged groups.

In a similar vein, Ukwueze and Ajala (2014) explored the role of ICT in early childhood education, drawing attention to the multifaceted challenges that mar the effective integration of technology in early learning. The nuanced understanding provided by their research underscores the crucial need for addressing these challenges to harness the transformative power of ICT in fostering enriched learning experiences in ECE. Romero-Tena et al. (2022) extend this dialogue to the realm of initial training for early childhood teachers, emphasizing the formidable challenge posed by the need for developing digital competences. Their cross-sectional study on the digital competences of early childhood teachers delineates the critical nature of this challenge, serving as a clarion call for enhancing training initiatives to bridge the existing competence gaps. Moreover, the dynamics of early childhood distance learning during events such as the COVID pandemic, as studied by Ford, et al. (2021), underscore the emergent challenges and opportunities in the ECE sector. Their research sheds light on the pressing need for adaptive solutions and innovative approaches to overcome the multifarious challenges and optimize the learning experiences for young children in such unprecedented circumstances.

2.2.7 Support Systems Available for Teachers to Use ICT in ECE

Support systems for teachers in the effective use of Information and Communication Technology (ICT) in Early Childhood Education (ECE) are crucial for the successful integration of ICT in the classroom. Several support systems are

available to teachers to use ICT in ECE in Ghana. One of the essential support systems is teacher training and professional development programs. Many organizations in Ghana, such as the Ghana Society for Education Technology (GSET), offer teacher training and professional development programs in the use of ICT in education (Gayatri, 2020). These programs aim to equip teachers with the necessary skills and knowledge to effectively integrate ICT into their teaching practices (Belo et al., 2016). Through these programs, teachers can learn about the use of digital learning resources and how to use them effectively in ECE. They also learn how to use ICT tools to enhance teaching and learning, such as interactive whiteboards, digital cameras, and educational software (Belo et al.; Gayatri).

Another support system available to teachers in Ghana is online resources and platforms. Various online resources and platforms are available for teachers to access digital learning resources and teaching materials. These resources include educational websites, online libraries, and e-learning platforms (Belo et al., 2016; Gayatri, 2020). Teachers can use these resources to supplement their teaching materials and provide students with additional learning opportunities. These resources also allow teachers to stay up-to-date with the latest developments in the field of ECE and ICT. Furthermore, teacher collaboration and mentoring programs are also support systems available to teachers in Ghana (Gayatri, 2020). These programs provide teachers with opportunities to collaborate with other teachers and mentors who have experience in the effective use of ICT in ECE (Anaman et al., 2022). Through these programs, teachers can share their experiences, learn from each other, and develop effective teaching strategies that incorporate ICT. Collaboration and mentoring programs also provide a support system for teachers to ask questions, seek advice, and receive feedback on their teaching practices (Belo et al.).

2.2.7.1 The Role of Leadership in ICT Integration

The role of leadership in navigating the trajectory of ICT integration within Early Childhood Education (ECE) is critically influential, serving as the catalyst that can both propel and hinder the synchronisation of technology within learning frameworks. For instance, Ukwueze and Ajala (2014) substantiated the importance of adept leadership in overcoming the myriad challenges and optimising the manifold opportunities inherent in the realm of ICT in ECE. Their insights draw attention to the intricacies of embedding ICT within early learning frameworks, highlighting the necessity of thoughtful leadership to harmonise the convergence of technology and pedagogy. In a related vein, Dong (2018) illuminated the crucial interplay between leadership and educators‘ perceptions of ICT, demonstrating how leadership can shape and refine the perspectives and interactions educators have with technology. The exploration into preschool teachers' perceptions by Dong offered valuable insights into the role leadership plays in fostering a conducive and harmonious learning environment, where the interweaving of education and technology is thoughtful and purposeful.

Furthermore, insights from Alanko, et al. (2019) and Martin et al. (2020) offered a nuanced understanding of how leadership influences not only the integration but also the perception and self-efficacy related to ICT among educators. They reveal how the strategic and discerning role of leadership is paramount in creating learning landscapes where educators feel empowered and competent to leverage technology effectively. The international perspective from studies like those by Al-Hassan (2019) and Dong and Newman (2016) also underscores the universal relevance and application of strong, informed leadership in driving successful ICT integration in varied cultural and educational contexts. They present a comprehensive view of the

multifaceted approaches to ICT integration in different educational landscapes, reinforcing the notion that effective leadership is the linchpin in actualising the potential of ICT in ECE. Conversely, the research of Hammed (2014) and Wiseman & Kumar (2021) accentuates the potential pitfalls and missed opportunities in the absence of solid leadership, underscoring the risks of fragmented and suboptimal ICT utilisation in early learning environments. These studies illustrate how, without the guiding hand of effective leadership, the alignment of ICT with educational goals can become a complex and unfulfilled endeavour.

2.2.7.2 Evaluation of the effectiveness of current support systems

The effectiveness of the current support systems available to teachers in Ghana in the use of Information and Communication Technology (ICT) in Early Childhood Education (ECE) varies. While these support systems have the potential to enhance the quality of education and improve learning outcomes, there are challenges that limit their effectiveness. Teacher training and professional development programs are one of the essential support systems available to teachers in Ghana (Zuurmond et al., 2018). However, these programs are not available to all teachers, particularly those in rural areas (Belo et al., 2016). Moreover, even when these programs are available, they may not be comprehensive enough to provide teachers with the necessary skills and knowledge to use ICT effectively in ECE (Belo et al.; Zuurmond et al.). Additionally, some of these programs may not be tailored to the specific needs of ECE teachers, who may require different training from teachers in other levels of education (Pisani et al., 2022).

The current support systems available to teachers in Ghana in the use of Information and Communication Technology (ICT) in Early Childhood Education (ECE) have several gaps and areas for improvement (Wolf et al., 2018). One of the

most significant gaps is the lack of comprehensive training programs. While teacher training and professional development programs are available, they may not be comprehensive enough to provide teachers with the necessary skills and knowledge to use ICT effectively in ECE (Wolf et al., 2019). There is a need for more comprehensive and specialized training programs that are tailored to the specific needs of ECE teachers. Such programs would help teachers acquire the necessary skills to use ICT effectively in their classrooms.

Another gap in the current support systems available to teachers in Ghana is limited access to these support systems (Belo et al., 2016). Many teachers, particularly those in rural or underserved areas, may not have access to the support systems available to other teachers. There is a need to expand the availability of support systems to ensure that all teachers have access to the necessary resources and tools to use ICT effectively in ECE (Zuurmond et al., 2018). Limited mentorship opportunities are also a gap in the current support systems available to teachers in Ghana. Teacher collaboration and mentoring programs can be effective support systems, but these opportunities may not be accessible to all teachers (Belo et al.; Zuurmond et al.). There is a need to expand the availability of mentorship opportunities to ensure that all teachers have access to the necessary support and guidance.

Finally, limited ICT infrastructure is a significant gap in the current support systems available to teachers in Ghana. Many schools in Ghana lack access to the necessary ICT infrastructure and equipment, such as computers, tablets, and reliable internet connectivity. There is a need for greater investment in ICT infrastructure to ensure that all teachers have access to the necessary resources and tools to use ICT effectively in ECE (Anaman et al., 2022).

2.2.7.3 Alternate Support Systems for Teachers ICT Integration

Alternative support systems are available to teachers in Ghana to use Information and Communication Technology (ICT) effectively in Early Childhood Education (ECE). Peer learning communities are one of the alternative support systems available (Agbenyega, 2018). These communities involve teachers coming together to share their experiences, ideas, and best practices in using ICT in ECE. This form of support system provides a platform for teachers to learn from each other and develop new teaching strategies (Adarkwah, 2021). Peer learning communities can be facilitated by educational institutions, non-governmental organizations, or professional associations (Wolf, 2020). This approach can enable teachers to interact with their peers and learn from their experiences, thereby building a community of practice around the use of ICT in ECE.

ICT mentors are another alternative support system for teachers in Ghana. ICT mentors are experienced professionals who provide one-on-one support to teachers in using ICT in their teaching practices (Shaeffer, 2016). This support system involves matching teachers with experienced ICT professionals who can provide guidance, coaching, and feedback on the effective use of ICT in ECE. This form of support system provides personalized support to teachers and enables them to develop the necessary skills and knowledge to use ICT effectively. ICT mentors can be sourced from educational institutions, professional associations, or non-governmental organizations (Wolf, 2020).

Online training programs are also an alternative support system available to teachers in Ghana. Online training programs are self-paced, flexible training programs that teachers can access online (Majoko, 2018). These programs provide teachers with the necessary skills and knowledge to use ICT effectively in ECE. Online training

programs can be accessed from anywhere, which makes them a convenient support system for teachers who may not have access to other forms of support. Online training programs can be developed by educational institutions, professional associations, or non-governmental organizations. ICT hubs are a physical alternative support system for teachers in Ghana (Ramot & Donitsa-Schmidt, 2021). ICT hubs are centres that provide access to ICT infrastructure, resources, and training programs for teachers. These hubs can be located in schools or other public spaces, and they can be used to provide teachers with access to computers, tablets, and reliable internet connectivity (Majoko, 2018). Additionally, ICT hubs can provide teachers with training programs and access to digital learning resources. ICT hubs can be established by the government, educational institutions, or non-governmental organizations.

2.3 Empirical Review

2.3.1 Teachers' Views of ICT Integration

Various studies have shown that teachers' views about ICT integration can significantly influence their future educational practices (Masoumi, 2021; Tondeur, et al., 2017; Tondeur et al., 2020). The perspective on ICT integration directly affects the development of teachers‘ digital competences and their comfortability with the use of technology as an educational tool (Meyer & Gent, 2016; Mónico et al., 2020). Sang et al. (2010) indicated that teachers' attitudes towards ICT integration are associated with their confidence in using technology and their beliefs about the effectiveness of technology in enhancing student learning. Thus, teachers who value ICT and perceive it as beneficial are more likely to integrate technology into their teaching.

Moreover, a study by Liu et al. (2017) reported that teachers' views of technology significantly influenced the extent of technology integration in the classroom. Teachers who viewed technology as an effective teaching and learning tool were more likely to integrate it into their instructional practices. Moreover, Deng et al. (2014) highlighted the impact of teachers' pedagogical beliefs on their views of ICT integration. According to the study, teachers with a student-centred approach to teaching were more likely to integrate ICT into their practices than those with a teacher-centred approach. Inan and Lowther (2010) also indicated that teachers' beliefs about the relative advantage of ICT, in terms of improving teaching and learning, have a positive effect on their ICT integration efforts. Conversely, teachers who perceive ICT as complex and difficult to use are less likely to integrate it into their teaching practices. Baydas and Goktas (2016) added that teachers' views about the usefulness and ease of use of technology can affect their intention to use ICT in their teaching. They reported that teachers who found ICT tools useful and easy to use were more likely to use them in their teaching.

Similarly, Muftawu (2024) conducted a study to explore parents‘ attitudes and perceptions towards the use of Information and Communication Technology (ICT) in early childhood education. The study involved 150 parents of children aged 3 to 6 years from 10 early childhood centers in urban areas of the Central Region of Ghana. A survey was used to collect data on parents‘ views about the effects of ICT on children‘s cognitive, social-emotional, and physical development, as well as their preferences on how and when ICT should be introduced. The results showed that most parents saw some educational benefits in using ICT, especially for children aged 4 to 6, but expressed concerns about overuse and exposure to inappropriate content. They were more cautious about ICT use for children under age 4. The study concluded that

while parents support ICT in early education, it should be used in a controlled and age-appropriate way. It recommended that early childhood centres develop ICT policies and guidelines that reflect parental expectations and protect young children.

Furthermore, Loh (2022) conducted a study to find out how kindergarten teachers in the North Dayi District of the Volta Region use Information and Communication Technology (ICT) tools in their teaching. The study used a descriptive survey design to collect data from 177 kindergarten teachers across six selected circuits in the district. The researcher used multistage sampling, including cluster, simple random, and purposive sampling techniques, to choose the schools and participants. Data were gathered through questionnaires, and results were presented using charts, tables, percentages, and bar graphs. The findings showed that most teachers believed ICT tools support language development, creativity, lesson understanding, cultural inclusion, and memory retention.

The study concluded that effective early-stage implementation of ICT is essential for successful teaching and learning. It recommended that headteachers provide enough ICT tools for classrooms, develop structured ICT learning plans, and ensure government policies support funding, installation, and maintenance of ICT resources. Teachers should also be trained and encouraged to develop positive attitudes toward using ICT in teaching. Despite substantial evidence on teachers‘ views toward ICT integration, there remains a need for context-specific, methodologically robust, and integrative studies that examine teachers‘ perspectives and actual classroom practices in Ghanaian early childhood education.

2.3.2 ICT Tools Available in Integration

In an increasingly digitized world, the range of ICT tools available for educational purposes is rapidly expanding. According to Ghavifekr et al. (2014),

computers and internet access are the primary tools for integrating ICT into education. Various educational software applications can be installed on computers to enhance learning experiences. Also, Henderson (2020) indicated that internet connectivity allows for the use of online learning platforms, websites, and resources. The availability of these basic tools may vary among schools, influenced by factors such as funding, infrastructure, and regional disparities (Ghavifekr et al., 2014).

Also, mobile devices such as tablets and smartphones have also gained traction in education due to their portability and versatility (Nikolopoulou & Gialamas, 2016). Applications for these devices facilitates interactive learning experiences, and their ability to connect to the internet enables access to online resources. In many developing countries, mobile technology is seen as a promising avenue for improving access to education (Miah & Omar, 2012; Misaki et al., 2016). In addition, digital projectors and interactive whiteboards can facilitate dynamic, visual, and interactive teaching experiences. They can make teaching more engaging and help cater to different learning styles (Gashan & Alshumaimeri, 2015).

A study by Abdulai (2014) conducted a study to explore the role of Information and Communication Technology (ICT) in early childhood education within the Winneba Municipality of Ghana. The study aimed to assess the availability, use, and administration of ICT tools in early childhood centers. A mixed-methods approach was used, involving questionnaires, field visits, and observations. A total of 44 early childhood educators from different schools and centers volunteered to participate in the study. The findings showed that there was limited availability and access to ICT tools in early childhood centers. Most teachers had little background in ICT, and ICT was often taught as a separate subject rather than being integrated across different subjects. The study concluded that ICT use in early childhood

education is low, and it recommended that teachers be trained to improve their ICT skills and to use ICT as a tool across all areas of learning.

Also, Asante (2014) carried out a study to find out how Information and Communication Technology (ICT) is being used in early childhood education in Ghana. The study took place in 250 schools across three regions of Ghana. One participant was conveniently selected from each school, and they answered a questionnaire designed by the researcher to collect information on the types of ICT tools available and teachers‘ background in ICT. Additionally, 50 of the participants were purposively chosen for interviews. The study used a mixed-method approach, combining survey and interviews. The findings showed that ICT use in early childhood classrooms, especially in public schools, was generally poor. The computer was the most commonly used ICT tool. Although many teachers believed ICT was important for teaching young children, 60% had no ICT knowledge, and 67% did not use ICT in their lessons. The study concluded that ICT integration in early years' education is low, and recommended that both pre-service and in-service teachers should be given specific training on how to use and apply ICT in teaching.

Another study by Enu et al. (2018) aimed to examine the ICT skills of basic school teachers and how they use ICT in the classroom. The study was carried out in basic schools located in selected regions across Ghana and involved 20 basic school teachers. A survey research design was used, and data were collected through lesson observations, questionnaires, and interviews. The qualitative analysis of the data showed that teachers had moderate ICT skills. However, it was found that most teachers used ICT mainly for personal purposes such as chatting and communicating on platforms like WhatsApp, Facebook, and WeChat. In the classroom, ICT integration was very low due to limited skills and lack of teaching resources. The

study concluded that although teachers have some ICT knowledge, they are not using it effectively in their teaching. It recommended that the Ghana Education Service should provide regular in-service training focused specifically on ICT integration for teaching and learning.

Similarly, Abdullai and Dery (2018) conducted a study to examine how Information and Communication Technology (ICT) is used to support parent-teacher engagement at the early childhood level in Ghana. The study was conducted at an early childhood center in the Central Region and used a descriptive cross-sectional survey design. A total of 172 participants, made up of 158 parents and 14 teachers, were selected through census sampling. Data were collected using a 12-item researcher-developed questionnaire and analyzed using frequencies, percentages, means, and standard deviations. The findings showed that smartphones and cell phones were the most commonly used devices for communication between parents and teachers, with announcements and homework being the main types of information shared. Both parents and teachers had a positive attitude towards using ICT for communication, although they raised concerns about limited access to ICT tools, lack of ICT training, and delayed responses. The study concluded that ICT is a useful tool for strengthening parent-teacher engagement and recommended efforts to improve access to ICT tools and training for both teachers and parents.

While prior studies have established that ICT availability and use in early childhood education in Ghana are generally low, there is a notable gap in research examining the effective pedagogical integration of diverse ICT tools, the specific competencies required by teachers, and the contextual factors influencing classroom implementation**.** Addressing these gaps would contribute to a deeper understanding of

how ICT can be meaningfully integrated to enhance teaching and learning in early childhood education.

2.3.3 Challenges Faced by Teachers in Using ICT Tools in Teaching

Several studies have highlighted the various challenges teachers face when trying to integrate ICT tools into their teaching practices. According to a study by Francom (2020), barriers to technology integration, such as access, time, and support, are external factors that teachers often report as obstacles. Despite the increasing availability of technology, issues related to inadequate access to resources and time constraints remain problematic for many teachers. Also, second-order barriers according to Pittman and Gaines (2015), on the other hand, are intrinsic and involve beliefs about teaching, learning, and technology. For instance, the study by Ertmer et al. (2015) found that teachers' beliefs about the complexity and difficulty of using ICT can hinder its integration into teaching practices.

Teacher education institutions also face significant challenges when trying to develop the learning environment required to combine teachers‘ technological, pedagogical, and content knowledge effectively (Jamil et al., 2018). In addition, technical problems and lack of competence are also significant barriers. A study by Buabeng-Andoh (2012) found that a lack of ICT skills was a significant barrier for teachers in Ghana, limiting their ability to integrate technology into their teaching effectively. Furthermore, institutional barriers such as a lack of support from school leadership, the absence of appropriate policies, and inadequate professional development opportunities can also hinder ICT integration (Arkorful et al., 2021). Another study by Amuko et al. (2015) also highlighted the significance of teachers‘ attitudes and beliefs about ICT and its relevance to their subject area as potential obstacles.

Raabu (2025) conducted a study to examine the effect of digital learning on Early Childhood Education (ECE) in the Northern Region of Ghana during the COVID-19 era. The study was carried out in three ECE centers using a qualitative case study approach. Participants included 15 ECE teachers and 3 parents, making a total of 18 individuals. Data were collected through interviews and focus group discussions and analyzed using deductive thematic analysis. The findings showed that teachers used audio, text, and visual-based learning methods, with their choices influenced by the availability and cost of resources. The overall impact of digital learning was moderate, with varying levels of effectiveness reported. Key challenges included limited access to digital devices, poor internet connectivity, language barriers, and low parental involvement. The study concluded that although digital learning has the potential to improve ECE in underserved regions, its success is limited by infrastructural, pedagogical, and socioeconomic barriers. The study recommended the implementation of digital literacy programs, improved infrastructure, better resource allocation, and professional development for teachers to support effective digital learning. Despite extensive identification of ICT integration barriers, there is limited empirical, theory-driven, and post-pandemic research particularly in Ghanaian ECE settings that examines how teachers‘ beliefs, competencies, and institutional support interact to influence sustained and effective ICT integration in everyday classroom practice.

2.3.4 Existing Support Systems Available for Teachers in ICT Integration

Support systems for teachers in integrating ICT tools come in various forms, including professional development programs, school resources, and educational policies, according to the literature. Professional development programs are crucial support systems, providing teachers with the necessary knowledge and skills to use

ICT tools effectively in their teaching (Perienen, 2020). These programs often include workshops, training sessions, and seminars, where teachers can learn about the latest ICT tools and how to use them to enhance teaching and learning. Also, a study by Ohlin (2019) found that effective professional development programs in ICT integration are characterised by their focus on content, active learning, coherence, duration, and collective participation. Such programs are designed to support teachers in overcoming the challenges of ICT integration. School resources are another form of support system. This includes physical resources such as ICT equipment and infrastructure, and human resources such as technical support staff. Adequate resources can facilitate the use of ICT tools in teaching (Anaman et al., 2022). Furthermore, educational policies can support ICT integration by providing a framework and guidelines for using ICT tools in teaching. Policies can also help address barriers to ICT integration, such as lack of resources, inadequate training, and resistance to change (Ohlin).

2.3.5 Alternate Support Systems Available to Teachers

The process of integrating technology into education is evolving, and so are the support systems that facilitate this integration (Quainoo et al., 2020). As teachers are required to adapt to this changing landscape, alternative or supplementary support systems have started to emerge, featuring innovative professional development programs, collaborative platforms, and reformed teacher education programs. Several studies have suggested the benefits of professional learning communities as a form of support system (Ohlin, 2019; Perienen, 2020). These communities are characterised by mutual cooperation, empathy, and shared responsibility among teachers, which can help them navigate the complexities of ICT integration together. In a study by Ferri et al. (2020), it was found that online communities can provide an effective platform for

teachers to share their experiences, strategies, and challenges in using ICT tools in teaching. These platforms can provide peer-based support, allowing teachers to learn from each other's experiences and to share best practices.

Furthermore, the literature suggests that teacher education programs need a significant shift towards more comprehensive training in ICT (Tondeur et al., 2017). This implies a reorientation of the curriculum to focus more on the pedagogical applications of ICT, rather than just the technical skills. New models of professional development are also emerging that focus on contextual, collaborative, and constructivist learning experiences. Such models consider teachers as active learners and support them in designing and implementing technology-enhanced learning activities (Ferri et al., 2020). In addition, policy support at the national and institutional level that focuses on incentivising the use of ICT in teaching could also serve as an effective alternate support system (Tondeur et al., 2017). Such policies could provide the necessary backing for the implementation and sustained use of ICT tools in teaching practices.

A review of previous studies reveals several key gaps that this study seeks to address. While studies such as Loh (2022), Asante (2014), and Enu et al. (2018) explored teachers' use of ICT in classrooms, they primarily focused on general usage patterns or teachers‘ ICT skills without thoroughly examining how these tools are used specifically for instructional purposes in early childhood education (ECE). Moreover, most of these studies did not explore the link between teachers' views, the availability of ICT tools, and how these factors influence classroom practice. Although Raabu (2025) and Abdulai (2014) touched on challenges related to digital learning and ICT use, their focus was broader and not limited to instructional use in early childhood settings. Significantly, none of the reviewed studies addressed the

existing support systems such as infrastructure, training, and administrative support that enable or hinder teachers' use of ICT in ECE classrooms. Furthermore, much of the existing research focused on national or regional levels, with limited attention to local contexts such as the Gomoa Central District. This creates a gap in localized data that can inform district-specific policies and interventions. Therefore, this study fills these gaps by providing a comprehensive and context-specific analysis of teachers' views, available ICT tools, instructional challenges, and support systems in early childhood centres within the Gomoa Central District.

There is a clear empirical and contextual gap in understanding how teachers‘ views, instructional use of ICT tools, associated challenges, and available support systems interact within early childhood education at the district level. This study addresses this gap by providing a comprehensive, context-specific analysis of ICT instructional practices and support systems in early childhood centres in the Gomoa Central District.

2.4 Conceptual Framework of the Study

The conceptual framework of this study presents a visual representation of the key variables explored in relation to the teachers use of ICT tools to support teaching and learning in Early Childhood Education (ECE) centres in Gomoa Central District. It outlines how the core elements of the study: teachers‘ views on ICT use, the availability of ICT tools, challenges encountered, and the support systems in place, interact to influence the overall integration of ICT in early childhood classrooms. This framework, as shown in Figure 1, is informed by the study‘s objectives and the existing literature on the use of ICT tools in ECE settings.

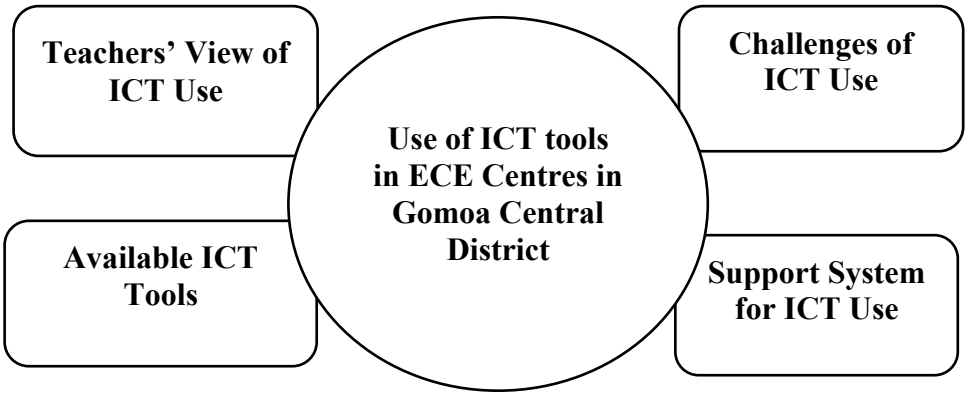

Figure 1: Conceptual Framework on teachers use of ICT tools to support teaching and learning in Early Childhood Education (ECE) centres in Gomoa Central District

Source: Researcher's Self-construct (2025)

At the centre of Figure 1 is the in use of ICT tools in ECE Centres in Gomoa Central District. Surrounding this are four interrelated variables: (1) teachers' actual experiences and views on ICT use, (2) the ICT tools available for instruction, (3) the challenges teachers face in using ICT, and (4) the support systems available to enhance ICT use. The framework highlights how these variables influence one another and collectively impact how ICT is used in practice within early childhood centres. For instance, teachers' views, shaped by their real-life experiences and exposure to technology, determine their willingness to adopt ICT in the classroom. When teachers perceive ICT integration as useful and feel confident in using it, they are more likely to integrate it into their teaching. However, these views are strongly influenced by the availability of ICT tools. Even motivated and knowledgeable teachers may be discouraged from using ICT if the necessary devices such as laptops, tablets, or projectors are unavailable or in short supply.

In addition, the challenges that teachers face, such as lack of training, poor infrastructure, and unreliable electricity, can directly hinder the use of ICT tools. These challenges not only make ICT use difficult but also negatively shape teachers' views, reducing their motivation and confidence. Support systems, such as

professional development, access to technical assistance, and administrative encouragement, play a crucial role in addressing these challenges. Effective support systems help teachers gain skills, boost confidence, and develop positive views about ICT use. Moreover, strong support can facilitate the provision and maintenance of ICT tools, thereby improving availability.

Together, these four variables interact dynamically. A deficiency in one area, such as weak support systems or limited access to tools, can affect the others and ultimately undermine ICT integration in early childhood classrooms in the District. On the other hand, when these elements work together effectively, they create a strong foundation for meaningful and sustained use of ICT in ECE in the Gomoa Central District.

2.5 Summary of Literature Review

The literature review synthesizes insights from theoretical frameworks, conceptual discussions, and empirical studies to provide a comprehensive understanding of the use of Information and Communication Technology (ICT) in Early Childhood Education (ECE), with a focus on the Gomoa Central District. The review was guided by two theoretical frameworks: the Technological Pedagogical Content Knowledge (TPACK) framework and the Diffusion of Innovation (DIT) theory. The conceptual review explored key themes such as the definition and purpose of ICT in education, the various tools used in early childhood classrooms, and the importance of integrating these tools into teaching and learning. It also addressed teachers‘ views on ICT use, the availability of ICT tools, challenges encountered in using these tools for instruction, and the types of support systems that enable or hinder their integration.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter presents the methodology that was followed to explore the teachers‘ use of ICT tools to support teaching and learning in Early Childhood Education (ECE) centres in Gomoa Central District. The chapter begins by establishing the philosophical underpinnings, followed by a detailed description of the research approach, design, study area, population, sample, sampling procedure, data collection methods, sampling procedures, and analytical techniques. The chapter also addresses the measures taken to ensure the quality and rigour of the research process as well as the ethical considerations.

3.1 Philosophical Assumption

This study is guided by the interpretivist research paradigm. Interpretivism focuses on understanding how individuals make sense of their world through their experiences and interactions (Ryan, 2018). It assumes that reality is socially constructed and shaped by personal meanings and interpretations (Pham, 2018). This makes interpretivism well-suited for the current study, which seeks to explore how early childhood teachers in the Gomoa Central District use ICT tools in their classrooms.

Since teachers‘ use of ICT is based on personal experiences, beliefs, and the context in which they work, the interpretivist approach allows the researcher to uncover the deeper meanings teachers attach to these practices (Alharahsheh & Pius, 2020). This is especially important for understanding not only what ICT tools are used but how and why they are used in specific ways. Interpretivism also emphasizes the role of context in shaping human behaviour. In this study, factors such as the school

environment, institutional support, and available resources are seen as influencing teachers‘ ICT practices. The paradigm‘s focus on rich, qualitative data is valuable for uncovering the challenges, motivations, and support systems teachers encounter.

Furthermore, the flexibility of the interpretivist approach allows the researcher to adapt to emerging insights during data collection (Curry, 2020), making it ideal for this exploratory study on a topic that has received limited attention in early childhood education. As a result of applying an interpretivist paradigm, this research has a good chance of capturing the intricate, multidimensional, and intensely personal experiences of teachers working in early childhood education within the Gomoa Central District who make use of information and communication technology (ICT) tools.

3.2 Research Approach

The qualitative research approach was utilised for this study. This approach allowed for an in-depth exploration of the perspectives of early childhood teachers in the Gomoa Central District regarding the use of ICT tools in teaching and learning. According to Creswell and Creswell (2018), qualitative research focuses on exploring and understanding the meaning individuals or groups ascribe to a social or human problem. It aims to capture real-life experiences and gain insights into how people interpret their world. This was essential for uncovering how teachers interact with ICT tools in their specific school environments.

Aligned with the interpretivist paradigm, the qualitative method supported the investigation of the teachers‘ subjective experiences, making it possible to collect rich, descriptive data that reflects the context and complexity of their daily practices (Lambert & Lambert, 2012; Ryan, 2018). It enabled the researcher to explore not only

what ICT tools are available but also how they are used, the challenges faced, and the support systems that exist within the teaching context.

The approach also offered the flexibility to adapt the study as new insights emerged, which is particularly important in exploratory research (Alharahsheh & Pius, 2020). Since the use of ICT in early childhood education has not been extensively studied in this specific context, the qualitative method allowed the researcher to probe deeper into under-researched areas and understand the broader socio-cultural and institutional factors that influence ICT use (Neely & Ponshunmugam, 2019).

Importantly, qualitative research does not only merely describe phenomena but also interpret and explain them based on participants‘ own accounts (Brannen, 2017). This made the approach suitable for addressing the study‘s objectives, including identifying the ICT tools available to teachers, exploring the challenges they face in using these tools, and examining the support systems that enhance their ICT integration. Therefore, the use of a qualitative research strategy for this study guaranteed that the research objectives are accomplished, and that the study creates useful insights and a better knowledge of the experiences that teachers have with ICT tools in early childhood centres in the Gomoa Central District.

3.3 Research Design

This study adopted the exploratory case study research design. An exploratory case study in qualitative research is a flexible, in-depth investigation used to examine phenomena with little prior research, aiming to define research questions, identify variables, or build hypotheses for future study (Baskarada, 2014). It provides a detailed, contextual understanding of a new or under-researched topic, often serving as a preliminary step for causal or explanatory research. This type of research design

lends itself particularly well to exploratory and descriptive inquiries. A detailed and nuanced knowledge of the phenomena that is being researched is possible because of the use of case studies, in which the unit of analysis is investigated in great detail within its actual-life setting (Gammelgaard, 2017). The design of a case study was used to develop comprehensive insights and give a better knowledge of complicated topics, both of which may not be attainable with other research design approaches.

Since the purpose of this study was to explore the teachers use of ICT tools in teaching and learning in early childhood centres located in the Gomoa Central District, case study, is an extremely appropriate choice. The researcher had the ability to dive deeply into the experiences of the teachers by using a case study approach. This allowed the researcher to capture the teachers‘ narratives, interpretations, and viewpoints on the utilisation of ICT tools in their teaching practise. Because of the way case study is designed, it was possible to conduct an in-depth investigation of the particular setting in which these experiences occur. This study included the socio-cultural, institutional, educational contexts, the individual experiences and practises of the teachers.

In addition, the design of the case study is consistent with the qualitative research technique and the interpretivist research paradigm that was selected for the research (Gammelgaard, 2017). The architecture of the case study is adaptable, which paves the way for an iterative process in which the researcher may modify the research tactics and questions depending on the newly uncovered information. This adaptability is especially useful for our study, which aims to investigate a subject that has received a comparatively low amount of previous research (Alharahsheh & Pius, 2020). During the course of the research process, there was always the possibility that new insights or unexpected results could surface, necessitating modifications to the

study methodologies. Therefore, the form of this study, a case study, is an excellent choice since it enabled an in-depth analysis of the experiences that teachers have had while utilising ICT tools in early childhood centres located within the Gomoa Central District.

3.4 Study Area

The study was conducted in the Gomoa Central District. The Gomoa Central District is situated within the Central Region of Ghana, West Africa. It is one of the twenty-two administrative districts of the region. Bordered to the north by the Agona East Municipal, to the south by the Effutu Municipal, to the east by the Awutu Senya East Municipal and to the west by Gomoa West District, its central location plays a significant role in its demographic composition, cultural richness, and economic activities. The Gomoa Central District is home to the Gomoa people, who are part of the larger Akan ethnic group, a predominant group in Ghana known for its rich cultural heritage. The district has a diverse population, consisting of individuals from different ethnic backgrounds. However, the majority are native Gomoa people who trace their lineage back to the original Akan settlers.

The principal language spoken in the Gomoa Central District is Fantse, a dialect of the broader Akan language. English, being the official language of Ghana, is also taught in schools and is used in formal settings such as governmental and non-governmental organizations. However, Fantse remains the dialect in day-to-day communications, community interactions, and cultural ceremonies. In 2023, the total population of the district was estimated to be 93,404. Out of this number, 42,438 were males, making up 45.4%, while 50,966 were females, making up 54.6% of the population. The Gomoa Central District's economy is primarily based on agriculture, with a significant proportion of the population engaged in farming activities. They

cultivate crops like cassava, maize, plantain, and other vegetables, which serve both local consumption and commercial purposes. Aside from agriculture, others are involved in trading, artisanal crafts, and a few in government and private-sector employment (Gomoa Central District Assembly, 2023).

Education in the Gomoa Central District is structured in accordance with the national policy of Ghana, providing basic education, secondary education, and vocational training. Currently, the district has about 81 basic schools with approximately 800 classrooms, covering both public and private institutions at the kindergarten, primary, and junior high school levels. It also has three Community Senior High Schools and a private university, Perez Dome, located in Pomadze (Gomoa Central District Assembly, 2023). These educational institutions play a crucial role in human resource development in the district.

3.5 Population

Population is about the complete collection of people, things, or occurrences that are of interest to the researcher because they have a trait or combination of qualities in common (Samii, 2016). It is the population from whom the researcher intends to generalise the findings of the study and draw conclusions. For the purposes of this study, the population of interest comprised all of the teachers who are currently working in early childhood centres located across the Gomoa Central District. Out of this general population, the target population comprised 108 teachers working in Kindergarten classrooms in the Gomoa Central District. The accessible population included all 58 Kindergarten teachers who had been trained and certified to teach at the Kindergarten level.

3.6 Sample and Sampling Procedure

A sample is a smaller group selected from a larger population to participate in a research study. Researchers use the responses and characteristics of a sample to draw conclusions about the entire population. The accuracy and generalizability of a study‘s findings largely depend on how the sample is selected (Brannen, 2017). For this study, a total of twenty (20) early childhood teachers were selected as participants. Purposive sampling technique was used to identify and select these participants. Purposive sampling is widely recognised in qualitative research for its effectiveness in selecting individuals who possess specific knowledge or experience related to the research topic. It allows the researcher to intentionally select participants who are most likely to provide rich, relevant, and detailed information (Etikan & Bala, 2017).

Given that the study aimed to explore the use of ICT tools in Early Childhood Education (ECE) classrooms, particularly in the context of the 2019 standards-based curriculum, specific criteria were established to guide selection of the participants. First, only teachers who were actively teaching in kindergarten classrooms (KG1 and KG2) were considered. Second, the study included only teachers who had formal training in Early Childhood Education, to ensure that the participants had the appropriate pedagogical foundation for the study. Third, only degree-holding teachers were selected, in line with the minimum qualification requirements outlined in the standards-based curriculum framework for ECE. Lastly, teachers with at least six years of teaching experience were included, as they were more likely to have been involved in various training prior to the rollout of the new curriculum and could speak meaningfully about the integration of ICT tools over time. This sampling approach ensured that the participants had both the academic background and practical

experience necessary to provide deep insights into the realities of ICT use in early childhood classrooms in the Gomoa Central District.

3.7 Data Collection Instruments

In collecting data on teachers‘ use of ICT tools to support teaching and learning in ECE centres in the Gomoa Central District, semi-structured interview guide and structured observation checklist were used.

3.7.1 Semi-structured interviews

Semi-structured interview guide was the primary instrument that was utilised in this study for the purpose of data gathering. Semi-structured interview allowed the researcher to explore teachers' personal view on the usage, challenges, and support systems regarding ICT integration in their teaching practices. The flexibility and adaptability of semi-structured interviews make them a popular choice in qualitative research (Tashakkori & Teddlie, 2010). This allows for a more in-depth study of a participant's viewpoints and experiences than is possible with more rigid interview formats. An interview guide is frequently used in semi-structured interviews. This guide gives an overview of themes or questions that are to be covered throughout the interview, but it also leaves room for impromptu questions and conversation. This type of interview gives the researcher the opportunity to probe for more specific replies, clarify unclear statements, and change questions as necessary based on the responses of the participants, all of which can result in the collection of data that is deeper and more complex (Karatsareas, 2022).

The interview guide that was used for this study was structured into five primary components, each of which aligned with the objectives of the study. The purpose of the questions was to investigate several aspects of the teachers'

experiences with the incorporation of ICT, such as their views on the use of ICT tools, the ICT tools that are already available, the challenges they encounter, and the support systems that are currently in place. The purpose of the first portion was to investigate the views of the teachers towards the integration of ICT resources into the classroom instructions. The questions that were asked in this section focused on the perspectives of the teachers, the effects that have been noticed, and the prospective improvements that may be made to teaching and learning via the use of ICT. In addition, the second part attempted to determine the many forms of ICT tools that are now accessible. The purpose of the questions in this part was to gain an understanding of the information and communications technology (ICT) tools that are most widely used, the access that teachers have to these tools, and the influence that these technologies have on teaching and learning.

Additionally, the third research question was devoted to research the challenges that teachers confront while utilising ICT resources. The questions that were asked in this section were designed to glean insights into the primary issues, their influence on teaching practises and outcomes, and potential methods to solve these challenges. Furthermore, the fourth aspect attempted to determine the various support structures that are already in place for the use of ICT-based teaching tools. The purpose of the questions in this part was to gain a better understanding of the efficiency, strengths, and limitations of the existing support systems, as well as prospective areas for development. The fifth and final section's objective was to investigate a variety of alternative support systems for the incorporation of ICT. The questions that were asked in this section aimed to discover potential extra support systems, practises from other areas or countries, and the potential roles that may be

played by external organisations and the government. The interview guide is provided in Appendix A.

3.7.2 Observation Checklist

Additionally, a non-participant classroom observation was used to collect valuable insights into availability of ICT tools, patterns and teaching behaviours in natural settings, capturing the gap between reported practices and actual implementation (Creswell & Poth, 2018). The study employed a structured observation checklist to examine the available of ICT tools the teachers used in their classrooms. According to O'Leary (2020), classroom observations are widely recognized for their ability to capture authentic instructional practices that might not be revealed through self-report methods. In this study, the researcher used non-participatory observation approach, meaning the researcher did not interact with teachers or learners during the lesson delivery. This allowed the researcher to focus objectively on the ICT tools available for teachers to use in natural classroom settings without influencing the behaviour of the participants. The observation checklist is provided in Appendix B.

Each teacher who participated in the interview was also observed once during a scheduled lesson. This approach ensured that the classroom practices of teachers across various centres in the Gomoa Central District were fairly represented. A structured observation checklist was designed to gather data on the availability and use of ICT tools by teachers in Early Childhood Education (ECE) centres. It focused on identifying specific ICT resources present in classrooms and whether these tools were actively used during instruction. The checklist consisted of nine (9) items developed in alignment with the study's second objective. The checklist was divided into two sections: Section A captured basic information about the class observed

while Section B listed various ICT tools (e.g., laptops, projectors, smart TVs) with options to indicate their availability and use. This instrument helped the researcher validate interview responses and obtain real-time, practical evidence of ICT integration in early childhood classrooms.

Each observation lasted for a single period of 30 minutes and was divided into two sections. During the observation, the researcher sat quietly in the classroom and recorded whether each checklist item was observed (Yes) or not observed (No). This method allowed the researcher to cross-check and validate the responses gathered through the interviews, offering a clearer picture of how ICT is being integrated into early childhood classrooms practices in the Gomoa Central District.

3.8 Research Trustworthiness

Several methods were used to assure the reliability of the study, which include credibility, transferability, dependability, and confirmability. Credibility was achieved through a variety of different methods. It was decided to use a method known as member checking, which involved providing the participants with the opportunity to evaluate and confirm the interpreted data. Because of this, the participants were given the opportunity to confirm that their viewpoints and experiences had been appropriately collected and reflected in the analysis. The findings were given an additional measure of credibility as a result of their responses and contributions. Detailed details of the research environment, participants, and the processes for data collection were supplied to guarantee that the findings might be applied to other situations. The purpose of this was to provide readers with a clear knowledge of the context and techniques of the study, which would allow them to decide the extent to which the findings may be transferable or relevant to other contexts or populations that are comparable. The findings of the study were made

available to other academics and practitioners who were interested in applying the findings in their own situations. This was made possible by giving exhaustive information regarding the research method.

To ensure dependability, an audit trail was kept and detailed documentation was compiled for each stage of the study process. As part of this, choices, methods, and adjustments made over the course of the research were recorded. It was assured that the findings of the study could be duplicated or validated by other researchers thanks to the meticulous documentation of the research method. The audit trail ensured there was no lack of openness and made it possible to investigate the study procedure for the presence of any possible biases, contradictions, or errors. Reflexivity was used to assure confirmability throughout the research process. This meant that the researcher acknowledged and reflected on their own viewpoints, assumptions, and potential biases at various points in the study. The researcher's assumptions were less of a factor in the data collecting and analysis as a result of this practise, which helped reduce their impact. Through the use of reflexivity, the researcher attempted to keep an objective and impartial attitude, which made it possible for the conclusions to be based on the experiences of the participants rather than the researcher's own judgements.

3.9 Data Collection Procedure

The data collection process begun with a letter of introduction (See Appendix C) obtained from the Head of Department of Early Childhood Education, University of Education, Winneba. Then, this letter was forwarded to the Gomoa Central District Education Directorate for another letter of introduction (See Appendix D) addressed to the heads of the various Early Childhood Centres in the District (see Appendix A). Subsequently, the researcher then visited the ECE centres with this letter. The heads

of the schools were briefed about the purpose of the study and the procedures to be used in collecting data.

The researcher then discussed the time schedules and appointments with the teachers such that the processes did not interfere with teaching and learning. With the interviews, these were conducted face to face because this data collection instrument allows for direct interaction between the researcher and the participants. The interviews lasted between 45 minutes to 1 hour, audio recorded by the researcher. This recording was done with the participants' express agreement, which ensures that their rights were respected and that there was no lack of transparency.

In order to foster an atmosphere that is amenable to candid and open exchange of ideas, the researcher ensured that each interview took place in a secluded and private setting. These settings were chosen by the teachers to ensure comfortability and less distractions. The objective was to provide a secure and private environment for the participants, within which they would be allowed to openly share their ideas and experiences in relation to the use of ICT tools. Before beginning the interviews, participants were given information on the objectives of the study, the fact that their participation was entirely voluntary, and the precautions that would be taken to protect their privacy and anonymity.

After the interviews, the researcher arranged separate days to observe each teacher in their classroom to see which ICT tools were available and whether they were used during teaching and learning. Each observation lasted about 30 minutes and followed a checklist. During the lesson, the researcher sat quietly and watched without interrupting. The researcher simply marked ―Yes" if something on the checklist was seen or ―No" if it was not. This helped confirm whether what the

teachers said in the interviews matched what they actually did in the classroom when using ICT tools.

3.10 Data Analysis Procedures

The data that was gathered through the interviews was analysed using Braun and Clarke's thematic analysis, which is a technique in qualitative research that is generally recognised and often used for discovering and analysing patterns or themes within the data (Braun & Clarke, 2006). The use of thematic analysis as a technique enabled a complete knowledge of the teachers' perspectives surrounding the use of ICT tools in early childhood centres located within the Gomoa Central District. This was made possible by the use of a method that was both systematic and rigorous in nature. It also helps identify patterns or themes from qualitative data.

First, the researcher listened to the recorded interviews and wrote them out word-for-word. The transcripts were then read several times to understand what the teachers were saying. Next, the researcher coded the data. This means important words or ideas were highlighted and labelled. These codes showed common ideas or experiences among the teachers. After that, the researcher looked for patterns in the codes. Similar codes were grouped together to form themes. These themes showed the key issues and ideas that came up in the interviews. The themes were then checked and improved. The researcher made sure the themes matched what the teachers said. Each theme was clearly named and explained. In the final stage, the researcher used quotes from the teachers to support each theme. The themes helped answer the research questions and gave insight into how teachers use ICT in early childhood centres in the Gomoa Central District. This step-by-step method helped the researcher organise the data well and made the findings trustworthy and meaningful. The observation was analysed using a checklist.

3.10 Ethical Considerations

This study took a number steps to guarantee that the research procedure complied with all ethical standards. Prior to the beginning of the study, approval letter from the department of Early Childhood Education, University of Education, Winneba) was sought out in order to satisfy ethical requirements. This phase was necessary for establishing the researcher's commitment to performing the study in an ethical manner and respecting the rights and well-being of the participants, which is one of the reasons why this step is so important. Before any of the participants were allowed to take part in the study, the researcher made sure to have their informed permission. The individuals who agreed to take part in the research were given in-depth information on the study, including its objectives, methods, possible drawbacks and upsides, as well as their rights as participants. Before freely giving their agreement to be included, they were given a sufficient amount of time to think about their involvement and ask any questions that came to mind. The procedure of obtaining informed consent ensured that participants were aware of the nature of the study as well as its ramifications, and that they were also aware that they were free to withdraw from the study at any time without incurring any penalties as a result of their decision.

Throughout the entirety of the study process, maintaining privacy and confidentiality was of the highest significance. The identity of the participants and any personal information that they provided were kept completely secret. In order to protect the participants' identity throughout the data processing and reporting processes, they were each given a distinct identification or a pseudonym. The researcher was the only person who had access to the data that was gathered, and suitable security steps were implemented to safeguard the data from being accessed or

disclosed by unauthorised parties. The outcomes of the research were presented in a manner that made certain that individual participants could not be recognised in any way. The rights and welfare of those who took part in the research were treated with the utmost consideration at all times. When interacting with the subjects of the study, the researcher made sure to keep a courteous and sympathetic attitude. Throughout the duration of the study procedure, the participants' independence, privacy, and dignity were treated with the utmost importance. Participants were given the assurance that their involvement was completely voluntary and that they might withdraw from the study at any point with no adverse effects occurring as a result of their decision. During the interviews, the researcher created a setting that was both secure and pleasant for the participants. This was done so that they would feel at ease speaking openly about their thoughts and experiences.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0. Overview

In this chapter, the researcher presented the data gathered from the interviews conducted on teachers‘ use of ICT tools to support teaching and learning in Early Childhood Education (ECE) centres in Gomoa Central District. This chapter is structured in line with the four research questions of the study. In line with the data analysis procedure adopted under the research methodology, the data were analysed under thematic headings. In most cases, direct quotations have been provided to put much emphasis where applicable.

4.1 Research Question One: What are teachers’ views regarding the use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?

This research question explored the teachers‘ views regarding the use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District.

Theme 1: Perceived Benefits of Using ICT Tools

The data indicate that ICT tools encourage greater attention, recall, and involvement, even among children previously passive in class. The study participants narrated that the digital tools help capture learners' interest and sustain attention, especially through interactive multimedia content. They also observed that when ICT is used through visually and auditorily engaging formats such as songs, videos, and pictures. It promotes higher learner engagement and retention. This is particularly evident in core foundational areas like literacy and numeracy. For instance, one teacher shared that storytelling sessions became more participatory when enriched

with visual and video content, which encouraged children's enthusiasm and involvement. This suggests that ICT doesn't just supplement learning; it reshapes how young learners interact with content, making learning more multisensory and memorable. While some teachers expressed initial ambivalence, they acknowledged that familiarity with digital devices among children could be leveraged pedagogically. One participant shared an optimistic view:

> *"I see how they can make learning exciting for the children, especially since many of them are already familiar with phones and TVs at home... I believe ICT can help... I started seeing how they could make teaching easier. For example, instead of drawing pictures on the board, I can show real images or videos"* (Interviewee I).

This sentiment was echoed by another teacher, who highlighted how ICT tools foster engagement, noting that:

> *"ICT tools made learning more interactive. The children pay more attention when they see moving pictures or hear sounds. For example, when we teach counting, instead of just using sticks, we sometimes play a counting song from a phone, and the children sing along and remember better"* (Interviewee Z).

Further reinforcing this view, a different teacher in an early childhood centre emphasised the impact of ICT on diverse learners, explaining:

> *"In language lessons, children who struggled to pronounce certain words improved when we played audio recordings. Also, in science, showing them, videos of animals helped them understand better than just looking at pictures in books. Even slow learners participate more when we use ICT"* (Interviewee W).

Another participant shared;

> *"ICT tools help children learn better; for example, using educational songs on the radio or videos helps children remember alphabet and numbers"* (Interviewee W).

Building on this, the participants further reflected on how visual and audio elements introduced through mobile devices have transformed traditional storytelling sessions into more interactive and participatory experiences.

> *I used the phone sometimes to show pictures and videos during storytelling. This makes children excited, and they participate more, which I didn't notice before using ICT*" (Interviewee H).

Insight gleaned from the dataset reveals a positive shift in how teachers perceive and utilise digital tools to enhance pedagogy. Teachers consistently described ICT as a catalyst for improving learner engagement, especially through multimedia that captures children's attention and aids memory retention. The data underscore how interactive technologies can support differentiated learning and promote inclusivity, especially for learners who typically struggle in traditional settings. The teachers further reported improvements in language acquisition and scientific understanding when using audio-visual aids. Thus, the study found that teachers with higher digital self-efficacy view ICT as a means to enhance learning rather than play.

Theme 2: Emotional Responses to Using ICT Tools

Teachers in early childhood centres in Gomoa Central District exhibit a range of emotional responses to ICT integration in early childhood education. From the data, this is shaped by their initial experiences and ongoing engagement with digital tools. The data indicate that early childhood teachers in the Gomoa Central Districts initially experience fear and hesitation due to limited knowledge of computers and concerns about handling fragile equipment. This apprehension is often linked to worries about potential damage to scarce resources and fear of blame, which can inhibit early adoption of ICT in their teaching practices. Relatedly, the exposure to targeted training sessions helped the teachers develop greater confidence and

recognise the potential benefits of ICT in easing instructional delivery. As a result, feelings of hopefulness and cautious optimism emerged regarding the future role of technology in pedagogy. These mixed perspectives illustrate the interplay between emotional responses, cultural norms, and practical realities in shaping ICT integration. This narrative is evident in the words of Interviewee B, who stated that:

> *–At first, I was afraid to use them because I didn't know much about computers. But after a few training sessions, I started seeing how they can make teaching easier*" (Interviewee T).

This fear was further highlighted when a different participant mentioned that:

> *–Some teachers are afraid, including me, to use ICT because they don't want to be blamed if something gets damaged*" (Interviewee D).

However, not all experiences were purely negative. Some of the participants provided a more balanced view:

> *–My view on ICT tools are mixed... some parents complain that too much screen time is bad. So, my perspective is shaped by both the benefits and the difficulties we face here*" (Interviewee G).

The data from the early childhood centre in Gomoa Central District illustrate the complex emotional and professional journey that early childhood teachers undergo when integrating ICT into their classrooms. The study uncovered that, initially, fear, uncertainty, and hesitancy were common due to limited digital literacy and concerns over damaging expensive or scarce equipment. These apprehensions were closely tied to feelings of accountability and a lack of confidence. However, with targeted ICT training, many teachers began to feel more competent and optimistic about the role of digital tools in easing their instructional workload.

Theme 3: Sociocultural Tensions around ICT Use

In the context of Gomoa, early childhood teachers navigating the integration of ICT in early childhood classrooms encountered notable socio-cultural tensions. From the study, these tensions stemmed primarily from a mismatch between the pedagogical intentions of teachers and the perceptions held by some parents and community members. For many families, especially those with limited formal education or exposure to digital learning tools, ICT use was misinterpreted as non-educational or recreational. The teachers disclosed how parents often associated screens with leisure and entertainment, leading to concerns that children were merely playing rather than engaging in structured learning. The narratives from the teachers indicate that the parents feared that prolonged exposure to digital devices could be detrimental to children's development. These concerns reflect broader socio-cultural values around child upbringing, discipline, and learning norms in rural Ghana. For instance, one teacher explained:

> *–Some parents think we're just letting children play instead of learning. Others complain that we're exposing them to too much screen time. But a few educated parents support it because they know it helps*" (Interviewee C).

Another teacher who highlighted parental resistance to ICT integration in the classroom:

> *–Some parents don't support ICT in school. They say it's a waste of time and that children should focus on books*" (Interviewee B).

Indeed, while ICT enhanced participation, it sometimes led to overstimulation, as noted by another teacher:

> *–The negative side is that sometimes they get too excited and start misbehaving, especially if the video or game is too entertaining*" (Interviewee R).

The integration of ICT tools in early childhood education centres in Gomoa Central District presents a complex interplay between educational innovation and socio-cultural expectations. Teachers‘ experiences highlight both the benefits and tensions involved. The data indicate improved classroom engagement and enthusiasm during ICT-based lessons. However, this engagement sometimes escalated into overstimulation, leading to behavioural issues when children were overly entertained by digital content.

4.1.1 Teachers' View of Their Own Digital Literacy and ICT Competency Levels

To demonstrate this evolution in digital literacy, one of the teachers shared a personal journey of overcoming initial challenges with interactive whiteboards, highlighting the role of persistence and collaboration.

> *"When I first started using the interactive whiteboard, I struggled with the calibration and often found myself pressing buttons that made the screen go blank. Through trial and error, I learned basic functions like drawing, highlighting, and playing videos. My colleagues helped me discover features I hadn't known existed, like the ability to save our group brainstorming sessions*" (Interviewee B).

Beyond individual experimentation, structured professional development also played a pivotal role, as evidenced by another teacher‘s experience with targeted training on technology integration:

> *"I attended a weekend workshop on integrating technology in early childhood education, which taught me how to use tablets effectively with young learners. The training covered age-appropriate apps and strategies for managing screen time in educational settings. I learned to create simple digital portfolios to document children's progress using photos and voice recordings. This knowledge transformed how I approached documentation and parent communication throughout the school year*" (Interviewee U).

Similarly, another teacher's account reflects how self-directed learning and gradual exposure to digital tools fostered confidence and creativity in tailoring technology to meet diverse classroom needs.

> *—Initially, I was intimidated by the computer software and often asked our IT volunteer to help set up activities. Over time, I taught myself to navigate basic programs like PowerPoint to create visual schedules and story presentations. I discovered how to adjust font sizes and colors to make materials more accessible for children with different needs. My confidence grew as I experimented with creating digital flashcards and simple interactive games that matched our curriculum objectives*" (Interviewee G).

The data from the Gomoa Central District indicate a progressive shift in digital literacy and competency among early childhood educators, shaped by personal effort, peer collaboration, and institutional support. The teachers described initial struggles with ICT tools like interactive whiteboards and tablets. These evolving experiences underscore that digital competence is not static but shaped by the learning environment and available support systems.

Insights gleaned from the dataset reveal that early childhood centres in the Gomoa Central District reveal a gradual yet meaningful evolution in digital literacy and competence. These personal accounts underscore the varied trajectories through which teachers in the region engage with and adopt ICT tools for pedagogical use. Most of the teachers initially encountered difficulties, ranging from interactive whiteboard calibration to anxiety in navigating computer software.

However, these early obstacles often became catalysts for learning, collaboration, and innovation. One of the teachers recounted a transition from struggling with the basic functions of the interactive whiteboard to confidently using it to save collaborative sessions and support peers. The data demonstrate that professional development opportunities, peer support, and personal initiative are central to building digital literacy. As such, digital competence is neither static nor

uniform; it evolves in tandem with exposure to tools, pedagogical needs, and institutional support structures.

4.2 Research Question Two: Which ICT tools are available to teachers for instructional purposes in Early Childhood Centres in the Gomoa Central District?

This research question aimed to identify the ICT tools available to teachers for instructional purposes in Early Childhood Centres in the Gomoa Central District. Three themes emerged from the research question as follows;

Theme 1: Mobile Phones and Tablets

This preference for mobile devices was echoed by teachers in the study, with one participant highlighting the widespread use of phones and the limited availability of other technologies:

> —..*.yes, phones and tablets are the most common ones. Almost every teacher use phone for videos or apps. Some schools have projectors, but they're shared. Desktop computers are rare—only a few schools have them, and they're mostly for admin work*" (Interviewee P).

Expanding on the role of mobile devices, Interviewee P later elaborated on how phones and tablets are integrated into classroom activities, particularly for engaging students with educational content:

> —..*.no, we mostly rely on what we have at hand. For most of us, that means our mobile phones. I use mine all the time in the classroom—whether it's downloading educational apps or playing short videos to explain a topic*" (Interviewee P).

Another teacher shared:

> —I*mostly use my smart phone. Sometimes, I use the tablets especially when my phone's battery is down. They're great for literacy and mathematics apps, particularly with the younger kids*" (Interviewee K).

The data suggest that smartphones and tablets are the most commonly available ICT tools to teachers in the early childhood centres in the Gomoa Central District. Others use education apps, radio and audio players. The data further suggest that these technologies foster interactive learning, support differentiated instruction, and improve children's cognitive, language, and socio-emotional development when used appropriately.

Insight gleaned from the dataset suggests that smartphones are increasingly central to digital access, especially in the early childhood centres in the Gomoa Central District. Their relative affordability and compatibility with existing mobile network infrastructure make them the most pervasive form of information and communication technology among teachers in the districts. Unlike desktop computers or advanced digital whiteboards, which require stable electricity and significant financial investment, smartphones are portable, user-friendly, and adaptable to low-resource settings. The study showed that basic mobile phones and tablets are often the primary tools used by teachers for instructional planning, communication with peer, and accessing digital teaching resources.

The study conducted in the Gomoa Central District highlights the increasing reliance on smartphones and basic mobile phones as the primary ICT tools used by early childhood teachers. These devices are accessible and cost-effective and align well with the infrastructural limitations typical of rural or low-resource settings. This pattern reveals a pragmatic approach by teachers, who use their personal devices for lesson planning, multimedia teaching, and communication, compensating for the limited availability of more advanced technologies like desktop computers and digital whiteboards.

Theme 2: Educational Software and Apps

To illustrate the practical application of these digital tools, Interviewee S shared experience using specific platforms to enhance literacy and numeracy skills.

> *"I regularly use ABCmouse and Starfall with my students for literacy development and basic mathematics concepts. The children respond well to the interactive games and animations, especially during rainy days when outdoor activities weren't possible. We also have access to a digital library with audio stories that help develop listening skills*" (Interviewee S).

In addition to literacy and mathematics-focused platforms, Interviewee S again highlighted the use of creative apps to foster problem-solving and imaginative play:

> *"Our school has installed several educational apps on the tablets, including ones for shape recognition and colour identification. I incorporate Toca Boca apps during creative playtime, which allowed children to explore different scenarios and develop problem-solving skills*" (Interviewee S).

Beyond dedicated educational apps, the teachers also leveraged widely accessible platforms to align digital content with classroom themes and support diverse learning activities. The following excerpt reveals this point;

> *"I used YouTube Kids extensively to find educational content that aligned with our weekly themes about animals, seasons, and community helpers. The platform provided access to quality educational videos that I couldn't afford to purchase individually. I created playlists for different subjects and used them during circle time to introduce new concepts*" (Interviewee H).

The data highlights how early childhood teachers are creatively leveraging ICT tools such as ABC mouse, Starfall, Toca Boca, and YouTube Kids to enhance literacy, numeracy, and creative learning. This use of interactive apps and digital platforms shows a shift toward compensating for infrastructural challenges like poor weather affecting outdoor learning and providing engaging and accessible educational alternatives

The integration of ICT tools into early childhood education is gaining momentum globally, yet its implementation in rural contexts such as the Gomoa Central District remains under-explored. Teachers in Gomoa Central District are increasingly utilising digital resources like ABCmouse, Starfall, and Toca Boca apps to support literacy, numeracy, and problem-solving through interactive and play-based learning. The data suggest that teachers used platforms such as YouTube Kids, which are also widely used to access affordable, theme-based educational content. These tools enhance engagement and compensate for infrastructural limitations, such as restricted outdoor activity during inclement weather.

Theme 3: Radio and Audio Players

To illustrate the practical application of radio in early childhood education, teachers in the Gomoa Central District shared specific examples of how they leverage this medium to engage young learners:

> *"We have a small radio that runs on batteries, and we tune into educational programs broadcast in Fante for young children. The Ghana Broadcasting Corporation has some good programs about counting, colours, and local stories that our children really enjoy and can relate to culturally*" (Interviewee U).

Beyond regular classroom use, radio proved especially vital during challenging times, as one teacher highlighted its role in maintaining educational continuity:

> *"During the COVID-19 period, radio became our lifeline for education. We encouraged parents to listen to educational radio programs with their children at home. Some teachers even recorded their lessons on their phones and shared audio files with parents who had basic phones that could play audio*" (Interviewee B).

In addition to radio broadcasts, teachers have also adopted creative audio-based solutions to enhance learning, particularly in resource-constrained settings:

> *–We use a portable speaker connected to our phones to play educational songs and stories. It's battery-powered, so we don't depend on electricity. The children love singing along to local folk songs that teach them numbers, days of the week, and good behaviour in our local language*" (Interviewee L).

The data reveal that radio remains a pervasive and accessible medium in the Gomoa Central District. Despite increasing attention to digital tools in education, radio continues to play a central role in content delivery, especially where internet connectivity and access to advanced technologies are limited. Its widespread availability, low cost, and ability to reach remote communities make it a key instructional tool, particularly for early childhood education. The data indicate that the teachers often face infrastructural and resource constraints. These limitations impact their ability to integrate high-end digital tools. Consequently, they turn to radio and other audio-based media as pragmatic alternatives for delivering foundational learning content. They represent an accessible technology and a culturally resonant method of engagement in early childhood pedagogy.

The data underscore the continued reliance on radio and audio-based learning tools in early childhood education within the Gomoa Central District, reflecting a broader pattern observed in rural Ghana. Despite national ICT policies emphasising digital transformation, infrastructural limitations and limited digital literacy among teachers have constrained the adoption of high-tech tools. As a result, accessible and culturally resonant media like radio have become indispensable for instructional delivery. The study's data, where teachers use battery-powered radios and mobile phones to play educational programs and share audio lessons, illustrates a pragmatic adaptation to resource constraints.

The data from the structured observation checklist further confirm the absence or limited availability of key ICT tools in Early Childhood Education (ECE) centres within the Gomoa Central District. The results are presented on Table 4.1.

Table 4.1 Observation data on available ICT Tools

Available ICT Tools	B	C	D	F	G	H	I	K	L	N	P	Q	R	S	T	U	V	W	Y	Z	YES F (%)
Desktop Computer / Laptop	×	√	√	×	√	×	√	×	×	×	√	×	×	×	×	×	√	×	×	√	7 (35)
Projector / Multimedia Device	√	×	×	×	×	√	×	×	√	√	×	×	×	√	×	×	×	×	×	√	6 (30)
Interactive Whiteboard	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0 (0)
Smart TV / Digital Screen	×	×	×	×	×	×	×	×	×	√	√	√	×	×	√	×	×	×	×	×	4 (20)
Tablet / iPad for Learners	×	×	×	×	√	√	√	×	√	√	√	×	√	√	√	×	√	√	√	×	12 (60)
Smart Phone	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20 (100)
Internet Connectivity / Wi-Fi	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0 (0)
Audio Devices	√	√	√	√	√	√	√	√	√	√	×	×	√	×	×	√	×	√	×	√	14 (70)
Educational Software or Apps	√	√	√	√	√	√	×	×	×	×	√	√	×	×	×	√	×	×	×	√	10 (50)

Rating Scale: Yes (√), No (×); I (Interviewer), A-T (serial numbers)

Source: Field Data (2025)

Data in Table 4.1 show that the most widely available device was the smartphone, present in 20 (100%) of the centres. This indicates that smartphones are the most accessible ICT tool. Tablets or iPads for learners were available in 12 (60%) of the classrooms. This suggests that while over half of the centres had learner-specific digital tools, a significant number still lacked them. Similarly, audio devices such as radios and speakers were observed in 14 (70%) of the centres, showing a relatively high presence likely due to their affordability and ease of use in delivering songs and stories. Educational software or apps were used in 10 (50%) of the classrooms. This indicates almost half of the classrooms observed had these tools to support learning. However, laptops or desktop computers were available in only 7 (35%) of the centres, showing limited access to basic computing resources. Projectors or multimedia devices were found in 6 (30%) of the classrooms, and Smart TVs or digital screens were observed in just 4 (20%). These low figures highlight the limited availability of display technologies that support whole-class teaching and multimedia presentation. Sadly, interactive whiteboards and internet connectivity or Wi-Fi were not observed in any of the classrooms, 0 (0%). This shows a complete lack of interactive and internet-based learning tools. This data suggests that while basic ICT tools like smartphones and audio devices are relatively common, access to more advanced and internet-enabled tools remains severely limited. This lack of infrastructure poses a major barrier to the effective integration of ICT in early childhood education in the district.

In addition to assessing the availability of ICT tools, the researcher also observed whether these tools were actively used to support teaching and learning in Early Childhood Education (ECE) centres within the Gomoa Central District. The data on this observation are presented in Table 4.2.

Table 4.2 Observation data on the use of available ICT Tools to Support Teaching and Learning in ECE centres

Available ICT Tools	B	C	D	F	G	H	I	K	L	N	P	Q	R	S	T	U	V	W	Y	Z	YES F (%)
Desktop Computer /Laptop	×	√	√	×	×	×	×	×	×	×	√	×	×	×	×	×	√	×	×	√	5 (25)
Projector / Multimedia Device	√	×	×	×	×	×	×	×	×	×	×	×	×	√	×	×	×	×	×	√	3 (15)
Interactive Whiteboard	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0 (0)
Smart TV / Digital Screen	×	×	×	×	×	×	×	×	×	√	√	√	×	×	√	×	×	×	×	×	4 (20)
Tablet / iPad for Learners	×	×	×	×	√	√	√	×	√	√	√	×	√	√	√	×	√	√	√	×	12 (60)
Smart Phone	√	√	√	√	×	√	×	√	×	×	×	√	√	×	√	√	√	√	×	√	13 (65)
Internet Connectivity / Wi-Fi	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0 (0)
Audio Devices	√	√	×	×	√	√	√	√	×	√	×	×	√	×	×	√	×	×	×	√	10 (50)
Educational Software or Apps	√	√	√	√	√	√	×	×	×	×	√	√	×	×	×	√	×	×	×	√	10 (50)

Rating Scale: Yes (√), No (×); I (Interviewer), A-T (serial numbers)

Source: Field Data (2025)

The observational data presented in Table 4.2 provide insights into the actual usage of ICT tools to support teaching and learning in Early Childhood Education (ECE) centres within the Gomoa Central District. The data indicate that, although some tools were available, their active use during instruction was limited and inconsistent across the centres. Out of the 20 teachers observed, only 5(25%) used desktop computers or laptops during lessons. This shows that even when these devices are present, their usage remains relatively low. Projectors or multimedia devices were used by only 3 teachers (15%), suggesting low integration of visual presentations or video-based learning aids in classroom instruction. Similarly, Smart TVs or digital screens were used by 4 teachers (20%), pointing to limited use of digital media content in early childhood teaching. The most commonly used ICT tool observed was the tablet or iPad, with 12 teachers (60%) integrating them into classroom activities. This indicates that portable devices may be more accessible and user-friendly for ECE environments.

Smartphones were also widely used, with 13 teachers (65%) relying on them. Audio devices such as speakers or recorders were used by half of the teachers (50%), supporting the use of songs, rhymes, or recorded stories in teaching. Educational software or apps were also employed by 10 teachers (50%), indicating that nearly half of the classrooms observed engagement these softwares. Regrettably, some key technologies such as interactive whiteboards and internet connectivity were completely absent from use (0%). The data shows that while certain ICT tools are being used to enhance teaching and learning, their usage is uneven and often constrained by limited infrastructure, inadequate training, and unreliable electricity.

A cross comparison of the availability and usage patterns of these ICT tools to support teaching and learning in Early Childhood Education (ECE) centres within the Gomoa Central District are presented in Table 4.3.

Table 4.3 Availability and Usage of ICT Tools in ECE centres

ICT Tool	Available (%)	Used (%)	Usage-to-Availability Match
Desktop / Laptop	7 (35%)	5 (25%)	Partial
Projector / Multimedia	6 (30%)	3 (15%)	Low
Interactive Whiteboard	0 (0%)	0 (0%)	Not available/use
Smart TV / Digital Screen	4 (20%)	4 (20%)	Full
Tablet / iPad for Learners	12 (60%)	12 (60%)	Full
Smartphone	20 (100%)	13 (65%)	Partial
Internet / Wi-Fi	0 (0%)	0 (0%)	Not available/use
Audio Devices	14 (70%)	10 (50%)	Partial
Educational Software / Apps	10 (50%)	10 (50%)	Full

Source: Field Data (2025)

Table 4.3 shows that smartphones are the most widely available ICT tool, reported in 20 (100%) of centres. However, only 13 (65%) use them. This suggests that although smartphones are accessible, they are not consistently used for instructional purposes. Tablets or iPads for learners and educational software/apps show full alignment between availability and usage, 12 (60%) and 10 (50%), respectively. This reflects a positive trend, as tools designed specifically for young learners are effectively applied in classroom instruction. Audio devices (e.g., radios,

speakers, recorders) are available in 14 (70%) of the centres, but only 10 (50%) use them, showing partial use and possible challenges in integrating them into lessons. Smart TVs or digital screens are available and used in 4 (20%) of centres, showing full usage when available. Desktops or laptops are available in 7 (35%) of the centres but used in only 5 (25%), indicating limited use. Projectors/multimedia devices are available in 6 (30%), but only 3 (15%) of centres use them. Interactive whiteboards and internet/Wi-Fi are entirely unavailable and unused, 0 (0%), showing a major gap in access to interactive and connected teaching tools. The data reveal that while some ICT tools are widely available and fully utilized, others are either underutilized or completely lacking in both availability and use. While tools like tablets and educational apps are fully used where available, others like smartphones are underutilized, and some tools like internet and interactive whiteboards are completely lacking.

4.3 Research Question Three: What challenges do teachers encounter when using ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?

The third research question examined the challenges teachers encounter in using ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District. Under this research question, four themes emerged from the dataset.

Theme 1: Inadequate ICT Infrastructure

To identify the challenges teachers encounter p using ICT tools for instructional purposes in Early Childhood Centres in terms of infrastructure. One of the study participants lamented:

> *"The issue is that we do not even have the tools in the first place. Look around, do you see any other tool apart from my phone? No, so how do they expect us to use them when they are not available*" (Interviewee Z).

Compounding the issue of limited availability, the functionality of these ICT tools further hinders integration efforts in Gomoa. One of the teachers shared:

> *–In my school, we have one radio, a projector that sometimes works, and a laptop that belongs to the headteacher. Most of us use our phones for recording lessons or playing songs*" (Interviewee V).

Beyond the functionality of devices, the lack of basic infrastructure in many of the schools adds another layer of challenges to effectively utilising technology for teaching.

> *–Many schools don't even have proper classrooms, let alone ICT tools. Some classrooms don't have enough sockets, so we can't charge devices. Even when there's electricity, the voltage is not stable, and it can damage the equipment*" (Interviewee T).

The data reveals that early childhood centres in the Gomoa Central District often lack digital tools, reliable electricity, limited teacher knowledge due to limited ICT workshops for teachers. Where ICT tools exists, it is typically insufficient in quantity or outdated, limiting both access and instructional creativity. The teachers also report minimal exposure to ICT-focused professional development. This limited capacity impacts not only teachers' confidence but also their willingness to experiment with digital tools in lesson planning and delivery.

The data reveal that inadequate ICT infrastructure poses a significant barrier to the effective implementation of ICT-based teaching in early childhood centres in the Gomoa Central District. The teachers face persistent power outages, especially during the rainy season, which limits the use of devices such as laptops and projectors. Many of the schools lack sufficient or functional ICT tools, with some relying on personal phones for instructional purposes due to the absence of institutional resources. Unstable voltage, limited access to power sockets, and poor classroom conditions further hinder technology use.

The data reflect a widespread and persistent challenge in educational systems, especially within developing regions. A lack of technological infrastructure, such as reliable internet access, hardware, and electricity, significantly hampers the teachers' ability to incorporate digital tools into their pedagogical practices.

Theme 2: Limited Teacher ICT Capacity

The implementation of ICT-based teaching methodologies in early childhood education holds transformative potential for instructional delivery and learner engagement. However, in Gomoa Central, the data indicates that this potential remains largely underutilised due to significant teacher-related barriers. Central among these is limited ICT capacity, which manifests through inadequate digital literacy, insufficient pedagogical integration skills, and a lack of confidence in handling technological tools. The data suggest that teachers' proficiency and comfort with ICT are critical determinants of successful technology integration. One of the study's participants disclosed:

> *–At first, I was afraid to use them because I didn't know much about computers. But after a few training sessions, I am now seeing how they can make teaching easier*" (Interviewee R).

While Interviewee B acknowledges the potential benefits of ICT after some initial training, they also express frustration with ongoing challenges in using these tools effectively.

> *–Right now, if something goes wrong, I just give up. I want to learn how to make simple PowerPoint slides, use educational apps, and fix small technical problems*" (Interviewee W).

Highlighting their desire to build practical skills, Interviewee W further emphasises the broader issue of inadequate training and support for the teachers in adopting ICT.

> *–Some teachers don't even know how to use them properly because they never got training... Even when training happens, there's no follow-up to see if we're applying what we learned*" (Interviewee W).

The data reveal a significant barrier to implementing ICT-based teaching in early childhood education: limited teacher ICT capacity. This challenge is not just about access to technology but is fundamentally tied to teachers' skills, confidence, and sustained professional development. Teachers reported a lack of digital literacy, weak pedagogical integration, and minimal troubleshooting ability. These challenges often led to superficial or inconsistent ICT use. Interviewee B's experiences encapsulate this struggle despite some positive effects of initial training, the lack of follow-up and support leaves teachers underprepared and frustrated. Indeed, insufficient ICT training is a core issue limiting effective integration.

Theme 3: Lack of Electricity

Teachers in the Gomoa Central District shared that they often struggle with poor infrastructure, especially the lack of electricity. This makes it difficult or impossible to use devices like laptops and projectors, even when they are available. Some schools experience power cuts especially during the rainy season. One of the teachers said:

> *–The biggest problem is electricity. In Gomoa, the lights go off very often, especially during the rainy season. Even when we have a laptop or projector, we can't use them if there's no power*" (Interviewee Z).

Some schools have no electricity at all as shared by another teacher:

> *–We don't even have light, how can we use ICT tools in the school*" (Interviewee Q).

This was further confirmed by another teacher who had this to say:

> *–As you can see here. My school does not even have electricity. So even if teachers manage to get these ICT tools, how can we charge*

> *them and use them? It is really a problem here in Gomoa Central*" (Interviewee B).

The data reveal a clear gap between ICT integration policies and the real classroom conditions in Early Childhood Centres within the Gomoa Central District. Although the government has introduced digital learning initiatives, unreliable electricity remains a major obstacle to implementation. The teachers reported that frequent power outages, especially during the rainy season, often make it impossible to use ICT tools such as laptops and projectors. In some centres, there is no electricity at all. As a result, even when digital devices are available, they cannot be used effectively for teaching and learning. This lack of reliable electricity limits the ability of teachers to deliver ICT-based lessons and undermines efforts to promote interactive, child-centred instruction in early years education.

Theme 4: Inadequate ICT Training for Teachers

This gap between policy and practice is evident in the experiences of the teachers, as highlighted by Interviewee B, who described the infrequency and limited access to professional development opportunities:

> *"The district sometimes organises training, but not often. The last one was two years ago, and only a few teachers were selected. Some of us learn from colleagues or try things on our own*" (Interviewee B).

Interviewee T also describes the limited scope and follow-up of the training received.

> *"My professional development has been limited. I've attended two workshops in the last three years, one on using tablets for literacy and another on projector-based teaching. They were helpful but too short, and there wasn't much follow-up. I learned how to use a few apps, but I still struggle with things like setting up a projector or troubleshooting software. Most of my skills come from experimenting on my own or learning from colleagues*" (Interviewee T).

Echoing these sentiments, Interviewee F further elaborates on the lack of practical relevance in the workshops, emphasising the disconnect between the training content and the realities of their teaching environment.

> *"I've had one workshop in the past two years, run by the district education office. It was about using tablets for teaching, but it was too general—more about theory than practice. I've learned more from experimenting and asking colleagues. The workshop assumed we had stable power and multiple devices, which isn't our reality. It taught me a few app names, but not how to use them with limited resources*" (Interviewee F).

Building on the need for more consistent support, Interviewee B also emphasised the importance of regular training and technical assistance to address ongoing challenges:

> *"We need regular training, not just one-time workshops. Also, there should be a technician we can call when devices fail. Right now, we have no one*" (Interviewee B).

In addition to the lack of consistent training and technical support, Interviewee B also pointed out the practical difficulties teachers face in adapting to unreliable infrastructure, which adds to their workload:

> *"They need to organize more training for us on some of these ICT tools. Not all of us even know how to use them personally let alone use them to teach. So it is very necessary, the workshops*" (Interviewee B).

The data from this study in the Gomoa Central District highlight a significant gap between policy intentions and practical realities in the integration of ICT in early childhood education. The interview data reveal that while ICT is acknowledged as a valuable educational tool, institutional and administrative inefficiencies, such as irregular training, limited professional development, and inadequate technical support hinder its effective use. These challenges force teachers to develop backup teaching strategies, adding to their workload and reducing the likelihood of sustained ICT use.

The data from the interviews revealed that efforts to promote ICT use in teaching and learning have encountered a number of systemic limitations. Institutional gaps manifest in the form of irregular training programs, insufficient in-service professional development, and the absence of reliable technical support structures. Administratively, there is often a disconnect between policy intentions and on-the-ground realities, particularly regarding sustained teacher support and capacity-building initiatives.

4.4 Research Question Four: What existing support systems are available to teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?

The essence of this research question was to examine the existing support systems available to teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District.

Theme 1: Informal Peer Support

Some of the teachers share tips, apps, and troubleshooting solutions, and informal demonstrations by colleagues provide hands-on learning that directly enhances ICT competencies.

One of the study participants intimated:

> *–There's also an informal group of teachers in the district who share tips via WhatsApp, which is really helpful. Sometimes, NGOs offer workshops or donate equipment, but that's not regular. I message the WhatsApp group or call a colleague who's tech-savvy. If it's a simple issue, like an app not working, I try to troubleshoot it myself using online tutorials*" (Interviewee B).

This reliance on informal networks is vividly illustrated by the teachers' first-hand experiences, as seen in the following account from Interviewee B, who

highlighted the practical role of WhatsApp groups and tech-savvy colleagues in addressing ICT challenges.

> *–My headteacher, because she's nearby and knows our devices. If she's unavailable, I check the WhatsApp group or call a colleague who's good with tech. A colleague's informal demo was the best. She showed me how to use a phonics app and organise group rotations with one tablet. It was practical and directly applicable. I started using the app the next week, and it improved my literacy lessons*" (Interviewee B).

Building on this, Interviewee B further emphasised the immediacy and practicality of these informal support systems, particularly the WhatsApp group and hands-on demonstrations, which proved instrumental in enhancing classroom practices.

> *–The WhatsApp group is the most accessible—I can get a reply in hours. But for urgent issues. A colleague's demo on using a phonics app was the best. She showed me how to manage groups with one tablet and shared free apps. It was practical and helped me improve my literacy lessons right away*" (Interviewee B).

The data highlight the critical role that informal peer networks play in supporting early childhood educators' use of ICT in the Gomoa Central District. In the absence of consistent formal training and technical support, the teachers rely heavily on community-based systems like WhatsApp groups and knowledgeable colleagues to troubleshoot issues and gain practical insights. The data indicate that these support structures offer immediate, hands-on assistance that is more responsive than sporadic NGO-led workshops or formal training programs. This grassroots, peer-led approach provides educators with context-specific solutions and fosters a culture of collaborative learning, significantly contributing to improved classroom practices and ICT competency.

The data suggest that the teachers frequently encounter challenges that require immediate solutions and practical guidance. The absence of consistent formal support

structures has led to the emergence of alternative support mechanisms that fill critical gaps in professional development. These informal networks provide more accessible, timely, and contextually relevant assistance than traditional professional development approaches. The data highlight the reliance on informal peer networks, particularly WhatsApp groups and tech-savvy colleagues, as immediate and practical support systems.

The data suggest that teachers primarily rely on informal peer networks, such as WhatsApp groups and tech-savvy colleagues, while external support, mostly from NGOs, tends to be occasional and lacking follow-up, limiting its long-term impact. Under this theme, the following subthemes emerged from the data: informal peer support, limited formal support, sporadic external support, and desired skill development.

Theme 2: Limited Formal Support

The reliance on informal networks is vividly illustrated by teachers' first-hand experiences, as seen in the following account from Interviewee B, who highlights the practical role of WhatsApp groups and tech-savvy colleagues in addressing ICT challenges

> *"We have a district education office that occasionally sends tech support staff, but they're not always available. My school has a headteacher who's good with technology, so I often ask her for help…The district office is far, and their tech staffs are stretched thin, so it can take days to get help. The headteacher is more accessible, but she's busy, so I can't always interrupt her*" (Interviewee Y).

Building on this, Interviewee B also emphasised the immediacy and practicality of these informal support systems, particularly the WhatsApp group and hands-on demonstrations, which proved instrumental in enhancing classroom practices.

> *–We have a district tech officer, but he's rarely available. My headteacher helps with basic issues, and we have a WhatsApp group for teachers to share tips. The district officer takes days to respond. The headteacher is helpful but busy. The WhatsApp group is the most accessible—I can get a reply in a few hours. But for urgent issues, I'm often left to figure it out myself*" (Interviewee B, 2025).

The data from the Gomoa Central District underscore a significant gap in formal professional development for early childhood educators in the area of ICT integration. Teachers reported inconsistent access to structured ICT training and instead relied heavily on informal peer networks, such as WhatsApp groups, and guidance from tech-savvy colleagues. This adaptive strategy reveals both the resilience of educators and a systemic shortfall in institutional support.

The data suggest that professional development opportunities remain limited or irregular, necessitating alternative mechanisms for continuous ICT skill acquisition. Informal peer support networks emerge as vital components of such mechanisms, enabling educators to share practical knowledge, troubleshooting strategies, and experiential learning through collegial interactions. In Gomoa Central District, where structured ICT training were sporadic, informal channels facilitated rapid knowledge exchange and timely problem-solving among teachers.

Theme 3: Sporadic External Support

Fragmented professional development landscape, characterised by limited follow-up and reliance on internal support, is vividly reflected in the experiences of individual teachers, such as Interviewee B, who highlights the sporadic nature of external support and the lack of sustained mentorship in their ICT training:

> *–Sometimes, NGOs offer workshops or donate equipment, but that's not regular. My professional development has been limited. I've attended two workshops in the last three years—one on using tablets for literacy and another on projector-based teaching. They were helpful but too short, and there wasn't much follow-up*" (Interviewee B).

Echoing these challenges, Interviewee B further elaborated on the inconsistent support structures, emphasising the reliance on both internal school resources and occasional external contributions, such as those from NGOs, while noting the practical but fleeting benefits of these interventions.

> –*Mostly, support comes from the headteacher or ICT coordinator, if there is one. Sometimes, NGOs provide help. I have attended two workshops. One was organised by the district, the other by an NGO. They were useful but too short. The NGO workshop gave us free resources we could use right away*" (Interviewee B).

The data suggest that external support for teacher ICT development typically comes from various sources, including non-governmental organisations (NGOs), district education offices, and educational technology initiatives, but is often characterised by inconsistency and lack of sustained engagement. NGOs, while well-intentioned, frequently provide one-off interventions such as short-term workshops or equipment donations without establishing long-term capacity-building frameworks. This creates a sporadic nature of support that leaves teachers with limited opportunities to systematically develop and refine their ICT skills.

The data reveal a significant gap in the continuity and depth of external support for ICT integration in early childhood education. The teachers‘ reliance on sporadic NGO-led workshops and one-off resource donations reflects a fragmented approach to professional development, limiting opportunities for sustained skill growth and pedagogical innovation. This mirrors findings in other rural and developing regions.

4.5 Discussion of Findings

4.5.1 Teachers' views regarding the use of ICT tools for instructional purposes in Early Childhood Centres.

The findings reveal that early childhood teachers in the Gomoa Central District generally view the use of ICT tools for instructional purposes as beneficial. However, these positive views are mixed with initial fears and hesitations, often linked to limited digital skills, fragile resources, and a lack of confidence. Teachers found ICT particularly useful in enhancing learner engagement, attention, and retention. They observed that multimedia content such as songs, videos, and pictures make lessons more interactive and effective, especially in foundational areas like literacy and numeracy. Additionally, some teachers encountered resistance from parents and community members who misunderstood the educational role of digital tools, often perceiving screen use as mere entertainment.

These findings are consistent with global literature. For instance, these findings are supported by Ihmeideh and Al-Maadadi (2018), who found that sustained ICT training improved both teacher confidence and integration of digital tools in classrooms. Similarly, Nikolopoulou and Gialamas (2015) observed that teachers with stronger ICT self-efficacy in Greek preschools were more likely to view digital tools as essential learning aids rather than play devices. In Gomoa, although teachers expressed a willingness to adapt, the absence of regular training and supportive infrastructure limited their ability to fully integrate technology into child-centred learning practices.

Additionally, the cultural concerns identified in this study, particularly from parents and community members, mirror the findings of Dong and Newman (2016) in China, where early childhood teachers hesitated to implement ICT due to unclear policies, cultural uncertainties, and a perceived conflict between traditional teaching

and digital learning. These challenges were echoed by Agyei (2020), who emphasized that socio-cultural resistance and the lack of community engagement were key obstacles to effective ICT integration in early education across sub-Saharan Africa.

Teachers‘ attempts to balance these tensions by blending digital media with physical, hands-on activities reflect adaptive pedagogical practices. This approach aligns with calls from Ihmeideh and Al-Maadadi (2018) for culturally responsive and blended learning models, especially in low-resource settings. Yet, as Abedi (2023) noted, a disconnect still exists between Ghana‘s national ICT policy which promotes student-centred approaches and the teacher-directed practices observed on the ground. This is supported by Akyeampong (2017), who highlighted that many Ghanaian educators lack the training and resources necessary to fully embrace active, learner-centred teaching methods.

Moreover, the community-level scepticism in Gomoa reflects broader patterns. Buabeng-Andoh (2019) found that community perceptions, coupled with poor infrastructure, often hindered the successful adoption of ICT tools in Ghanaian classrooms. These same perceptions were also found to be barriers in Nigeria, where Festus and Emmanuel (2025) reported that cultural traditions, underfunding, and lack of technical expertise constrained the adoption of digital teaching methods. Internationally, Dong and Mertala (2019) reported similar resistance among Chinese preservice teachers, who feared that ICT tools might displace hands-on learning and violate traditional classroom norms. This further highlights that ICT integration is not only a matter of technical access or training but also of navigating socio-cultural expectations around childhood learning.

Teachers‘ indicated a progressive shift in digital literacy and competency, shaped by personal effort, peer collaboration, and institutional support. They

described initial struggles with ICT tools like interactive whiteboards and tablets, but these challenges often led to increased confidence and mastery through trial, training, and shared learning. This local progression aligns well with global patterns identified in similar contexts. For instance, Masoumi (2015) observed in Swedish preschools that ICT tools were adopted not just as teaching aids but as transformative instruments for documentation, communication, and curriculum enrichment, influenced heavily by teachers‘ values and evolving practices.

Similarly, research in Flanders emphasised that teachers‘ self-perceived competence and professional development were key factors influencing the depth and quality of ICT integration in preschool settings (Kerckaert et al., 2015). However, contrasts can also be found. For example, Dong and Newman (2016) reported that preschool teachers in Shanghai recognised the value of ICT but often underutilised it due to limited understanding and structural barriers, indicating the importance of national curriculum support and policy clarity. This difference highlights how broader systemic frameworks can accelerate or hinder digital adoption in early education.

In the Ghanaian context, similar findings have been reported. For instance, the teachers highlighted that multimedia resources, such as songs, videos, and pictures helped make lessons more interactive and effective, especially in foundational subjects like literacy and numeracy. These observations are strongly supported by Loh (2022), who found that most kindergarten teachers in the North Dayi District believed that ICT tools enhanced language development, creativity, understanding, and memory retention. Similarly, Raabu (2025) noted that teachers using audio-visual resources observed improved learner involvement during the COVID-19 pandemic, although the effectiveness varied depending on access and resources.

However, despite their positive views, many teachers expressed initial fears and hesitations, largely due to limited digital skills, inadequate ICT infrastructure, and low confidence. This aligns with Abdulai (2014), who found that most early childhood teachers in the Winneba Municipality had minimal ICT knowledge and limited access to tools. ICT was often treated as a standalone subject, rather than being meaningfully integrated across the curriculum. Likewise, Asante (2014) discovered that although teachers acknowledged ICT‘s importance, 60% lacked ICT knowledge, and 67% did not use it in their teaching, highlighting a widespread implementation gap.

Moreover, your findings highlight a disconnect between national ICT policies and classroom realities. This mirrors the conclusion by Loh (2022), who recommended structured ICT learning plans and consistent government investment in ICT infrastructure, teacher training, and maintenance. The same policy-practice divide is echoed by Raabu (2025), who stressed that infrastructural and socioeconomic limitations, including poor internet connectivity and high device costs, continue to undermine the success of digital learning in early childhood education.

Another important barrier highlighted in your study is the misunderstanding of ICT by some parents and community members, who associate screen use with entertainment rather than education. This sociocultural concern is well documented in Muftawu (2024), who found that while most parents of children aged 4–6 recognized the benefits of ICT in learning, they remained cautious—especially regarding overuse and inappropriate content for children under 4 years. He recommended that early childhood centres develop ICT policies and guidelines that align with parental expectations and protect young children. This reinforces the need for community

engagement and sensitization efforts to ensure that parents understand and support ICT use in education.

Additionally, the findings reflect concerns about fragile resources and lack of technical support, which discourage teachers from integrating ICT in the classroom. Enu et al. (2018) reported that many basic school teachers had moderate ICT skills, but primarily used them for personal communication rather than instructional purposes, due to limited teaching resources and lack of training. Similarly, Asante (2014) and Abdulai (2014) both emphasized the insufficiency of digital tools and the absence of professional development programs to empower teachers.

Furthermore, the findings indirectly touch on home-school collaboration, particularly how parent attitudes can affect classroom practices. In this regard, Abdullai and Dery (2018) found that while both parents and teachers positively viewed ICT-based communication, they also cited concerns about access limitations, lack of ICT training, and response delays. This suggests that fostering ICT use for educational communication could bridge school-home gaps, provided there are efforts to improve access and capacity for both parties.

This discussion has shown that while early childhood teachers in the Gomoa Central District recognize the value of ICT tools for instruction, their views are shaped by both pedagogical benefits and cultural, emotional, and systemic challenges. These findings align with global research emphasizing the importance of not only providing infrastructure and training but also fostering community awareness and cultural acceptance. Without such engagement, even well-intentioned ICT initiatives may face rejection or limited uptake, particularly in early childhood settings where parental influence and local norms are strong.

4.5.2 ICT tools available to teachers for instructional purposes in Early Childhood Centres

The findings show that smartphones (20; 100%) and tablets (12; 60%) are the most commonly available ICT tools to teachers in early childhood centres in the Gomoa Central District. Educational apps (10; 50%) and audio devices (14; 70%) are also widely available and often used. Overall, while some tools are fully utilized, others remain underused or entirely absent, highlighting disparities in access and the need for more supportive infrastructure.

These findings are consistent with global literature. For example, Hu and Yelland (2017) observed that teachers in under-resourced schools in Hong Kong often favoured teacher-directed ICT use due to infrastructural limitations. Similarly, Nikolopoulou and Gialamas (2015) found that in Greece, ICT integration in preschools was influenced by teacher self-efficacy and the inconsistent availability of advanced technologies. The Gomoa data reflect this trend, with basic, accessible tools being more widely used than more sophisticated alternatives.

Furthermore, the study affirms that teachers in Gomoa adapt ICT use to meet specific pedagogical needs. Examples include the use of battery-powered radios for storytelling and culturally relevant audio lessons—strategies that promote inclusion and accessibility, especially in the absence of internet connectivity. This mirrors Adarkwah‘s (2020) findings, which emphasized the importance of low-bandwidth technologies like radio during the COVID-19 pandemic in Ghana as a practical response to resource constraints.

The use of mobile phones and radios also illustrates what Abedi (2023) described as a disjunction between ICT policy intentions and actual classroom practice. In contexts like Gomoa, teachers tend to use technology to support existing teacher-centred methods, rather than to foster interactive or learner-centred

instruction. This is further supported by Quaicoe and Pata (2020), who noted that although many Ghanaian teachers reported having basic digital literacy, their classroom use of ICT remained limited due to infrastructural and professional development deficits.

Despite these limitations, the teachers in Gomoa Central are making practical use of available digital platforms such as YouTube Kids to enhance teaching in early childhood classrooms. This is aligned with Yang et al. (2018), whose study in rural China found that computer-supported collaborative teaching helped improve student engagement and teacher development, even in under-resourced settings. The findings also echo insights from Ihmeideh and Al-Maadadi (2018), who emphasized that access, beliefs, and training shape ICT use in early childhood education. While Gomoa teachers demonstrate creativity in using available tools for specific learning goals, the lack of formal training and infrastructure prevents them from maximizing the full potential of ICT for child-centred, exploratory learning.

In the Ghanaian context, similar trend of availability of ICT tools have been reported based on local studies conducted in Ghana. For instance, Raabu (2025), who found that audio, text, and visual-based resources were the most utilized digital learning tools during the COVID-19 pandemic in the Northern Region. Raabu noted that the availability and cost of devices influenced their selection, a reality also evident in the current study where desktops, projectors, and smart TVs remain largely underused or unavailable. Similarly, Muftawu (2025) found that although many parents and teachers acknowledged the usefulness of ICT, implementation was often limited to more accessible mobile technologies rather than high-end digital tools.

The reliance on mobile devices is also supported by Abdullai and Dery (2018), who identified smartphones and cell phones as the most commonly used tools for

parent-teacher communication in early childhood settings. Their study shows that mobile technology is not only used for instructional purposes but also plays a central role in school-home engagement, further justifying its prominence in Ghana‘s early childhood landscape.

The findings reflect Abdulai (2014) and Asante (2014), who both reported limited availability of modern ICT infrastructure in early childhood centres across Ghana. In particular, Abdulai (2014) found that ICT was often taught in isolation due to limited integration across subject areas and insufficient tools, while Asante (2014) revealed that 60% of early childhood teachers had no ICT knowledge, and 67% did not integrate ICT in their lessons, often due to tool scarcity.

The underutilization of ICT tools like projectors and desktop computers also mirrors the findings of Enu et al. (2018), who discovered that while some teachers had moderate ICT skills, these were primarily used for personal purposes due to the lack of teaching resources and inadequate ICT integration training. This underlines the critical need for targeted in-service training and investment in equipment that can support whole-class engagement, not just individual learning through mobile apps.

Additionally, the use of radio as an educational tool in the absence of internet connectivity is particularly notable. This echoes Raabu‘s (2025) recommendation that traditional broadcast media like radio can serve as valuable educational delivery systems in low-resource settings where digital infrastructure is weak. The continued reliance on radio underscores the digital divide that persists in many Ghanaian districts.

Finally, the complete absence of internet access and interactive whiteboards exposes a major infrastructural gap that limits real-time digital learning and interactivity. This infrastructure deficit reinforces Loh‘s (2022) call for structured ICT

investment, including government-supported installation and maintenance of tools, and for school leaders to ensure equitable access to ICT.

It is evident that the findings show that while some ICT tools, especially mobile devices and educational apps are both available and appropriately used, others remain underutilized or completely absent. Teachers in the Gomoa Central District display resourcefulness in their use of basic technologies to enhance instruction, but the disparity in access and training underscores the need for targeted infrastructure investments and professional development. These adaptations reflect broader trends across similarly under-resourced settings, where grassroots ICT use compensates for formal system limitations but cannot fully replace the need for structured support and robust digital ecosystems.

4.5.3 Challenges teachers encounter in using ICT tools for instructional purposes in Early Childhood Centres

The findings show that teachers in early childhood centres in the Gomoa Central District face multiple challenges in using ICT tools for instructional purposes. These include inadequate ICT infrastructure, unreliable electricity supply, and a shortage of functional digital devices. Even where tools exist, they are often out-dated or insufficient in quantity. Teachers also reported limited exposure to ICT-focused training and a lack of on-going professional development, which affects their confidence and ability to integrate technology into their lessons. Poor classroom conditions, unstable power supply, and the absence of technical support further complicate ICT use. Additionally, there is a gap between educational policy and the actual support provided at the school level. These systemic and teacher-related barriers significantly limit the effective use of ICT in early childhood instruction within the district.

These findings align with those of Mpumuje (2024) in Rwanda, where rural schools also struggled with limited ICT resources and connectivity. Similarly, Ngodu et al. (2024) found that Tanzanian schools suffered from equipment shortages and poor maintenance, which, despite curriculum reforms, hampered effective ICT integration. These regional studies highlight that material constraints are a common barrier across many low-resource education systems in Africa.

Beyond physical infrastructure, the study also highlighted systemic barriers such as the absence of sustained professional development. Teachers expressed concerns about limited access to ICT training, reflecting similar conclusions by Dong (2018), who found that preschool teachers often lacked the necessary training and institutional backing to use ICT confidently. The Gomoa findings also mirror Ihmeideh and Al-Maadadi (2018), who emphasized that structured and consistent ICT training significantly improves teacher confidence and classroom practice. Without such training, integration efforts often stall or regress. Moreover, the study reinforces Masoumi's (2020) observation that discrepancies between pre-service training and classroom realities leave teachers feeling unprepared. This is particularly relevant in Gomoa, where early career educators reported feeling unsupported in applying ICT knowledge practically due to mismatched expectations and the lack of follow-up or mentoring.

The data also confirm patterns found across sub-Saharan Africa. Barakabitze et al. (2019) noted that outdated infrastructure, underfunding, and lack of institutional support remain significant obstacles to meaningful ICT use in education. Similarly, Schwartz et al. (2019) emphasized that poor access to professional development undermines instructional quality, as teachers must compensate for systemic shortcomings on their own. This often leads to increased workload, stress, and

reluctance to adopt technology-driven instruction. The mismatch between training and classroom reality was also widely noted. Even when training programs are offered, they tend to be generic, overly theoretical, or designed for better-resourced contexts. As Masoumi (2020) and Dong (2018) argued, such training often fails to account for teachers‘ lived experiences, particularly in rural or low-income areas, making them less effective.

The findings also share commonality with local studies conducted in Ghana. For instance, Abdulai (2014) reported that early childhood centres in the Winneba Municipality suffered from limited ICT availability, and that most teachers lacked a background in ICT. ICT was often taught as a standalone subject rather than being integrated into regular teaching activities, primarily due to the absence of both tools and training.

Similarly, Asante (2014) found that although teachers recognized the value of ICT in early learning, 60% of them had no ICT knowledge, and 67% did not use ICT in their lessons. The study pointed to the lack of infrastructure, equipment, and teacher training as the most pressing obstacles. These same factors are present in the Gomoa Central District, where many tools, when available, are often outdated or insufficient in number, and teachers lack the exposure and ongoing development needed to build confidence in ICT use.

The findings also emphasized unstable power supply and poor classroom conditions, which are persistent issues that hinder the effective use of ICT. This aligns with Raabu (2025), who found that in the Northern Region, even when digital learning tools were made available, their use was frequently constrained by electricity challenges, internet limitations, and poor physical infrastructure. Raabu concluded that these infrastructural issues, combined with limited digital literacy and teacher

support, significantly reduce the effectiveness of ICT integration in underserved regions.

Moreover, the study found that technical support is largely absent, leaving teachers to navigate ICT issues on their own. This lack of support contributes to teacher anxiety and underuse of digital tools. Loh (2022) similarly emphasized that ICT integration cannot succeed without adequate support systems. Loh recommended that schools should not only provide ICT equipment but also ensure technical assistance and structured ICT learning plans to guide implementation.

Additionally, the findings highlight a disconnect between national ICT policy and the actual support available at the school level. While Ghana's education policy framework advocates for early digital literacy, teachers report that these policy intentions are not matched by investments in resources or professional development. This gap is echoed in Muftawu‘s (2024) study, which noted that although parents support the introduction of ICT in early childhood education, there is a need for institutional guidelines and policies that reflect both teacher realities and parental expectations.

Furthermore, Enu et al. (2018) found that although teachers had moderate ICT skills, these were often underutilized due to lack of resources and classroom-level support. Instead of being used for instruction, ICT tools were mainly used for personal communication purposes such as WhatsApp and Facebook. This underutilization illustrates how resource constraints and lack of pedagogical training limit the transformative potential of ICT in education.

Lastly, the study's findings point to a clear need for on-going professional development. Without regular in-service training, teachers struggle to keep pace with technological changes or develop confidence in integrating digital tools into early

childhood pedagogy. Both Asante (2014) and Abdulai (2014) emphasized that targeted ICT training both pre-service and in-service is essential for equipping early childhood teachers with the necessary knowledge and skills.

These findings point to a critical issue: while teachers in Gomoa recognize the value of ICT, their ability to implement it is curtailed by structural and systemic deficiencies. Without reliable electricity, sufficient resources, and continued support, even the most motivated teachers struggle to integrate digital tools into early childhood instruction. This reflects Ihmeideh and Al-Maadadi's (2018) view that sustained and context-specific training, combined with practical support, is essential to overcoming barriers to ICT use. It is evident from the discussion that In sum, the challenges reported in Gomoa Central are not isolated but part of a broader trend in low- and middle-income countries.

4.5.4 Existing support systems available to teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District

The findings indicate that existing support systems for teachers' use of ICT tools in early childhood centres in the Gomoa Central District are largely informal and inconsistent. Teachers mainly rely on peer support through platforms like WhatsApp and assistance from more tech-savvy colleagues. These informal networks help teachers share resources, solve technical issues, and build confidence in using digital tools. Formal and structured support, including professional development and training, remains limited and irregular. External support, mostly from NGOs and district initiatives, tends to be one-off and lacks sustained follow-up, limiting its long-term impact. Overall, while informal peer networks play a vital role in supporting ICT use, the absence of consistent, formal support systems and on-going training hinders teachers' ability to fully integrate technology into early childhood instruction.

Similar patterns have been observed globally. For instance, Dong and Newman (2016), who found that preschool teachers in Shanghai lacked systematic institutional support and depended heavily on personal initiative and informal learning networks for ICT use. Similarly, Schwartz et al. (2019) reported that in rural Ghana, where access to formal training was limited, peer support and mentoring filled critical gaps in teachers‘ professional development. These parallels highlight a pattern where, in low-resource contexts, informal systems become not just supplementary but central to teachers‘ ICT skill development.

However, while informal support helps bridge immediate gaps, the findings also underscore its limitations. Teachers in Gomoa noted that these networks lack depth and consistency, leaving them without the pedagogical grounding and long-term capacity-building needed for sustained ICT integration. This contrasts with findings from Ihmeideh and Al-Maadadi (2018), whose study in Qatar demonstrated that well-structured and continuous ICT training significantly improved teachers‘ digital competence and classroom practice. Their work emphasizes that formal training when contextually tailored and consistently delivered can strengthen teachers‘ ability to integrate ICT effectively.

The Gomoa teachers' experience of irregular NGO workshops and short-term interventions with no follow-up mirrors concerns raised by Tondeur et al. (2017) in Kenya and Mapisa and Makena (2024) in South Africa. These studies revealed that while professional development programs do exist, they often suffer from poor design, lack of contextual relevance, and insufficient follow-up, which weakens their overall impact on teaching practice.

Moreover, the finding that ICT training in Gomoa often assumes ideal conditions and fails to address local constraints is echoed in Dong (2018), who found

that teachers in under-resourced settings perceived training as inadequate and disconnected from classroom realities. Similarly, Brown and Englehardt (2016) emphasized that many professional development programs fail to engage meaningfully with the real challenges teachers face, limiting their practical value.

While peer networks provide essential short-term solutions, the lack of structured and sustained support risks deepening the digital divide. As noted by Yang and Rao (2020), school-based and individualized mentoring programs in rural China had a tangible positive effect when consistently applied, demonstrating that even in low-resource settings, tailored and school-based professional development can succeed when embedded in ongoing support. Thus, the findings from Gomoa Central not only affirm the value of informal support but also expose a critical deficit in institutionalised ICT-related professional development.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter presents the summary of the study, key findings, conclusions, and recommendations drawn from the study on teachers‘ use of Information and Communication Technology (ICT) tools to support teaching and learning in Early Childhood Centres in the Gomoa Central District. It also offers suggestions for further studies.

5.1 Summary of Study

The purpose of this study was to explore teachers‘ use of Information and Communication Technology (ICT) tools to support teaching and learning in Early Childhood Centres in the Gomoa Central District. The study was grounded in two theoretical frameworks: the Technological Pedagogical Content Knowledge (TPACK) framework and the Diffusion of Innovation Theory. It adopted an interpretivist philosophical approach and employed a qualitative case study design to gain in-depth insights into teachers‘ experiences and practices. A total of twenty (20) early childhood teachers were purposively selected as participants for the study. Data collection was carried out using two main instruments: a semi-structured interview guide and a structured observation checklist. The data collected were analysed thematically to address the following research questions.

1. What are teachers‘ views regarding the use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?
2. Which ICT tools are available to teachers for instructional purposes in Early Childhood Centres in the Gomoa Central District?

3. What challenges do teachers encounter when using ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?
4. What existing support systems are available to teachers to enhance their use of ICT tools for instructional purposes in Early Childhood Centres in the Gomoa Central District?

5.2 Summary of Key Findings

5.2.1 Teachers' Views on ICT Use in Early Childhood Centres in the Gomoa Central District

The findings of the study revealed that teachers in Early Childhood Centres in the Gomoa Central District viewed ICT tools as beneficial for engaging learners and improving retention, especially in literacy and numeracy. Teachers consistently reported that ICT tools significantly enhanced learner engagement through interactive multimedia content, with children showing improved attention, participation, and retention in core subjects like literacy, numeracy, and science.

5.2.2 ICT Tools Available in Early Childhood Centres in the Gomoa Central District

Findings from the study revealed that smartphones and tablets were the most commonly available ICT tools in Early Childhood Centres in the Gomoa Central District. The findings also revealed that, educational apps and audio devices were also widely used, while desktops, projectors, and smart TVs are less available. Educational software and digital content resources, including ABCmouse, Starfall, Toca Boca apps, and YouTube Kids, to support literacy, numeracy, and problem-solving skills, particularly during adverse weather conditions when outdoor activities were restricted. Teachers also used radio and audio-based learning tools, with battery-powered radios to access educational programs in the local Fante language.

5.2.3 Challenges in ICT Use in Early Childhood Centres in the Gomoa Central District

The findings revealed that teachers in Early Childhood Centres in the Gomoa Central District face major challenges such as inadequate ICT infrastructure, unreliable electricity, and outdated equipment. Limited training and lack of ongoing professional development reduce teachers‘ confidence and skill levels. The study demonstrates that inadequate ICT infrastructure constitutes the most fundamental barrier, severe shortage of functional ICT tools that forces many educators to rely on personal mobile phones for instructional purposes. The absence of policy support and technical assistance further hinders effective ICT integration.

5.2.4 Support Systems for ICT Use in Early Childhood Centres in the Gomoa Central District

Findings from the study revealed that teachers in Early Childhood Centres in the Gomoa Central District largely depend on informal peer networks like WhatsApp and tech-savvy colleagues for ICT support. Teachers primarily rely on informal peer networks, such as WhatsApp groups and tech-savvy colleagues, which provide practical, timely assistance in the absence of structured, formal training.

5.3 Conclusion

Through comprehensive data collection and analysis, the research provides critical insights into the current state of ICT adoption in early childhood centres and the multifaceted factors influencing its implementation. The following conclusions synthesise the key findings and their implications for early childhood education in the district. The study concludes that early childhood teachers in the Gomoa Central District view the use of ICT tools for instructional purposes as both a pedagogical opportunity and a logistical burden.

Teachers in Early Childhood Centres across the Gomoa Central District use a mix of modern and traditional ICT tools. Smartphones and tablets are the most commonly available and accessible ICT tools along with educational apps and audio devices to enhance instruction, while tools like desktops, projectors, and smart TVs are less accessible and underused. Infrastructure limitations, such as the lack of internet and interactive whiteboards, continue to constrain effective integration. The study reveals that teachers face multiple interconnected challenges, including unreliable electricity, inadequate ICT infrastructure, outdated devices, and limited access to professional development. These issues, combined with the lack of technical support and gaps between policy and practice, significantly hinder teachers‘ ability to effectively integrate ICT into teaching and learning. The study concluded that teachers in the Gomoa Central District largely depend on informal support systems such as WhatsApp groups and assistance from tech-savvy colleagues.

5.4 Recommendations

Based on the key findings, the following recommendations are made.

1. To build teacher confidence and address parental scepticism, The Ghana Education Service (GES) and district education offices in Gomoa Central should organize ICT orientation workshops for early childhood teachers, focusing on building confidence in basic digital skills. These sessions should also include parent sensitization forums to educate families about the educational value of ICT and address misconceptions about screen use in classrooms.
2. The Gomoa Central District Education Directorate should seek support from the Ghana Education Service (GES) to procure and distribute affordable,

portable ICT devices such as smartphones and battery-powered radios adapted to local conditions.

3. The Gomoa Central District Education Directorate should improve the power stability in schools, and regularize ICT workshops for ECE teachers.
4. The Gomoa Central District Education Directorate should formalize and expand existing peer support systems by setting up ICT Teacher Learning Communities (TLCs) within the district. These groups should meet regularly to share best practices, receive mini-trainings, and serve as a support system for sustained ICT skill development.

5.5 Suggestion for Future Research

Building on the study's findings, it is essential to deepen scholarly inquiry into several key aspects of ICT integration in early childhood education. The following areas represent critical gaps for further investigation.

1. A future study could examine teachers' competencies in employing specific ICT tools for teaching and learning in ECE centres and the factors influencing their choices for instructional use.
2. Another study could explore teachers' knowledge and self-efficacy in using ICT tools, focusing on how confidence levels affect integration into early childhood teaching.
3. Also, a study could assess the effectiveness of mobile-based ICT interventions (e.g., smartphone apps) in improving learning outcomes in early childhood settings, particularly in resource-limited districts like Gomoa Central.
4. lastly, a follow-up study could explore the effectiveness of peer-led ICT learning communities in enhancing teachers' digital skills over time. It could

examine how these informal networks might be scaled or integrated into formal professional development frameworks.

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APPENDICES

APPENDIX A

INTERVIEW GUIDE

Research Title: TEACHERS' USE OF ICT TOOLS TO FACILITATE TEACHING IN EARLY CHILDHOOD CENTRES IN THE GOMOA CENTRAL DISTRICT

Purpose of the Interview

This interview is designed to explore your experiences, perspectives, and challenges as an early childhood educator using Information and Communication Technology (ICT) tools in your teaching practice. Your insights will contribute to a better understanding of how ICT integration can be improved in early childhood education within the Gomoa Central District.

What to Expect

This interview will take approximately 45-60 minutes and covers four main areas:

1. Your views on using ICT tools in early childhood education
2. The ICT tools currently available to you and their accessibility
3. Challenges you encounter when using ICT tools in your teaching
4. Support systems available and suggestions for improvement

Confidentiality and Consent

- Your participation is voluntary, and you may withdraw at any time
- All responses will be kept confidential and used solely for research purposes
- Your identity will be protected through the use of pseudonyms in any publications
- The interview will be recorded (with your permission) to ensure accuracy in data collection
- You have the right to review any quotes before they are used in the research

Research Question 1: Teachers' views regarding the use of ICT tools

1. What is your overall view of the use of ICT tools in teaching at Early Childhood Centres?
    - Could you explain what influenced your perspective on ICT use in early childhood education?
    - How has your view on ICT tools changed over time, if at all?
2. How do you think ICT tools enhance teaching and learning in Early Childhood Education?
    - Can you give specific examples of learning outcomes that improved through ICT integration?
    - In what specific subject areas do you find ICT tools most beneficial?
3. What has been your observation about positive or negative effects of using ICT tools in your teaching practices?
    - How do children typically respond when you integrate ICT tools into your lessons?
    - What unexpected outcomes have you observed when implementing ICT in your classroom?

Research Question 2: Available ICT Tools

1. What are the most commonly used ICT tools for teaching Early Childhood Education in the Gomoa Central District?
    - How frequently are these common tools actually used in classrooms?
    - Are these tools provided by the schools or do teachers bring their own?
2. What specific ICT tools do you have access to for your teaching?
    - How adequate are these tools for meeting your teaching objectives?
    - Do you have reliable access to these tools whenever needed?

- How do you decide which ICT tools to use for different learning activities?

3. Which ICT tools do you think are lacking in your teaching practices?
    - How would having these additional tools change your teaching approach?
    - What specific learning experiences could you offer if you had access to these tools?
    - Have you or your colleagues found any creative solutions to compensate for lacking certain ICT tools?

Research Question 3: Challenges

1. What are the challenges you face in using ICT tools such as laptop, printer, mouse, desktop computer, projector, radio and phone for teaching in Early Childhood Education?
    - Which of these challenges impact your teaching most significantly?
    - How do you attempt to overcome these challenges?
    - How do these challenges affect the quality of education you're able to provide?
2. What are the challenges faced in using items such as infrastructure and electricity in teaching at Early Childhood centres?
    - How often do electricity issues disrupt planned ICT activities?
    - What backup strategies do you use when facing infrastructure limitations?
3. Share with me your experience in professional development in using ICT tools to teach at Early Childhood Centres in the Gomoa Central District.
    - What specific ICT skills would you like to develop further?

- How relevant have the training sessions been to your actual classroom context?
- What was the most valuable professional development experience you've had related to ICT?

4. Are there any other challenges you would like to talk about, aside from the ones you mentioned earlier?
    - How do parents and the community view the use of ICT in early childhood education?
    - What challenges do you face in terms of maintaining and repairing ICT equipment?

Research Question 4: Existing support systems available to teachers

1. What support systems are available to you for using ICT tools in teaching?
    - How accessible are these support systems when you need immediate help?
    - Who do you typically turn to first when facing ICT-related difficulties?
    - Is there any peer-to-peer support network among teachers for ICT use?
2. How effective are these support systems in helping you to use ICT tools in teaching?
    - Could you share a specific instance where support systems were particularly helpful?
    - What aspects of the current support systems could be improved?
3. What measures do you think should be put in place to improve the use of ICT tools in teaching?
    - How might these suggested measures specifically benefit early childhood learners?

APPENDIX B

STRUCTURED OBSERVATION CHECKLIST

Objective: To identify the ICT tools available and in use by teachers during instruction in Early Childhood Education (ECE) centres.

Section A: Basic Information Details

Class Observed (KG1/KG2): ……

Strand/Substrand: ……

Date of Observation: ……

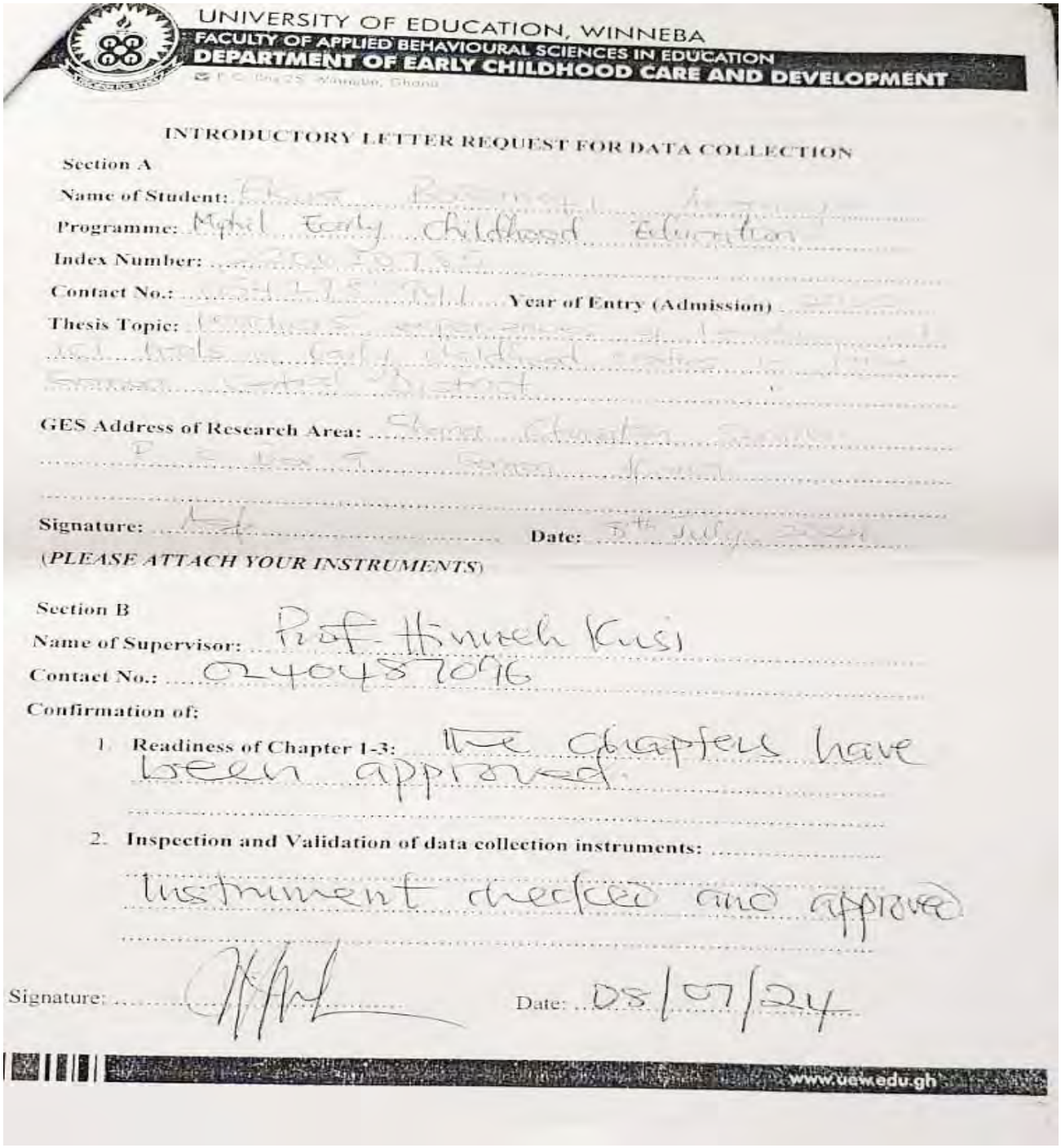
Section B: ICT Tools (Availability and Usage)

Please tick (✔) Yes or No for each item observed.

ICT Tool	Available in Classroom?	Used During Lesson?
Desktop/Laptop Computers	☐ Yes ☐ No	☐ Yes ☐ No
Projector/Multimedia Device	☐ Yes ☐ No	☐ Yes ☐ No
Interactive Whiteboard	☐ Yes ☐ No	☐ Yes ☐ No
Smart TV / Digital Screen	☐ Yes ☐ No	☐ Yes ☐ No
Tablet / iPad for Learners	☐ Yes ☐ No	☐ Yes ☐ No
Mobile Phone (used for instruction)	☐ Yes ☐ No	☐ Yes ☐ No
Internet Connectivity / Wi-Fi	☐ Yes ☐ No	☐ Yes ☐ No
Audio Devices (e.g., Radio, MP3 Speakers)	☐ Yes ☐ No	☐ Yes ☐ No
Educational Software or Apps (e.g., ABC apps)	☐ Yes ☐ No	☐ Yes ☐ No

THE END

APPENDIX C



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INTRODUCTORY LETTER REQUEST FOR DATA COLLECTION

Section A

Name of Student: [illegible]

Programme: Mphil Early Childhood Education

Index Number: [illegible]

Contact No.: [illegible] Year of Entry (Admission) [illegible]

Thesis Topic: [illegible]

GES Address of Research Area: [illegible]

Signature: [illegible] Date: 5th July, 2024

(*PLEASE ATTACH YOUR INSTRUMENTS*)

Section B

Name of Supervisor: Prof. Hinneh Kuisi

Contact No.: 0240487096

Confirmation of:

1. Readiness of Chapter 1-3: The chapters have been approved.

2. Inspection and Validation of data collection instruments: Instrument checked and approved

Signature: [signature] Date: 05/07/24

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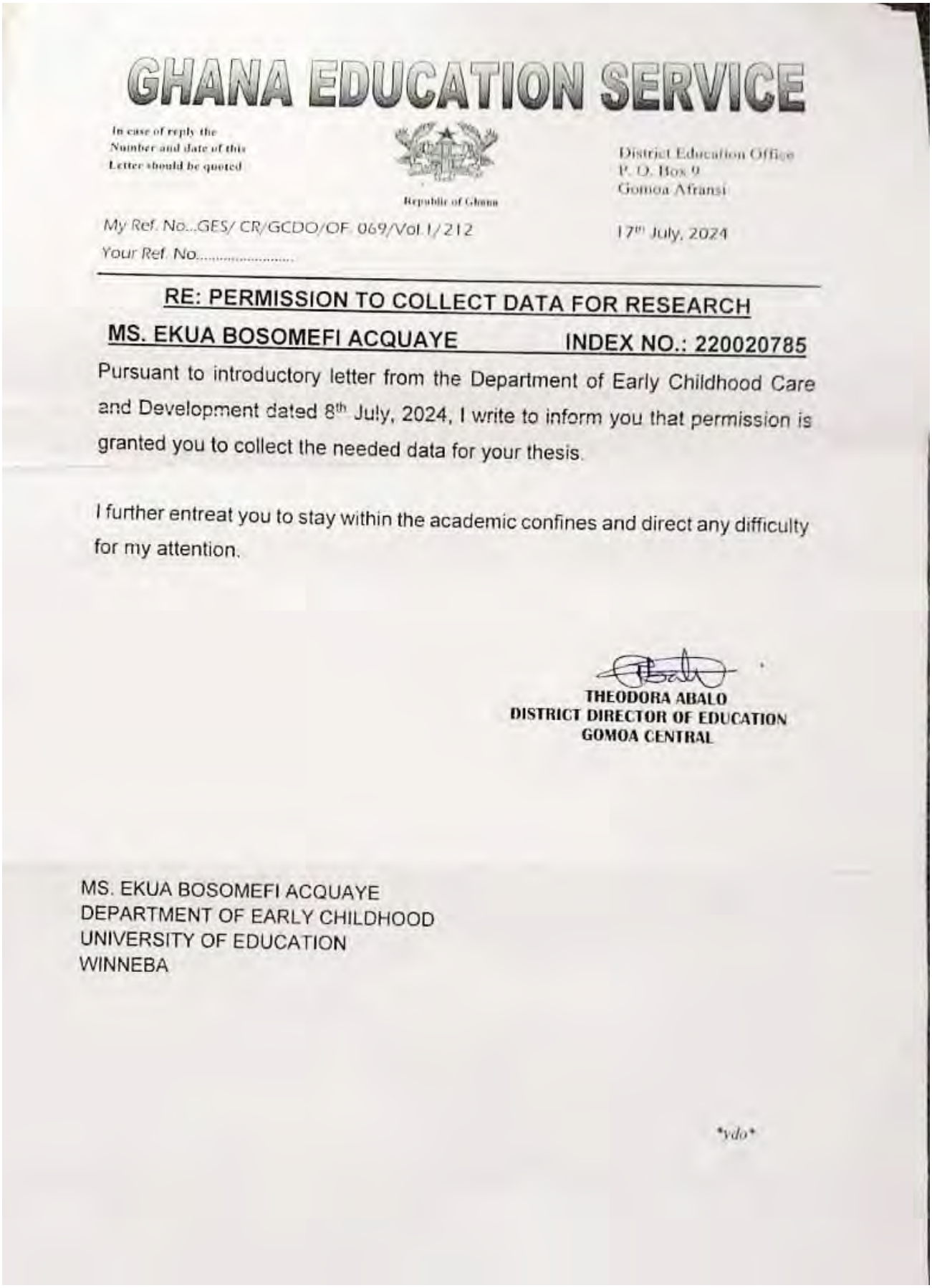
APPENDIX D



GHANA EDUCATION SERVICE

In case of reply the Number and date of this Letter should be quoted

Republic of Ghana

District Education Office
P. O. Box 9
Gomoa Afransi

My Ref. No...GES/ CR/GCDO/OF. 069/Vol.1/212

17th July, 2024

Your Ref. No.....

RE: PERMISSION TO COLLECT DATA FOR RESEARCH

MS. EKUA BOSOMEFI ACQUAYE INDEX NO.: 220020785

Pursuant to introductory letter from the Department of Early Childhood Care and Development dated 8th July, 2024, I write to inform you that permission is granted you to collect the needed data for your thesis.

I further entreat you to stay within the academic confines and direct any difficulty for my attention.

THEODORA ABALO
DISTRICT DIRECTOR OF EDUCATION
GOMOA CENTRAL

MS. EKUA BOSOMEFI ACQUAYE
DEPARTMENT OF EARLY CHILDHOOD
UNIVERSITY OF EDUCATION
WINNEBA

vdo