

UNIVERSITY OF EDUCATION, WINNEBA

**TEACHERS' USE OF DIGITAL TOOLS IN TEACHING AND LEARNING IN
KINDERGARTEN CENTERS WITHIN THE ASUNAFO NORTH
MUNICIPALITY**

ISSAH SUSOROKANA ISMAIL

MASTER OF PHILOSOPHY

2025

UNIVERSITY OF EDUCATION, WINNEBA



**TEACHERS' USE OF DIGITAL TOOLS IN KINDERGARTEN CENTERS IN
ASUNAFI NORTH MUNICIPALITY**

**ISSAH SUSOROKANA ISMAIL
(8241900009)**

**A thesis 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)**

**DEPARTMENT OF EARLY CHILDHOOD EDUCATION
FACULTY OF APPLIED BEHAVIOURAL SCIENCES IN EDUCATION
UNIVERSITY OF EDUCATION, WINNEBA**

JULY, 2025

DECLARATION

Student's Declaration

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

Signature:

Date:

Supervisor's Declaration

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

Supervisor's Name: Dr. Adam Awini

Signature:

Date:

DEDICATION

To my mother, Madam Rahinatu Salifu, my wife, Mrs. Lulua Amissauw and my lovely daughter, Binechie Iqra.

ACKNOWLEDGEMENTS

I wish to express my sincerest appreciation to a number of people who, in diverse ways, offered me help to successfully complete this thesis. I owe a great debt of gratitude to, especially, Dr. Adam Awini, my supervisor, for his patience, constructive criticisms and professional advice during the course of writing the thesis.

I also thank my course lecturers and all the research fellows and the administrative staff members at the Department of Early Childhood Education of the University of Education, Winneba, most especially, Prof. Michael Subbey - HOD for the Department. I am also grateful to Mr. Dery Titus, a PhD student from the Department of Special Education, University of Education Winneba, and Miss Hamida Quenda, of University of Cape Coast.

I appreciate the effort of colleague teachers in Edwinase M/A Basic school. I cannot forget Mr. Eric Nombare, Mr. Francis Nantiera and Mr. Lulua Mohammed, all of Tumu College of Education for their unflinching support. I also acknowledge the efforts of Mr. Frank Atoah for always being through with me. Special thanks also go to my uncle, Mr. Kassim Ibrahim, Madam Abigail Larweh, Mr. Sadique Mohammed, and Mr. Kamara Tijani, all of whose encouragement and motivation kept me moving throughout the period.

Lastly, I appreciate the staff members of Asunafo North Municipal Education Directorate for their support during the data collection process, especially Mr Richard Boamah, the Human Resource Manager, Mr. Isaac Siaw, Headteachers and Kindergarten teachers of the various Circuits who supported in diverse ways.

TABLE OF CONTENTS

Content	Page
DECLARATION	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
ABSTRACT	xi
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the study	1
1.2 Statement of the problem	6
1.3 Purpose of the study	9
1.4 Research Objectives	9
1.5 Research Questions	9
1.6 Significance of the Study	10
1.7 Delimitation of the Study	11
1.8 Operational definition of terms	12
1.9 Organization of the study	13
CHAPTER TWO: LITERATURE REVIEW	15
2.0 Introduction	15
2.1 Theoretical Framework	16
2.2 Unified Theory of Acceptance and Use of Technology (UTAUT) Theory	16
2.3 Technological Pedagogical and Content Knowledge (TPACK) Theory	18
2.3 Kindergarten Education in Ghana	24
2.4 Digital Tools	26
2.5 Impact of Digital Tools on Teaching and Learning Outcomes in Kindergarten Education	27
2.6 Policy and Regulatory Frameworks Supporting Technology Use in Kindergarten Education	33
2.6 Sustainability of Technology Integration	41
2.7 Teachers' Attitudes and Perceptions towards Technology in Early Education	45

2.8 Integration of Digital Tools into Early Childhood Curricula	50
2.9 Barriers and Challenges to Technology Adoption in Early Childhood Education	55
2.10 Best Practices and Successful Models of Digital Integration in Early Education	63
2.11 Summary of literature review	70
CHAPTER THREE: METHODOLOGY	72
3.0 Introduction	72
3.1 Philosophical Underpinning	72
3.2 Research Approach	72
3.3 Research Design	73
3.4 Population	74
3.5 Sample and Sampling Technique	74
3.6 Data Collection Instruments	76
3.7 Pilot Testing	77
3.8 Trustworthiness of the Qualitative Data	78
3.9 Validation of Instrument	79
3.10 Reliability of Instrument	80
3.11 Data Collection Procedures	80
3.12 Data Analysis Procedures	81
3.13 Ethical Considerations	82
CHAPTER FOUR: DATA PRESENTATIONS, ANALYSIS, AND DISCUSSION OF FINDINGS	84
4.0 Introduction	84
4.1 Presentation of Demographic Data	84
4.2 Analysis of Research Questions	87
4.3 Discussion of Research Questions	99
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	107
5.0 Introduction	107
5.1 Summary of the Findings of the Study	107
5.2 Conclusions	108

5.3 Limitations	110
5.4 Recommendations	110
5.5 Suggestions for Further Studies	111
REFERENCES	113
APPENDIX A	125
APPENDIX B	127
APPENDIX C	128
APPENDIX D	129

LIST OF TABLES

Table	Pages
4.1: Gender of Respondents	84
4.2: Age Range of Respondents	84
4.3: Academic Qualifications of Respondents	85
4.4: Specialized area of Respondents	86
4.5: Number of Years of Teaching Experience of Respondents	86
4.6: How skillful teachers are in the utilization of digital tools	92
4.7: Challenges teachers face in using digital tools	98

LIST OF FIGURES

Figure	Pages
2.1: Conceptual framework for the study: Teachers' use of digital tools in kindergarten centers	22

ABSTRACT

This study explores the use of digital tools in kindergarten centers in Asunafo North Municipality by teachers in those levels. We live in a digital world, and implementing technology within early childhood centers is very essential. The study aims at investigating teachers' perspectives and their level of skillfulness with digital tools, the way they integrate digital tools into their classroom practices, and the difficulties they encounter. A concurrent triangulation mixed methods design was used, in which quantitative and qualitative methods were applied. Structured questionnaires were administered to 155 kindergarten teachers for quantitative data, and 11 teachers were sampled purposively and interviewed for qualitative data. Quantitative data was analyzed using descriptive statistics – means and standard deviations, whereas qualitative responses were analyzed thematically. The study's findings revealed that teachers acknowledge the impact of digital tools but use them minimally due to poor infrastructure, lack of institutional support and inadequate training. While some teachers basically were highly skilled in using digital tools such as the ability to surf the internet and use of social media, others lack proficiency to effectively integrate digital tools into their teaching. The results highlight a gap between policy intentions and classroom realities. Teachers' limited skills and infrastructural constraints significantly hinder the adoption of digital tools. The study recommends targeted professional development and improved resource allocation. Future research could explore the effectiveness of specific training interventions and strategies for sustainable technology integration in early childhood education settings.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The need for digital transition across all organizations is becoming undeniably inevitable. As the world becomes increasingly digital, all organizations and sectors are going digital. Globally, the use of digital tools in education at all levels has grown in popularity with the percentage of internet users rising from 16% in 2005 to 66% in 2022 and about 50% of the world's lower secondary schools connected to the internet for pedagogical purposes in 2022 (UNESCO, 2023). They also stated that digital tools reduce the time teachers and students spend on menial tasks, time that can be used in other, educationally more meaningful activities. All organizations and sectors are said to be going digital as more than 60% of the global Gross Domestic Product (GDP) in 2022 was envisaged by the World Economic Forum to depend on digital technologies (World Economic Forum, 2023).

Organization for Economic Co-operation and Development (OECD) (2010) states that, although we are living in a technology-dominated society, the school might be the only place for some children to use digital tools because they have different family backgrounds and cultures. However, teachers who will implement the use of digital tools have varying perspectives on its use. New attitudes will have to emanate from teachers, such as to learn to adopt technology, and further, to know how to facilitate learning with technology (Wake & Whittingham 2013). The perspectives of teachers are highly important and have the tendency to influence whether teachers will accept or adopt and use technology.

Teachers' confidence and belief that technology was important for students' learning were the main factors contributing to technology integration, and also affected students' confidence in using it (Al-awidi & Alghazo 2012; Wastiau et al., 2013). However, Tezci (2011) concluded that having a computer and access to the Internet were perceived by teachers as influencing factors in enhancing school culture towards technology integration.

Teachers in Asunafo North are recorded to have varying views on the use of digital tools in kindergarten centers. I found this out from the Municipal early childhood Coordinator who stated that he gathered from teachers upon seeking to know their perspectives on digital tools use in early childhood settings. He reported that, some teachers were of the view that, young learners should be nurtured in line with the current dispensation-technology, whereas others held the view that computer use has influencing factors that will deviate learners from our cultural norms.

The study focused on Asunafo North Municipal Kindergarten schools, which were predominantly rural. A report for June-July 2021 by the Monitoring and Supervision Unit of the Asunafo North Municipal Education Directorate highlighted some significant issues, this included though some little availability of ICT facilities in some schools, teachers rarely incorporating technology into teaching (MOE, 2021). The report expressed concern over the prevalent use of traditional, teacher-centered lecture methods, which contradicts the Municipality's aim to enhance educational standards through ICT integration. These findings underscored the necessity to investigate and understand teachers' use of digital tools in early childhood education centers in the Municipality.

Teachers' perspectives on the need for digital tools in kindergarten Centers have a great influence on their adoption and use in their lesson deliveries. Digital transition involves the integration of digital tools into every aspect of learning. Education systems must, therefore, be positioned in a place with the digital literacy and skills they need to succeed in the workforce and society. Higgins et al., (2017) stated that, while there is a growing need for acceptance and use of digital tools, the emphasis is shifting to determining which technologies are appropriate for different use cases and how best to integrate them into different educational contexts.

Teachers' digital skills are essential for effectively integrating technology into classrooms and enhancing educational outcomes. These skills include basic digital literacy, information literacy, communication and collaboration, content creation, problem-solving and critical thinking, safety and responsibility, adaptability and learning, and creativity and innovation (Crompton, 2023). The importance of digital skills is underscored by the growing digital divide, which can exacerbate educational inequalities. Teachers with limited digital skills may struggle to provide students with necessary technology exposure, leading to reduced engagement and motivation (Prensky, 2001) and unequal access to educational opportunities (Selwyn, 2016). Research shows that teachers' digital skills significantly impact teaching practices and student outcomes. Koehler and Mishra (2013) emphasize the importance of Technological Pedagogical Content Knowledge (TPCK), which combines technological, pedagogical, and content knowledge. However, teachers face challenges such as limited access to digital tools, inadequate training and support, technical issues, and lack of institutional backing (U.S. Department of Education, 2017). Addressing these challenges through continuous professional development is crucial for enhancing teachers' digital competencies and ensuring effective technology

integration in the classroom (European Commission, 2020). Despite the impact of teachers digital skills mentioned above, few teachers in Asunafo North have reported possessing some level of digital skills including typing and use of mobile phones in making searches on the internet. Many were those who expressed not having any skills at all.

In early childhood education, digital tools have primarily served as a pedagogical tool to bolster the quality of teaching and learning in areas such as Science, Technology, Engineering, and Mathematics (STEM) education (Dorouka et al., 2020 & Marsh et al., 2018), mathematics (Cicconi, 2014 & Sinclair, 2018), and literacy (Burnett, 2010 & Neumann, 2018). Moreover, the Ministry of Education's Information and Communication Technology (ICT) Education Policy identified ICT's integration into teaching all subjects as one of the three domains that any curriculum for schools in Ghana needs to address through teacher planning and delivery of the curriculum and teacher use of ICT to access information relevant to education under the Education Strategic Plan 2018-2030 which is also in line with Sustainable Development Goal (SDG) 4 (Ministry of Education, 2018). Lee et al., (2015) as cited in Muia (2021) observed that one of Singapore's education system key pillars has been the focus on integration of ICT into the classroom. Thus, school principals, students, and teachers' use of ICTs forms the foundation of Singapore's education system. A Mobile Learning and Digital Books in Primary Education project (known as the "Digital Book Project", 2014–2016) was instituted in Finland where six primary schools in a mid-sized city in western Finland collaborated and designed a new learning environment for primary education based on digital technologies.

In the case of Asunafo North Municipality, early childhood teachers do not incorporate digital tools into their classroom deliveries. This is per a report for June-

July 2021 by the Monitoring and Supervision Unit of the Asunafo North Municipal Education Directorate, which stated that teachers rarely incorporate technology in their teaching (MOE, 2021).

The incorporation of digital tools in teaching by teachers and its general use are faced with challenges. Some studies suggest that there could be a variety of obstacles that prevent teachers and schools from using ICT in classrooms. The European ICT in Education survey categorized barriers as follows: three main categories of obstacles: those pertaining to devices, pedagogy, and attitude (European Commission, 2020). Tormala (2021) posits that the school network does not allow too many pupils to connect at the same time, and the learning situation is chaotic owing to many technical challenges, lack of skills, and lack of time. Technology creates a new layer for the school and needs continuous updating, security, and support for teachers as well as pupils.

According to Abedi et al. (2023), teachers' readiness and capacity to use technology are influenced more by first-order hurdles than by second-order barriers. These constraints include lack of professional development, poor technology leadership, and restricted technological resources. Abdulai (2013) states that, teachers are faced with challenges regarding lack of equipment. He also noted a greater percentage (65.9 %) of early childhood teachers in Winneba agreeing to the use of the Internet to augment notes; a further probe on Internet accessibility and reliability proved very poor and critical. The above statement is not different in the case of Asunafo North Municipality where some of the areas in the municipality are rural with critical internet accessibility issues, many schools lacking digital tools resources, and others having to struggle with partly functioning devices.

1.2 Statement of the problem

The demand for digital tools in classrooms has been increasing, with the Ghanaian Ministry of Education implementing an ICT policy to encourage integration and boost stakeholder commitment (Ministry of Education, 2018). However, despite the Municipal Director of Asunafo North Municipality, Madam Margaret Buobu, emphasizing the need for digital tools in classrooms, many teachers in the area do not utilize technological tools, as revealed in a 2021 monitoring report.

Teachers' perspectives significantly influence the successful integration of digital tools. Many teachers in Asunafo North Municipality express concerns about the availability, reliability, and appropriateness of digital tools. This was gathered in my engagement with some early childhood teachers in the Municipality at a workshop on pedagogical strategies in Goaso- the capital city of the Municipality as a teacher in the area for the past five (5) years. Others may perceive digital tools as a distraction or a potential health risk, citing concerns about excessive screen time and its impact on children's well-being (American Academy of Paediatrics, 2016). These beliefs and perceptions can result in underutilization or misuse of available technology, diminishing its potential benefits.

Being a teacher in the Municipality for the past five years, I engaged a number of teachers on the issue of digital tool usage and some expressed having some level of digital skills including typing and use of mobile phones in making searches on the internet. Many were those who expressed not having any skills at all. I made these engagements on two separate occasions, one during a circuit-based workshop at the Ayomso Circuit A and B, while the other happened in a District workshop in the capital of the Municipality- Goaso. Meanwhile the lack of digital skills among kindergarten teachers has significant implications for young learners both today and

in the future. Young learners may experience limited exposure to technology, impeding their development of essential digital literacy skills from an early age (Resnick, 2017). This can lead to reduced engagement and motivation, as traditional teaching methods may not captivate young learners as effectively as interactive digital tools (Prensky, 2001). Additionally, unequal access to educational resources can arise if teachers struggle to integrate online resources and educational apps into their teaching (Selwyn, 2016). Looking ahead, the digital divide may widen, affecting students' future educational and career opportunities (Van Dijk, 2020). Students who lack early digital skills may struggle to compete in a job market that increasingly demands digital literacy (World Economic Forum, 2021). Furthermore, they may face challenges in lifelong learning and adapting to new technologies, which are crucial for continuous personal and professional growth (European Commission, 2020). The absence of digitally skilled teachers can significantly impact young learners' immediate and long-term educational and career prospects, underscoring the need for comprehensive digital skills training for educators.

Effective integration requires teachers to understand both the technological tools and the pedagogical strategies to leverage them for optimal learning outcomes. However, many teachers face challenges in achieving this, and the potential dangers of incorrect technology integration, such as excessive screen time and health risks, are substantial (American Academy of Paediatrics, 2016). Misuse of technology can result in a disjointed learning experience, hindering the development of crucial cognitive and social skills (Frost et al., 2008). My engagement with some colleague teachers in the municipality in kindergarten centers revealed that they do not incorporate digital tools in their teaching, confirming what the early childhood coordinator and the municipal director reported. The lack of incorporation of digital tools may leave these young

learners in a state of no-exposure to digital experience which is becoming the order of the day, consequently making them not to be familiar this all important and shift in paradigm.

Engaging with some kindergarten teachers in Asunafo North Municipality as a teacher in the Municipality for the past five years, revealed several barriers to digital tools adoption. Some teachers found digital tools time-consuming and tedious, while others lacked necessary resources or faced internet-related issues. Some also expressed worries of not having the technical know-how to incorporate digital tools into their lessons. These setbacks may hinder the integration of digital tools in Asunafo North Municipality. The resulting consequent may include underutilization of available resources, robbing young learners off the benefits of exposure to digital tools at an early age.

The Technology Acceptance Model (TAM) has been used to describe technology usage behavior in the majority of studies examining teachers' adoption of digital technologies. TAM has several limitations even if it offers insightful information on perceived utility and perceived ease of use. In particular, TAM gives little attention to institutional, pedagogical, and contextual elements that are especially important in kindergarten settings, such as training opportunities, policy support, resource availability, and age-specific teaching needs. Because the model might not adequately capture the numerous elements impacting kindergarten teachers' use of digital tools, the over-reliance on TAM results in a theoretical gap.

While several studies have looked at how instructors use digital tools in the classroom, most of them have concentrated on secondary and postsecondary educators. As a result, despite their crucial role in influencing students' early digital

exposure and basic abilities, kindergarten or early childhood instructors have been significantly underrepresented in empirical research. Because the results from higher school levels might not accurately reflect the reality, competences, and contextual challenges faced by kindergarten instructors, this leads to a population gap.

1.3 Purpose of the study

The purpose of this study was to explore how teachers in kindergarten centers in the Asunafo North Municipality use digital tools to teach learners.

1.4 Research Objectives

The following objectives guided the study:

1. Find out teachers' perspectives about the use of digital tools in kindergarten centers in the Asunafo North Municipality.
2. Assess how skillful teachers use digital tools in kindergarten centers in the Asunafo North Municipality.
3. Find out how teachers incorporate digital tools in their teaching in kindergarten centers in the Asunafo North Municipality.
4. Identify the challenges teachers face in using digital tools in kindergarten centers in the Asunafo North Municipality.

1.5 Research Questions

The following research questions were raised;

1. What perspectives do teachers have on the use of digital tools in kindergarten centers in the Asunafo North Municipality?
2. How skillful are teachers in the utilization of digital tools in kindergarten centers in the Asunafo North Municipality?

3. How do teachers incorporate digital tools in their teaching practices in kindergarten centers within the Asunafo North Municipality?
4. What are the challenges teachers face in using digital tools in kindergarten centers in the Asunafo North Municipality?

1.6 Significance of the Study

This study's practical importance stems from its ability to enhance kindergarten centers' instructional strategies. Teachers can be motivated to adopt more engaging and productive teaching strategies by the research's identification of best practices and creative applications of digital resources. Furthermore, by comprehending the difficulties teachers encounter, specialized professional development initiatives and assistance networks can be created. This can improve the digital literacy and competency of teachers, which can ultimately benefit young children's learning experiences. The knowledge acquired can be used to improve early childhood education practices more widely by being implemented not only in the Asunafo North Municipality but also in other educational settings.

The study holds significant policy implications. By exploring teachers' perspectives and assessing their skills, the findings can guide policymakers in developing targeted initiatives to support digital integration in early childhood education. Understanding the challenges teachers face can inform resource allocation decisions, ensuring that necessary infrastructure and support systems are in place. This can lead to the formulation of evidence-based policies that enhance the quality of education and prepare young learners for a digital future.

This study contributes to the existing body of knowledge on digital tool usage in educational settings, particularly in early childhood education. By examining how

teachers incorporate digital tools into their teaching practices, the research provides insights into effective pedagogical approaches. The findings can enrich educational theories and models, offering a context-specific analysis that can be compared with other studies. This theoretical contribution can advance our understanding of the role of digital tools in enhancing learning outcomes and teacher effectiveness.

1.7 Delimitation of the Study

Firstly, the study was geographically confined to the Asunafo North Municipality. This allowed for a context-specific analysis of digital tools usage in kindergarten centers within the area. The educational context, including resources, infrastructure, and cultural factors, can vary significantly across different regions. By concentrating on the Asunafo North Municipality, the study provided insights that are directly relevant and applicable to the local educational context, ensuring that the findings are practical and actionable for stakeholders in this area.

Secondly, the study focused specifically on kindergarten centers, excluding other educational levels such as primary or secondary schools. This delimitation was crucial because the use of digital tools and its associated challenges may vary significantly across different educational levels. Kindergarten education has unique characteristics, including the developmental stage of the children, the pedagogical approaches used, and the resources available. By concentrating on kindergarten centers, the study can provide in-depth insights into the unique needs and practices of early childhood educators, ensuring that the findings are tailored to this specific educational context.

Thirdly, the study employed a mixed-methods concurrent triangulation design, which combines quantitative and qualitative data collection and analysis methods. This approach allowed for a comprehensive understanding of the research topic by

integrating the strengths of both methodologies. The quantitative component, involving questionnaires provided a broad overview of teachers' skills and challenges, allowing for generalizations and statistical analysis. The qualitative component, included interviews, exploring the variations of digital tool integration in teaching practices and what teachers generally perceive about the use of digital tools in kindergarten centers, providing a deeper understanding of the complexities and context-specific factors. By using a mixed-methods approach, the study offered a more holistic and robust analysis of the research topic.

Lastly, the study was delimited to the perspectives and practices of teachers, excluding other stakeholders such as parents, administrators, or policymakers. This focus is because teachers are the primary users of digital tools in the classroom and play a crucial role in the effective integration of these tools into teaching practices. Their experiences, perspectives, and challenges are central to understanding the current state of digital tool usage in kindergarten centers in the area.

1.8 Operational definition of terms

For the purposes of this study, the following definitions will apply:

Digital Tools: Digital tools refer to any electronic devices, software, applications, or online platforms used to support teaching and learning activities. Examples include computers, tablets, interactive whiteboards, educational apps, and online learning platforms.

Kindergarten Centers: Kindergarten centers are educational institutions that provide early childhood education for children typically aged 3 to 5 years. These centers focus on the social, emotional, and cognitive development of young children.

Teachers' Perspectives: Teachers' perspectives refer to the attitudes, beliefs, opinions, and perceptions that teachers hold regarding the use of digital tools in their teaching practices.

Skills: Skills refer to the abilities and competencies that teachers possess in utilizing digital tools effectively for educational purposes. This includes technical proficiency, pedagogical knowledge, and the ability to integrate digital tools into teaching practices.

Teaching Practices: Teaching practices encompass the methods, strategies, and approaches that teachers employ in the classroom to facilitate learning. This includes the use of digital tools to enhance instruction and engage students.

Challenges: Challenges refer to the obstacles, difficulties, or barriers that teachers face when using digital tools in their teaching practices. These can include technical issues, lack of resources, inadequate training, or resistance to change.

1.9 Organization of the study

The study comprises five chapters. Chapter one includes the background to the study, statement of the problem, purpose of the study, objectives, research questions, significance of the study, delimitations of the study, operational definition of terms and organization of the study. Chapter two covers a review of literature. This particularly looks at theoretical framework, conceptual framework, and review of concepts relevant to the study and also a conduct of empirical review of earlier works related to the study. Chapter three deals with research paradigm, research approach, design, population, sample and sampling procedures, research instruments, data collection procedures and data analysis and ethical considerations. Chapter four

consists of data presentation and analysis. Chapter five presents a summary, conclusions and recommendations for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter focused on the review of related literature for the study. The literature review was structured under the following sub headings, theoretical framework, the empirical review and the summary of the literature. The following themes guided the review of literature.

- Theoretical Framework
- Unified Theory of Acceptance and Use of Technology (UTAUT) Theory
- Technological Pedagogical and Content Knowledge (TPACK) Theory
- Kindergarten Education
- Digital Tools
- Impact of Digital Tools on Teaching and Learning Outcomes in Kindergarten
- Policy and Regulatory Frameworks Supporting Technology Use in Kindergarten Education
- Sustainability of Technology Integration
- Conceptual Framework
- Empirical Review
- Teachers' Attitudes and Perceptions towards Technology in Early Education
- Integration of Digital Tools into Early Childhood Curricula
- Barriers and Challenges to Technology Adoption in Early Childhood Education
- Best Practices and Successful Models of Digital Integration in Early Education
- Summary of the literature

2.1 Theoretical Framework

2.2 Unified Theory of Acceptance and Use of Technology (UTAUT) Theory

The Unified Theory of Acceptance and Use of Technology (UTAUT) were developed by Venkatesh, et. al. in 2003 as a comprehensive framework for explaining and predicting the acceptance and use of technology by individuals. This theory was built by integrating elements from eight previous models of technology acceptance, including the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), and the Innovation Diffusion Theory (IDT). The primary aim of UTAUT is to provide a unified view of how individuals come to accept and use technologies in different contexts (Venkatesh et al., 2003).

UTAUT identifies four core determinants that influence the adoption and use of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy refers to the degree to which individuals believe that using a particular technology will improve their job performance. Effort expectancy deals with the perceived ease of use associated with the technology. Social influence refers to the extent to which an individual believes that important others think they should use the technology, and facilitating conditions refer to the perceived availability of the necessary resources and support for using the technology. UTAUT also introduces four moderators age, gender, experience, and voluntariness of use that impact the strength of the relationships between these determinants and technology adoption behaviors (Venkatesh et al., 2003).

Scholars have made significant contributions to the UTAUT framework since its development. Venkatesh and colleagues (2012) extended the model to include additional variables such as hedonic motivation, habit, and trust, especially in the context of newer technologies like mobile and online services (Venkatesh et al.,

2012). Moreover, the theory has been widely applied across various industries, including healthcare, education, and e-commerce, demonstrating its versatility. Researchers such as Williams et al. (2015) have used UTAUT to investigate technology acceptance in these fields, further validating its robustness (Williams et al., 2015). The theory has also been tested in cross-cultural settings, as scholars like Taiwo and Downe (2013) emphasized that cultural norms and technological infrastructure can significantly influence user behavior and acceptance patterns, showcasing the model's adaptability to different cultural contexts (Taiwo & Downe, 2013).

UTAUT is based on several key assumptions. First, it assumes that individuals make rational decisions regarding the use of technology, weighing the benefits and the effort required. It also assumes that social influence plays a vital role in technology acceptance, particularly in environments where usage may be mandated. Furthermore, UTAUT assumes that adequate technical and organizational infrastructure must be in place for successful technology adoption. The theory's broad application is grounded in the assumption that these factors are universal across different types of users and technologies (Venkatesh et al., 2003).

One of the main advantages of UTAUT is that it integrates constructs from multiple models, offering a more comprehensive framework than any individual model alone. Its predictive power is significant, explaining up to 70% of the variance in user intention to adopt technology, substantially more than previous models like TAM or TRA (Venkatesh et al., 2003). Another strength of UTAUT is its flexibility; it has been adapted for use in various contexts, ranging from enterprise software to educational technology tools (Williams et al., 2015). The inclusion of moderators

such as age, gender, and experience further enhances the model's applicability across different demographic groups (Venkatesh et al., 2003).

Despite these advantages, UTAUT has faced several criticisms. Some scholars argue that the model's complexity, with its many variables and moderators, makes it difficult to apply in practical research settings (Bagozzi, 2007). Additionally, while UTAUT has been validated in many contexts, some critics claim it may not effectively explain voluntary versus mandatory technology use, especially in scenarios where external pressures to adopt the technology are high (Venkatesh et al., 2012). Furthermore, while UTAUT has been tested in different cultural settings, some researchers argue that its original development in a Western context might limit its applicability in non-Western societies (Im et al., 2011).

UTAUT is the chosen theoretical framework for this study because it offers a more comprehensive and integrated approach to understanding technology adoption compared to other models like TAM or TRA. Its inclusion of a wide range of determinants and moderators allows for a more understanding of user behavior, making it particularly well-suited for studying how external and internal factors influence technology use. Its adaptability to different contexts, predictive power, and ability to account for individual differences make UTAUT the most appropriate framework for this research, offering deeper insights than alternative theories (Venkatesh et al., 2003).

2.3 Technological Pedagogical and Content Knowledge (TPACK) Theory

Mishra and Koehler in 2006, provides a comprehensive understanding of the dynamics between content, pedagogy, and technology in teaching. This framework builds on Shulman's concept of Pedagogical Content Knowledge (PCK), which

emphasizes the integration of content and pedagogy, adding technology as a crucial third component (Mishra & Koehler, 2006). The theory argues that effective teaching in the digital age requires educators to develop knowledge in three interconnected areas: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). The intersection of these domains creates a unique form of knowledge that is essential for integrating technology meaningfully into teaching practices.

The TPACK framework asserts that technology should not be viewed in isolation but should be blended with pedagogy and content to enhance learning outcomes. Teachers need to understand how technology can transform the way they teach specific content and how it can be used to facilitate better learning experiences. This dynamic and integrated approach recognizes that teaching with technology is more than just knowing how to use digital tools—it requires an understanding of how these tools relate to pedagogy and content (Mishra & Koehler, 2006).

Since its inception, TPACK has been widely discussed and extended by scholars, particularly in the context of teacher education and instructional design. Angeli and Valanides (2009) explored how TPACK could be systematically incorporated into teacher preparation programs, emphasizing the importance of developing all three types of knowledge in tandem (Angeli & Valanides, 2009). Additionally, Koehler, Mishra, and Cain (2013) showed how the TPACK framework can be used to design technology-rich learning environments, highlighting its value in helping teachers reflect on how their knowledge of technology, pedagogy, and content intersect to improve teaching effectiveness (Koehler et al., 2013). The theory has also been applied across various disciplines, from science education to language learning, demonstrating its versatility and relevance in diverse educational settings.

TPACK rests on several key assumptions. Firstly, it assumes that technology in education should be integrated with pedagogy and content to create meaningful learning experiences. It also presumes that teaching is a dynamic process that requires flexibility, as educators must continuously adapt their technological, pedagogical, and content knowledge to meet the evolving needs of students and the rapidly changing technological landscape. Additionally, TPACK assumes that teachers need ongoing professional development to enhance their ability to integrate these three knowledge domains effectively (Mishra & Koehler, 2006). One of the major advantages of the TPACK framework is its holistic approach to understanding the knowledge required for effective teaching with technology. By emphasizing the integration of content, pedagogy, and technology, TPACK provides educators with a comprehensive framework for navigating the complexities of modern teaching environments. Its adaptability across different subjects and contexts is another significant advantage, as it can be applied to various disciplines and educational levels.

Furthermore, TPACK encourages continuous professional development, recognizing that the integration of technology in education is an ongoing process that requires teachers to stay updated with new tools and pedagogical strategies (Angeli & Valanides, 2009). However, the TPACK framework has also faced criticism. Some scholars argue that the complexity of the model, with its focus on three distinct areas of knowledge, makes it difficult for educators to apply in practice. Teachers, especially those with limited experience in using technology, may find it challenging to balance content, pedagogy, and technology in their teaching. Critics like Brantley-Dias and Ertmer (2013) have also pointed out that TPACK tends to focus on the individual teacher's knowledge and skills while overlooking systemic factors such as access to resources and institutional support, which are critical for successful

technology integration (Brantley-Dias & Ertmer, 2013). Additionally, the rapid pace of technological advancements can make it difficult for educators to stay up-to-date with the latest tools and practices, potentially limiting the applicability of the TPACK model in rapidly changing environments.

The choice of TPACK as a complementary theory to UTAUT in this study is driven by the desire to address both the adoption and effective use of technology in educational settings. While UTAUT provides insights into the factors that influence technology acceptance and use, TPACK focuses on how technology can be effectively integrated into teaching practices to enhance learning. This dual approach offers a more comprehensive understanding of how teachers adopt and utilize technology in their classrooms, making it an ideal theoretical framework for studies exploring educational technology. TPACK's emphasis on the intersection of content, pedagogy, and technology provides valuable insights into the practical challenges and opportunities of using technology in education, complementing UTAUT's focus on the broader factors influencing technology adoption (Mishra & Koehler, 2006).

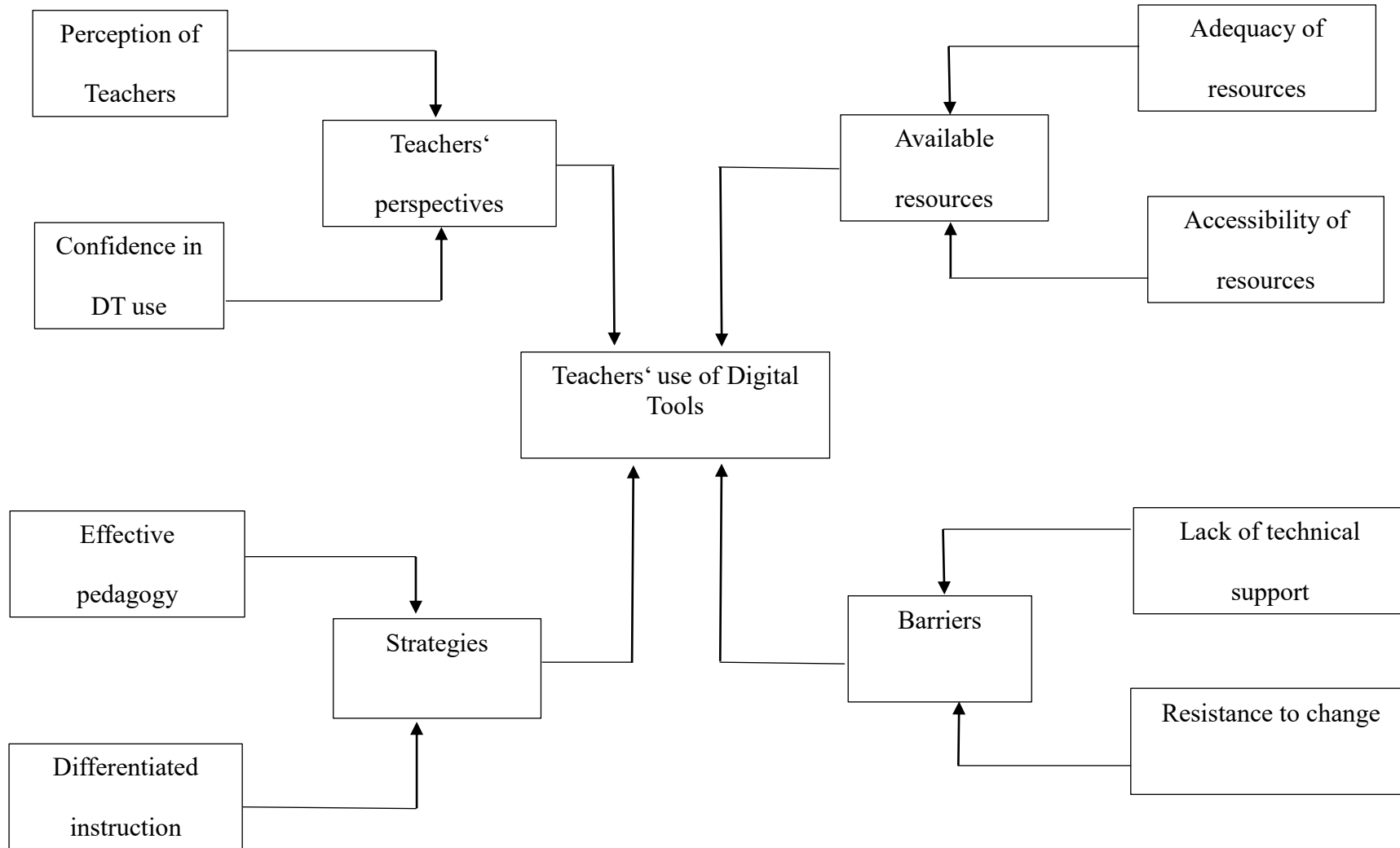


Figure 2.1: Conceptual framework for the study: Teachers' use of digital tools in kindergarten centers.

Digital tool use is controlled by several factors. In the presence of some of these factors such as digital technology resource availability, training and confidence of usage, accessibility of resources and good perception of technology use, the results of usage prove positive and it proves otherwise in the absence of the above listed as well. This conceptual framework guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003) will be used to assist in the understanding of the factors that influence the use of digital technologies. The UTAUT model proposes four key constructs that directly influence an individual's behavioral intention to use a technology, which in turn impacts their actual use behavior. These constructs are:

Performance Expectancy: This refers to the degree to which an individual believes that using the technology will help them attain gains in job performance. If users perceive digital technologies as useful and productive tools that can enhance their work efficiency and effectiveness, they are more likely to adopt them.

Effort Expectancy: This captures the perceived ease of use associated with the technology. Digital technologies that are intuitive, user-friendly, and require minimal effort to learn and operate are more likely to be accepted and used by individuals.

Social Influence: This construct reflects the extent to which an individual perceives how important others (e.g., colleagues, supervisors, friends) believe they should use the technology. This subsequently leads to change where as in the case of resistance to, the technology use is not accepted. Social influence can play a significant role in shaping an individual's intention to use digital technologies, especially in organizational or group settings.

Facilitating Conditions: This is the degree to which an individual believes that organizational and technical infrastructure exists to support the use of the technology. Adequate resources, training, and compatibility with existing systems can facilitate the adoption and sustained use of digital technologies.

In addition to these four key constructs, the UTAUT model also considers moderating variables such as age, gender, experience, and voluntariness of use, which can influence the strength of the relationships between the constructs and behavioral intention. These constructs are interconnected and can influence each other in shaping an individual's intention to use digital technologies. For example, if a digital technology is perceived as useful (performance expectancy) and easy to use (effort expectancy), and if the social environment encourages its use (social influence), and if the necessary support and resources are available (facilitating conditions), then individuals are more likely to develop a positive intention to adopt and use that technology. By understanding these interconnected factors and their relative importance in a given context, organizations or technology developers can design and implement strategies to promote the acceptance and effective utilization of digital technologies among their target user.

2.3 Kindergarten Education in Ghana

Kindergarten is a day-care service offered to children from age three until the child starts attending formal school and it is integrated into basic school structure. According to Boateng and Sekyere (2017) the aim of integrating kindergarten education into the basic school structure in Ghana was to ensure that all primary school children have a basic education rooted in good kindergarten training. The incorporation of kindergarten education into the Free Compulsory Universal Basic Education seeks to achieve about five objectives. The objectives are to (1) pre-dispose

children to conditions of formal schooling in order to accelerate the learning process during formal education; (2) strengthen primary education through the provision of pre-school education; (3) inculcate in children the desire of learning; (4) introduce children to basic hygiene and sanitation for healthy living; and (5) minimize gender barriers which seem to affect girls even before they enter primary school (Boateng & Sekyere 2017). McGi-Frazen (2000) opines that Kindergarten education is the education for children usually between the ages of 5 – 6 years olds which is to prepare them for formal school. Kindergarten develops basic skills and social behaviour by games, exercises, music and simple activities (McGi-Frazen, 2000). Teachers provide manipulative materials and activities to motivate children to learn and develop holistically. Kindergarten classrooms provide a nurturing atmosphere which nourishes young imaginations and instils self confidence in the children to lay a solid foundation for the formal school. Kindergarten education serves as a basis for human development and exposes children to experiences that will have lasting influence in childhood. It lays the foundation for creativity, imagination, self-reliance and survival of the young child (Asenso-Boakye, 2005). Kindergarten became an integral part of the formal educational system in Ghana in 2003, following recommendations from the President's Committee on Review of Education Reforms about the importance of early childhood development. The government in its bid to enhance quality kindergarten education made a conscious effort to provide resources to support the expansion of kindergarten facilities. It is the aim of the government that every child in Ghana has access to quality kindergarten education and to ensure that all primary school children have basic education that is rooted in good kindergarten education.

2.4 Digital Tools

Digital tools encompass a broad spectrum of technologies designed to assist users in performing tasks more efficiently. These tools can be categorized into several types, including productivity software, communication platforms, educational technologies, and data analysis tools. For instance, productivity software like Microsoft Office and Google Workspace are widely used in both educational and professional contexts to streamline workflows and enhance collaboration (Microsoft, 2021; Google, 2022). Communication platforms such as Zoom and Slack have become essential for remote work and online learning, enabling real-time interaction and collaboration (Zoom, 2020; Slack, 2021).

In the educational context, digital tools play a crucial role in supporting teaching and learning. Educational technologies, such as learning management systems (LMS) like Moodle and Blackboard, provide platforms for course delivery, assessment, and student engagement (Moodle, 2022). Interactive whiteboards, educational apps, and online resources further enrich the learning experience by offering multimedia content and interactive activities (Gökçearsan et al., 2019). Research has shown that the integration of digital tools in education can lead to improved student outcomes and increased engagement. For example, a study by Gökçearsan et al., (2019) found that the use of digital tools in educational contexts can enhance critical thinking and problem-solving skills among students. Additionally, digital tools can support personalized learning by allowing educators to tailor instruction to individual student needs (Lee et al., 2018).

In professional settings, digital tools are essential for enhancing productivity, communication, and data management. Data analysis tools, such as Tableau and

Power BI, enable organizations to visualize and analyze data, making informed decisions (Tableau, 2022; Power BI, 2021).

The adoption of digital tools in the workplace has been linked to increased efficiency and innovation. For instance, a report by McKinsey & Company (2020) highlighted that organizations leveraging digital tools experienced significant improvements in operational efficiency and customer satisfaction. Furthermore, digital tools facilitate remote work and flexible working arrangements, which have become increasingly important in the modern work environment (Slack, 2021).

2.5 Impact of Digital Tools on Teaching and Learning Outcomes in Kindergarten Education

Digital tools are seen to enhance various cognitive, social, and academic outcomes for young children, but several key gaps remain that challenge their effective and equitable implementation. For instance, the integration of digital tools within kindergarten classrooms is highly influenced by how teachers understand and apply these technologies. Ivanova discusses the use of the SAMR framework (Substitution, Augmentation, Modification, and Redefinition), which supports educators in transforming their pedagogical approaches. While this framework provides structure, it heavily depends on the individual teacher's skill and enthusiasm for digital adoption. This introduces variability in outcomes, as teachers with limited digital literacy may not realize the full potential of the tools (Ivanova, 2024).

In a different study, Zaranis et al. (2013) explored the use of mobile devices for teaching mathematics using the Realistic Mathematics Education (RME) approach. Their findings suggest that mobile devices, coupled with well-designed apps, significantly improved children's mathematical understanding. However, the success

of these interventions is contingent on both the quality of the apps and the teachers' ability to integrate them effectively. Without appropriate professional development, many teachers may fail to leverage these tools' full capabilities, thus limiting their impact.

Studies like those by Goodwin (2008), who examined the impact of interactive multimedia on learning fractions in kindergarten, indicates the potential for digital tools to deepen conceptual understanding. In her research, students who used dynamic visual tools exhibited more advanced cognitive structures compared to their peers who followed traditional methods. However, this study, like others, fails to account for the long-term retention of these skills, raising questions about the sustainability of the gains achieved through digital interventions (Goodwin, 2008).

While digital tools can aid in learning, the challenges of proper implementation and training are highlighted in Laanpere et al. (2023), who critically analyzed the development of digital competencies in teacher training programs. They found that current curricula do not adequately prepare teachers for integrating digital tools into early education. The absence of structured support for teachers results in inconsistent outcomes, with some educators struggling to incorporate technology meaningfully into their lessons. This gap highlights the urgent need for better teacher training and ongoing professional development.

Bonneton-Botté et al. (2020) offer further details by examining the use of tablet applications to improve handwriting skills. Their study reveals that children with medium-level handwriting skills showed the most improvement, while those with lower skill levels did not benefit as much. This suggests that digital tools may inadvertently widen achievement gaps unless they are carefully tailored to the diverse

needs of students. The study also indicates the importance of adaptive feedback mechanisms to maximize the effectiveness of digital interventions (Bonneton-Botté et al., 2020).

At the intersection of technology and pedagogy, Strawhacker et al. (2018) conducted an investigation into the relationship between teaching styles and student outcomes in kindergarten classrooms using Scratch Jr, a programming environment designed for young learners. Their study revealed that children's success in learning to code was highly dependent on the flexibility and responsiveness of the teacher. Teachers who adapted their teaching styles to accommodate the new technology and foster independent thinking saw better outcomes. This reinforces the idea that the effectiveness of digital tools is not just a function of the technology itself, but also the pedagogical practices that accompany it (Strawhacker et al., 2018).

Another study by Lin et al. (2017) examined the impact of digital tools on learning motivation and outcomes. Their findings show that digital learning presents better motivational effects than traditional methods, particularly through its ability to provide immediate feedback and engage learners in interactive activities. However, they also caution that an over-reliance on extrinsic motivators, such as the digital platform's rewards and feedback loops, might detract from developing intrinsic motivation for learning. This is a critical area that requires more exploration to ensure that digital tools do not diminish students self-motivated learning (Lin et al., 2017).

On a broader scale, Ertmer and Ottenbreit-Leftwich (2013) reviewed how teacher knowledge, beliefs and their culture intersect in technology use and identified conflicting data regarding their impact. While digital environments like educational games can enhance creativity, there are discrepancies in how different types of digital

media influence educational outcomes. This calls for a more detailed approach to evaluating these tools, particularly in understanding how the interaction between the child, teacher, and technology shapes learning experiences.

The integration of artificial intelligence (AI) in early education presents another dimension to digital learning. Samawi (2023) explored AI's role in personalizing learning experiences for kindergarten children. While AI tools can tailor educational content to meet individual needs, the study warns of the risks of widening digital disparities, particularly for children from disadvantaged backgrounds. Without careful implementation, AI could exacerbate existing inequalities, limiting its potential to foster inclusive educational environments.

The literature indicates that while digital tools can significantly improve learning outcomes in kindergarten, these benefits are not uniformly distributed. The effectiveness of digital interventions depends heavily on teacher preparedness, the adaptability of the tools, and the socio-economic context in which they are deployed. In the context of Ghana, the integration of digital tools into kindergarten education has gained increasing attention, particularly in light of global trends that emphasize technology-enhanced learning. However, the implementation and outcomes of such initiatives in Ghana's early childhood education system remain mixed, as the country grapples with infrastructural challenges, teacher preparedness, and equitable access to technology.

Several Ghanaian scholars have explored the impact of digital tools in early childhood education. For instance, Drigas and Kokkalia, (2014) examined the effects of digital learning tools on early literacy development in Accra-based kindergartens. Their study revealed that digital applications such as literacy games and storytelling apps

significantly improved children's phonological awareness and vocabulary acquisition. However, the researchers also pointed out that the success of these tools heavily depends on the digital literacy of teachers and the availability of resources. Many teachers in their sample lacked the necessary skills to integrate these tools effectively into their classrooms, which limited their potential impact on learning outcomes. This raises concerns about the level of teacher training and support available in the Ghanaian context, as digital education remains a relatively new domain.

Similarly, Agyei and Voogt (2011) inform the importance of professional development in ensuring the successful adoption of digital tools in early childhood education. In their study on teachers use of technology in Ghanaian classrooms, they found that many educators remain hesitant to adopt digital tools due to inadequate training. Their research emphasizes that for digital tools to make a meaningful impact on learning outcomes, there must be a concerted effort to train teachers not only on how to use the tools but also on how to integrate them into pedagogical practices in ways that enhance learning. This gap in teacher training has been a significant barrier to the successful implementation of digital tools in Ghanaian kindergartens.

Further complicating the integration of digital tools in Ghanaian kindergartens is the issue of infrastructure. Acheampong (2019) explored the infrastructural challenges facing public schools in rural Ghana and how these barriers impede the adoption of educational technology. His study found that many rural kindergartens lack basic digital infrastructure such as stable electricity, internet connectivity, and even computers. In these contexts, the introduction of digital learning tools is often seen as impractical, leading to disparities between urban and rural schools in terms of access to and use of technology. This digital divide further exacerbates educational

inequalities in Ghana, limiting the potential of digital tools to positively impact learning outcomes for all children.

Zaranis et al. (2021) explored the role of mobile learning applications in Ghana's kindergarten system. Their study focused on the use of mobile devices to teach foundational numeracy skills. While the researchers found that the use of apps led to significant improvements in children's ability to perform basic mathematical operations, they also noted that the high cost of digital devices and data bundles in Ghana makes mobile learning inaccessible to many families. This limits the scalability of such interventions and raises questions about the sustainability of relying on digital tools in resource-constrained environments.

In terms of policy, Mereku (2019) examined the role of Ghana's Ministry of Education in promoting digital literacy in early childhood education. They found that while there have been some efforts to introduce ICT into the curriculum; these efforts have largely been concentrated in urban centers, with little attention paid to rural areas. Moreover, the implementation of these policies has often been hampered by a lack of coordination between stakeholders, including schools, parents, and government agencies. The researchers argue that without a comprehensive strategy that addresses both infrastructural and training needs, digital tools are unlikely to have a significant impact on learning outcomes in Ghanaian kindergartens.

Another critical issue raised by Ghanaian scholars is the impact of digital tools on social and emotional learning. Frimpong and Osei (2020) studied the effects of interactive whiteboards on the social skills development of kindergarteners in Kumasi. Their findings suggest that while digital tools can enhance cognitive development, they may also reduce opportunities for children to engage in face-to-

face interactions, which are crucial for social learning at this stage of development. They recommend a balanced approach to digital tool integration that emphasizes both technological literacy and traditional social learning activities.

Finally, Ampomah (2021) examined the role of parents in supporting digital learning at home. Their study found that while many parents in urban areas were enthusiastic about using digital tools to supplement classroom learning, those in rural areas expressed concerns about the appropriateness and cost of these tools. The researchers concluded that parental support is critical to the success of digital learning initiatives, particularly in contexts where schools may lack the resources to provide comprehensive digital education.

While digital tools hold promises for improving teaching and learning outcomes in Ghanaian kindergartens, several challenges must be addressed to fully realize their potential. These include improving teacher training, addressing infrastructural deficiencies, and ensuring equitable access to technology across both urban and rural areas. Furthermore, there is a need for a coordinated policy approach that integrates digital learning tools into the national curriculum while also considering the unique social and cultural context of Ghanaian education.

2.6 Policy and Regulatory Frameworks Supporting Technology Use in Kindergarten Education

Global policy responses are often fragmented, focusing either too much on infrastructural development or too little on teacher preparedness. For instance, Stephen and Plowman (2013) propose a holistic ICT framework that emphasizes interoperability between systems to facilitate early childhood education, highlighting the potential for technology to foster communication between families and educators.

However, despite the promise of such frameworks, their implementation remains inconsistent. The lack of standardized approaches across different jurisdictions results in a disparity between policy and practice, with many systems under-utilizing the potential of ICT to support early learning.

The development and enforcement of policies supporting technology use in early education have largely been reactive rather than proactive. Alvarado and Lopez (2020), for instance, analyzed the Omnibus Policy on Kindergarten Education in the Philippines, which includes provisions for ICT integration. While their study praises the policy's focus on assessment, instruction, and evaluation, it also criticizes its lack of comprehensive support for the development of play areas and ICT infrastructure, reflecting a broader global issue: policies often prioritize core educational components while neglecting the role of technology in fostering holistic child development.

One critical gap in the literature is the failure of many global policies to recognize the cultural and contextual factors that influence the adoption of technology in early childhood settings. Li et al. (2011) offer a new theoretical framework based on Chinese philosophy to evaluate the success of policy implementation. They argue that imported models of early childhood education often fail when they do not align with local sociocultural and educational contexts. Their analysis of U.S.-originated models in Hong Kong demonstrates the need for hybrid approaches that blend global best practices with local realities. This indicates a critical gap in existing policies: the one-size-fits-all approach to technology integration does not work across diverse educational settings.

Moreover, while several studies affirm the potential benefits of technology in kindergarten education, the regulatory focus often remains limited to infrastructure

and hardware provision, neglecting critical aspects such as teacher training and curriculum alignment. Laanpere et al. (2023) critique teacher training programs, which often fail to equip educators with the necessary digital competencies to incorporate technology meaningfully into their teaching practices. They argue for the integration of digital competencies into teacher training curricula and highlight that current training often focuses more on technical skills rather than pedagogical applications of technology (Laanpere et al., 2023).

Furthermore, the role of technology in assessment within kindergarten education is increasingly being explored. Danniels point out that while technology can streamline assessment practices in early education, many teachers report a lack of meaningful integration of technology beyond administrative tasks. This suggests a significant gap between the potential of technology as an educational tool and its actual application in assessment practices (Danniels et al., 2020).

Policy inconsistencies are further exacerbated by divergent global perspectives on early childhood education. For example, Hayashi contrasts the Japanese “hands-off” approach to curriculum guidelines with more prescriptive approaches in countries like China and the U.S. In Japan, early childhood curriculum policies provide minimal directive, fostering flexibility but also leaving technology integration to the discretion of individual teachers. This approach contrasts with more centralized policies that aim for standardization, yet often lack the flexibility to accommodate the nuanced needs of different learning environments (Hayashi, 2011).

One of the key findings across the literature is the importance of intentional technology use in ECE. Ching et al. (2006) emphasizes that technology, when integrated thoughtfully, can promote children's autonomy, support classroom

management, and develop technological literacy. Their study reveals that educators often struggle to balance the beneficial and resisted uses of technology in the classroom, especially when policies do not provide sufficient guidance. This aligns with Li et al. (2011), who argue for inquiry-based learning supported by digital tools. However, they highlight a lack of integration in many existing software packages, which limits the effectiveness of technology in promoting critical thinking and problem-solving in early learners.

A significant gap noted in the literature pertains to the lack of developmentally appropriate frameworks for integrating technology into early childhood curricula. Rosen and Jaruszewicz (2009) introduce the concept of Developmentally Appropriate Technology Use (DATU), which emphasizes the need to align technological tools with children's cognitive and social development stages. Despite the recognition of this need, many national and local policies fail to provide clear guidelines for educators, leaving them to make ad-hoc decisions about the use of technology in their classrooms.

The absence of robust policies is particularly evident in low-resource settings. Kozma (2005) examines the policy frameworks for ICT integration in Kenyan preschools, finding that the lack of infrastructure, funding, and national guidelines hampers the effective use of technology in education. His study highlights a broader issue seen in many developing nations: while there is recognition of the importance of technology, inadequate policy support and resource allocation prevent meaningful implementation.

In more developed regions, policy frameworks tend to be more comprehensive but still face challenges. For instance, Lyons and Tredwell propose a five-step process for

integrating technology in inclusive early childhood programs in the U.S., focusing on the need for professional judgment and policy alignment. However, they critique current policies for their failure to adequately prepare teachers for the practical challenges of integrating technology in inclusive classrooms, particularly when dealing with children with special needs (Lyons & Tredwell, 2015).

Teacher attitudes towards technology also play a crucial role in its successful integration. Blackwell et al. (2014) reveal that teachers' beliefs about the value of technology are shaped by factors such as socioeconomic status (SES) and available policy support. Their study shows that while teachers generally acknowledge the potential benefits of technology, their confidence in using these tools is often undermined by inadequate policy frameworks and training, particularly in low-SES schools.

In contrast, some countries have begun to address these gaps more systematically. For example, Turja et al. (2009) examine technology education frameworks across six countries and find that while most curricula mention technology education, the specifics are often vague and lack practical guidance for educators. The authors argue for a more explicit integration of technology education into early childhood curricula, particularly with a focus on gender equity and hands-on learning.

Additionally, studies like that of Bird and Edwards explore how technology can be used in play-based learning, a cornerstone of early childhood education. They introduce the Digital Play Framework, which provides educators with tools to observe and assess how children use technology through play. However, they critique the lack of policy support for such frameworks, which often leaves educators without the

necessary training or resources to implement technology effectively in play-based settings (Bird & Edwards, 2015).

One of the persistent critiques across these studies is the disconnect between policy and practice. While many policies advocate for the use of technology in early childhood education, they often fail to provide the necessary support for educators to implement these tools effectively. This is especially true in low-income areas or countries with underdeveloped infrastructure. Additionally, there is a notable gap in policies that address the development of teachers' digital competencies, as highlighted by Ackah-Jnr et al. (2022) in their study of early childhood education in Ghana. They argue that while access to education has improved, the quality of training for teachers, particularly in integrating technology, remains insufficient (Ackah-Jnr et al., 2022).

In the Ghanaian context, the integration of technology in kindergarten education is shaped by a variety of policies and regulatory frameworks, yet significant challenges persist. Ghana's approach to early childhood education (ECE) has evolved from traditional forms of care into a more structured system of education, as noted by Ackah-Jnr et al. (2022). The implementation of policy frameworks in ECE reflects a blend of distributive, regulatory, and redistributive strategies designed to enhance equity and access. However, gaps in teacher training and parental involvement remain critical concerns. The authors argue that these deficiencies hinder the full realization of the policy's goals, especially in promoting technology use in kindergartens.

Despite commendable efforts, ICT integration in early childhood education is still hampered by infrastructural inadequacies and uneven implementation across schools and regions. Asare et al. (2023) systematically review the policy frameworks governing ICT in Ghanaian education, pointing out that while policies like the ICT for

Accelerated Development (ICT4AD) Policy offer a solid foundation, the lack of sufficient ICT resources and comprehensive teacher training programs significantly impedes progress. This is further exacerbated by the disparity in ICT implementation between urban and rural areas, reflecting broader inequities in the education system.

Furthermore, the integration of technology in teacher education is critically underdeveloped. The study by Gyamfi examines pre-service teachers' attitudes toward ICT use, revealing a general lack of confidence and proficiency in integrating technology into teaching practices. Although ICT facilities are increasingly available in teacher training institutions, there is a notable gap in pedagogical integration. This disconnects between availability and effective use mirrors broader challenges in the education system, where teachers are often not adequately trained to utilize Digital tools for instructional purposes (Gyamfi, 2017).

Natia and Al-hassan (2015) similarly highlight the underutilization of ICT in basic schools, despite government efforts to provide ICT resources through initiatives such as the One Laptop Per Child policy. The study finds that while these resources are theoretically available, issues such as a lack of maintenance, inadequate teacher training, and inconsistent electricity supply severely limit their effectiveness. The authors argue that without addressing these systemic barriers, the government's ICT initiatives will continue to have limited impact on educational outcomes (Natia & Al-hassan, 2015).

Another critical barrier is the socio-cultural context within which these policies are implemented. Thompson (2019) investigates the influence of socio-cultural factors on early childhood pedagogy in Ghana, showing that teachers often adapt their instructional methods to align with local cultural norms, which may conflict with the

introduction of foreign technology-based teaching methods. This cultural mediation complicates the integration of ICT in kindergartens, as teachers struggle to reconcile traditional teaching practices with modern technological tools (Thompson, 2019).

In terms of policy solutions, Owusu-Ansah (2015) critique the Ghanaian government's ICT policies, particularly the One Laptop Per Child initiative. They argue that while the initiative was well-intentioned, it failed to consider the contextual challenges of implementation, such as the lack of infrastructure and trained personnel to maintain and use the laptops effectively. This underscores a broader issue in Ghana's education policy - well-designed frameworks often falter in the face of practical implementation challenges.

Moreover, early identification and support for children with special educational needs (SEN) in kindergartens also suffer from inadequate policy frameworks. Soma et al. (2023) point out that while Ghana's inclusive education policy emphasizes the rights of SEN children, there is no comprehensive system in place for identifying and supporting these children, particularly in early childhood education. The lack of trained teachers and appropriate resources further complicates the integration of ICT to assist SEN children in kindergartens (Soma et al., 2023).

While Ghana has made strides in creating policy frameworks that support the use of technology in kindergarten education, significant challenges remain. The lack of infrastructure, inadequate teacher training, and socio-cultural factors all hinder the effective implementation of these policies. For technology to play a transformative role in early childhood education in Ghana, there needs to be a concerted effort to address these systemic barriers, provide continuous professional development for

teachers, and create more context-specific policies that take into account the unique challenges of the Ghanaian educational landscape.

2.6 Sustainability of Technology Integration

Globally, studies point to the potential for technology to enhance early childhood education, yet emphasize the need for thoughtful implementation to ensure lasting benefits. Crisostomo and Reinertsen (2020) argue that technology must be aligned with sustainable practices to prepare children for a future in a science-driven society, but also caution that equity of access and social justice must be considered to prevent further widening of educational gaps. Teo (2011) support this view, emphasizing that teacher training programs must focus on sustainability by ensuring that educators are equipped with the skills needed to maintain and evolve their use of technology over time. Niederhauser et al. (2018) highlight the scalability challenges of technology initiatives, noting that successful local programs may fail to sustain their impact when expanded to broader educational contexts. This can occur due to a lack of alignment with local policies or inadequate infrastructural support, illustrating the importance of adapting interventions to fit diverse educational environments. Similarly, Spector and Yuen (2016) show that integrating sustainability into teacher education through blended learning approaches can enhance teachers' ability to foster sustainability-oriented thinking in young learners, promoting long-term benefits both for education and environmental awareness.

Wang et al. (2019) offer practical details from their work in China, where sustainability concepts were integrated into kindergarten curricula through hands-on activities like waste sorting and nature exploration. These efforts, however, face challenges in terms of teacher preparedness and curriculum alignment, pointing to the challenges of embedding sustainability in everyday educational practices. Similarly,

Yurt and Cevher-Kalburan (2011) demonstrate that while children's use of technology, such as digital photography, can enhance social interaction and cognitive development, sustaining these practices requires consistent investment in resources and teacher support to avoid superficial integration that lacks depth and long-term impact.

Gunn (2010) further explores the sustainability of e-learning initiatives, pointing out that grassroots innovations, while promising, often falter due to institutional barriers and insufficient long-term funding. This reinforces the need for collaborative efforts across various levels of the educational system to ensure that technology integration moves beyond initial enthusiasm and achieves sustained effectiveness. Again, the work of Ertmer and Ottenbreit-Leftwich (2013) suggests that while the presence of computers in early childhood classrooms has become more common, debates persist around their appropriateness, particularly concerning their social and emotional impact on children. Ensuring that technology serves educational goals while supporting holistic child development remains a central challenge for sustainable integration.

The sustainability of technology integration in early childhood education is a growing focus of global research, reflecting the need for systemic approaches to ensure long-term benefits. One example comes from Scherer et al. (2020), who advocate for a project-based method to integrate sustainability into the curriculum. Their study demonstrates how project-based learning enhances sustainability competencies in early childhood education, allowing children to develop environmental and social awareness through hands-on activities. This suggests that the integration of technology in education must go beyond mere tools and address sustainability issues directly through pedagogy.

Campbell and Speldewinde (2022) also highlight the role of STEM education in fostering sustainability in early childhood. Their ethnographic research shows how early exposure to STEM activities helps children understand environmental sustainability. By employing interactive and play-based learning, this approach fosters independent learners who are responsive to environmental issues. The authors recommend a whole-kindergarten approach to building sustainable practices, emphasizing that the benefits of technology integration in early childhood education should extend to fostering environmental stewardship.

A broader review by Somerville and Williams (2015) examines the theoretical frameworks guiding sustainability education in early childhood. They find that while there has been an increase in empirical research, many studies still lack a robust theoretical foundation. Their critique of existing literature suggests a need for more comprehensive approaches that connect children rights, environmental awareness, and post-human frameworks, which can enhance early childhood education's contribution to planetary sustainability. This is crucial for developing long-term, sustainable integration of technology in early learning environments.

Ackah-Jnr et al. (2022) offer specific recommendations for embedding sustainability in early childhood education systems. Their work, developed in collaboration with international bodies like UNESCO, emphasizes the integration of sustainability in all aspects of early childhood education policy and practice. This research indicates the importance of international cooperation and policy frameworks to ensure that sustainability principles are embedded from an early age.

Ogunlade (2023) calls for the transformation of early childhood education to prioritize sustainable development. He argues that teaching young children environmental

security, personal hygiene, and waste management through play and other interactive methods is crucial for securing their future. He emphasizes the importance of embedding sustainability into national curricula and policies to ensure that early childhood education not only meets present needs but also fosters a future-oriented mindset among young learners.

Scherer et. al., (2020) focus on developing reliable indicators for measuring sustainability practices in early childhood education settings. Conducted in various international contexts, their study used the OMEP Environmental Rating Scale for Sustainable Development to assess the effectiveness of sustainability practices in preschools. Their research reveals that sustainability indicators must be adapted to local contexts to provide accurate measures, suggesting that sustainability in technology integration requires continuous assessment and localization to ensure its long-term success.

The sustainability of technology integration in early childhood education in Ghana faces significant challenges related to infrastructure, teacher training, and policy gaps. A study reveals that while there is enthusiasm about the role of ICT in education, many public schools struggle with inadequate resources and insufficient teacher competencies, making technology integration unsustainable in practice. The lack of access to necessary tools and training results in limited use of ICT in public schools (Asante, 2014).

Further analysis on the post-COVID-19 landscape highlights the limitations of policies such as the ICT for Accelerated Development (ICT4AD) initiative. While the policy aims to enhance technology usage across the country, rural schools continue to face issues like unreliable internet and electricity. This disparity between urban and

rural schools is a key barrier to achieving sustainable technology integration in education (Adarkwah, 2021).

In another perspective, the role of continuous teacher training is emphasized as critical to the success of integrating technology in classrooms. Without professional development, teachers are unable to fully incorporate Digital tools effectively, even where infrastructure and policies are in place. Continuous investment in teacher training is necessary to ensure that technological advancements in education can be sustained over time (Ackah-Jnr et al., 2022).

Looking at STEM and STEAM education, innovative approaches that blend modern technologies with culturally relevant practices can promote sustainable development. By combining local knowledge with technology, teachers can enhance student engagement and make technology more accessible and relevant to the local context (Ihmeideh, 2009).

While efforts are being made to integrate technology into early childhood education in Ghana, the long-term sustainability of these initiatives requires addressing infrastructural challenges, investing in teacher training, and developing culturally tailored approaches. Coordinated efforts between government, educators, and communities will be essential to ensure that technology integration in education can achieve its full potential.

2.7 Teachers' Attitudes and Perceptions towards Technology in Early Education

The integration of technology into early education has been met with generally positive perceptions from teachers globally. Teachers often recognize the potential of technology to enhance learning, engage students, and improve teaching practices. For instance, early childhood educators in Turkey perceived technology as a tool that

could enhance classroom interaction and student engagement, suggesting that teachers see its potential to improve learning outcomes. However, the challenge often lies in translating this positive perception into effective practice in classrooms, particularly due to resource limitations or inadequate professional support (Koc, 2014).

Studies across different contexts reflect a broad recognition of technology's benefits. In Spain, teachers working in inclusive early childhood education environments noted how digital tools could help meet the diverse needs of students, especially those with special educational requirements. This positive outlook was largely grounded in the belief that technology could bridge learning gaps and create more equitable learning environments (Utami & Hidalgo, 2020). Despite these optimistic perceptions, teachers still face significant challenges in applying technology effectively in everyday classroom settings. Many of these issues stem from the disparity between the theoretical benefits of technology and the practical barriers that teachers encounter, such as limited access to tools or insufficient institutional support.

The perceived benefits of technology often focus on its ability to make learning more engaging. Teachers believe that digital tools can foster interactive learning experiences, which is particularly appealing in early education where keeping young children's attention can be a challenge. For example, the integration of technology into lessons can transform traditional teaching methods, allowing for more visual and dynamic content. However, there is a tendency in the literature to focus heavily on engagement as a key benefit without adequately exploring whether this increased engagement leads to deeper, long-term learning (Berson et al., 2022). This creates a gap in understanding the true impact of technology on educational outcomes, beyond immediate interest and engagement.

In terms of developmental appropriateness, some educators express concerns about how well digital tools align with the pedagogical foundations of early childhood education. While technology can support cognitive development, there is ongoing debate about its impact on social and emotional learning. Teachers worry that an overreliance on technology may reduce opportunities for children to engage in physical play and face-to-face social interactions, which are critical in early development. This concern is particularly salient in regions where technology is becoming more integrated into classrooms without fully considering its broader developmental implications. There is, therefore, a gap in the research that critically evaluates how technology affects holistic child development, beyond cognitive skills (Mertala, 2019).

Moreover, teachers' perceptions of technology are strongly influenced by the training they receive. Those who have undergone comprehensive professional development are more likely to have positive views on technology's role in the classroom. Conversely, teachers who have not received adequate training often feel overwhelmed or unsure about how to integrate technology effectively. This suggests that the perceived usefulness of technology is closely tied to teachers' confidence and self-efficacy, which in turn depends on the quality of their professional development experiences. A major gap identified in this area is the lack of consistent and widespread training programs, especially in under-resourced regions. Without such training, many teachers are left to navigate technology integration on their own, which can lead to frustration and lower perceived usefulness (Blackwell et al., 2014).

Another concern raised by educators is the practical challenge of incorporating technology into daily teaching routines. While many teachers acknowledge the potential benefits of digital tools, they often struggle with a lack of resources, such as

outdated equipment, unreliable internet connections, or insufficient institutional support. This issue is especially prevalent in schools in lower-income regions where access to up-to-date technology is limited. Teachers in these settings may perceive technology as a promising tool but feel unable to fully capitalize on its potential due to these constraints. This gap between perception and implementation tells the need for more research into how resource limitations affect teachers' ability to integrate technology effectively in early childhood education (Ogegbo & Aina, 2020).

While the literature on teachers' perceptions of technology is generally positive, it also reveals critical gaps that must be addressed to ensure that these perceptions lead to effective practice. Many studies emphasize the surface-level benefits of technology, such as engagement and interactivity, without sufficiently examining the long-term educational impact or how technology affects other aspects of child development. Furthermore, teachers' perceptions are often shaped by the level of support and resources they have access to, suggesting that attitudes towards technology may improve if these barriers are addressed. Professional development remains a key factor in shaping teachers' perceptions, but there is a significant lack of consistent, high-quality training programs available to many educators, particularly in less affluent areas.

In Ghana, teachers' perceptions of technology in early education reveal a mix of optimism and challenges. Many educators recognize the potential benefits of integrating digital tools into early childhood classrooms, but their enthusiasm is often tempered by practical limitations and concerns about pedagogical appropriateness.

On the positive side, several studies indicate that teachers generally perceive technology as a valuable tool for enhancing student engagement and learning. For

instance, a study investigating teachers' perceptions and practices of Information and Communication Technology (ICT) integration in teacher training institutions found that teachers and pre-service educators believed that technology could play a significant role in improving the teaching and learning process. This perception was driven by the recognition that Digital tools could foster more interactive and student-centered learning environments, which is essential in early education settings (Asare et al., 2023). Similarly, another study examining technology acceptance among teachers in the New Juaben Municipality revealed that teachers were increasingly open to using computers for teaching. Factors such as perceived usefulness and ease of use had a significant positive effect on their intention to integrate technology into their teaching practice (Okyere-Kwakye et al., 2016).

However, these positive perceptions are often hindered by a lack of resources and infrastructure. In many schools, particularly public institutions, teachers face significant challenges in accessing the necessary technological tools to support their teaching. A study exploring ICT use in Ghanaian early childhood classrooms revealed that while many teachers held positive views about the potential of technology, the actual integration was limited due to the unavailability of resources such as computers and reliable internet access. The findings indicated that only a few schools had the necessary infrastructure to support meaningful technology integration, which in turn affected teachers' ability to effectively use these tools in their teaching (Asante, 2014).

In addition to resource challenges, some teachers in Ghana express concerns about the developmental appropriateness of technology for young learners. Early childhood education traditionally emphasizes play-based, hands-on learning, which some educators fear may be compromised by the introduction of digital tools. A study

focused on the provision of early childhood education in Kumasi found that stakeholders, including teachers, believed that early years should prioritize physical interaction and play over the use of technology. They worried that excessive reliance on screens could undermine children social and emotional development, which is critical at this stage of education (Oppong Frimpong, 2021).

Another significant perceived barrier to the integration of technology in Ghanaian early education is the lack of teacher training. Many educators feel ill-equipped to incorporate digital tools into their lessons due to insufficient training and professional development opportunities. A study that assessed the training of early childhood teachers in the Tema West Metropolis found that while teachers generally understood the value of technology, many lacked the practical skills to integrate it effectively. This gap in training contributed to negative perceptions, as teachers felt unprepared to use Digital tools in ways that would enhance learning (Sarpong et al., 2022).

Overall, while Ghanaian educators recognize the potential of technology in early education, their perceptions are shaped by significant challenges. Resource limitations, developmental concerns, and insufficient training all contribute to a gap between the perceived value of technology and its practical implementation in classrooms. These findings indicate the need for more comprehensive professional development programs and better infrastructure to support the meaningful integration of technology in early childhood education across Ghana.

2.8 Integration of Digital Tools into Early Childhood Curricula

The integration of digital tools into early childhood curricula has become a transformative element in educational practices worldwide, with research telling both the potential benefits and the challenges involved. Across various studies, digital tools

are increasingly seen as essential for enhancing cognitive, social, and creative skills among young learners.

A prominent study discusses the use of digital tools in creating innovative educational designs in kindergartens, emphasizing how these technologies can modernize traditional pedagogical approaches. Digital tools like tablets, interactive games, and educational software offer a more engaging and cognitively stimulating environment for young learners. This aligns with the broader goal of early childhood education to foster creativity and exploration. However, the focus primarily on the technical aspects leaves a gap in understanding how these tools influence social-emotional learning and peer interaction (Ivanova, 2024).

Digital storytelling is another powerful method for integrating digital tools into early education. By allowing children to create narratives using multimedia elements such as text, images, and sound, this method enhances creativity and cognitive development. Digital storytelling tools have been found to be particularly effective in engaging children with different literacy levels, supporting language skills and creative expression. Despite these advantages, there is limited research on how this method supports broader developmental goals, such as fostering social interaction and collaboration between peers (Manousi & Prentzas, 2021).

The alignment of digital tools with play-based learning is critical in early childhood education. Research on the *Digital Play Framework* illustrates how children can learn to use digital technologies through play-based activities. The framework suggests that digital tools can be successfully incorporated into traditional forms of play, promoting cognitive development and problem-solving. This integration indicates the potential for digital technologies to enhance play rather than replace it. However, there is a

need for further exploration on how to balance screen-based activities with physical and social play to maintain a holistic approach to early childhood development (Bird & Edwards, 2015).

Teachers' perceptions play a vital role in determining how digital tools are integrated into early childhood curricula. One study highlighted that, educators with positive attitudes toward digital tools are more likely to design engaging and innovative activities for their students. Teachers who see the instructional value in these tools are better equipped to create effective learning experiences. However, this research also points to a gap in the availability of professional development programs that consistently support educators in adopting digital technologies, especially in contexts with limited digital experience (Hsu et al., 2020).

In North America, the use of computers in early childhood education has been widely explored, particularly in relation to their impact on cognitive and social development. Studies suggest that the use of computers supports skills like creative thinking, problem-solving, and language development. Digital tools, especially in collaborative settings, encourage communication and teamwork among young learners. However, critics argue that focusing too much on technology may reduce the time spent on other critical aspects of early development, such as physical play and interpersonal communication (Mohammadi, 2015).

The integration of programming and digital literacy into early childhood education has also gained attention, particularly in Sweden, where teachers are incorporating programming activities through digital tools. This integration helps children develop computational thinking and problem-solving skills, reinforcing other learning areas such as mathematics and science. While these developments are promising, there

remains a gap in understanding how the focus on digital literacy affects traditional learning goals and whether it might exacerbate inequalities among children with different access to technology at home (Otterborn et al., 2019).

Additionally, research indicates the potential of web-based tools for early childhood educators to create digital content. One study introduces a tool that allows educators with minimal programming skills to design interactive learning activities for their students. This tool empowers teachers to incorporate digital literacy into their lessons, reflecting a growing trend toward teacher autonomy in curriculum design. However, the study acknowledges that more research is needed to determine how such tools can be scaled across different educational settings, particularly in areas with limited access to technology (Penz & Mäkiö, 2019).

Again, a significant study by Asante (2014) investigated the status of ICT use in early childhood education across 250 schools in three regions of Ghana. The findings revealed that, despite a positive outlook on the potential of ICT, its integration was minimal, particularly in public schools. Computers were the most commonly available tool, but other essential digital resources, such as tablets and interactive apps, were largely absent. While teachers recognized the importance of digital tools, a striking 60% of them had no formal ICT training, leading to low levels of integration in their classrooms. This tells a critical gap in teacher preparation and resource allocation, limiting the effective integration of technology into the curriculum.

The competence of teachers in integrating digital technologies was further explored in a study of undergraduate in-service teachers. The research indicated that teachers' skills in using digital tools such as educational robotics and internet-based resources were notably low. Despite access to some digital tools, teachers struggled with

practical applications in their classrooms. The study concluded that more comprehensive training programs were needed to improve teachers' ability to integrate digital technologies into the early childhood curriculum (Bulus et al., 2022). This points to an ongoing challenge in teacher development, where the availability of technology alone does not guarantee effective use without adequate professional support.

In rural settings, the integration of digital tools faces additional challenges. Research on teachers' perceptions of digital game-based learning (DGBL) in rural Ghana revealed that many educators viewed DGBL as a distraction rather than an effective teaching method. This negative perception was largely due to a lack of knowledge and training on how to incorporate digital games into the curriculum. The study highlighted the importance of government-supported professional development programs to change these perceptions and equip rural teachers with the skills needed to utilize digital tools effectively (Owusu & Govender, 2023). Without such interventions, the integration of digital tools in rural early childhood education will remain limited.

Beyond teacher competence and perceptions, resource availability remains a key barrier to the successful integration of digital tools. A comprehensive review of early childhood education policy in Ghana identified resource constraints as a major issue. Despite policy efforts to improve access to early childhood education, many schools lacked the necessary technological infrastructure to support the integration of digital tools. The study recommended increased investment in ICT resources and infrastructure to ensure that digital tools are available and accessible in all early childhood settings (Ackah-Jnr et al., 2022).

Additionally, the integration of digital tools has implications for the professional development of educators. A study exploring teacher training in early childhood education found that the lack of specialized training programs for early childhood educators was a significant hindrance to the effective use of digital tools in the classroom. The findings pointed to the need for ongoing professional development that focuses not only on basic ICT skills but also on the pedagogical integration of digital tools to enhance learning outcomes (Mereku, 2019).

In summary, while the potential for integrating digital tools into early childhood curricula in Ghana is recognized, there are significant challenges that must be addressed. These include inadequate teacher training, limited access to digital resources, and negative perceptions among some educators, particularly in rural areas.

2.9 Barriers and Challenges to Technology Adoption in Early Childhood Education

One of the most persistent barriers to the adoption of technology in ECE is the lack of adequate infrastructure and resources. Studies across multiple contexts reveal that early childhood settings often lack the basic technological tools needed to support digital learning. In a study conducted in Mainland China, early childhood educators identified several first-order barriers, such as the lack of hardware (computers, laptops, and tablets) and limited access to educational content and pedagogical models. Teachers in this study found it difficult to implement technology-based teaching due to the absence of necessary devices and a clear framework for their pedagogical integration (Liu & Pange, 2015). This suggests that while access to technology is essential, it must be supported by a pedagogical strategy to ensure effective use.

Similarly, a study conducted in Greece highlighted the lack of mobile devices such as tablets as a significant barrier to integrating technology in early childhood classrooms. Even though mobile devices are recognized for their potential to create interactive learning environments, the lack of resources and insufficient funding meant that their use was limited. Teachers in this study expressed frustration with the unequal distribution of resources, which hindered their ability to use mobile devices effectively in their pedagogical practices (Nikolopoulou, 2021). These infrastructural challenges highlight the gap between the availability of technology and its actual implementation, pointing to a global issue of resource scarcity in early childhood education.

Even in wealthier regions where resources are more abundant, challenges persist. For example, internet connectivity issues remain a major obstacle to technology adoption in many rural and underdeveloped areas. Teachers in such regions often find it difficult to access online platforms or engage in web-based learning activities due to unstable internet connections, further limiting their ability to implement technology effectively in the classroom. These infrastructural challenges call for broader policy interventions that go beyond simply providing devices and focus on ensuring reliable internet access and ongoing technical support.

Another critical barrier to technology adoption in ECE is the lack of adequate teacher training. While technology is increasingly integrated into educational systems, many early childhood educators feel unprepared to use these tools effectively. A study by Blackwell et al. (2014) emphasized that teachers' self-efficacy and confidence in using technology significantly impacted its adoption in classrooms. Even in environments where access to technology was not an issue, teachers with lower levels of confidence were less likely to incorporate technology into their teaching practices.

Conversely, teachers who believed in the benefits of technology for children's learning were more likely to overcome extrinsic barriers such as resource limitations (Blackwell et al., 2014).

This need for improved teacher training is echoed in studies from various regions. In a study on professional development programs in Greece, it was found that teachers' lack of confidence, combined with insufficient training opportunities, hindered the effective use of computers in early childhood settings. Teachers expressed that without targeted training programs, they were unable to develop the skills necessary to implement digital tools, even when these tools were available (Nikolopoulou & Gialamas, 2015).

A similar issue was noted in China, where despite the government's investment in improving ICT infrastructure, teachers' self-efficacy in using digital tools remained low due to a lack of hands-on training. Teachers often felt unprepared to integrate these tools into their teaching practices, despite having access to them, indicating the importance of coupling resource availability with professional development (Luo et al., 2021). These findings suggest that without ongoing professional development and hands-on training, the full potential of digital tools in early childhood education cannot be realized.

Pedagogical concerns also represent a major barrier to the integration of digital tools in early childhood education. Many educators express reservations about how technology fits into traditional play-based learning models, which prioritize hands-on exploration, social interaction, and physical development. A study conducted in Finland found that school principals were concerned that integrating digital technologies into early childhood settings might detract from key aspects of child

development, such as play, socialization, and outdoor activities. While the potential benefits of technology were acknowledged, there was a strong belief that its use needed to be balanced with more traditional learning approaches to avoid undermining children's developmental needs (Kinnula et al., 2015).

Similarly, a study focusing on the integration of mobile devices in early childhood classrooms in Spain revealed that teachers struggled with the pedagogical appropriateness of these tools. While they recognized the value of digital tools in fostering engagement, many educators found it difficult to maintain children attention during digital activities and expressed concerns about limiting children hands-on experiences. The study indicated that the integration of digital tools requires careful consideration to ensure they complement, rather than replace, traditional play-based learning models (Utami & Hidalgo, 2020).

This misalignment between digital tools and pedagogical approaches presents a significant challenge for early childhood educators. Many teachers feel that technology, when used excessively or inappropriately, can inhibit the development of social, emotional, and motor skills that are critical in the early years. Therefore, effective technology integration must ensure that digital tools enhance, rather than detract from, these fundamental areas of development.

Again, resistance to technology adoption is another key barrier identified in the literature. Studies indicate that some educators are hesitant to embrace new technologies due to a variety of reasons, including fear of the unknown, concerns about the additional workload, and skepticism about the educational value of digital tools. In a study examining the relationship between technology difficulty and teacher attitudes, it was found that educators who were less inclined toward innovation were

more likely to abandon their efforts to integrate technology when faced with challenges. Teachers who were not early adopters often cited the time required to learn new tools and a perceived lack of benefits as reasons for their resistance to technology adoption (Aldunate & Nussbaum, 2013).

Further research into professional development models suggests that addressing teachers' external barriers - such as access to resources and time constraints - can help alleviate some of their internal resistance. A professional development study in early childhood education emphasized that once external barriers were resolved, teachers became more willing to change their attitudes and beliefs about technology, leading to greater adoption of digital tools in the classroom (MacKay & Hall-Kenyon, 2020). This indicates that comprehensive support systems are necessary to foster positive attitudes toward technology integration.

The literature on the barriers and challenges to technology adoption in early childhood education reveals a range of issues that educators face in implementing digital tools effectively.

In Ghana, like in many other parts of the world, the integration of technology into early childhood education faces significant barriers and challenges. One of the most significant barriers to integrating technology into early childhood education in Ghana is the lack of adequate infrastructure and resources. A comprehensive study by Asante (2014) examined the availability of technological resources in 250 early childhood schools across three regions in Ghana. The study revealed that public schools were particularly disadvantaged, with limited access to ICT resources such as computers and mobile devices. The computer was identified as the most widely available technological tool, but other essential resources like tablets, interactive whiteboards,

and specialized educational software were largely absent. Despite teachers having a generally positive attitude toward ICT integration, more than 60% of the teachers surveyed lacked formal training in the use of technology, limiting its practical application in the classroom.

Similarly, Adarkwah (2021) informed infrastructural challenges in Ghana's education system during the COVID-19 pandemic, when online learning became critical. The study revealed that despite the government's efforts to promote ICT in education, many rural schools lacked the infrastructure to support online learning. Limited access to internet connections, inadequate electricity supply, and insufficient technological devices exacerbated the challenges faced by schools, especially in under-resourced areas. This study underlined that for online learning and ICT integration to be successful in Ghanaian early childhood education, there must be substantial investments in infrastructure to bridge the digital divide between rural and urban schools.

Teacher preparedness is another critical barrier to effective technology integration in early childhood education in Ghana. Many early childhood educators lack the necessary training and experience to effectively incorporate digital tools into their teaching practices. Asante (2014) found that most teachers in early childhood education had little to no formal ICT training, with 67% of teachers admitting that they did not integrate technology into their teaching due to a lack of confidence and knowledge. This lack of preparedness creates a significant gap between the availability of technology and its actual use in the classroom. The study recommended that pre-service and in-service teachers undergo targeted ICT training to improve their competence and confidence in using digital tools for teaching and learning.

In line with this, Abdulai (2014) conducted a study in the Winneba municipality, where he found that lack of teacher training was a significant barrier to technology adoption in early childhood education. The study also indicated a lack of parental involvement in early childhood education, which compounded the challenges faced by teachers in integrating technology. Abdulai suggested that both teachers and parents need to be sensitized to the benefits of technology in early childhood education to foster a collaborative approach to ICT integration.

A major concern surrounding the integration of digital tools into early childhood education is the perceived misalignment between traditional pedagogical approaches and the use of technology. Many educators are concerned that introducing technology into early childhood education may undermine traditional play-based learning, which is fundamental to early childhood development. Ntumi (2016) explored the challenges faced by preschool teachers in implementing the early childhood curriculum in the Cape Coast Metropolis. The study found that teachers struggled to integrate technology into their teaching due to a lack of understanding of how to balance digital tools with the play-based approach that is crucial for young children cognitive and social development. The findings revealed that many teachers were unsure of how to use digital tools in a way that complemented traditional learning methods, suggesting the need for professional development programs that focus on pedagogical alignment.

Similarly, Lanbon et al. (2022) examined the integration of assistive technologies in schools for the blind and visually impaired in Ghana. The study found that while assistive technologies could significantly improve learning outcomes for students with disabilities, teachers' lack of knowledge and skills in using these tools hindered their effective implementation. This misalignment between the availability of technology

and teachers' ability to use it effectively highlights a broader challenge in the integration of digital tools in early childhood education settings.

Financial constraints remain a significant barrier to the successful integration of technology in Ghanaian early childhood education. The cost of purchasing and maintaining technological devices, coupled with the need for reliable internet connectivity, places a heavy financial burden on schools, particularly in rural areas. Yalley (2022) conducted a tracer study on the challenges affecting the use of ICT in pre-tertiary school administration in Ghana. The study revealed that while school administrators were satisfied with the availability of computers, they were dissatisfied with the lack of access to educational software, photocopiers, and reliable internet. This limited access to key technological resources hindered the ability of schools to fully integrate ICT into their curriculum and administrative processes.

Moreover, Ntumi (2016) found that private schools were better equipped to handle the financial demands of integrating technology into early childhood education, whereas public schools, particularly those in rural areas, were significantly under-resourced. The study emphasized that without financial support from the government or external organizations, many schools would continue to struggle with integrating digital tools into their teaching and learning practices. Financial constraints, therefore worsen the already existing inequalities in access to quality education between urban and rural schools.

In addition to financial and infrastructural barriers, the involvement of parents and the public perception of technology in early childhood education play a crucial role in its successful adoption. Abdulai (2014) highlighted the importance of parental involvement in addressing the challenges associated with technology integration in

early childhood education. The study found that many parents were either unaware of the benefits of technology in early childhood education or did not view it as a necessary component of their child's development. This lack of awareness contributed to a broader societal perception that undervalued the role of technology in early learning. To address this barrier, the study recommended that schools and policymakers engage in public sensitization campaigns to educate parents and the wider community about the benefits of ICT in early childhood education.

The adoption of technology in early childhood education in Ghana faces numerous barriers, ranging from infrastructural challenges and financial constraints to pedagogical concerns and lack of teacher preparedness. These challenges are further compounded by limited parental involvement and societal perceptions that undervalue the role of technology in early learning. Despite these obstacles, there is a growing recognition of the potential benefits of integrating digital tools into early childhood education, particularly in enhancing learning outcomes and fostering cognitive and social development.

2.10 Best Practices and Successful Models of Digital Integration in Early Education

The global integration of digital tools into early childhood education has brought forward numerous successful models and best practices, highlighting diverse approaches to enhancing learning environments.

One of the most recognized strategies in digital integration in early education is the use of collaborative learning communities. In an inquiry-based learning community model, a study explored how collaboration among teachers fosters successful digital integration. The model emphasizes the necessity of reflective inquiry and teacher

collaboration in building digital competence and improving student learning outcomes. A key gap in this research is the absence of a strong focus on how student engagement evolves with increased technology use, leaving room for future studies on how digital tools impact different learning styles (Calderón & Tannehill, 2021).

Similarly, another study examined Technology Integration Planning (TIP) practices, demonstrating the value of digital collaboration tools such as digital science notebooks. This approach enhances critical thinking and problem-solving skills in early childhood classrooms. The model successfully integrates student collaboration while emphasizing teacher evaluation methods. A key similarity between this model and Calderón and Tannehill work is their focus on collaborative learning, but this work leans more toward students' collaboration rather than focusing on the role of teacher communities. Both models offer insights into collaborative frameworks but point to the need for more integrated teacher and student-focused research (Scalise, 2018).

Teacher training and the development of digital competencies play a critical role in the success of digital integration. One flexible model of teacher training includes active learning strategies, enabling educators to develop diversified digital skills that they can apply to teaching. This approach highlights the importance of self-driven professional development. The flexibility of this model allows teachers to explore digital tools autonomously, fostering creativity and adapting to individual learning environments. However, a gap in this research lies in how such training affects long-term student outcomes. Future research could investigate the sustainability of this model and how it influences teaching effectiveness over time (Rodrigues, 2020).

In contrast, research identified significant challenges in early childhood teacher preparation programs regarding the integration of ICT. Despite teachers having positive attitudes toward digital tools, they reported feeling unprepared to incorporate them into their teaching practices. Teacher educators, however, felt they were adequately preparing preservice teachers, indicating a disconnect between perceptions of teacher educators and preservice teachers' experiences. The gap between expectations and real-world application suggests that teacher training programs must undergo further refinement to ensure that preservice teachers feel more confident in integrating digital tools upon entering the classroom (Masoumi, 2021).

Face-to-face instruction with digital tools, is gaining traction as an effective model for digital integration. One study presented a best-practice model for redesigning virtual learning environments (VLEs) to support blended learning. This research found that the integration of flexible digital pathways significantly enhanced both teacher and student experiences. A key strength of this model is the focus on making digital platforms accessible and engaging, which is crucial in early childhood settings. However, while the study demonstrates the effectiveness of blended learning, it lacks understanding into how these VLEs can be scaled for use across different educational systems, a gap that needs further investigation (Power & Kannara, 2016).

Another study introduced the *Digital Education Shifting (DES) model*, which supports sustainable digital transformation in educational settings, emphasizing the need for flexible and adaptive learning environments. This model, grounded in cognitive load theory and constructivism, was particularly effective in addressing the educational challenges posed by crises like the COVID-19 pandemic. Both models prioritize flexibility and adaptability in integrating technology, but Aldhafeeri's work goes a step further by focusing on the scalability of these models in diverse educational

contexts. Nonetheless, both models highlight the potential of blended learning environments in early childhood education (Pu et al., 2022).

One increasingly popular approach to digital integration in early education is introducing young children to programming and computational thinking. A study conducted in Sweden investigated how preschool educators integrate computer programming into their teaching practices. The study found that teachers used both unplugged (non-digital) and digital activities to promote computational thinking in children. This recontextualization of traditional teaching methods provided new opportunities for early learners to engage with digital tools. However, a gap in the study is the lack of longitudinal data on the long-term cognitive and educational benefits of introducing programming to young children, an area future research could explore (Otterborn et al., 2019).

In the context of multilingual early childhood classrooms, a study revealed that teachers and parents are key actors in the adoption of technology for multilingual learners. This research used the Arena Framework to illustrate the co-evolution of digital technologies and education across different levels, from local to global contexts. The approach provided details into how digital tools can be used to support language learning and cognitive development in young multilingual learners. However, the study could benefit from more practical examples of successful digital integration strategies that directly address the unique needs of multilingual classrooms. Future research could focus on developing more specific guidelines for educators working with multilingual populations (Davis 2020).

The global landscape of digital integration in early education is rich with diverse approaches, each offering details into best practices for fostering digital literacy and

enhancing learning experiences. Successful models emphasize collaborative learning, professional development, and innovative pedagogical frameworks that make digital tools accessible and effective in early childhood classrooms. However, several gaps remain, particularly in teacher preparedness, the long-term impact of digital tools on early learners, and scalability of successful models across different educational systems. The integration of digital tools into early childhood education in Ghana is evolving, but it faces both challenges and opportunities. Scholars in Ghana have explored various models and best practices for successfully implementing digital tools in the education system, especially in early childhood settings.

Research conducted by Mereku (2019) focused on the capacity of Ghanaian educational institutions to integrate digital tools into their pedagogical frameworks. Mereku's study identified gaps in teacher preparation and resource availability as major barriers to effective digital integration, particularly in early childhood settings. The study also noticed the importance of building collaborative learning communities where teachers can share best practices and receive support for integrating technology into their classrooms. This approach aligns with global best practices that emphasize the value of teacher collaboration and professional development. However, the research noted that these communities often lack sufficient institutional support, pointing to a gap in policy implementation at the governmental level.

Another study by Ackah-Jnr (2018) examined the role of leadership in supporting digital integration in inclusive early childhood education. The study emphasized that successful digital integration requires resource architecture, including both system-level and school-level support. While the study offers a comprehensive framework for digital inclusion, it identifies a gap in the actual implementation of these models in under-resourced areas, where both leadership and infrastructure are lacking. Similar to

Mereku's findings, Ackah-Jnr indicates the need for stronger leadership and resource allocation to empower teachers and improve student outcomes.

Teacher training and professional development are critical components of successful digital integration. Gyamfi (2016) explored pre-service teachers' readiness for computer use in Ghanaian educational settings, using the Technology Acceptance Model (TAM) as a framework. The study found that many pre-service teachers felt inadequately prepared to integrate digital tools into their classrooms, despite the widespread availability of ICT resources in some urban areas. This finding aligns with global research that emphasizes the importance of early and sustained professional development for teachers to build their digital literacy. A gap echoed by Gyamfi's study is the lack of hands-on training in teacher education programs, which leaves new teachers underprepared for the practical challenges of integrating digital tools into early childhood education.

Similarly, Quaicoe and Pata (2018) developed a model based on Vygotsky's Zone of Proximal Development (ZPD) to examine the digital competence of Ghanaian teachers. Their research found that teachers' personal attitudes toward digital tools significantly influenced their ability to incorporate these technologies into their teaching practices. The study emphasized the importance of continuous professional development and personalized training models that address both technical skills and pedagogical approaches to digital integration. However, the study also revealed a gap in the availability of digital infrastructure and support within schools, limiting the effectiveness of even the most well-trained teachers.

The blended learning model, which combines face-to-face instruction with digital learning tools, is gaining traction in Ghanaian early childhood education. Asare et al.

(2023) explored perceptions of ICT integration in Ghanaian Colleges of Education, particularly in how it impacts teacher training. The study found that teacher educators and pre-service teachers recognized the value of blended learning in fostering digital literacy and improving educational outcomes. However, the research also pointed out significant challenges in the adoption of blended learning, including limited access to technology in rural areas and a lack of structured professional development programs. This gap between urban and rural educational settings reflects a broader challenge in ensuring equitable access to digital tools in Ghana (Asare et al., 2023).

Furthermore, Sarpong et al. (2022) assessed the effectiveness of online training programs for Ghanaian teachers under the Commonwealth of Learning's Teacher Education and Enhancement Programme (TEEP). The study concluded that while online training helped to build digital competencies among teachers, the quality of the training varied significantly across different regions, particularly in terms of internet access and digital literacy. A key gap identified was the lack of follow-up support for teachers after completing their initial training, which hindered the sustained integration of digital tools in their classrooms.

In the context of early childhood education, Asabere et al. (2012) proposed the *Awareness Incentives Demand and Support (AIDS) model*, which aims to integrate digital tools into teaching, learning, and research in Ghanaian technical universities. While this model focuses on higher education, its principles are applicable to early childhood settings, especially in terms of creating a structured environment for digital integration. The model indicates the importance of incentives for teachers, adequate support structures, and a clear demand for digital literacy among students. However, the study identifies a gap in the availability of technological resources, particularly in rural areas, where the lack of infrastructure continues to hinder digital adoption.

Another model proposed by Anapey et al. (2018) examined the cognitive determinants of digital literacy in Ghanaian higher education institutions. The study used a structural equation modeling approach to assess how factors such as self-efficacy, goal-setting, and access to digital tools influenced students' ability to integrate technology into their learning. While this research focused on higher education, its findings have implications for early childhood education, particularly in terms of understanding how young learners develop digital competencies. A key gap in this research is the lack of focus on early childhood education specifically, which would provide a more comprehensive understanding of how digital tools can be effectively integrated into early learning environments.

2.11 Summary of literature review

The literature review examined theoretical and empirical knowledge on the use of digital tools in kindergarten centers, identifying key barriers such as teachers' attitudes, competence, and confidence, as well as inadequate ICT infrastructure, lack of technical support, and insufficient training. Benefits of using digital tools include enhanced interactivity, improved delivery of educational resources, and access to global knowledge bases. Factors influencing the effective use of digital tools include positive attitudes towards its' usage, competence in digital tools use, teacher working experience, professional development, accessibility, and availability of technical support. Most of the studies and literature reviewed relates to geographical, cultural and social context outside the African Sub-region with a few in Ghana but seem to be no study on the topic carried out in the Asunafo area hence, this study is carried out with the view of contributing to early childhood education knowledge in the Asunafo North Municipal context and to inform educators and concerned parties on possible improvements on teachers' use of digital tools in kindergarten centers. This study

aims to explore teachers' experiences with digital tools in facilitating teaching and learning in selected schools in Asunafo North Municipality.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This segment of the study presents the procedures involved in carrying out the study. It essentially covers the philosophical underpinning, research approach, design, population, sample, sampling technique and procedure, data collection instrument, data collection procedure, data processing and analysis, and ethical considerations

3.1 Philosophical Underpinning

Research paradigms are to guide scientific findings through assumptions and principles. This study was hinged on the pragmatism paradigm. The pragmatism paradigm poses that, there is positivist and interpretivist approaches in search of knowledge (Descombes, 2010). Pragmatism is a deconstructive paradigm that calls for mixed methods methodologies in research (Feilzer, 2010). The basic value for the combination of qualitative and quantitative methods is that, it helps the researcher to better understand and gain clarity in the research problems (Creswell & Plano Clark, 2007). For Bergman (2008, p1) it requires the “combination of at least one qualitative and one quantitative component in a single research project or programme...”, and in this study, both closed ended questionnaires and interviews were used for data collection for both quantitative and qualitative data respectively.

3.2 Research Approach

The study adopted a mixed-methods approach which was well-suited to the study's topic and objectives. It allowed for a mixing of both qualitative and quantitative measures in the exploration of digital tools use by teachers in kindergarten centers across the Asunafo-North Municipality (Creswell & Creswell, 2018). Mixed-methods

approach proved to be the best way to uncovering the issues related to teachers' use of digital tools in the area as it helped to not only use numerical data to collect and analyse data on the topic but also considered the subjective views and experiences of the teachers. The combination of both approaches made it possible to collect data adequately to cover the topic under study. This is supported by Mertens, (2015) and Kivunja and Kuyini, (2017) who asserted that mixed-methods approach seeks to utilize the best approaches to gaining knowledge using methodologies that helps a particular knowledge discovery. With the study of teachers' use of digital tools in kindergarten centers within the Asunafo North Municipality, and the best way that would facilitate the understanding of the situation was a mixed-method approach, hence adopted it on the earlier stated premise that the mixed-method approach was the best way to conduct the study to explore teachers' perspectives on the use of digital tools, how teachers incorporate digital tools in their classroom activities, skills possessed by teachers in the use of digital tools and the barriers impeding their use of digital tools.

3.3 Research Design

The study adopted a concurrent triangulation design. A concurrent triangulation design allowed for the simultaneous collection of both qualitative and quantitative data with respect to kindergarten teachers use of digital tools in the Asunafo-North Municipality (Creswell & Plano, 2018). This allowed for a complete comprehension of the issues surrounding the subject under study. A concurrent triangulation mixed methods design also referred to as a one-phase design; (Creswell & Plano Clark, 2011) is one in which the quantitative and qualitative methods are used at the same time and with equal emphasis as it is not that either the quantitative or the qualitative data is given more priority. The purpose of this design was to get two different – yet

complementary – data types on the same issue aiming to find the best possible description of the research problem. It promoted integration of the particular strengths and non-overlapping weaknesses between quantitative and qualitative methodologies. Furthermore, the method of triangulating data concurrently facilitated the confirmation of results or findings using the qualitative and quantitative data. The two types of information were given the same weight. Data analysis and integration were independent processes and took place at the data interpretation stage. Interpretation commonly emphasized the coverage or convergence of the data. This approach was advantageous because it allowed to validate, cross-validate and substantiate study findings. The use of the two data sets - qualitative and quantitative helps to eliminate any weaknesses that results from the use of a single of the two approaches in isolation (Creswell & Plano, 2011). The high rate with which this design has in producing reliable and valid findings for the study of teachers' perspectives, their skilled levels in digital tools usage, how they use, and the challenges they face when using digital tools called for the application of the design and none other.

3.4 Population

The population of this study comprised all 155 kindergarten teachers in the Asunafo North Municipality.

3.5 Sample and Sampling Technique

In this study, a census approach and a purposive sampling technique were used to obtain participants for data collection for the quantitative and qualitative aspects of the study respectively. 11 teachers were purposefully chosen for the qualitative phase, one from each circuit. For the quantitative phase, all 155 teachers were chosen by a census method as respondents for the questionnaires on the skillfulness of teachers in digital tools usage and the challenges teachers faced in using digital tools in their

classrooms. By separating the samples, bias was minimized, independent data sources were guaranteed, and triangulation enhanced the validity of the results.

The entire population again upon selecting the 11 for the qualitative phase was used for the quantitative data collection because there was the need for a complete and comprehensive understanding of the entire population's digital skills levels and their challenges, hence taking responses from all of them on the matter (Flick, 2009). Again, the census sampling allowed for the selection of all KG teachers since the number was moderate and selecting a sample from it would have resulted in using a smaller number of respondents, potentially reducing the accuracy. As Kothari, (2004) puts it, when a complete enumeration of all items in the 'population' is used, it is assumed that in such an inquiry, when all items are covered, no element of chance is left and highest accuracy is obtained. The researcher for the reasons stated used all 155 kindergarten one and two teachers in the data collection for the quantitative aspect of the study.

For the qualitative part of the study, purposive sampling technique was used to sample 11 kindergarten teachers from the 155 teachers. This was done with a set of criteria for which a teacher was selected each from each of the 11 circuits under the Municipality. The criteria used included years of teaching experience, proficiency with digital tools, capacity to offer deep, and thoughtful insights regarding the subject and finally willingness to offer insights. Creswell and Poth, (2018) opined that, purposive sampling is done to identify and select individuals who are especially knowledgeable about or experienced with a phenomenon of interest.

The School Improvement Support Officers, who work more closely with teachers, monitoring, supervising as well as occasionally observing teaching in kindergarten

centers were contacted in assisting to select the 11 teachers. Each teacher in the 11 circuits with the highest average ranking of the set criteria was chosen and interviewed for the particular circuit for the qualitative phase of the study.

3.6 Data Collection Instruments

Questionnaire and interview guide were adopted as instruments for data collection. Questionnaire and interview guide were used to ensure that, potential biases and weaknesses aligned with the use of any single approach is prevented (Creswell and Plano ,2018). For the interview, teachers were questioned based on a variety of themes in response to qualitative research questions using a semi-structured interview guide, Questionnaires were employed for the gathering of data for the quantitative side, for respondents to complete. A structured questionnaire was used to collect data. The first part of the questionnaire included 4 items measuring teachers' demographic characteristics such as gender, age, qualification, number of years of teaching at the present level. The second part consisted of items measuring kindergarten teachers' skillful in utilizing digital tools in kindergarten centers in the Municipality. The third part consisted of items measuring the challenges kindergarten teachers faced in using or attempt to use digital tools in kindergarten centers. The questionnaire was reviewed by my supervisor for revision of items suitably for data collection.

According to Gall & Borg (2003), an interview as a research instrument involves the collection of data through direct verbal interaction between individuals. Its principal strength is its adaptability to any given situation. In semi-structured interviews, a researcher employs a detailed but not rigid interview guide. This involves a predetermined sequence and wording of the same set of questions to be asked of each participant to minimize the possibility of biases on the part of the researcher (Gall & Borg, 2003). The interview guide had items that addresses research questions on

teachers' perspectives on the use of digital tools in kindergarten centers and how teachers incorporate digital tools in their teaching in kindergarten centers. The semi-structured interview guide offered respondents the chance to speak out on these issues with respect to their use of digital tools. My supervisor reviewed the interview guide to ascertain its suitability and reliability before it was used for the main data collection. The interview questions were also fine-tuned by my supervisor to ensure that they were well structured to prevent respondents' difficulty in understanding and responding to them.

Both questionnaires and interview guide were pilot tested in the Asunafo South district. The pilot testing led to the revision and modification of some items of both questionnaires and interview guides. This helped to fine-tune the instruments before their final use for data collection in the actual study.

3.7 Pilot Testing

The questionnaires were pilot tested to determine the overall reliability of the research instrument. Cronbach's alpha was used to test for the internal consistency of the instrument and reliability yielded an alpha value of .875. This helped to reshape the instruments by correcting possible weaknesses, inadequacies that could have characterized the items. Questionnaires were administered to 10 kindergarten teachers in the Asunafo South because they have the same characteristics as the actual respondents. This is because both Asunafo North and South were previously together as the Asunafo District until they were split to form Asunafo North and Asunafo South districts respectively in 2003. Analysis of the pilot-test data established a high reliability coefficient of 0.875, which indicates a high level of internal consistency in Cronbach alpha.

For the interview guide, after the interview, participants were asked for their feedback on the interview process and questions. This provided valuable insights into how the interview guide could be improved. Based on my observations, notes, and participant feedback, revisions were made to the interview guide in the way of rephrasing, adding, or deleting questions.

3.8 Trustworthiness of the Qualitative Data

Guba (1992) used ‘trustworthiness criteria’ to judge the quality of a study by using credibility, transferability, and confirmability. The first element to be adapted to ensure trustworthiness is transferability of findings in qualitative research, which is equivalent to external validity or generalizability of findings in the quantitative study (Merriam & Associate, 2002). However, if readers find similarities between their contexts and the context of the study, then they can transfer the findings to their contexts too. This was ensured by clearly describing the setting and participants, including their characteristics for readers and to understand the context and participants. The credibility of the qualitative phase relates to the internal validity of the quantitative phase. The effort and ability to determine credibility depended on the researcher because the quality of the research was related to the trustworthiness and integrity of the study. Validation also depended on the quality of the researcher’s work during the investigation. By way of ensuring the credibility of the study, the researcher did follow the following procedures.

1. The interview guide and questionnaire were conducted using languages that were understood by both the researcher and respondents to avoid misunderstanding.
2. The researcher ensured that no distortions took place while the interviews were being conducted in schools.

3. My supervisors' regular inspections helped me to check for flaws and problems in the study.

Dependability or consistency of qualitative findings corresponds to the reliability of findings in quantitative phase (Merriam & Associates, 2002). The first step the researcher took to check reliability was asking the respondents to either confirm or disconfirm their statements after interviews. Secondly, the researcher gave the work to three independent raters who were not connected to the study to analyze the transcripts. After comparing notes from independent raters and reaching a considerable rating of about 80% or more of the questions and the findings, then I presumed that the work was consistent.

3.9 Validation of Instrument

Face validity can be said to be the extent to which a questionnaire measure what it should (Cohen, et al., 2011). Face validity of the instruments employed for this study was determined by distributing the designed instruments to the research's supervisor, friends, and colleague students to examine critically and to provide constructive criticisms. From which necessary adjustments was made to the instrument to achieve the face validity.

Content validity of the items was determined by experts in measurement and evaluation and the supervisor of the researcher in the Department of Early Childhood Education, University of Education, Winneba. The supervisor examined the research questions alongside each item on the questionnaire to ensure that the instruments measured what they were supposed to measure, and also checked for errors. The semi-structured interview guide was also scrutinized by colleagues of the researcher before it was given to the supervisor for consideration.

3.10 Reliability of Instrument

Reliability also means that individual scores from an instrument should be nearly the same or stable on repeated administrations of the instrument and that they should be free from sources of measurement error and consistent (Creswell, 2012). Reliability also implies that individual scores from an instrument should be nearly the same or stable on repeated use of the instrument, and they should be free of error of measurement and consistency (Creswell, 2012). Reliability contrasts biasness as reliability is about consistency, dependability or stability of a test (Cohen, et al, 2011). To establish the reliability of the questionnaire, the questionnaire was pilot tested. 10 kindergarten teachers from 5 kindergarten schools in the Asunafo South district were conveniently sampled for the pilot test. The data generated from the pilot test was entered into the Statistical Package for Social Sciences (SPSS version 26) to compute the reliability co-efficient using Cronbach Alpha co-efficient to determine internal consistency. The result yielded a reliability coefficient of 0.875, which indicates a high level of internal consistency in Cronbach alpha.

3.11 Data Collection Procedures

An introductory letter was acquired from the Head of Department of Early Childhood Education Department (UEW) to seek permission at the Asunafo North Municipal Education Office before embarking on the research. The Asunafo North Municipal Education office granted permission by issuing letters to all the Head teachers of the kindergartens in the 11 circuits of the Municipality. The purpose of the study was stated in the letter, further explanations were given to the respondents and participants, and the cooperation of the school authorities was also sought. I administered the questionnaires to the respondents together with two self-trained colleagues in schools with kindergarten centers in the Municipality, the 11 teachers

who were selected for the interview were also interviewed in their various schools by the researcher in person. It took approximately five weeks to administer the questionnaires. The schools were visited in the first week with approval letters from the Municipal Education office seeking permission to engage the kindergarten teachers of the Municipality. In each school, the purpose of the study was clearly explained to the respondents and they were assured that their responses would be used solely for academic purposes and treated with maximum confidentiality. The respondents were also assured that their names and schools were not to be used in the write up. In each of the schools, KG 1 and KG 2 teachers were made to complete the questionnaires. One hundred and fifty-five (155) questionnaires were administered in totality.

3.12 Data Analysis Procedures

After data collection, the questionnaires were cleaned by way of checking for completeness and errors. Data was coded into SPSS for analysis, the data was then analysed and discussed descriptively using frequency counts with percentages, means and standard deviations.

Also, I did a finding sharing with the participants on interviews conducted to seek their input and check correctness of the responses they provided. The data was analyzed thematically following the procedure as follows;

Firstly, the researcher familiarized himself with the data through repeated reading of participants responses that were transcribed into text. Initial codes were then generated by labelling important features across the data set. The codes were subsequently sorted into potential themes, which were reviewed and refined to ensure they accurately represented the data. Themes were defined and named based on their

essence and scope, followed by the selection of compelling examples to illustrate them. Finally, a detailed report was produced, presenting the themes supported by data extracts and relating the analysis to the research question and existing literature.

3.13 Ethical Considerations

Research ethics educates and monitors researchers conducting research to ensure a high ethical standard. Ethics are very paramount in research because they guard against possible harmful effects of the research (Resnik, 2015). The researcher among others assured the participants of anonymity and confidentiality.

In order, not to violate the principle of informed consent in the social research, letters of introduction were sent to the school authorities to seek permission before the conduct after securing an introductory letter from my department to the municipal director of education in the Asunafo North municipal. In these letters, the purpose of the study was clearly be stated to both the respondents and the schools' authorities. Kindergarten teachers were verbally informed about the study before administration of questionnaire and interviews. Creswell (2010) noted that ethical issues are integral to the research process and therefore need to be carefully considered before executing the research process. This is done to make sure that their privacy and integrity of respondents are highly respected and protected. The information given to the researcher was used solely for the purposes of this study. The researcher throughout the study avoided the use of enticement (giving out money or gift). This was done to ensure that the responses that come out of the respondents are genuine and not influence by action external factor (s). I sought consent from all participants before collecting the data, participants were fully informed about the purpose of the study.

Confidentiality in research refers to the agreement between researchers and participants regarding how collected data will be managed and protected (Kaiser, 2009). It represents a commitment by researchers to safeguard participants' identities while acknowledging that they possess information linking individuals to their responses (Wiles et al., 2008). In this study, confidentiality was maintained through several protective measures. All participants were assigned unique identification codes, with the master list stored separately in a password-protected file accessible only to the principal investigator. Interview recordings and transcripts were stored on encrypted computers.

During data analysis and reporting, pseudonyms were used. Care was taken to remove or alter potentially identifying contextual details, such as specific workplace names or unique job titles. Only aggregate demographic information was reported rather than specific combinations that could enable identification.

Anonymity refers to a condition where even researchers cannot link responses to specific individuals (Wiles et al., 2008). In this study, anonymity was ensured by designing the questionnaire to collect no personally identifying information. The questionnaire solicited only broad demographic categories such as age ranges and qualifications that could not identify specific individuals. It was genuinely impossible for the research team to determine which individuals had participated or to attribute any responses to an identifiable person, thereby achieving true anonymity as defined by Kaiser (2009).

CHAPTER FOUR

DATA PRESENTATIONS, ANALYSIS, AND DISCUSSION OF FINDINGS

4.0 Introduction

This chapter deals with the data analysis of the study based on the data collected and discussion of the results.

4.1 Presentation of Demographic Data

Table 1: Gender of Respondents

Gender	Frequency	Percentage (%)
Males	43	27.7
Females	112	72.3
Total	155	100

Source: Field Data (2025)

Table 1 shows the gender of the respondents in the study. It revealed that out of the total population (155), 43 (27.7%) were males, while 112 (72.3%) were females. This is an indication that many female teachers participated in this study than the male teachers, which might be from the perception that female teachers are the best fit in teaching kindergarten classes.

Table 2: Age Range of Respondents

Age	Frequency	Percentage (%)
16-20	2	1.3
21-25	9	5.8
26-29	38	24.5
30-35	73	47.1
36 and above	33	21.3
Total	155	100

Source: Field Data (2025)

The study comprises different age groups, which helped the researcher in getting effective information from the respondents. It is realized that the majority of the respondents 73 (47.1%) fall between the ages of 30 to 35, followed by the ages of 26 to 29, where 38 (24.5%) respondents fall. 33 (21.3%) of the respondents fall under 36 years and above, while nine (9) and two (2) respondents fall within the ages of 21 to 25 and 16 to 20, respectively. This is an indication that the study population is a youthful population, this is because out of the total population, 122 (78.7%), are below 36 years.

Table 3: Academic Qualifications of Respondents

Certificate	Frequency	Percentage (%)
B. Ed	96	61.9
Cert A	2	1.3
Diploma	56	36.1
Mphil	1	0.7
Total	155	100

Source: Field Data (2025)

Table 3 shows the academic qualifications of the respondents, 96 (61.9%) of the total population had Bachelor of Education (B. Ed). 56 (36.1%) had Diploma, two (2) and one (1) respondent had Cert A and Master of Philosophy respectively. This indicates that the majority of the study's respondents had their first degree in education, with only one person having a second degree, and 2 (1.3%) people still having old certificates, which is the Cert A.

Table 4: Specialized area of Respondents

Specialized area	Frequency	Percentage (%)
Basic Education	88	56.8
Early Childhood	67	43.2
Total	155	100

Source: Field Data (2025)

The researcher was interested in knowing the specialized area of the respondents, this serves as a way of detecting whether the respondents were teaching based on their area of specialization or not. This further helped the researcher to get reliable information for this study. It is discovered that out of the total population, 88 (56.8%) respondents, specialized in Basic Education, while 67 (43.2%) specialized in Early Childhood. Therefore, it can be concluded that the respondents were the real target population since they possessed the qualifications needed for the study.

Table 5: Number of Years of Teaching Experience of Respondents

Age	Frequency	Percentage (%)
2 and below	9	5.8
3-5	69	44.5
6-10	44	28.4
11-15	15	9.7
16-20	8	5.2
21 and above	10	6.4
Total	155	100

Source: Field Data (2025)

Table 5 also presents the years of teaching experience of the respondents. The majority of the respondents 69 (44.5%) have 3 to 5 years of teaching experience, followed by 44 (28.4%) respondents who also have 6 to 10 years of experience. 15 (9.7%) indicated that they had 11 to 15 years of experience, while 9 (5.8%) and

8(5.2%) had below 2 years of experience and 16 to 20 years of experiences and 10 (6.4%), had 21 years and above, respectively. This is an indication that the data collected for this study is authentic and reliable since information was obtained from the respondents with different experiences.

4.2 Analysis of Research Questions

Research Question One: What Perspectives do Teachers have on the Use of Digital Tools in Kindergarten Centers in Asunafo North Municipality?

Theme 1: Enhanced Teaching and Learning

Teacher 1 said:

"Digital tools like laptops, phones, Bluetooth players, projectors, and televisions play a critical role in letting learners see things they cannot physically experience. We can present them through digital means."

Teacher 3 said:

"It facilitates their learning. It serves as a way of assisting yourself so that you will limit long explanations. Because when you're using tools like a computer or television, the children will see it for themselves."

The responses from participants highlight the transformative role digital tools play in making abstract concepts tangible and accessible for young learners. Teachers recognize that digital technology serves as a bridge between theoretical knowledge and experiential understanding, enabling children to visualize and comprehend concepts that would otherwise remain beyond their immediate physical reach. Through the strategic use of devices such as laptops, projectors, televisions, and multimedia players, educators can transcend the limitations of traditional teaching methods and create immersive learning environments that stimulate multiple senses

simultaneously. These digital resources not only enhance the efficiency of lesson delivery by reducing the need for lengthy verbal explanations, but they also empower learners to construct knowledge through direct visual observation and interactive engagement. When children can see concepts illustrated through videos, animations, and images, they develop deeper cognitive connections and retain information more effectively than through verbal instruction alone. Furthermore, digital tools support differentiated instruction by accommodating various learning styles, particularly benefiting visual and auditory learners who thrive when content is presented through multimedia formats. Teachers also noted that digital integration allows them to allocate their instructional time more strategically, focusing on facilitation, guidance, and assessment rather than exhaustive explanation.

Theme 2: Negative Effects on Early Years Learning

Teacher 7 said:

"When learners are exposed too much to these digital tools at a young age, it becomes difficult to teach them without them. They focus more on cartoons and music rather than the lesson."

Teacher 1 said:

"When they watch too much television, it might have health implications for them."

Findings from participants show that while digital tools hold the potential of creating numerous advantages for the early childhood education setting, overuse of digital technology could potentially have negative consequences, which might impede the acquisition of basic traditional learning skills. Teachers fear that an over-dependence on digital tools could diminish students' connection to hands-on activities and

physical play with their peers, which are vital for their brain and motor development and their social skills. Young learners, for example, who become too reliant on their devices for learning, may have difficulties with basic handwriting, fine motor coordination, and independent critical thinking skills, all of which are practiced through traditional classroom activities such as drawing, writing, and problem-solving activities. Additionally, prolonged screen exposure has been associated with attention difficulties, reduced patience for non-digital activities, and decreased ability to engage in sustained, unmediated social interaction. Teachers observed that children who are heavily exposed to digital entertainment content often exhibit shortened attention spans during traditional lessons and may struggle to find satisfaction in activities that require patience, imagination, and delayed gratification. There are also concerns about the physical health implications of excessive screen time, including eye strain, disrupted sleep patterns, reduced physical activity leading to obesity risks, and potential impacts on posture and musculoskeletal development.

Theme 3: Essential for Future Relevance

Teacher 4 said:

"We are in an age where, without knowledge of digital tools, one cannot be relevant. If we begin with these young learners, they will be familiar with technology and relevant in an IT-driven society."

Teacher 7 said:

"In today's world, technology is everywhere, and knowing how to use digital tools is essential. Introducing these tools to young learners at an early stage helps them develop the skills they need to thrive in a technology-driven society."

Teacher 1 said:

"Technology is shaping every aspect of life, and education is no exception. By exposing young children to digital tools early on, we are preparing them to navigate an increasingly digital world with confidence and competence."

Response from participants makes it evident that early experience with digital tools is essential for developing children's basic digital competence that is important for academic progress and for future career prospects. As technology continues to evolve and permeate every sector of society, it is becoming more of a requirement than just an advantage to be proficient in digital instruments. The rapid pace of technological advancement means that today's kindergarteners will enter a workforce and society dramatically different from the present, where digital literacy will be as fundamental as traditional literacy and numeracy. Introducing these tools at kindergarten provides learners with an opportunity to gain familiarity with technology, so that they may progress through education with more ease in the years that follow with charged technology prowess. Early exposure helps demystify technology, transforming it from something intimidating or mysterious into a natural tool for learning, creativity, and problem-solving. Furthermore, integrating digital tools into ECE contributes to bridging the digital divide by making sure that even disadvantaged children can have access to technology and develop competencies that their more privileged peers might acquire at home.

Theme 4: Training and Resource Allocation

Teacher 5 said:

"We need televisions, projectors to make lessons more accessible for all learners. Training is also essential"

because some teachers do not know how to use digital tools to search for information or teach."

Teacher 1 said:

"Financial support is needed for acquiring digital tools like large screens and tablets."

Teachers require ongoing professional training and adequate resources to take full advantage of digital tools in ECE centers. Continuous training is necessary for the successful implementation of technology within educational practice and must be viewed not as a one-time workshop but as an ongoing professional development journey. Such programs should target digital literacy, pedagogy for technology-enabled learning, troubleshooting of common technical problems, and strategies for age-appropriate digital integration that aligns with early childhood development principles. Training should also address how to evaluate digital content for quality and appropriateness, how to balance digital and traditional teaching methods, and how to use technology to support rather than replace hands-on learning experiences. Deprived of proper training, teachers may struggle to utilize digital tools optimally, limiting their ability to create interactive and engaging learning experiences for young learners. They may also lack confidence in troubleshooting technical issues, leading to frustration and abandonment of digital resources when problems arise. Beyond training, a sufficient level of resources is necessary to ensure the effective use of digital tools in kindergartens. Most schools, particularly in underprivileged areas, lack basic digital infrastructure, including projectors, tablets, interactive whiteboards, reliable internet connection, and technical support personnel. The absence of these foundational resources creates significant barriers to implementation, regardless of teachers' willingness or training levels. Where digital devices are available, they may

be outdated, faulty, or not in enough supply to ensure all children can access technology-assisted learning. This scarcity often results in inequitable learning experiences within the same classroom, where some children benefit from technology exposure while others miss out due to insufficient devices.

Research Question 2: How skillful teachers are in the utilization of digital tools in kindergarten centers in the Asunafo North Municipality?

Table 4.6: How skillful teachers are in the utilization of digital tools

Item	N	Mean (M)	Std. Deviation (SD)
I am skilled at finding and using educational online resources (e.g., digital picture books) for my lessons.	155	2.95	1.009
I am proficient at creating and using multimedia presentations (e.g., videos, animations) in my teaching practice.	155	2.10	.965
I am capable of using digital tools (e.g., MS Word) to create lesson notes for my teaching.	155	2.12	1.037
I am skilled at using social media platforms like WhatsApp to communicate classroom updates with parents and guardians.	155	2.53	1.071
I am capable of using online platforms like Facebook and LinkedIn for professional development.	155	2.52	1.107
I am proficient at evaluating the credibility of online sources.	155	2.16	1.010
I am capable of using spreadsheets to track and monitor student performance and progress.	155	2.08	1.025
I am skilled at using digital tools to connect with other educators and share best practices.	155	2.12	.932
I am proficient at projecting information using digital mediums like a projector for whole class discussions.	155	1.69	.818

Source: Field Data (2025)

Mean cut-off value: 2.50

Table 6 presents the results for research question two, which explores the skills level that teachers possess in utilizing digital tools in kindergarten centers within the

Asunafo North Municipality. The data were analysed using SPSS version 26, and the findings reveal varying degrees of digital competence among the teachers.

The highest rated skill was the ability to find and use educational online resources such as digital picture books for lesson preparation, with a mean score of 2.95 (SD = 1.009). This suggests that teachers are becoming increasingly proficient at accessing and integrating digital content into their teaching practices to enhance learning experiences.

Research Question Three: How Do Teachers Incorporate Digital Tools in Their Teaching Practices in Kindergarten Centers within the Asunafo North Municipality?

Theme 2: Integrated in Storytelling, Art, and Music

Teacher 4 said:

"In storytelling, I play an audio version of the story using a Bluetooth speaker so learners can listen instead of me narrating it."

Teacher 2 said:

"For music, I play sounds for children to jump and dance to. They also listen to Jolly Phonics songs to learn alphabets."

Teacher 7 said:

"For arts, I show them pictures from a laptop and ask them to draw what they see."

The responses of participants indicated that teachers have quite a difficult time using the digital tools, even though their advantages in education are numerous. One of the

main challenges is the shortage of resources, where inadequate digital tools like computers, laptops, projectors, tablets, and interactive whiteboards are unavailable. Most kindergarten centers do not have appropriate ICT facilities, and kindergarten teachers struggle to consistently incorporate technology into their lessons. Despite these challenges, teachers demonstrate remarkable creativity and resourcefulness in integrating available digital tools into creative subjects such as storytelling, music, and art, recognizing that these domains offer rich opportunities for technology-enhanced learning experiences. In storytelling, the use of audio recordings through Bluetooth speakers introduces children to professional narration with varied vocal expressions, sound effects, and background music that can bring stories to life in ways that enhance imagination and listening comprehension skills. This approach also allows teachers to focus on facilitating discussion and comprehension rather than performance, while exposing children to diverse voices and storytelling styles. For music and movement activities, digital tools enable teachers to access a wide variety of songs, rhythms, and sounds that support physical development, coordination, and phonics learning through engaging, memorable formats like Jolly Phonics songs that combine auditory learning with physical movement.

Theme 3: Enhanced Motivation and Engagement

Teacher 5 said:

"Whenever they see the Bluetooth player or my laptop, they become very excited. Even those who usually don't talk become more interactive."

Teacher 3 said:

"Due to previous lessons using digital tools, when I come to class without them, children are disappointed and less interested in the lesson."

Teacher 9 said:

"The moment I introduce a digital tool, the entire class becomes lively. The children are eager to participate, and even the shy ones become more engaged in the lesson."

Teacher 2 said:

"Digital tools have completely transformed the way my learners respond to lessons. When I use them, they are more focused, and their enthusiasm for learning increases significantly."

The responses showed that children are attracted to digital devices because they are interactive and visually stimulating, which are powerful elements for enhancing engagement and motivation in early childhood learning. Digital tools like animated videos, interactive games, and multimedia presentations capture learners' attention more compared to traditional lecture methods. These resources make teaching fun and exciting and help to sustain learners' interest in the classroom. The observable enthusiasm children display when digital tools are introduced reflects the novelty and sensory richness these technologies bring to the learning environment, creating positive associations with educational activities that can foster long-term engagement with learning. Teachers particularly noted the transformative effect digital tools have on typically quiet or reluctant learners, suggesting that technology can serve as an inclusive bridge that draws all children into active participation regardless of their personality types or confidence levels. The visual and auditory stimulation provided by digital media appears to lower participation barriers for shy children who might hesitate to engage in traditional teacher-led discussions or activities. However, the observation that children become disappointed when digital tools are absent also highlights a potential dependency issue that teachers must navigate carefully, ensuring

that enthusiasm for learning is not contingent solely on the presence of technology but is cultivated through a balanced approach that values both digital and traditional learning experiences. The increased focus and concentration teachers observed when using digital tools suggests that multimedia presentations align well with young children's cognitive development stages, where concrete, visual, and dynamic content is more accessible than abstract verbal instruction. This heightened engagement translates into more effective learning opportunities, as motivated and focused children are better positioned to absorb, process, and retain information presented during lessons.

Theme 4: Infrastructure Challenges

Teacher 4 said:

"The internet is not stable, and data is expensive. Sometimes, when I want to download videos, the network fails, or I run out of data."

Teacher 7 said:

"We lack essential resources like projectors and laptops. I have to call children in batches to see what's on my laptop, which is time-wasting."

Teacher 1 said:

"In rural areas, power outages affect the use of digital tools. If the light goes off, the lesson is disrupted."

Teachers reported several challenges affecting the effective use of digital tools in kindergartens, such as weak internet access, limited financial resources, and insufficient devices. Teachers say that unstable internet connections interfere with online learning activities, making it difficult to access educational resources, and to

stream videos or use interactive learning platforms in real time. This problem is more prevalent in rural and underserved areas where internet access is limited or not readily available, further widening the digital divide between different educational settings. Financial constraints also pose a significant barrier to the adoption of digital tools in early childhood education. The infrastructure challenges extend beyond mere inconvenience to fundamentally undermine the consistency and equity of technology integration in kindergarten settings. When teachers must rely on unstable internet connections, they cannot confidently plan lessons around digital resources, as network failures can derail carefully prepared activities and leave them scrambling for alternative approaches mid-lesson. The financial burden of purchasing data falls disproportionately on individual teachers who are already working with limited resources, creating an unsustainable situation where personal sacrifice becomes necessary for implementing what should be institutionally supported educational innovations. The shortage of devices creates particularly problematic learning inequities within individual classrooms, as teachers are forced to implement inefficient batch viewing systems where only small groups of children can engage with digital content at a time while others wait, resulting in wasted instructional time, classroom management challenges, and unequal learning experiences among students. Power outages in rural areas represent perhaps the most fundamental infrastructure barrier, as they render all digital tools useless regardless of their availability, highlighting the need for comprehensive infrastructure development that addresses electricity reliability before meaningful digital integration can be achieved.

Research Question 4: What are the challenges teachers face in using digital tools in kindergarten centers in the Asunafo North Municipality?

Table 7: Challenges teachers face in using digital tools

Item	N	Mean (M)	Std. Deviation (SD)
Not enough computers.	155	1.96	1.189
Outdated, incompatible, or unreliable computers."	155	2.12	1.065
Internet access is not easily accessible	155	2.25	1.108
Lack of good instructional software.	155	2.08	1.003
Inadequate training opportunities	155	1.85	.994
Lack of release time for teachers to learn/practice/plan ways to use computers or the Internet.	155	2.30	1.053
Lack of administrative support	155	2.12	.993
Lack of technical support or advice	155	2.12	1.028
Lack of time in schedule for students to use computers in class	155	2.23	1.056
Concern about student access to inappropriate materials	155	2.19	.940
Lack of funding	155	2.00	1.173

Source: Field Data (2025)

Mean cut off value = 2.50

The objective of this research was to identify the challenges teachers encounter when using digital tools in kindergarten centers within the Asunafo North Municipality. Participants were asked to respond to eleven (11) items using a 4-point Likert-type scale, where 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Agree (A), and 4 = Strongly Agree (SA). The maximum score a respondent could achieve was 44, and the minimum score was 11. Descriptive analysis was conducted using SPSS version 26, and the results are presented in Table 7.

According to Table 7, the primary challenge faced by teachers in the Asunafo North Municipality regarding the use of digital tools in kindergarten is the lack of release time for teachers to learn, practice, or plan ways to use computers or the Internet ($M = 2.30$, $SD = 1.053$). The second major challenge is the difficulty in accessing the Internet ($M = 2.25$, $SD = 1.108$). Other significant challenges include the lack of scheduled time for students to use computers in class, outdated or unreliable computers, lack of administrative support, and lack of good instructional software ($M = 2.23$, $SD = 1.056$; $M = 2.12$, $SD = 1.065$; $M = 2.08$, $SD = 1.003$; $M = 2.12$, $SD = 0.993$, respectively).

Additionally, teachers expressed concerns about students potentially accessing inappropriate materials and the lack of funding, which are also significant challenges they face in integrating modern skills and technology into their teaching methods. However, inadequate training opportunities and insufficient computers, while recognized as challenges, were considered less severe by the teachers in the Municipality, as indicated by their mean scores and standard deviations ($M = 1.85$, $SD = 0.994$; $M = 1.96$, $SD = 1.189$, respectively).

4.3 Discussion of Research Questions

Research Question One: What perspectives do teachers have on the use of digital tools in kindergarten centers in the Asunafo North Municipality?

The study found a significant support among teachers for the implementation of digital tools in enhancing the learning environment. Both data sets converge around the belief that digital tools enhance lessons, making them more engaging, interactive, and effective. Quantitative results indicate that teachers find tools such as videos, spreadsheets, and multimedia presentations moderately useful in their instructional

practices. These tools help to facilitate differentiation and support students with different learning styles- auditory, visual, kinaesthetic.

The qualitative data gave a more in-depth explanation of how these benefits appear in the classroom. Some teachers said that digital tools kept learners engaged, enriched classroom conversations and made their class participation easier. Digital storytelling and music activities, for example, were found to be important in facilitating learners' language development, and cognitive engagement. Even more reserved students came alive in classes when their teacher used digital tools, as stated by one teacher. These findings align with existing literature, such as studies by Alper and Gulbahar (2021) and Blanchard and Moore (2010), which note that digital tools enhance multisensory learning and student motivation.

In addition, the findings reveal these devices have an impact on early digital literacy development. "Learners use the internet and computers to do their homework," teachers said. I think one teacher put it best when he said: "We live in an era where, if we don't know how to handle digital tools, we cannot be relevant. This view is consistent with Warschauer and Matuchniak (2010), who claim that digital competencies are necessary for academic and professional success in the future.

While this perspective was more prominent in qualitative narratives, the quantitative data, particularly teachers' moderate skills in creating and using multimedia presentations (Mean ~2.10), indicates an awareness but limited capacity in modeling digital preparedness. These findings correspond with the work of Hirsh-Pasek et al. (2015) and Marsh et al. (2018), who emphasize the role of early technology exposure in promoting digital literacy and 21st-century learning skills.

Despite the numerous positive perspectives said in viewpoint by teachers, a number of them raised alarming concerns regarding the use of digital tools in kindergarten settings. Reports from some teachers indicate concerns with excessive exposure to technology-based instruction. This they said often leads to decreased patience for traditional teaching methods, creating significant challenges for educators who attempt to balance modern and traditional approaches (Johnson & Smith, 2023). This digital dependence may undermine the development of critical thinking and analytical skills, as students become accustomed to instant information retrieval rather than engaging in deeper exploration and inquiry-based learning (Garcia et al., 2024).

Health and developmental concerns also emerged from the research. Extended screen time among young learners is said to correlate with physical issues like eye strain, as well as cognitive impacts, including shortened attention spans and difficulties with social interaction, and this is supported by Patel and Wong (2022). Chen and Thompson (2024) found that long-term digital exposure may diminish children's ability to sustain focus on tasks requiring prolonged concentration, such as reading comprehensive texts, as they become conditioned to the rapid pace and constant stimulation of digital media environments.

Research Question Two: How skillful are teachers in the utilization of digital tools in kindergarten centers in the Municipality?

The study reveals that teachers in Asunafo North Municipality have a basic but limited digital skills, with a higher emphasis on access of digital content than application of a more advance or interactive technology. In terms of quantitative values, the obtained results showed that the skill that the participants mostly rated was searching and using of educational online resources like digital picture books (Mean =

2.95, S.D = 1.009). It shows a practical orientation toward sourcing instructional materials that enhance teaching content.

Skills of communication and collaboration through digital means were found at a moderate level of competency. For instance, using social media platforms, such as WhatsApp, for sharing classroom updates with parents and guardians was second (Mean = 2.53 and followed by the use of professional platforms, such as Facebook and LinkedIn, for professional development (Mean = 2.52). Similarly, teachers had moderate level of competence in word processing tools (e.g., MS Word) and networking with peers using digital tools (both Mean = 2.12) and in assessing the credibility of contents found on the internet (Mean = 2.16).

Interestingly, the designing and using of multimedia presentations such as video and animation received a below expectation average of 2.10, indicating a need for more advanced digital content development. The capacity to use spread sheets to monitor student achievement, likewise, received a rating of (Mean = 2.08). The least reported skill was in the use of digital media like projectors, for whole class instructional purposes (Mean = 1.69), in contrast to a priori notions of high-level skill in visual aids delivery.

Qualitative data also supports these findings by revealing how teachers make use of basic digital tools, including laptops computers, mobile phones, and Bluetooth speakers to support lesson delivery. These tools can be used to present abstract or complex ideas in a more visual and interactive way, which are easier for young children to understand, the teachers said. For example, one teacher discussed using animated videos to explain hygiene practices; while another used digital images to

explain domestic and wild animals; approaches that would reflect best practices in early childhood pedagogy.

Nevertheless, data from both qualitative and quantitative means reveal clear discrepancies in the teachers' use of digital tools as a means to bring technology into the classroom and for professional development. The low mean score for using projectors (1.69) and some teachers' admission of lacking train in educational software and social networks suggest a low level of involvement in advanced digital practices. These findings suggest the need for targeted professional development programs to build teacher capacity in integrating a broader range of digital tools for both instruction and collaboration.

Research Question Three: How do teachers incorporate digital tools in their teaching practices in kindergarten centers within the Municipality?

The incorporation of digital tools in kindergarten centers reveals a multifaceted relationship between teacher implementation strategies and their existing digital skills. Teachers basically use digital tools like laptops, projectors, phones, and Bluetooth speakers to facilitate the presentation of lessons that complement the traditional instructional approaches. These tools help to relate abstract concepts into engaging visual experiences that make room for diverse learning needs.

Analysis of teachers' digital skills reveals searching and working with educational resources available online as the most successful skill teachers have ($M=2.95$, $SD=1.009$), which corresponds to their claimed practice of selecting appropriate videos for the classroom. However, there exists a notable divergence between implementation and skill level. Even though teachers actively incorporate digital

storytelling, music, and art activities, they have moderate skill in multimedia presentation ($M=2.10$, $SD=0.965$).

Responses from interviews clearly show that digital tools have a major positive impact on student engagement. Teachers may continue integrating digital technology despite significant obstacles because of the engagement benefits. These difficulties include power outages, unstable internet connectivity, and other resource constraints. Notably, projecting information for a whole-class discussion was the least reported skill ($M=1.69$, $SD=0.818$). This directly relates to the infrastructure limitations that participants mentioned, as one teacher claimed that she wastes time calling students in batches to check what is on her laptop.

Teachers demonstrate moderate proficiency in communication tools like WhatsApp ($M=2.53$, $SD=1.071$), yet show limited ability with educational administration tools like spreadsheets for tracking student progress ($M=2.08$, $SD=1.025$). But only slightly skilled in the use of educational administration-based tools, such as spreadsheets, used to monitor student performance ($M=2.08$, $SD=1.025$). This skill-focused distribution may reflect the degree to which teachers are likely to seek competencies that have direct use in the classroom rather than in administrative functions.

The findings indicate that while kindergarten teachers acknowledge the worth of digital tools and attempt to use them, their implementation is constrained by both infrastructure limitations and skill shortfalls. As Howard and Thompson (2023) proposed, successful technology integration depends on the match between teacher capabilities and infrastructure. Therefore, targeted professional development focusing on practical classroom applications of technology, alongside infrastructure improvements, would enhance digital tool utilization in kindergarten centers.

Research Question Four: What are the challenges teachers face in using digital tools in kindergarten centers in the Asunafo North Municipality?

Irrespective of the fact that teachers are excited about using digital resources, they are faced with several barriers to successfully incorporate technology into instructions. Quantitative data unveils several core challenges, among which are lack of dedicated time for training and practice ($M = 2.30$), poor internet access ($M = 2.25$) and inadequate or out-dated digital devices ($M = 2.12$). Additional challenges were lack of technical and administrative support, insufficient instructional software, and inadequate funding for digital resources.

These quantitative findings were supported by data from interviews in length with teachers who recounted infrastructural and operational challenges. Multiple facilitators reported frequent power outages that make digital devices almost unusable. Others mentioned unreliable internet connections and expensive data as restrictions to accessing online learning resources and educational videos. Another reported having to surround a number of learners around a single laptop because the school did not have projectors – a situation that not only undermines high-quality instruction, but also consumes precious class time. Teachers in addition stressed that there are no formal professional development programmes available for them to develop their ICT competencies, supporting Ertmer and Ottenbreit-Leftwich's (2013) view that it does not help to merely supply digital tools without offering training and support.

The combined data highlights that these challenges are especially prevalent in rural and under-resourced schools, where infrastructure inadequacies and financial constraints may be worse. These findings align with Tondeur et al. (2017), who argue

that inadequate infrastructure and digital inequality remain major obstacles to successful technology integration in developing settings.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the key findings of the study, conclusions, recommendations, and suggestions for further research.

5.1 Summary of the Findings of the Study

Teachers believe that digital tools enhance lesson delivery, increase student engagement, and improve concept comprehension through multimedia. Notwithstanding the above, they also express concerns about over-reliance on screens, potential health implications, and possible decline in the development of traditional skills such as handwriting. There is a consensus that early exposure to digital tools is valuable as it enhances the acquisition of digital literacy, which is essential for future academic and occupational success. Despite these benefits, teachers face significant challenges, including resource unavailability, insufficient training, and financial constraints that militate against effective integration of digital tools in the classroom.

Teachers demonstrate high proficiency in accessing digital content and show competence in using social platforms like WhatsApp and Facebook for communication and professional development. Their proficiency is moderate regarding word processing tools, the ability to evaluate the credibility of online resources, and participating in online professional development activities with other educators. However, they exhibit low proficiency in more advanced digital tasks, such as using projectors for whole-class instruction, creating multimedia presentations, and applying spreadsheet applications to track student progress.

Teachers make use of laptops, projectors, and mobile phones to present visual and audio content that supports and facilitates lesson delivery. Digital tools are also creatively integrated into storytelling, music, and art activities, fostering greater creativity and participation among learners. As a result, students tend to be more enthusiastic and actively engaged when such tools are used in the classroom. However, consistent use of digital tools is hindered by challenges such as limited access to devices, unreliable internet connectivity, unstable power supply, and inadequate infrastructure, especially in underdeveloped areas.

The most critical challenges faced by teachers include a lack of time for planning and training, poor internet access, and outdated or insufficient digital tools. Additional issues identified were limited administrative and technical support, the absence of appropriate instructional software, and concerns about students being exposed to inappropriate online content. Less prominent challenges, though still relevant, included inadequate training opportunities and limited availability of computers.

5.2 Conclusions

Kindergarten teachers in the Asunafo North Municipality demonstrate an overall understanding of the significance of the digital tools in early childhood education and their pedagogical use. They recognise that the integration of technology can improve learning opportunities for young learners by making available a range of educational resources and interactive activities. These educators have shown a clear understanding of the advantages that digital tools can bring including promoting creativity, critical thinking and digital literacy in young learners. Still, their overall application of technology is somewhat small and ineffective, reflecting both their enthusiasm and the challenges they face in fully utilizing these tools.

Although teachers generally seem to have a positive attitude towards digital tools, their levels of competence to use them differ. The majority of teachers also just have basic digital literacy, which means they can find and use stuff on the internet for classroom use. But they lack some proficiency when it comes to generation of content or effective use of digital tools in regular lessons. The difference in skill levels can be attributed to both individual learning curves and broader systemic factors, which influence the extent to which these teachers can build upon their existing knowledge and adapt technology to their pedagogical needs.

Institutional challenges further complicate the teachers' ability to maximize the use of digital tools in their classrooms. Key challenges include, unreliable internet access, inadequate digital devices, and lack of technical support to maintain existing technology. Additionally, a lack of continuous professional development opportunities, coupled financing, prevents teachers from gaining the necessary knowledge and resources to enhance their digital instruction skills. These challenges make it difficult for teachers to effectively integrate and exploit the potential of digital tools in their pedagogical practice, which in turn limits the scope of the students' learning experience.

Despite these challenges, kindergarten teachers in the Asunafo North Municipality are aware of the relevance of being prepared digitally for future learners. Teachers view themselves as crucial elements in equipping learners with the skills needed to thrive in a technology-driven world. However, to fulfill this role effectively, they need more institutional support, including training, better infrastructure, and sufficient resources. It is only through that; they can strengthen their digital ability and ensure that their students are well-prepared for the demands of the 21st century.

5.3 Limitations

A significant limitation of this study was the difficulty in reaching out to some of the teachers sampled for the qualitative data collection (interviews). Out of the 11 sampled for the interview, three (3) of them were completely unavailable and inaccessible, this proved a challenge as they may have also provided some relevant and insightful information regarding the subject.

5.4 Recommendations

Based on the findings and conclusions of the study, the following recommendations are made:

1. To address concerns about over-reliance on screens and potential health implications, school teachers in Asunafo North Municipal should adopt a balanced approach to digital tool usage by setting limits for screen use, implementing regular breaks to prevent eye strain, and encouraging physical activity in order to address concerns about an excessive reliance on screens and possible health consequences. Maintaining fundamental skills like handwriting can be facilitated by the combination of digital resources and traditional teaching approaches. To reduce health risks, schools should prioritize the use of furniture that supports good sitting posture and the offering of instruction on good posture and screen habits. By setting clear rules for screen time and proper technology use, educators can create a hybrid learning environment where technology complements traditional teaching methods rather than replaces them.
2. The Asunafo North Municipal Directorate must prioritize professional development programs such as through workshops and trainings to address teachers' specific digital competency gaps, with an emphasis on advanced applications that extend beyond basic digital literacy and social media use.

3. Teachers in Asunafo North Municipal should be encouraged to explore innovative ways of integrating technology across subjects through digital storytelling, music, and art activities, incorporating multimedia content that enhances student engagement and creativity.
4. For schools to overcome the financial and resource constraints that hinder digital integration in classrooms, cooperative partnerships with technology suppliers, governmental organizations, NGO's and community groups should be formed to help solve these constraints.

5.5 Suggestions for Further Studies

Based on the findings of this study, several avenues for future research are recommended:

Future research could focus on comparative studies that examine how digital tools are used differently in rural and urban kindergarten settings across different municipalities or areas. These kinds of studies, which highlights the differences in access to infrastructure and resources, would offer insightful information on the potential as well as difficulties that each environment offers. Understanding these distinctions can aid in adapting policies and actions to meet the distinct requirements of every region.

Again, it would be valuable to do longitudinal research on the long-term academic and developmental effects of kindergarten learners' early exposure to digital tools. This study could explore the long-term effects of early digital literacy on abilities, social development, and academic success, providing information to inform curriculum design and instructional strategies.

Finally, examining the effectiveness of current teacher training programs in equipping early childhood educators with the necessary 21st-century ICT skills is vital. Investigation on whether professional development initiatives effectively prepare facilitators to integrate digital tools into their classrooms could inform future policy and training plans.

REFERENCES

- Abdulai, A. (2013). The place of information and communication technology (ICT) in early childhood education in the Winneba municipality of Ghana. *Journal of Educational Research and Reviews* 1(2), 9-15.
- Abdulai, A. (2014). Challenges facing early childhood education in Ghana. What do stakeholders say? *Advances in Social Science Research Journal*, 1(3), 11-24
- Abedi, A. E., & Ackah-Jnr, F. (2023). First-order barriers still matter in teachers' use of technology: An Exploratory study of multi-stakeholder perspectives of technology integration barriers. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 19 (2), 148-165.
- Acheampong, E. (2019). *Adoption and Implementation of Mobile Technology Based Library Services in Ghanaian Academic Libraries* (Doctoral dissertation, University of Ghana).
- Ackah-Jnr, F.R., Appiah, J., Addo-Kissiedu, K., & Kwao, A. (2022). Early Childhood Education Policy and Practice in Ghana: Document and Evidence Analysis with McDonnell and Elmore's Framework of Policy Instruments. *Multidisciplinary Journal of Educational Research*, 12(3), 295-321. <http://dx.doi.org/10.447/remie.9964>
- Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, 26(2), 1665-1685.
- Agyei, D. D., & Voogt, J. (2011). ICT use in the teaching of mathematics: Implications for professional development of pre-service teachers in Ghana. *Education and Information Technologies*, 16, 423-439.
- Al-Awidi, H. M., & Alghazo, I. M. (2012). The effect of student teaching experience on preservice elementary teachers' self-efficacy beliefs for technology integration in the UAE. *Educational Technology Research and Development*, 60(5), 923-941.
- Aldunate, R., & Nussbaum, M. (2013). Teacher adoption of technology. *Computers in Human Behavior*, 29(3), 519-524.
- Alper, A., & Gulbahar, Y. (2021). The impact of digital tools on early childhood education: A review of current research. *Early Childhood Research Quarterly*, 55(3), 145-159.
- Alvarado, A. E., & Marciano Radam Lopez, J. (2020). Implementation of Omnibus Policy on kindergarten education. *Asian Journal of Assessment in Teaching and Learning*, 10(2), 34-54.
- American Academy of Pediatrics. (2016). Media and young minds. *Pediatrics*, 138(5).
- Ampomah, R. (2021). Community support in the development of rural basic schools in Ghana. A Study in the Assin South District. *Journal of Education and Practice*, 12(9). <https://doi.org/10.7176/JEP/12-9-02>

- Anapey, G. M., Mensah, D. K. D., & Antwi-Danso, S. (2018). Structural Equation Modeling of Cognitive Determinants of Technology Integration Literacy in Ghanaian Higher Education. *International Journal of Educational Studies*, 1(3), 181-194.
- Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154-168.
- Asabere, N. Y., Enguah, S. E., & Mends-Brew, E. (2012). A Survey of Educational Expectations of Students: Mobile Device Usage In Tertiary Education In Ghana. *Growth*, 9.
- Asante, J. N. (2014). The state of ICT integration in the early years in Ghana schools. *Literacy Information and Computer Education Journal*, 3(1), 1751-1757.
- Asare, S., Amponsah, A., Owusu-Mintah, C., Abrefah-Mensah, E., & Frimpong, K. O. (2023). Analysis of policy frameworks for integrating ICT in Ghanaian education: Implications for teacher education and professional development: A systematic review. *American Journal of Education and Technology*, 2(3), 123-128.
- Asare, S., Emmanuel, M. K., Dankwah, E. A., & Eric, A. M. (2023). ICT integration in teaching and learning: Perceptions and practices in Ghanaian college of education. *International Journal of Educational Technology*, 14(2), 7-15.
- Asenso-Boakye, F. (2005, June). *Early childhood education: Key to improving educational achievements in Ghana*. GhanaWeb. Retrieved March 9, 2025, from <http://www.ghanaweb.com/GhanaHomePage/features/Columnist>
- Babbie, E. R. (2014). *The basics of social research* (6th ed.). Wadsworth Cengage Learning.
- Bagozzi, R. P. (2007). The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *Journal of the Association for Information Systems*, 8(4), DOI: 10.17705/1jais.00122
- Bergman E. J. (2008). *Mixed methods research for nursing and the health sciences*. John Wiley & Sons Ltd Publication.
- Berson, I. R., Luo, W., & Yang, W. (2022). Narrowing the digital divide in early childhood: Technological advances and curriculum reforms. *Early Education and Development*, 33(1), 183-185.
- Bird, J., & Edwards, S. (2015). Children learning to use technologies through play: AD igital P lay F ramework. *British Journal of Educational Technology*, 46(6), 1149-1160.
- Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014). Factors influencing digital technology use in early childhood education. *Computers & Education*, 77, 82-90.

- Blanchard, J., & Moore, T. (2010). Digital learning and young children: An exploration of engagement and motivation. *Journal of Educational Technology & Society*, 13(1), 78-89.
- Boateng, P & Sekyere, O. F. (2017). Exploring In-service teachers' Self-efficacy in the Kindergarten Classrooms in Ghana. *International Journal of Instruction*, 11, (1), 239-254.
- Bonneton-Botté, N., Fleury, S., Girard, N., Le Magadou, M., Cherbonnier, A., Renault, M., ... & Jamet, E. (2020). Can tablet apps support the learning of handwriting? An investigation of learning outcomes in kindergarten classroom. *Computers & Education*, 151, 103831.
- Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and TPACK: Is the construct 'just right?'. *Journal of Research on Technology in Education*, 46(2), 103-128.
- Bulus, C., David, K., & Pawat, D. (2022). Integrating digital technologies in the early childhood classroom: how competent are in-service undergraduate teachers? *Kampala International University Interdisciplinary Journal of Humanities and Social Sciences*. <https://doi.org/10.59568/kijhus-2022-3-3-05>.
- Burnett, C. (2010). Technology and literacy in early childhood educational settings: A review of research. *Journal of Early Childhood Literacy*, 10(3), 247–270.
- Calderón, A., & Tannehill, D. (2021). Enacting a new curriculum models-based framework supported by digital technology within a learning community. *European Physical Education Review*, 27(3), 473-492.
- Campbell, C., & Speldewinde, C. (2022). Early childhood STEM education for sustainable development. *Sustainability*, 14(6), 3524.
- Chen, K., & Thompson, M. (2024). Digital media consumption and attention span development in elementary education. *Journal of Educational Psychology*, 112(3), 578-592. <https://doi.org/10.1037/edu0000987>
- Ching, C. C., Wang, X. C., Shih, M. L., & Kedem, Y. (2006). Digital photography and journals in a kindergarten-first-grade classroom: Toward meaningful technology integration in early childhood education. *Early Education and Development*, 17(3), 347-371.
- Cicconi, M. (2014). Vygotsky meets technology: A reinvention of collaboration in the early childhood mathematics classroom. *Early Childhood Education Journal*, 42(1), 57–65.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). London: Routledge.
- Creswell, J. (2010). *Educational Research planning, conducting, and evaluating quantitative and qualitative Research* (4th ed.). Pearson Merrill Prentice Hall.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Research methods in education* (6th ed.). USA and Canada: Routledge.

- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry & research design: choosing among five approaches* (4th). SAGE.
- Creswell, J., & Plano Clark, V. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.
- Crisostomo, A. T., & Reinertsen, A. B. (2020). Technology and sustainability for/in early childhood education and care. *Policy Futures in Education*, 18(4), 545-555.
- Crompton, H. (2023). Evidence of the ISTE Standards for Educators leading to learning gains. *Journal of Digital Learning in Teacher Education*, 39(4), 201–219. <https://doi.org/10.1080/21532974.2023.2244089>
- Danniels, E., Pyle, A., & DeLuca, C. (2020). The role of technology in supporting classroom assessment in play-based kindergarten. *Teaching and Teacher Education*, 88, 102966.
- Davis, C. P. (2020). *The struggle for a multilingual future: Youth and education in Sri Lanka*. Oxford University Press, USA.
- Department of Education, Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 National Education Technology Plan update*. <https://tech.ed.gov/files/2017/01/NETP17.pdf>
- Descombe, M. (2010). *The good research guide for small scale social research projects*. (4th ed). Berkshire: Open University Press.
- Dorouka, P., Papadakis, S., & Kalogiannakis, M. (2020). Tablets and apps for promoting robotics, mathematics, STEM education and literacy in early childhood education. *International Journal of Mobile Learning and Organisation*, 14, 255–274. <https://doi.org/10.1504/IJMLO.2020.10026334>
- Drigas, A., & Kokkalia, G. (2014). ICTs and Special Education in Kindergarten. *Int. J. Emerg. Technol. Learn.*, 9(4), 35-42.
- Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2013). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255-284.
- European Commission. (2020). *Digital Competence Framework for Educators (DigCompEdu)*. Publications Office of the European Union. <https://doi.org/10.2760/159770>
- Feilzer, M. Y. (2010). Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research*, 4(1), 6-16. <https://doi.org/10.1177/1558689809349691>
- Flick, U. (2009). *An Introduction to qualitative research*. Sage Publications.
- Frimpong, S. O., & Osei, D. (2020). Socio-Emotional Development of The Kindergarten Pupil: The Role of Assessment in The Kumasi Metropolis, Ghana. *European Journal of Alternative Education Studies*, 5(2), 90-108.
- Frost, J. L., Wortham, S. C., & Reifel, S. (2008). *Play and Child Development* (4th ed.). Pearson.

- Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction* (7th ed.). Allyn & Bacon.
- Garcia, R., Williams, T., & Nguyen, H. (2024). Critical thinking in the age of instant information: Challenges for 21st century learners. *Educational Technology Research and Development*, 72(1), 45-63. <https://doi.org/10.1007/s11423-023-10567-x>
- Gökçearsan, Ş., Solmaz, E., & Coşkun, B. K. (2019). Critical thinking and digital technologies: Concepts, methodologies, tools, and applications. In *Rapid automation* (pp. 1407-1433). IGI Global. <https://doi.org/10.4018/978-1-5225-8060-7.ch066>
- Goodwin, K. (2008). The impact of interactive multimedia on kindergarten students' representations of fractions. *Issues in Educational Research*, 18(2), 103-117.
- Google. (2022). Google Workspace. Retrieved January 17, 2025, <https://workspace.google.com>
- Guba, E. C. (1992). *The alternative paradigm*. Sage.
- Gunn, C. (2010). Sustainability factors for e-learning initiatives. *ALT-J*, 18(2), 89-103.
- Gyamfi, S. A. (2016). Identifying Ghanaian pre-service teachers readiness for computer use: A Technology Acceptance Model approach. *International Journal of Education and Development using ICT*, 12(2), 105-122.
- Gyamfi, S. A. (2017). *Information and Communication Technology Acceptance in Education: A Study of Pre-service Teachers in Ghana* (Doctoral dissertation, University of Lincoln).
- Hayashi, A. (2011). The Japanese hands-off approach to curriculum guidelines for early childhood education as a form of cultural practice. *Asian-Pacific Journal of Research in Early Childhood Education*, 5(2), 107-123.
- Higgins, A., & Cherrington, S. (2017). What's the story? Exploring parent-educator communication through Portfolios. *Australasian Journal of Early Childhood*, 42(4), 13-
- Hirsh-Pasek, K., Zosh, J. M., & Golinkoff, R. M. (2015). Putting education in -educational" apps: Lessons from the science of learning. *Psychological Science in the Public Interest*, 16(1), 3-34.
- Howard, S., & Thompson, K. (2023). Working the system: Development of a system model of technology integration to inform learning task design. *British Journal of Educational Technology*. 50. [10.1111/bjet.12560](https://doi.org/10.1111/bjet.12560).
- Hsu, P. C., Chang, I. H., & Chen, R. S. (2020). Early childhood educators' attitudes to Internet self-efficacy and Internet-related instructional applications: The mediating effects of Internet enjoyment and professional support. *Sage Open*, 10(1), 2158244020914390.
- Ihmeideh, F. M. (2009). Barriers to the use of technology in Jordanian pre-school settings. *Technology, Pedagogy and Education*, 18(3), 325-341.

- Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & Management*, 48(1), 1-8.
- Ivanova, B. (2024). Game Technologies for STEM/STEAM Education in Kindergartens. *Педагогика*, 96(7), 981-990.
- Johnson, P., & Smith, A. (2023). Balancing digital and traditional pedagogies: A mixed-methods study of teacher perspectives. *Teaching and Teacher Education*, 119, 103826. <https://doi.org/10.1016/j.tate.2022.103826>
- Kaiser, K. (2009). Protecting respondent confidentiality in qualitative research. *Qualitative Health Research*, 19(11), 1632–1641. <https://doi.org/10.1177/1049732309350879>
- Kinnula, M., Iivari, N., & Ijäs, T. (2015, September). Designing for young people's ICT use. In *Proceedings of the 19th International Academic Mindtrek Conference* (130-137).
- Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, 6(5), 26-41.
- Koç, K. (2014). The use of technology in early childhood classrooms: An investigation of teachers' attitudes. *Gaziantep University Journal of Social Sciences*, 13(3), 807-819.
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13-19.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.) New Age International, Publishers.
- Kozma, R. B. (2005). National policies that connect ICT-based education reform to economic and social development. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*.
- Laanpere, M., Sillat, L. H., Luik, P., Lehiste, P., & Pozhogina, K. (2023). National Policies and Services for Digital Competence Advancement in Estonia. In *IFIP World Conference on Computers in Education* (675-686). Cham: Springer Nature Switzerland.
- Lanbon, J. B., Lee, K. C. S., & Yan-Li, S. (2022). Enhancing Effective Teaching and Learning of ICT in the Schools for the Blind in Ghana: The Role of Assistive Technology. *International Journal of Web-Based Learning and Teaching Technologies*, 17(3), 1-12.
- Lee, D., Huh, Y., Lin, C.-Y., & Reigeluth, C. M. (2018). Technology functions for personalized learning in learner-centered schools. *Educational Technology Research and Development*, 66(5), 1269-1302. <https://doi.org/10.1007/s11423-018-9615-9>
- Li, H., Rao, N., & Tse, S. K. (2011). Bridging the gap: A longitudinal study of the relationship between pedagogical continuity and early Chinese literacy acquisition. *Early Years*, 31(1), 57-70. <https://doi.org/10.1080/09575146.2010.515944>

- Lin, M., Chen, H., & Liu, K. (2017). A Study of the Effects of Digital Learning on Learning Motivation and Learning Outcome. *Journal of Mathematics Science and Technology Education*, 13(7), 3553-3564.
- Liu, X., & Pange, J. (2015). Early childhood teachers' perceived barriers to ICT integration in teaching: a survey study in Mainland China. *Journal of Computers in Education*, 2, 61-75.
- Luo, T., So, W. W. M., Li, W. C., & Yao, J. (2021). The development and validation of a survey for evaluating primary students' self-efficacy in STEM activities. *Journal of Science Education and Technology*, 30, 408-419.
- Lyons, C. D., & Tredwell, C. T. (2015). Steps to implementing technology in inclusive early childhood programs. *Computers in the Schools*, 32(2), 152-166.
- MacKay, K. L., & Hall-Kenyon, K. M. (2020). An Early Childhood Professional Development Model for Technology Integration: Attending to Internal Barriers. In *Professional and Ethical Consideration for Early Childhood Leaders* (pp. 28-49). IGI Global.
- Manousi, M., & Prentzas, J. (2021). Evaluation of Web-based Digital Storytelling Tools for Early Childhood Education. In *2021 International Conference on Computational Science and Computational Intelligence (CSCI)* (907-912). IEEE.
- Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J., Lahmar, J., & Scott, F. (2018). Play and creativity in young children's use of apps. *British Journal of Educational Technology*, 49(5), 870-882.
- Masoumi, D. (2021). Situating ICT in early childhood teacher education. *Education and Information Technologies*, 26(3), 3009-3026.
- McGi-Frazen, A. (2000) *Kindergarten literacy: Matching assessment and instruction in kindergarten*: New York Scholastic
- McKinsey & Company. (2020). The future of work after COVID-19. Retrieved October 12th 2024, from <https://www.mckinsey.com>
- Mereku, D. K. (2019). Sixty years of teacher education in Ghana: Successes, challenges and the way forward. *African Journal of Educational Studies in Mathematics and Sciences*, 15(2), 69-74.
- Merriam, S. B., & Associates, (2002). *Qualitative research in practice: examples for discussion and analysis*. San Francisco, CA: Joseey-Bass.
- Mertala, P. (2019). Teachers' beliefs about technology integration in early childhood education: A meta-ethnographical synthesis of qualitative research. *Computers in Human Behavior*, 101, 334-349.
- Mertens, D. M. (2015). Mixed Methods and Wicked Problems. *Journal of Mixed Methods Research*, 9(1), 3-6. <https://doi.org/10.1177/1558689814562944>
- Microsoft. (2021). Microsoft Office. Retrieved April 17th 2025, from <https://www.office.com>

- Ministry of Education, (2018). *Education Strategic Plan 2018 – 2030* Ghana. Ministry of Education.
- Ministry of Education, (2021). Teacher Observation and Evaluation Report. Asunafo North Education Directorate.
- Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Mohammadi, H. (2015). Social and individual antecedents of m-learning adoption in Iran. *Computers in Human Behavior*, 49, 191-207.
- Moodle. (2022). Moodle: Open-source learning platform. Retrieved April 17, 2025 from <https://moodle.org>
- Muia, R, K. (2021). *Factors influencing the integration of ICT in teaching and Learning. A case of public primary schools in Kitui Central Sub County, Kitui County, Kenya*. Nazarene University.
- Natia, J., & Al-hassan, S. (2015). Promoting teaching and learning in Ghanaian Basic Schools through ICT. *International Journal of Education and Development using ICT*, 11(2).
- Neumann, M. M. (2018). Using tablets and apps to enhance emergent literacy skills in young children. *Early Childhood Research Quarterly*, 42, 239–246.
- Niederhauser, S. D., Howard, K. S., Voogt, J., Agyei, D. D., Laferriere, T., Tondeur, J., & Cox, J. M. (2018). Sustainability and Scalability in Educational Technology Initiatives: Research-Informed Practice. *Technology, Knowledge and Learning* (2018) 23:507–523. <https://doi.org/10.1007/s10758-018-9382-z>
- Nikolopoulou, K. (2021). Mobile devices in early childhood education: teachers' views on benefits and barriers. *Education and Information Technologies*, 26(3), 3279-3292.
- Nikolopoulou, K., & Gialamas, V. (2015). ICT and play in preschool: early childhood teachers' beliefs and confidence. *International Journal of Early Years Education*, 23(4), 409-425.
- Ntumi, S. (2016). Challenges Pre-School Teachers Face in the Implementation of the Early Childhood Curriculum in the Cape Coast Metropolis. *Journal of Education and Practice*, 7(1), 54-62.
- OECD. (2010). Are the new millennium learners making the grade? Technology use and educational performance in PISA. *Derby: Centre for Educational Research and Innovation*.
- Ogebo, A. A., & Aina, A. (2020). Early childhood development teachers' perceptions on the use of technology in teaching young children. *South African Journal of Childhood Education*, 10(1), 1-10.
- Ogunlade, I. (2023). A Novel Pedagogical Tool For Childhood Education In STEM And STEAM Towards Achieving Sustainable Development Goals In Africa. *SFU Educational Review*, 15(1), 41-56.

- Okyere-Kwakye, E., Nor, K. M., & Ologbo, A. C. (2016). Technology acceptance: Examining the intentions of Ghanaian teachers to use computer for teaching. *African Journal of Library, Archives & Information Science*, 26(2), 119.
- Opong Frimpong, S. (2021). The Influence of Perception on the Provision of Early Childhood Education in the Kumasi Metropolis of Ghana. *African Educational Research Journal*, 9(1), 179-188.
- Otterborn, A., Schönborn, K. J., & Hultén, M. (2019). Investigating preschool educators' implementation of computer programming in their teaching practice. *Early Childhood Education Journal*, 48(3), 253-262.
- Owusu, K., P & Govender, I. (2023). Teachers' perception of digital game-based learning in early childhood education in rural schools in Ghana. Conference: Education and New Developments 2023. DOI:[10.36315/2023v2end104](https://doi.org/10.36315/2023v2end104)
- Owusu-Ansah, S. (2015). One laptop per child policy in Ghana: Any impact on teaching and learning. *Library Philosophy and Practice*, 2, 1-20.
- Patel, S., & Wong, L. (2022). Screen time effects on physical and social development in primary education settings. *Child Development*, 93(4), 1142-1159. <https://doi.org/10.1111/cdev.13792>
- Penz, B., & Mäkiö, J. (2019). Concept and Implementation of a Web Based Tool for The Development of Online Games for Early Childhood Educators. In *EDULEARN19 Proceedings* (3817-3826).
- Power B. I. (2021). Power BI: Business analytics service. Retrieved March 17, 2024 from <https://powerbi.microsoft.com>
- Power, E. J., & Kannara, V. (2016). Best-practice model for technology enhanced learning in the creative arts. *Research in Learning Technology*, 24(1), 1-16.
- Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon*, 9(5), 1-6.
- Pu, R., Tanamee, D., & Jiang, S. (2022). Digitalization and higher education for sustainable development in the context of the Covid-19 pandemic: A content analysis approach. *Problems and Perspectives in Management*, 20(1), 27-40.
- Quaicoe, J. S., & Pata, K. (2018). Basic school teachers' perspective to digital teaching and learning in Ghana. *Education and Information Technologies*, 23, 1159-1173.
- Resnick, M. (2017). *Lifelong kindergarten: cultivating creativity through projects, passion, peers, and play*. MIT Press.
- Resnik, D. B. (2015). What is Ethics in Research & Why is it Important? National Institute of Environmental Health Sciences.
- Rodrigues, A. L. (2020). Digital technologies integration in teacher education: the active teacher training model. *Journal of e-learning and Knowledge Society*, 16(3), 24-33.

- Rosen, D. B., & Jaruszewicz, C. (2009). Developmentally appropriate technology use and early childhood teacher education. *Journal of Early Childhood Teacher Education*, 30(2), 162-171.
- Samawi, F. S., & Al-Assaf, J. A. F. (2023). Empowering Early Learners: The Prospective Impact of Artificial Intelligence on Kindergarten Education. *Int J Edu Sci*, 42(1-3), 54-62.
- Sarpong, L., Danso, H., & Addai-Poku, C. (2022). Assessment of the Effectiveness of the Online Training of the Teacher Education and Enhancement Programme (TEEP) in Ghana. *Tenth Pan-Commonwealth Forum on Open Learning*. <https://doi.org/10.56059/pcf10.3354>.
- Scalise, K. (2018). Next wave for integration of educational technology into the classroom: Collaborative technology integration planning practices. *Assessment and teaching of 21st century skills: Research and Applications*, 239-255.
- Scherer, R., Siddiq, F., & Tondeur, J. (2020). All the same or different? Revisiting measures of teachers' technology acceptance. *Computers & Education*, 143, 103656.
- Selwyn, N. (2016). *Is technology good for education?* Polity Press.
- Shamir, A., & Shlafer, I. (2011). E-books for young children: Research and applications. *Computers in the Schools*, 28(1), 3-20.
- Sinclair, N. (2018). *Time, immersion and articulation: Digital tools for early childhood mathematics*. In E. Iliada, J. Mulligan, A. Anderson, A. Baccaglioni-Frank, & C. Benz (Eds.), *Contemporary research and perspectives on early childhood mathematics education* (205–221). Springer
- Slack. (2021). Slack: The collaboration hub. Retrieved January 17, 2025 from <https://slack.com>
- Soma, A., Kissiedu, K., & Nyame, I. (2023). Barriers to Early Identification and Intervention for Children with Special Education Needs (SEN) in Public Kindergartens (KGs) in the Sagnarigu District of the Northern Region, Ghana. *European Journal of Education and Pedagogy*, 4(6), 30-40.
- Somerville, M., & Williams, C. (2015). Sustainability education in early childhood: An updated review of research in the field. *Contemporary Issues in Early Childhood*, 16(2), 102-117.
- Spector, J. M., & Yuen, A. H. (2016). *Educational technology program and project evaluation*. Routledge.
- Stephen, C., & Plowman, L. (2013). Digital technologies, play and learning. *Early Childhood Folio*, 17(2), 3-8.
- Strawhacker, A., Lee, M., & Bers, M. U. (2018). Teaching tools, teachers' rules: exploring the impact of teaching styles on young children's programming knowledge in ScratchJr. *International Journal of Technology and Design Education*, 28, 347-376.

- Tableau. (2022). Tableau: Data visualization software. Retrieved January 17, 2025 from <https://www.tableau.com>
- Taiwo, A. A., & Downe, A. G. (2013). The theory of user acceptance and use of technology (UTAUT): A meta-analytic review of empirical findings. *Journal of Theoretical & Applied Information Technology*, 49(1), 48-58.
- Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, 57(4), 2432-2440.
- Tezci, E. (2011). Turkish primary school teachers' perceptions of school culture regarding ICT integration. *Educational Technology Research and Development*, 59(3), 429-443.
- Thompson, M. (2019). Early childhood pedagogy in a socio-cultural medley in Ghana: Case studies in kindergarten. *International Journal of Early Childhood*, 51(2), 177-192.
- Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review. *Educational Research Review*, 19(1), 23-45.
- Törmälä, V. (2021). ePortfolios in craft education at the primary level. *Design and Technology Education: An International Journal*, 26(2), 28-45. <https://ojs.lboro.ac.uk/DATE/article/view/2918>
- Turja, L., Endepohls-Ulpe, M., & Chatoney, M. (2009). A conceptual framework for developing the curriculum and delivery of technology education in early childhood. *International Journal of Technology and Design Education*, 19, 353-365.
- UNESCO (2023). *Technology in education: A tool on whose term? Global education monitoring report*, UNESCO. <https://doi.org/10.54676/aatw1274>
- Utami, A., & Hidalgo, F. J. P. (2020). Teachers' Perceptions Towards Technology Integration Into Inclusive Early Childhood Education: A Case Study in the Spanish Context. In *Research Anthology on Early Childhood Development and School Transition in the Digital Era* (pp. 257-276). IGI Global.
- Van Dijk, J. A. G. M. (2020). *The digital divide*. Polity Press.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). *Unified Theory of Acceptance and Use of Technology (UTAUT)*. APA PsycTests. <https://doi.org/10.1037/t57185-000>
- Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 157-178.
- Wake, D., & Whittingham, J. (2013). Teacher candidates' perceptions of technology supported literacy practices. *Contemporary Issues in Technology and Teacher Education*, 13(3), 175-206.

- Wang, G., Zhou, X., & Cui, H. (2019). Exploring Education for Sustainable Development in a Chinese Kindergarten: An Action Research. *ECNU Review of Education*, 2, 497-514. 10.1177/2096531119897638.
- Warschauer, M., & Matuchniak, T. (2010). New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes. *Review of Research in Education*, 34(1), 179-225.
- Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013). The use of ICT in education: A survey of schools in Europe. *European Journal of Education*, 48(1), 11–27
- Wiles, R., Crow, G., Heath, S., & Charles, V. (2008). The management of confidentiality and anonymity in social research. *International Journal of Social Research Methodology*, 11(5), 417–428. <https://doi.org/10.1080/13645570701622231>
- Williams, M. D., Rana, N. P., & Dwivedi, Y. K. (2015). The unified theory of acceptance and use of technology (UTAUT): a literature review. *Journal of Enterprise Information management*, 28(3), 443-488.
- World Economic Forum (2023). Why we need to prioritize digital transformation - even in a downturn. *Forum Institutional*. <https://www.weforum.org/agenda/2023/01/davos23-digital-transformation-investment-priority-downturn/>
- World Economic Forum. (2021). The future of Jobs Report 2021. *Intelligent Information Management*, (17) 4, 1-157.
- Yalley, C. E. (2022). A tracer study on challenges affecting the use of ICT in pre-tertiary school administration in Ghana: Administrators' perspective. *Cogent Education*, 9(1), 2062893.
- Yurt, Ö., & Cevher-Kalburan, N. (2011). Early childhood teachers' thoughts and practices about the use of computers in early childhood education. *Procedia Computer Science*, 3, 1562-1570.
- Zaranis, N., Kalogiannakis, M., & Papadakis, S. (2013). Using mobile devices for teaching realistic mathematics in kindergarten education. *Creative Education*, 4(07), 1.
- Zoom. (2020). Zoom: Video conferencing platform. Retrieved April 23, 2024, from <https://zoom.us>

APPENDIX A

INSTRUMENT FOR DATA COLLECTION

**UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF APPLIED BEHAVIOURAL SCIENCES IN
EDUCATION, DEPARTMENT OF EARLY CHILDHOOD
EDUCATION**

QUESTIONNAIRES

The questionnaire is part of a research study by Ismail Issah Susorokana, a student pursuing an MPhil thesis on teachers' use of digital tools in kindergarten centers in Asunafo North Municipality. The study aims to understand how digital skills influence classroom integration and identify challenges. Data will be kept confidential and participants are encouraged to respond honestly. Thanks for being part of this study.

1. Gender: Male [] Female []

2. Class taught: KG 1 [] KG 2 []

3. Age range of teacher: 16-20 [] 21-25 [] 26-29 []
30-35 [] 36 and above []

5. What is your highest academic qualification?
MPhil [] M. Ed [] Dip. Ed []
B. Ed [] Cert.[] Any other please specify _____

6. Specialized Area:
Early Childhood Education [] Basic Education []
Any other, please specify _____

7. Years of teaching experience: 2-5 [] 6-10 [] 11-15 []
16-20 [] 21 and above [] below 2 []

8. Indicate your position in your school
Head teacher [] Class teacher []
any other, please specify _____

9. Have you ever undergone any training on the use of digital tools for teaching in kindergarten classrooms? Specify the training type(s) and state number of times

-
-
1. Please tick (√) for the statement that state degree to which you agree or disagree. There is no wrong or right answer. 1 (Strongly agree), 2 (Agree), 3 (Strongly disagree), 4 (Disagree)

SN	STATEMENT	SA	A	SD	D
Digital skills					
10	I am capable in finding and using educational online resources (e.g digital picture books) for my lessons.				
11	I can create and use multimedia presentations (e.g., videos, animations) in my teaching practice.				
12	I can effectively use digital tools (e.g ms word) to create lesson notes for my teaching practice.				
13	I am skilled in using social media platforms like WhatsApp to communicate classroom updates with parents and guardians.				
14	I am able to use online platforms like Facebook and LinkedIn to participate in professional development opportunities.				
15	I am confident in my ability to evaluate the credibility of online sources.				
16	I can effectively use digital tools like spreadsheets to track and keep student performance and progress.				
17	I can use digital tools to connect with other educators and share best practices.				
18	I am able to project information using digital medium like a projector for whole class discussion.				
Please indicate (√) to what extent, if any, you agree or disagree to each of the following as barriers to your use of digital tools in your classroom activities. 1 (Strongly agree), 2 (Agree), 3 (Strongly disagree), 4 (Disagree)					
S/N	STATEMENT	SA	A	SD	D
Challenges					
19	Not enough computers.				
20	Outdated, incompatible, or unreliable computers.				
21	Internet access is not easily accessible.				
22	Lack of good instructional software.				
23	Inadequate training opportunities.				
24	Lack of release time for teachers to learn/practice/ plan ways to use computers or the Internet.				
25	Lack of administrative support.				
26	Lack of technical support or advice.				
27	Lack of time in schedule for students to use computers in class.				
28	Concern about student access to inappropriate materials.				
29	Lack of funding				

APPENDIX B

INTERVIEW GUIDE

Hello, and thank you for participating in this interview. Ismail Issah Susorokana is conducting a study on kindergarten teachers' use of digital tools in Asunafo North Municipal. The interview seeks teachers' perspectives on digital tools and their incorporation in teaching. All information shared is confidential and protected. Thank you.

1. What role do digital tools play in teaching at the kindergarten level?
2. Could you provide examples of how you have incorporated digital tools in your classroom?
3. What are your thoughts on the growing emphasis on integrating digital tools into early childhood education?
4. What kind of support or resources do you believe are essential to improve the use of digital tools in kindergarten education?
5. Describe how digital tools are utilized in a typical lesson in your classroom?
6. How are digital tools are incorporated into activities like storytelling, arts, or music in your classroom?
7. Describe how learners react to the use of digital tools in your classroom?
8. What challenges do you encounter when integrating digital tools into your teaching and how do you address them?

APPENDIX C

GHANA EDUCATION SERVICE

*In case of reply the
number and date of this
letter should be quoted.*

My Ref: GES/ASN/454/V.3/
EMAIL: asunafonorthges@gmail.com



REPUBLIC OF GHANA

Asunafo North Municipal
Education Office,
P. O. Box 11, Goaso,
Ahafo Region.
Tel. 03520-91894

Your Ref:

20th January, 2025

INTRODUCTORY LETTER

I write to introduce to you Mr. Issah Susorokana Ismail, a teacher stationed at Edwinase M/A Basic School in the Asunafo North Municipal Education Directorate.

Mr. Issah Susorokana Ismail is writing thesis on the topic: "Teachers' use of Digital Tools in Kindergarten Centres in the Asunafo North Municipality." Accord him the necessary assistance he may need to enable him collect data for the research.

Please ensure that your activities do not affect teaching and learning greatly.

Thank you.

Richard Boamah (Mr.)
Deputy Director (HRMD)
For: Municipal Director


DISTRIBUTIONS

All Heads of Basic School, Asunafo North
All School Improvement Support Officer (SISOs), Asunafo North

Cc:
Mr. Issah Susorokana Ismail
M/A Basic School
Edwinase

@rb

APPENDIX D



UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF APPLIED BEHAVIOURAL SCIENCES IN EDUCATION
DEPARTMENT OF EARLY CHILDHOOD EDUCATION

✉ P. O. Box 25, Winneba, Ghana 📧 ece@uew.edu.gh

FABSE/DECE/I.1 13TH JANUARY, 2025

The Director
Ghana Education Service
P.O.BOX 11
Goaso Ahafo Region

Dear Sir/ Madam,

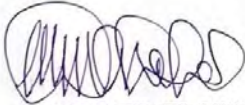
INTRODUCTORY LETTER

I kindly write to introduce to you **Mr. Ismail Issah Susorokana** with index number: **8241900009** who is an M.Phil. student at the Department of Early Childhood Education, University of Education, Winneba. He is in his final year and has to embark on his thesis on the topic: *“Use of Digital Tools in Kindergarten Centers in Asunafo North Municipality”*.


Mr. Ismail Issah Susorokana is to collect data for his thesis, and I would be most grateful if he could be given the needed assistance.

Thank you.

Yours faithfully,



PROF. MICHAEL SUBBEY, (PhD.)
HEAD OF DEPARTMENT



www.uew.edu.gh