UNIVERSITY OF EDUCATION, WINNEBA

KINDERGARTEN TEACHERS' USE OF EXISTING ICT TOOLS IN CLASSROOM ASSESSMENT PRACTICES IN ASIKUMA ODOBEN BRAKWA DISTRICT

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A thesis in the Department of Early Childhood Education, Faculty of Educational Studies, submitted to the School of Graduate Studies in partial fulfillment of the requirements for the award of the degree of Master of Philosophy (Early Childhood Education) in the University of Education, Winneba

OCTOBER 2022

DECLARATION

Declaration

I Mohammed Saibu Belo, hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Signature: ……..…….

Date: …….

Supervisor's Declaration

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

Name: Dr. Nutifafa K. Banini

Signature: ……..…….

Date: …….

DEDICATION

To the almighty Allah.

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I want to express my profound gratitude to my supervisor, Dr. Nutifafa K. Banini of the Department of Early Childhood Education for the relentless encouragement and guidance given me in the course of this study. I want to also thank Mr. Kotor Asare for the supportive role he played. Finally, I am sincerely indebted to my family and my friends for their significant contributions that led to the successful completion of this study.

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CAA:	Computer – Assisted Assessment
CAI:	Computer Assisted Instructions
CAT:	Computer Adaptive Test
CBA:	Computer – Based Assessment
CD:	Compact Disc
CT:	Communication Technology
DSL:	Digital Subscriber Line
DVD:	Digital Video Disc
EIFL:	Electronic Information for Libraries
ICILS:	International Computer and Information Literacy Study
ICT:	Information and Communication Technology
ICT4AD:	Information and Communication Technology for Accelerated Development
IEA:	International Association for the Evaluation of Educational Achievements
Ipad:	Interactive Personal Application Device
IS:	Information System
IT:	Information Technology
LAN:	Local Area Network
LMS:	Learning Management Systems
MP3:	Moving Picture Experts Group (MPEG) Audio Layer 3
mSRC:	mobile School Report Card
OECD:	Organization for Economic Co-operation and Development

OMR:	Optical Mark Reader
PDAs:	Personal Assistant Devices
PDEs:	Personal Digital Entertainment Devices
RLG:	Roagams Link Ghana limited – Communication Company
SITES:	Second Information Technology in Education Study
SMS:	Student Management Systems
SPSS:	Statistical Product for Social Sciences
SRI International:	Stanford Research Institute
TAI:	Television Assisted Instruction
UB:	Use Behaviour
UCL Institute of Education:	The University College London Institute of Education
UNICEF:	United Nations Children's Fund
UTAUT:	Unified Theory of Acceptance and Use of Technology.
VOIP:	Video over Internet Protocol

ABSTRACT

Integration of ICT into all levels of Ghanaian education has been a concern to the government of Ghana. As a result, the government in collaboration with other stakeholders of education have undertaken steps to ensure that ICT integration into education in Ghana becomes a reality. Despite the numerous efforts by the government and other stakeholders towards ensuring comprehensive ICT integration, in most cases the opposite is what is realized in practice. With all of the research on kindergarten teachers' use of ICT in education, very little studies centred on ICT use in classroom assessment practices of the kindergarten teachers. Using a descriptive survey design, a research was undertaken on kindergarten teachers' use of existing ICT tools in classroom assessment practices in Asikuma Odoben Brakwa district. Census was employed in the selection of participants and therefore all the 193 public school kindergarten teachers in the district (37 male and 156 female) were used as participants in the study. Meanwhile, descriptive statistics alongside inferential statistics (Independent Sample T-Test) were employed to analyse the data. Findings of the study, revealed that the existing types of ICT tools in the kindergarten classrooms were tablet, printer, computer, pen drive, mobile phone, video game, radio cassette recorder, television, television decoder, and Bluetooth speaker; majority of the classrooms did not have most of the types of ICT tools. It was also revealed in the study that majority of the teachers at the kindergarten level do not most of the time use ICT tools in classroom assessment practices. The study further found that majority of the kindergarten teachers have inadequate knowledge in using ICT tools in classroom assessment practices. Generally, majority of the kindergarten teachers according to the findings of this study, have challenges most of the time in their use of ICT tools in classroom assessment practices and these challenges include inadequate computers, inadequate knowledge in using the ICT tools, developmentally inappropriate ICT tools, lack of technical support, inadequate time and limited understanding of ICT integration into classroom assessment. Also, the study found that there was no statistically significant difference in ICT use in classroom assessment practices between the mean scores of the male teachers and the female teachers. In view of the findings of the study, recommendations were made to the government of Ghana and its educational stakeholders to support the schools by providing developmentally appropriate ICT tools to kindergarten classrooms in the district. The Ghana Education Service with its partner organizations should also provide regular in-service training to kindergarten teachers and support them in diverse ways to resolve the challenges they encounter in using ICT tools in the conduct of their classroom assessment practices.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to Delclos, Burns, Bransford and Hasselbring (1992) and Poehner (2007), assessment is an ongoing activity through which learners' skills, knowledge, attitudes and beliefs are noted and recorded in measurable terms. However, Wortham (2014) points out that McAfee, Leong and Bodrova (2004, p.3) described assessment in Early Childhood Education as a process used to gather information about children from different sources of evidence, keeping the information on record and interpreting it to share findings with stakeholders for the success of teaching and learning and child development. Assessment is important for both teachers and their learners (Capraro, Caskey, Strahan, Bishop, Weiss & Swanson, 2012). The assessment of children plays an important role in education and care for young children (Nah & Kwak, 2011). Assessment also has a critical role with respect to the implementation of every curriculum, by helping to communicate the effectiveness or otherwise of the curriculum to the teachers, educational administrators (for example Ghana Education Service officials) and curriculum planners (National Council for Curriculum and Assessment - (NaCCA, 2019). However, classroom assessment is the kind of assessment used by teachers to collect information on how children learn in the classroom context, through variety of classroom practices (Vlachou, 2018). The classroom assessment practices at the Early Childhood Education centres include scoring of learner assessment task, constructing assessment tasks for learners, sharing feedback on learner assessment and analysing learner assessment data among other things. While construction of assessment task for learners is the process of carefully

developing developmentally appropriate and content relevant set of test items and running them on learners to ascertain the effectiveness of learning (Ramsay & Reynolds, 2000), scoring of assessment tasks is described as the process of quantifying the performance of learners on a given task with an aim of using the results for making decision on the progress of their learning (Wainer & Thissen, 2001). The analysis of assessment data is also considered as the process used to interpret assessment results to find relevant information that could be used to take appropriate learning decision on the learner and the learning (John, 2021). Meanwhile, sharing feedback on learners' assessment which is also an important classroom assessment practice is described as an act of giving constructive information to teachers, parents and learners or receiving information from any such stakeholders on the outcome of an assessment task given to learners (Hattie & Timperley, 2007). According to Vlachou (2018), classroom assessment and classroom assessment practices provide feedback that can be useful to improving learning. Classroom assessment of learners is primarily used to also improve classroom instructions of teachers (Shepard, 2000). Teachers can also use classroom assessment to assess learner skills and abilities and can use the feedback to give learners a different learning experience (Price, Pierson & Light, 2011).

Meanwhile, ICT tools used for the classroom assessment as opined by Christensson (2010), are technological devices used in the fields of Information and Communication Technology like, iPads, computers, televisions, radios, projectors and software applications among others. McCormick (2010) pointed out that ICT has an influence on assessment, which is that ICT improves assessment practices. ICT tools,

potentially have the capacity to enhance assessment in Early Childhood Education (Maddux, Johnson & Willis, 2001) as cited in (Danniels, Pyle & DeLuca, 2019).

Majid (2019) indicated that ICT tools are significant to children's assessment for reasons that they can be used to construct assessment tasks more effectively, deliver assessment tasks promptly, analyze assessment results efficiently and deliver feedback accurately and timely to the children themselves and the other stakeholders. Every assessment which is considered standard is appropriately driven by technology (National Council for Curriculum Assessment - (NaCCA), 2019) and therefore integrating ICT into education and assessment for that matter, has become very important (Ghavifekr, Razak, Ghani, Ran, Meixi & Tengyue, 2014). The recent separate educational reports by the United States of America and Australia saw the relevance of ICT and therefore recommended the integration of technology into educational assessment of children (Neumann, Anthony, Erazo & Neumann, 2019).

Using technology may bring to the fore, a means of solving some challenges that come with modern day classroom assessment practices (Neumann et al 2019, citing Black & Wiliam (1998) & Heritage (2018). Also, the increase in availability of ICT tools and their use in the classrooms provides opportunities for enhanced teaching and learning and assessment practices of Kindergarten teachers (Danniels et al, 2019). In Neumann et al. (2019) it was stated, that the use of technology in classroom assessment will improve the nature of assessment by enhancing its features, allowing for faster feedback and provision of timely information that will be used to provide remediation or improve the classroom teaching and learning quality.

It is in the light of the need for technological enhancement of classroom assessment that teachers of this era are encouraged to incorporate ICT as part of ICT integration drive globally, into their teaching and learning and assessment activities, so that we can have the modern tools and facilities of ICT replace the traditional strategies that existed (Ghavifekr et al, 2014). Teachers, including kindergarten teachers are therefore tasked to use ICT in their teaching and learning and assessment practices in order to provide dynamic and proactive learning environment as well as efficient engagement with educational administrators and other stakeholders to speed up information sharing on the progress of learning.

Given the need for assessment literacy on the part of teachers and accountability in line with the progress of teaching and learning in educational circles in recent times, it has become essential for teachers and educational authorities to come up with some innovative ways of constructing learners assessment materials, reporting on assessment findings and supporting children's learning (Wilson, 2004). Such innovative ways will have to be empowered with technological or ICT tools, especially because, many children between the ages of 4 – 5 enter kindergarten in recent times, already having the exposure to the use of some kinds of technological or ICT tools from their homes and most of them use digital technologies in their schools daily (Marsh, 2004; Berson & Berson 2010, as cited in (Danniels et al., 2019). Most parents also lately use digital phones or traditional mobile phones through which assessment findings and remediation strategies can be communicated to them by the teachers teaching their wards.

As a result, Ghana Education Service in collaboration with UNICEF in 2014 introduced an Android – Based mobile phone application called (mSRC) mobile School Report Card and by the end of March, 2018, extended the programme to 20 districts of the country, including Asikuma Odoben Brakwa; with a coverage of 1,880 schools nationwide (Ghana Education Service & UNICEF, 2018). Unfortunately, there is just one tablet in each school, available to either the ICT teacher or the head teacher to submit assessment data on behalf of the individual teachers. Again, the focus of the mSRC program has been the children's general weekly school attendance and that of the teacher, as well as the teacher's output of work within each school week. Individual children's assessment data in the respective subjects have not been of essence as per the data required for the mSRC program.

Notwithstanding the significant role ICT plays in teaching, learning and assessment, as alluded to by many researchers, Danniels et al (2019) are of the view that though a couple of studies have examined how classroom instructions benefit from technology use, very little can be said of studies that were very specific on how technology enhances the classroom assessment practices of kindergarten teachers. Studies on technology use as reviewed by Venkatesh et al (2003) and cited in Luhamya, Bakkabulindi & Muyinda (2017) also shows that the approaches used by earlier researchers have been more of qualitative than quantitative and mixed method.

Despite the increase in the number of ICT tools in the classrooms, Smeets in 2005, indicated that "research studies have revealed how most teachers do not make use of the potential of ICT to contribute to quality of teaching and learning, although they value the potential quite significantly" (Noor -Ul – Amin, 2013). For the role gender plays in ICT use by teachers, many have wondered if there is any significant

difference between male and female teachers in the use of the ICT tools, but Gebhardt, Thomson, Ainley and Hillman (2019) concluded that differences exist and that the differences that exist among the male and female teachers are insignificant and may vary from one country to another and from one variable to the other.

Until 2007, ICT integration into education was not being championed and ICT was not being studied as a course or subject at any level of education in Ghana (Government of Ghana, 2015). The government of Ghana realizing the need for ICT integration into education introduced the educational reforms in 2007 to allow among other things for ICT use as subject of study and as a tool for learning (Government of Ghana, 2015). In 2008, Ghana's Education Ministry drafted the "ICT in Education Policy" to deal with the needs of ICT in the education sector (Government of Ghana, 2015). Other policies like the Basic School Computerization Policy were introduced to support the ICT in Education Policy of Ghana (Natia & Al-hassan, 2015). The ICT integration into education in Ghana has consequently been embraced by educational stakeholders. Generally, there is significant improvement with regards to the availability of ICT tools and their use in our classrooms (For example Asante & Owusu-Ansah, 2015). Meanwhile, the One Laptop Per Child Policy of Ghana, which was introduced in 2008, was found to have contributed to the increase in technological resources and access to computers in basic schools (Asante & Owusu-Ansah, 2015). Hands on computer training for 1,800 Ghanaian basic school children which was provided by Electronic Information for Libraries, equally contributed to the increasing access and use of technology (Electronic Information for Libraries (eifl), 2015).

Notwithstanding the numerous facts supporting the use of ICT in education and the efforts put in place so far by the government of Ghana, the researcher in his interactions with kindergarten teachers in about 10 public schools visited in Asikuma Odoben Brakwa district observed, that some kindergarten teachers in the district do not create e-portfolios or soft copy portfolios for their learners. They do not keep soft copy data of the formative assessment scores of the learners despite intervention by government and other agencies to have teachers use ICT tools in schools. The teachers do not use ICT tools to collect assessment data, they also do not make use of ICT tools when analysing the assessment data of their learners. Aside that, ICT tools were not being used by some of them in the sharing of assessment information and for employing intervention strategies for special needs children. This forms the basis for the study on kindergarten teachers' use of ICT tools in classroom assessment practices.

1.2 Statement of the Problem

A study by Smeets in 2005 revealed that most teachers do not utilize the potential ICT has in their teaching, learning and assessment practices (Noor-Ul-Amin, 2013). Despite the role ICT plays and the calls for ICT integration, Redecker (2013) points out that the effectiveness of ICT tools in the assessment of learners have not been fully explored by teachers. Though research has shown that technology enhances classroom instructions, few studies (for example Neumann et al, 2019) have specifically examined how technology is used to enhance the classroom assessment practices of teachers (Danniels et al., 2019). While Mikre (2011) is of the view that teachers are just reluctant in adopting technological innovations into their professional practices, Adebi-Caesar (2012), Buabeng-Andoh and Yidana (2015) and Asante and

Owusu-Ansah (2015) reported that teachers are challenged in the use of ICT tools in their professional practices. Meanwhile National Council for Curriculum Assessment –NaCCA (2019, p.30) noted that ICT integration into education will not fully materialize if teachers are proficiently challenged in their use of technology, especially to integrate computer based strategies into classroom assessment.

In an attempt to address some challenges observed with paper based report cards and consequently improve assessment quality and accountability in teaching and learning, Ghana Education Service in collaboration with UNICEF introduced a mobile phone application called (mSRC) as an intervention programme in 20 districts including Asikuma Odoben Brakwa district (Ghana Education Service & UNICEF, 2018). Though many studies (for example Acquah (2012), Agyei (2013), Ghavifekr et al. (2014), Asante and Owusu – Ansah (2015) and Natia and Al-hassan (2015) have examined ICT use for teaching and learning, studies by Jackson (2015) and Baidoo-Anu et al., (2019) were the only studies found in Asikuma Odoben Brakwa district specifically conducted on Senior High School teachers' knowledge in ICT use. Aside that, a report by Ghana Education Service (G.E.S) and UNICEF in 2018 on the implementation of mobile School Report Cards (mSRC) programme in basic schools in Ghana appears to be the only source of information on ICT use and classroom assessment practices at basic schools level in the district, based on the current knowledge of the researcher. The report however shows that the intervention programme failed to consider individual children's assessment data and how the data can be used to improve learning. Therefore, there was no study to the best of knowledge of the researcher, conducted in the district on kindergarten teachers' use of ICT tools in classroom assessment practices. That notwithstanding, the researcher in

his interactions with kindergarten teachers in about 10 schools visited within the catchment area of the study found that some of the kindergarten teachers appeared to have limited the use of the ICT tools to just classroom instructions; neglecting the aspect of ICT use in classroom assessment practices. If teachers do not use ICT tools in their classroom assessment, the efficiency in classroom assessment practices will be affected negatively and the effort by the government of Ghana on ICT integration into education will largely be affected too. In view of the above, the researcher identified knowledge gap and this study intends to fill that gap.

1.3 Purpose of the Study

The purpose of this study was to discover the extent to which Kindergarten teachers in Asikuma-Odoben-Brakwa district employed the use of Information and Communication Technology tools (ICT) in their classroom assessment practices.

1.4 Objectives of the Study

The researcher will by the end of the study be able to;

1. Identify the types of ICT tools existing in the kindergarten classrooms.
2. Examine the various ways by which the existing ICT tools are used in classroom assessment of kindergarten teachers.
3. Find teachers' levels of knowledge regarding the use of the existing ICT tools in classroom assessment practices.
4. Assess the challenges faced by teachers when using the existing ICT tools in classroom assessment practices.

1.5 Research Questions

1. What are the types of ICT tools existing in the kindergarten classrooms?
2. How are the existing ICT tools used in kindergarten teachers' classroom assessment?
3. What is the teacher's levels of knowledge regarding the use of the existing ICT tools in kindergarten classroom assessment practices?
4. How are teachers challenged in their use of the existing ICT tools in kindergarten classroom assessment practices?

1.6 Research Hypothesis

H_0. There is no statistically significant difference in the mean scores of male and female teachers in the use of the existing ICT tools in classroom assessment practices.

H_1. There is statistically significant difference in the mean scores of male and female teachers in the use of existing ICT tools in classroom assessment practices.

1.7 Significance of the Study

The study will contribute greatly to knowledge by enhancing the professional development of the researcher as it equips the researcher with the necessary skills in the conduct of research in the field of education. By way of its contribution to knowledge, the study will serve as resource or reference material for future studies on ICT use in kindergarten classroom assessment.

The study will improve practice because, the recommendations that will be made can be implemented by educational authorities by way of organizing in-service training and providing the necessary ICT tools to kindergarten classrooms to enhance teachers' classroom assessment practices. As a result of enhanced assessment

practices of the kindergarten teachers at the various kindergarten centres in the district, the boredom among learners which may have resulted from traditional assessment strategies will be reduced if not eliminated. Fabrication of assessment figures due to the loss of paper recorded assessment figures which usually leads to wrong categorization or diagnosis of learners and application of wrong intervention strategies by practicing teachers will also be avoided.

Meanwhile, the flow of feedback on learner assessment to parents of school children and educational authorities will help improve the school curriculum and school policy on assessment as the information will point out areas of strength of the curriculum and the policy as well as the areas needing improvement and can even necessitate new policy direction. But importantly, ICT in teacher assessment practices will potentially improve teacher accountability which will also enable Ghana Education Service, Ministry of Education of Ghana and UNICEF Ghana get appropriate information that will inform their policy directions on classroom assessment.

Finally, the use of ICT tools like kids tablets in teaching and learning and assessment practices particularly in the classrooms will help in ensuring the realization of the complete goal of Ghana's ICT in Education Policy; which according to the Government of Ghana (2015) is to enable "learners from Ghana education institutions to confidently and creatively use ICT tools and equipment to develop needed skills and knowledge that will make them active participants in the global economy".

1.8 Delimitations of the Study

The study considered only kindergarten 1 and 2 teachers of public schools in Asikuma Odoben Brakwa district of Ghana on the topic "Kindergarten Teachers' Use of Existing ICT tools in classroom Assessment Practices in Asikuma Odoben Brakwa district". The researcher chose Asikuma Odoben Brakwa district because the area is considered as one of the deprived districts in the Central Region. Meanwhile, only public schools kindergarten teachers were studied because the district directorate of education did not have an up to date data on private schools teachers in the district at the time of the study.

1.9 Limitations to the Study

The use of questionnaire may create room for some respondents having to provide responses they deem suitable but not actually responses that reflect their ways of using the ICT tools in classroom assessment practices, their knowledge levels in using the ICT tools and the challenges they have when using the ICT tools. As a result, some of the findings may not be a reflection of the reality as they may be influenced by some level of motivation on the part of the respondents.

1.10 Organization of the Study

The beginning chapter of this study covered the background to the study, the statement of the problem, purpose as well as significance of the study. The chapter also presents research questions that guided the study, limitations to the study, delimitation of the study as well as the definition of terms. The second chapter deals with the review of related literature to the research work, theoretically and empirically on; the history of ICT in Ghana educational system, definitions and descriptions of ICT, types of ICT tools available in the kindergarten classrooms, nature of

kindergarten classroom assessment and ICT, integration of ICT into kindergarten education and assessment, the various ways through which existing ICT tools are used in classroom assessment, the teachers level of knowledge with the use of existing ICT tools in classroom assessment practices, the challenges teachers encounter when using the existing ICT tools in their classroom assessment, and then gender and ICT tools. It also addresses the theoretical and conceptual frameworks supporting the study. Chapter three talks about the research methodology to this study. The section described the research design, the population, the sample as well as the sampling technique(s) of the study. It throws more light on the research instruments used, the data collection procedure employed and the data analysis strategies employed for the study. The fourth chapter, which is the last but one, presents the results and discussion on the findings made on the study. Chapter five deals with the summary, key findings, conclusions and recommendations to the study. It also deals with the suggestions made by the researcher for further research and improvement.

1.11 Operational Definition of Terms

Assessment Practices: Practices such as construction of assessment tasks, storage of assessment data, sharing assessment findings, analysing assessment results, construction of e-portfolios, administration of assessment task and scoring of assessment tasks.

Blogs: These are discussion website platforms that are posted on the World Wide Web

Digital Phones: Smart phones or phones with touch screens

Educational Authorities: Authorities like the Minister of education, national, regional and district education directorate administration officials, School Improvement Support Officers, head teachers and assistant head teachers.

E-portfolios: Records of work on learner assessment stored in online folders identifiable to individual learners

Ipod: A kind of portable media player and multi-purpose mobile device designed by Apple Inc

Popplet: A technological tool used in collaborative learning to allow participants to create visualized ideas such as graphic organizers

Tablet: It is a wireless and mobile computer for individual use designed with a touch screen interface

Traditional Mobile Phones: Mobile phones with keypads that are pressed instead of touched.

Use of ICT: This refers to the various ways of using ICT tools in classroom assessment practices (for example construct, score, analyse, store, share and administer assessment tasks and construct e-portfolios for pupils' learning).

Wikis: These are online tools that allow learners (individuals) to share their views on related course materials posted.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter discussed the theoretical and empirical literature review under the following headings;

1. Theoretical Framework
2. Conceptual Framework on the use of existing ICT tools in classroom assessment practices
3. History of ICT in Ghanaian Educational System
4. Definitions and descriptions of ICT
5. Types of ICT tools existing in kindergarten classrooms
6. Nature of kindergarten classroom assessment and ICT
7. The various ways of using ICT tools in classroom assessment
8. Teachers' level of knowledge with the use of ICT tools in classroom assessment
9. Challenges teachers face in using ICT tools in classroom assessment practices
10. Gender and ICT tools.

2.1 Theoretical Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh, Moris, Davis and Davis (2003) guided the study. The (UTAUT) is a theory of technology use that explains the relationship between the individual (user), his/her intentions to utilize information systems (IS) (user intentions) and the usage (use behaviour) (UB), using four key determinants including "performance expectancy",

"effort expectancy", "social influence" and "facilitating conditions". The “Performance expectancy” can be described as the level at which users of an ICT tool share in the belief that ICT tools’ usage can increase their work rate and improve their work outcome. This determinant has some five constructs, which include perceived usefulness, extrinsic motivation, job fit, relative advantage as well as outcome expectations.

“Effort Expectancy” has also been explained to mean the level of ease with which the individual uses an ICT tool. This determinant has about three constructs. The constructs here include, perception of ease of use, complexity and also the actual ease with which the user uses the technological tool. Meanwhile, “social influence” is the perception people have about other important people, thinking that those important others will expect them to use an ICT tool, especially the current ones. The social influence determinant is associated with constructs such as a subjective norm, social influencing factors and image. Finally, “facilitating conditions” are explained as the belief a potential ICT user has, that the available and accessible ICT tools and infrastructure will help them in their adoption of technology. Three constructs have also been associated with this determinant and they include perceived behavioural control, facilitating conditions and compatibility. Gender, age, experience and voluntariness of use are the variables that control the key determinants (Venkatesh et al., 2003). Gender, age, experience and voluntariness of use control how the four determinants of UTAUT affect the intention of the technology user and his or her usage of the ICT tool.

The researcher opted for the UTAUT because Venkatesh et al. (2003) have indicated that the theory was examined with primary data and was found to have outperformed the eight other theories of Information Technology (IT) acceptance that were reviewed prior to the formulation of the UTAUT. The eight reviewed theories include the innovation diffusion theory, the theory of reasoned action, the technology accepted model, the theory of planned behaviour, the motivational model, a model combining the technology acceptance model and the theory of planned behaviour, the model of PC utilization, and the social cognitive theory (Venkatesh et. al, 2003). Apart from the fact that the theory creates one single framework that integrates eight past theories of technology acceptance, it is also designed to provide comprehensive knowledge of all factors that lead to individuals accepting and using the technology (Venkatesh et al., 2003). Since the introduction of UTAUT by Venkatesh et al. (2003), many researchers have adopted and are increasingly studying the theory to explain technology use by individuals (Sezer & Yilmaz, 2019). This theory is therefore best suited for explaining technology use.

2.2 Conceptual Framework on the use of existing ICT tools in classroom assessment practices

This conceptual framework seeks to establish how availability of ICT tools, teachers' knowledge level in the use of ICT tools, challenges teachers encounter relating to ICT tools usage and how teachers' gender affect the teacher's use of ICT tools in their classroom assessment practices. The variables (existing ICT tools, teachers' level of knowledge in ICT tools usage, challenges teachers encounter when using ICT tools and gender of the ICT tool user) either independently or jointly impact on the usage of the ICT tools in the teachers' classroom assessment practices.

It can be observed from the conceptual framework below that there are four key determinants to kindergarten teachers' usage of ICT tools in classroom assessment practices. The determinants are "the existing ICT tools" (including computers, mobile phones, printers and tablets among others), "the kindergarten teachers' knowledge" in ICT tools usage (for example, the teachers' ability to use ICT tools to score pupils' assessment tasks, ability to use ICT tools to share assessment findings with parents and other stakeholders, ability to construct assessment tasks using ICT tools, the ability to analyse and store assessment data with ICT tools et cetera), "the challenges kindergarten teachers face" in their use of ICT tools (for instance, inadequate technical support, inadequate ICT tools, unstable supply of electricity, lack of internet et cetera) and " the teacher's gender". The four determinants (D) are the independent variables in the framework while the use of ICT tools represents the dependent variable. The usage of ICT tools in classroom assessment include the use of the ICT tools to score, share, store/save, analyse and construct assessment tasks for the kindergarten learners. Each of the determinants (D) influences the usage of ICT tools in classroom assessment practices of the teachers. When the ICT tools are available to the teacher in his or her classroom, the usage will be positively influenced. When the teachers are knowledgeable in using the ICT tools available to them in their classrooms, the usage will be positively influenced too. However, if teachers experience challenges regarding the use of available ICT tools in their classrooms, their usage will be negatively affected. Meanwhile, the gender of the user of the ICT tools may positively or negatively affect the usage of the ICT tools by the individual but may make no statistically significant difference. In effect, existence of ICT tools in kindergarten classroom and the level of knowledge of kindergarten teachers in ICT tools usage will both impact positively on the usage of the ICT tools in classroom

assessment practices, while challenges to the ICT tools usage impact negatively on the usage of the ICT tools. The impact of gender on the usage of the ICT tools in classroom assessment practices could be positive or negative. Consequently, all the determinants in this framework affect the usage of ICT tools in classroom assessment practices of teachers.

Conceptual Framework on the Use of Existing ICT Tools in Classroom Assessment Practices

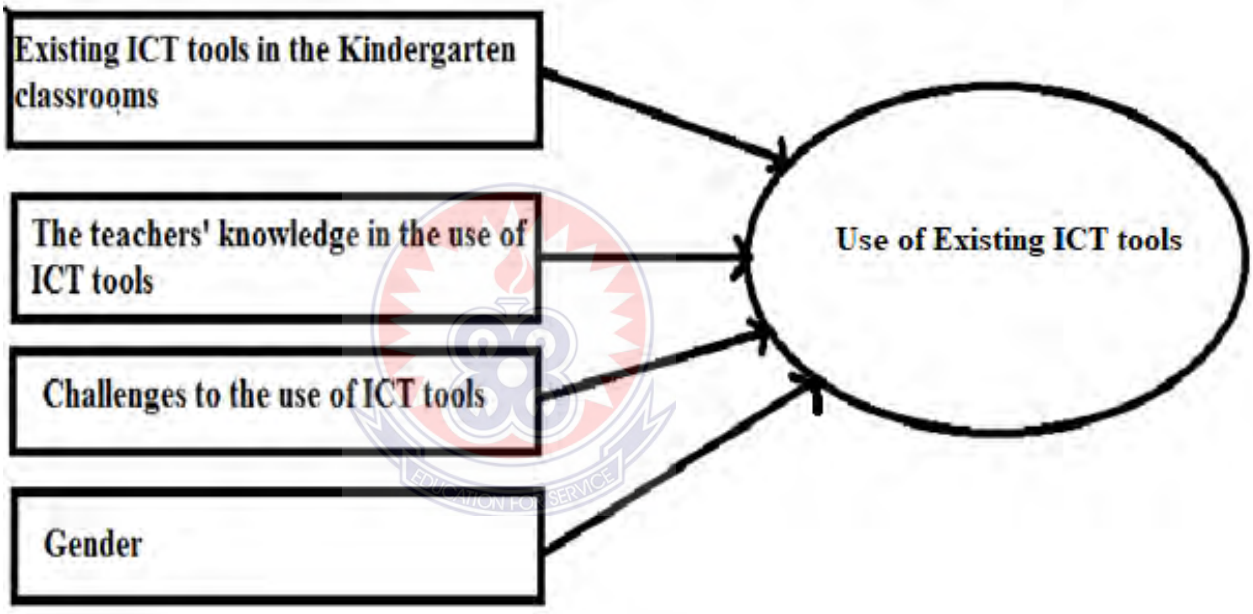

Figure 1: Conceptual framework, 2022

2.3 History of ICT in Ghanaian Educational System

In the last couple of years, until 2007, ICT was not effectively being championed for use in education and was not being studied as a subject/course in basic, secondary and tertiary institutions (Government of Ghana, 2015). It was the 2007 educational reforms of Ghana that led to the ICT integration into education, as a subject of study and as a tool for teaching and learning at the various educational levels in Ghana (Government of Ghana, 2015); in kindergarten for instance, ICT is being integrated

only as an instrument for promoting quality of teaching and learning and assessment. Subsequently in 2008, the Ministry of Education formulated a policy for ICT in Education as a means of dealing with ICT needs within the sector of education in Ghana (Government of Ghana, 2015). The ICT in Education Policy of Ghana came as a result of an earlier policy called ICT for Accelerated Development. The (ICT4AD) ICT for Accelerated Development Policy was introduced in 2003 to help in transforming Ghana into an ICT nation; full of human resource that is knowledgeable in the use of ICT to accelerate the developmental agenda of the nation (Government of Ghana, 2008). In 2011, the government of Ghana working through the Education Ministry further introduced the Basic School Computerization Policy as a backup to the ICT Policy in education and as a means of having computer introduced into all levels of education in Ghana alongside the introduction of e-learning (Natia & Al-hassan, 2015). There was also the formulation of the One Laptop Per Child Policy of Ghana in 2008 to guide the Ministry of Education and the government on how to distribute the laptops to basic school children in the country (Asante & Owusu-Ansah, 2015). Consequently, a company by name RLG was contracted to produce and provide Ghanaian teachers with laptops. The company also trained Ghanaian teachers on the use of ICT in teaching, learning and research (Natia & Al-hassan, 2015). In Ghana today, every single teacher trained either at the teachers' training college or the university, from 2008 till date, undertook a course in ICT; particularly educational technology. This therefore gives them the requisite skills to employ technology use in their teaching and practices.

However, prior to 2007, there were other activities that went on towards ensuring full integration of ICT into education in Ghana, including the initial workshop organized in 2001 for sector stakeholders under the ICT for Accelerated Development (ICT4AD) Policy of Ghana, development of ICT in Education Policy Framework in 2002, workshop on ICT integration in education which was organized in 2002 for education policy makers, development of Education Strategic Plan in 2003 to address the need for the introduction of ICT in education and series of workshops in 2004 on educational reforms at all levels of education in Ghana (Government of Ghana, 2015, p.2). Globally, Asante Nsiah (2014) argues that there are many countries that are more developed technologically than Ghana but Ghana can be recognized as part of the countries which value and champion ICT use in education due to efforts made by the government since 2007 in the ICT integration process. According to Bede, Termit & Fong (2015) and Kwache (2007), integrating ICT in education guarantees free opportunity to every key information in the learning process, alongside the provision of free access to development in various subject arrears.

It is obvious that the government of Ghana has since 2007 made a lot of efforts in promoting ICT and ensuring effective ICT integration into Ghanaian educational system by way of policy formulation and provision of some ICT tools. However, there is still a lot more to do in terms of supply of ICT tools to schools and this must be supported with training of teachers and effective supervision by educational authorities.

2.4 Definitions and Descriptions of ICT

Many authorities and organizations have defined or described ICT in many different ways. However, these definitions and descriptions have also many things in common. Murray (2011) says, that Information and Communication Technology has ICT as its acronym. ICT relates to two separate concepts; Information Technology (IT) concept and Communication Technology concept (CT). While the Information Technology (IT) relates to software and equipment that are used to get, retrieve, save and present information electronically, Communication Technology (CT) is described as infrastructural facilities and software from which information can be obtained. These equipment and software include phones, faxes, modems, digital networks as well as DSL line.

According to Bolstad (2004) ICT can be described as a tool that helps people to access the needed information and share the information with each other, or use electronic or digital tools to have an impact on the world. In early childhood education, ICT refers to computer hardware and software, digital cameras and video cameras, the internet, telecommunication equipment, programmable toys, and a variety of other devices and services. ICT can be described as "anything that enables us to obtain information, to communicate or to influence our environment through electronic or digital equipment" (Siraj-Blatchford & Siraj-Blatchford, 2002, p. 4). ICT also refers to the application of practical scientific tools to collect information, process information, store and disseminate information. Consider all the existing applications of digital technologies to assist individuals, governments, companies, and organizations in their use of information as a better way to consider ICT (Wilson, 2008).

Brian and Sawyer (2003) define ICT as a technology that employs both computing and high-speed communication links to transport data, sound, and video. Computers, telephones, televisions, projectors, cameras, cell phones, and fax machines are examples of ICT resources. However, according to Heeks (1999), ICT includes the technological infrastructure that connects users in different parts of the world using multimedia resources for data, information, and knowledge management in order to broaden the spectrum of human abilities. Computers, software, networks, satellite links, and related technologies are all referred to as ICT tools according to the Association of African Universities (2000, p.3) because they enable individuals to obtain, analyze, develop, share, and use information and knowledge in previously unthinkable ways.

Reasoning with all the definitions, it can be conclude that ICT involves the use of technological tools and infrastructure to gather and manage data, either by sharing, storing or just by way of manipulation. ICT brings people far and near together and helps to improve access to information to people of different ages. However, in Early Childhood Education, ICT could refer to the technological devices or multi-media tools that teachers and learners use to enhance formal teaching and learning.

Regardless of who defines ICT, the concepts remains related or common, i.e digital or electronic tools to process, store, receive or share information. What is significant to note however is that the scope of ICT continues to widen on almost daily basis with the introduction of more sophisticated ICT tools. These tools may come with improved speed levels and improved interface icons among other things. There are many ICT tools but their use in teaching and learning will depend hugely on their appropriateness to the developmental levels of the learner.

2.5 Types of ICT Tools Existing in Kindergarten Classrooms

ICT tools are becoming more integrated and pervasive in children's environments, particularly the classrooms. These technologies have a huge impact on people in every aspect. ICT will almost certainly continue to play an important role in an environment where children learn during their schooling and into adulthood. What is significant for practitioners to note, is the consideration of developmentally appropriate practices that relate to the use of ICT. Although using images and videos in early childhood education is not a new phenomenon (for example, pedagogical documentation; Buldu, 2010), new digital devices and apps have changed how teachers and learners interact with technology in the classrooms. Since its introduction in 2010, the iPad has been widely used in classrooms, accompanied by a proliferation of other educational applications for both children and educators (Reeves, Gunter, & Lacey, 2017). Personal computers, mobile phones and related technological tools have also been common in schools and classrooms with the sole aim of promoting teaching, learning and assessment. The integration has been accepted by educational policymakers and educational experts (for example, Ghana's ICT in Education Policy; Government of Ghana, 2015, acknowledges the need for ICT and outlined steps for ICT integration into education). According to the Ontario Ministry of Education (2014, p.4), pupils should have access to a wide variety of educational resources, "including the ability to learn from the efficient and acceptable use of technology in the classroom".

Ghavifekr et al. (2016) identified ICT tools as simple technological devices like computers, laptops, digital cameras and other related devices that are used in the classrooms for teaching and learning. But according Fusic, Anandh and Thangavel

(2020), flipped classrooms, mobile apps and other modern technological devices used by learners and educators during their classroom engagements are referred to as ICT tools. ICT tools that can be found in kindergarten classrooms can be put into three groups; including hardware, software and network communications (Koech, 2021).

There are many ICT tools but their use for teaching and learning depends largely on their appropriateness to the developmental levels the learner. Generally, ICT tools and infrastructure employed in classrooms will include but not limited to internet, personal computers, televisions, projectors, digital cameras, printers, tablet computers, pen drives, microphones, interactive white board and video games. These tools and more play very important roles in teaching and learning processes, including the enhancement of learning concepts, sustaining learners' attention and promoting effective communication.

2.5.1 Hardware ICT tools

Hardware ICT tools are the ICT tools that can be seen and touched. They include computers, cameras, printers, pen drives, projectors, television and radio among others. Tondeur, Valcke and Break (2008) identified the computers as hardware ICT tool in education and classroom for that matter but argued that the use of computers alone cannot be enough in helping for the realization of education for all goals. Computers should therefore be provided together with other ICT infrastructure like the local area network (LAN), computer-assisted instructions (CAI), Television-assisted-instruction (TAI) and internet among others. Many schools in developing countries do not have enough access to ICT tools and infrastructure in the classrooms. This is because governments do not give adequate attention to ICT in education. However, according to the United States Energy Information Administration (2016),

between the periods of 1999 and 2012, the total number of computers distributed to schools in United States of America have shot up by 71%. Etherington (2013) states that globally, a little more than 8 million ipad tablets were bought by schools to be used in classrooms. In a study conducted by Natia and Al-hassan (2015, pp. 113-125) in the Ghanaian regions of Northern, Upper East, Upper West, and Volta, using cross-section design with randomly selected 333 primary and 295 junior high schools together with 10 districts and 4 regional directors of education respectively, ICT tools available in the classrooms were identified to include laptops computers, desktop computers, projectors, printers, personal mobile phones, digital cameras and tablets. It was found that the personal mobile phone was the most common tool; and the Northern region recorded the highest number of personal mobile phones with 48%. Upper West region recorded the lowest number of personal mobile phones of 12% in the classrooms. There are also higher number of personal mobile phones in the primary schools than the junior high schools; making up to 53 % and 47 % respectively. The other tools (laptops, desktops, projectors, printers, digital cameras and tablets) were also available but in much lesser proportions as compared to the personal mobile phones. The study concluded that many schools lack computers and related hardware ICT tools.

Desktop computers, laptop computers, projectors, digital cameras, printers, tablets, popplets, pen drives, Ipods, Ipads, webboards, scanners, microphones, interactive white boards, DVDs, CDs, flash discs, and video games are examples of appropriate hardware ICT tools for teaching, learning, and assessment practices. However, teachers working with special needs children, as well as special needs children themselves, may require special ICT tools such as text magnifiers, head wands,

cerebral palsy keyboards, braille, typing aids, large prints, and audio books (Koech, 2021). As opined by Bochner, Krause, Duchesne, and McMaugh (2010), the hardware ICT tools and devices as mentioned are not exhaustive but are provided to give guidance to teachers as they prepare to use different ICT tools in their teaching. These tools as listed, give an understanding of the kinds of technological tools one may find in the classroom. They can be found at all levels of education and used with all learners, including the learners aged 4 – 5 (Kindergarten 1 and 2 learners). Such tools according to Bochner et al. (2010), also include teaching, learning and assessment tools like the interactive whiteboard, mobile delivery devices like storage devices, Personal Digital Entertainment Devices (PDEs), MP3 players and Personal Digital Assistant (PDAs) Devices. UNESCO's International Institute of Educational Planning (2021) states that these ICT tools can be used to send, create, manage and store data as they are being used in teaching and learning programs. The tools used in various countries differ and this variation can be associated with the economic ability of the countries and their people. However, policies can be formulated to bridge the resource gap that exist between countries and to provide equal or equitable access to the hardware ICT tools needed in the classrooms.

Visible and touchable ICT tools are considered hardware. These hardware tools are the first to come to mind when talking about ICT tools, especially to the beginners in ICT. The other two categories of ICT tools (software & network communication) depend on the hardware ICT tools to be effective.

2.5.2 Software ICT tools

The software ICT tools are a set of data or instructions used to give command to the computer system (Sundararajan, 1999). Software ICT tools are programs used on computers to cause them do assigned work (Rosencrance, 2021). Hardware and software ICT tools are interdependent and so both are require in order to have a computer system work effectively (Sundararajan, 1999). There are different categories of software tools. However, the main categories are two, including the system software and application software tools. The others are the middleware and driver software. The middleware is situated between the two main software; system software and application software but the driver software is the software that tends to make the peripherals of the computer work (Rosencrance, 2021).

While application software are used by computer users to carry out different tasks on the computer (for example; typing text using Microsoft Word), the system software serves as a platform on which application software operate (Rosencrance, 2021). Software helps hardware to work. Software, especially the educational ones (whether online or offline) help in enhancing educational experiences of both teachers and their learners. Among other things, software can be used to manage learner information by way of storage and analysis (Mawia, 2021).

For ICT tools like mobile phones, iPads, personal computers and tablet computers to be effectively operational, they require the installation of software. These software cause the hardware tools to function according to design. There are two main categories of software (system software & application software). The application software are mounted on the system software.

2.5.3 Network communication ICT tools

Networking or collaborative tools are tools for online projects used to enhance group work. The internet for example can be used for online collaborative activities, including information sharing, meeting and other related activities. The interactive electronic whiteboard is also a collaborative network tool for meetings and it is quite commonly used by teachers (Weiser & Jay, 1996). An interactive electronic whiteboard is defined by Weiser and Jay (1996) as an electronic tool developed with various interfaces of the computer, where images are displayed and manipulated for interactive purposes. According to Mona (2004), network communication tools help in sharing of information, knowledge construction and stimulation of individual growth of the user. Communicative network tools are tools generally used to effectively and efficiently communicate information to others. They are used for communications between teachers and learners, learners and learners and teachers and parents. For example, Lim and Lee (2002) have indicated that mobile phones and PDAs (Personal Digital Assistance) devices enhance simultaneous and asynchronous communication between two or more individuals. This especially occur while using online platforms. Chen, Hsu and Hung (2000) identified e-mail, electronic bulletin boards, chat, electronic whiteboard and teleconference as network communicative tools. In their view, the network communicative tools, especially those used for synchronous interaction, like chat and video conferencing enhance the sharing of information and getting feedback within reasonable time. However, the exchange of information using for example the electronic whiteboard and email delay because such tools are not platforms with live signals.

With gradual dominance of the use of network communication tools, learning is shifting from being individual activity to group or social activity, where learners and teacher interact (Bonk & King, 1998). Some network communication tools allow teachers and learners to take learning beyond the classroom, as they can continue to use a single online platform to continuously engage each other (Chen et al, 2000). Network communication infrastructure should also include web-based tools and applications for managing teaching and learning, like Learning Management System (LMS), Student Management Systems (SMS), Digital Student Report Card Systems, Online Collaborative Workplaces, Virtual Classroom and e-portfolios. Digital Television, Video Over Internet Protocol (VOIP), blogs and wikis are other kinds of network communication tools that can enhance collaboration and bring information to educators and learners with a simple click (Bochner et al., 2010). The tools can also be used to manage, send, create and store information regarding teaching and learning. In countries where the ICT resources are not adequate, policies can be made to bridge the gap and improve access (UNESCO's International Institute for Educational Planning, 2021).

Network communication is therefore the sharing of information between one ICT tool on one side and another ICT tool on the other side. This form of communication is facilitated with use of internet. The internet has made it so easy today for learners and their teachers to collaborate with each other and share so much information from the touch of a single bottom. Networking tools have also made it easy to have online classroom platforms like virtual classroom (eg. google classroom) to enhance learning, especially when teachers and learners cannot come into physical contact with each.

2.6 Nature of Kindergarten Classroom Assessment and ICT

In various Kindergarten researches and policies, there have been three forms of assessment that are usually cited: the summative assessment/assessment of learning, formative assessment/ assessment for learning, together with assessment as learning, which is described as being related to assessment for learning/formative assessment (McNair, Bhargava, Adams, & Kyros, 2003; Earl, 2013; OME, 2016a; Braund & DeLuca, 2018). The focus of assessment of learning is the measurement of existing knowledge and competencies of learners, as data is being gathered to give feedback on specified learning goals (Taras, 2005; Kibble, 2017). Assessment for learning involves the gathering and analysis of data on children's learning, so that we can understand and appreciate their learning progress in order that we can intervene appropriately (Broadfoot, Daugherty, Gardner, Harlen, James & Stobart, 2002). However, assessment as learning requires a learners' active involvement in assessment tasks that facilitates how learners reflect on their own learning (Earl, 2013).

Formative assessment basically supports how children learn; it is not used as a means of providing accountable feedback on learning progress. In order to encourage both formative and summative assessment practices, DeLuca, Pyle, Roy, Chalas and Danniels (2019) have suggested some important assessment principles for kindergarten education, including that; assessment should be continues process that influences classroom instruction, different approaches should be used to collect assessment data from different learners, curriculum learning objectives be guided by the process of assessment and that assessment should show efforts made towards developmentally appropriate practices and child centred activities. In addition,

educational policies around the world require kindergarten educators to make assessment part of their practice in order to promote children's learning (formative assessment) and to give feedback on learning (summative assessment). This gives an indication that kindergarten kind of assessment is conducted on regular basis (OME, 2016a; Riley-Ayers, 2014).

The assessment practices include the ongoing compilation and interpretation of children's learning data by educators and learners, which is linked to developmental objectives and academic goals, as well as the constructive use of data (evidence) to drive learning forward productively. The assessment principles in the kindergarten classrooms can be significantly supported and promoted with the aid of ICT tools for assessment (for example, Ipad apps, e-portfolios, digital cameras and videos). These assessment tools, for example, store and share various kinds of assessment information and give opportunities to learners to explain their knowledge and ideas in various ways (Johns, Troncale, Trucks, Calhoun & Alvidrez, 2017).

The introduction of digital assessment tools in early grade education and how their use have affected the assessment practices of educators have been examined in few recent studies. The perspective of educators on implementation of an e-portfolio project in a preschool in New Zealand was examined by Beaumont–Bates (2017) and realized that the use of e-portfolios increased the reported parent and teacher level of collaboration and showed a greater improvement as compared to the paper portfolios. However, the challenges that affect technology use, including the time consuming nature of visual data uploading and management, have been articulated (Beaumont–Bates, 2017). A digital software program for assessment was piloted in British Columbia for six weeks period in seven primary and two middle school classrooms,

after which educators reported an improvement in their formative assessment practices. However, opportunities were frequently given for professional engagement between educators, scholars and software developers, which were crucial to these productive changes (Carter & Crichton, 2014).

Pyle and DeLuca (2017) examined assessment practices of educators at the early grade levels. They found that assessment data gathering was improved due to the use of technology. However, the educators did not have data on literacy skills to obtain useful details for assessment purposes and this was an issue also expressed in recent theoretical research work on educators' assessment literacy (Eyal, 2012; Heitink, Van der Kleij, Veldkamp, & Kipper, 2016). Generally, evidence exist about the positive influence ICT tools can have on classroom assessment practices of educators, however, these evidence mainly come from studies that considered just one ICT tool (eg. e-portfolio). There is the need to examine how a significant number of these tools can impact classroom assessment practices of early childhood teachers.

In summary, there are three forms of assessment at the kindergarten levels of education and these are stated as assessment of learning (summative in nature), assessment for learning (formative in nature) and assessment as learning (also formative in nature). Because data on learner assessment are to be either processed, analyzed, store or shared, there is that need to facilitate the processes with the use of ICT. E-portfolios among other tools have significant impact on early grade assessment.

2.6.1 Integration of ICT into kindergarten education and assessment

Educators should be encouraged to integrate technology in their assessment practices meaningfully. Usually, pre-service teachers learn about assessment practices through practicum encounters in schools, with awareness passed on from mentoring teachers (DeLuca & Klinger, 2010; Graham, 2005). Just six of the twenty participating classrooms in a study addressed how technology strengthened assessment for and assessment as learning practices. This means that techniques for meaningful technology integration in assessment may not be widely passed down to educators who have no experience in ICT usage. Professional development opportunities based on assessment, on the other hand, are key to the acquisition of the needed experience and these are therefore encouraged (Klinger, Volante & DeLuca, 2012). To this extent, providing details about the integration of technology in assessment during professional development workshops will be helpful.

Furthermore, although pre-service assessment courses are often not regular (DeLuca & Klinger, 2010; Volante & Fazio, 2007), they provide a framework for addressing the use of emerging technologies. With the abundance of new software and applications of diverse quality, educators are increasingly required to suggest what features are needed and how such options can be used best to improve assessment practices in the classroom. Technology discussions of assessment can also be further integrated into current curricular and policy reports. Although the teachers included in the study by Ontario Ministry of Education on "The Kindergarten Program 2016" have generally commented on the idea of technology to enhance teaching and support the learning of children in kindergarten (OME 2016b, p. 105), there are no specific

examples describing how this can be carried out and no technology references are provided within the focal policy of assessment (OME, 2016a).

Finally, it will be useful to disseminate findings about the uses of technology by educators for assessment, for training and to software developers. Feedback on how educators can use assessment tools to improve pupils' learning as well as which features are deemed beneficial, will be particularly helpful in supporting the continued creation and refinement of educational applications and their use in early childhood education and beyond. To that end, establishing a researcher and application developer relationship in which the perspectives of the developer and the instructor are combined will result in the development of useful assessment software for classroom use (OME 2016b, p. 105).

Many are those who share the view that ICT integration in classroom assessment helps significantly in improving the conduct of assessment and ensuring that goals of assessing learning are achieved. Since pre service training in all Ghanaian teacher training institutions require student teachers to take up a course in ICT and educational technology, authorizing classroom teachers to integrate ICT into their classroom assessment will not pose so much challenge and so will not require a long period of in-service training.

2.7 The Various Ways of Using ICT Tools in Kindergarten Classroom Assessment

Technology has the capacity to assist teachers in assessing pupils' learning in the classrooms (Marina, 2015). The various forms of latest ICT tools that can be employed in the classroom assessment according to Educational Broadcasting

Corporation of America (2004), have been brought to the doorsteps of the educators by modern day technology. They further cited the role of technology, saying that technology is significant in the assessment and tracking of learners by educators, sharing of assessment information regarding learners' performances, keeping digital records of learner performance (storage of assessment data), alongside helping the educators to have evidential appreciation of how far their work in the classroom have been successful. The school administration can also use ICT tools to check how educators and learners are performing and help them improve through the implementation of designed strategies. Also, e-portfolios of children's learning can be produced with the use of ICT tools (Educational Broadcasting Corporation of America, 2004).

According to Redecker (2013), the effectiveness of ICT tools in assessing major skills among learners have not been fully explored by teachers. However, how powerful an ICT based assessment procedure is, will depend on the skill area it is being used to assess. Therefore, various skill areas will need different tools and different approaches. Harlen and Deakin-Crick (2003) found that summative assessment can be carried out using questions developed onto the computer with computerized scoring. More so, storage and digital capturing of information about the progress of learners can be done with the use of ICT tools. ICT tools can also be used to give feedback on learners' performance, so that the necessary support can be put in place for the individual learners.

Meanwhile, Black and Wiliam (1998) and Heritage (2018) argued that assessment is challenging and therefore ICT tools may help solve the challenges that come with modern day classroom assessment. In that regard, developers of technology-based

assessment applications, tools or software, will have to incorporate the views of policy makers on standardization of content, views of experts and views of classroom teachers who will use or monitor the use of the tools in their classrooms (Beatty, 2010, p.21). According to Parshall, Davey and Pashley (2000), in Early Childhood classroom assessment, test tools/application developers should design test that corresponds with the new ways of computerized tests. The areas test application developers have to explore for innovative designs include 'item format', 'response action', 'media', 'interactivity' and 'scoring algorithms' (Clements & Sarama, 2003; Labbo & Reinking, 2003; Chen & Chang, 2006; Schmid, Miodrag & Francesco, 2008). Meanwhile, some teachers have begun using technology to enhance their class assessment (Danniels, et al., 2019).

In short, ICT tools can be employed in classroom assessment by teachers to track learning progress of every individual learner, share the learner's progress of learning with parents and educational authorities, store assessment data for future reference and analyze assessment data of all learners. Notwithstanding that, ICT tool are used by educational administrators to monitor the performance of teachers in their assigned classrooms.

2.7.1 Use of ICT tools for information and administration purposes

Computer in recent times has become the major tool for planning administrative tasks in many institutions, including Early Childhood Education centres. Significantly, ICT plays two principal roles with respect to school administration and information management. It helps with creation and maintenance of digital records that can be converted into many different forms. It also uses network or internet to share electronic information with different sources and individuals (Bolstad, 2004, p.57).

Technology also helps administrators to make changes based on data. For example, aggregate classroom reports can help administrators at school level to decide how to allocate limited continuing education resources, limited curriculum materials, and complementary school services to teachers. Aggregate reports at the school level and the district level can also support district administrators and national level administrators in deciding on the needs for professional development, curriculum needs, additional programming needs and current policies of education (Neumann et al., 2019, pp.7-8).

With regards to administrators' use of ICT, Bolstad (2004, p. 68) indicates that study in New Zealand Early Childhood Education centres shows that while fifty-nine percent of school managers do not have digital systems in place to carry out their administrative activities, forty-one percent of their counterparts have reported having such systems in place at their various centres.

At school level of administration, ICT tools are used fundamentally for planning school activities, monitoring school programs and activities, storing data that the administrators get in the day to day activities and sending these data to individuals and authorities who need to be updated. It is however not all schools that have or use ICT tools for administrative purposes.

2.7.2 Use of ICT tools for test items development and test administration

Computers can be used to develop and administer test. The computer basically has two functions with regards to test development and test administration; a test medium and test scorer functions (Jonassen, Howland, Marra & Crismond, 2009). With increased technology, test administration can become more standardized, and

efficient, as well as provide a more diverse ways for learners to demonstrate their knowledge. Computer-assisted testing reduces teacher test administration difficulties (Foorman, York, Santi & Francis, 2008). Arguably, the use of the computer in developing and administering test simplifies the assessment tasks of teachers and school administrators (Jonassen et al., 2009). Meanwhile, computerized assessment can be developed and administered online or offline using modern technological tools. It can as well be used for both formative and summative assessment of pupils learning and their school success (Majid, 2019). The use of computer to develop and administer assessment tasks helps to give quick feedback to both the learners and their teachers. Teachers can improve their instructions using the feedback, but the learners get motivated upon getting the feedback (Schogen-Phelan & Keegan, 2016).

The system of using computer to develop and administer test can be described as computer-assisted assessment (CAA) or computer-based assessment (CBA). According to Kuruvilla (2018), the use of computers to manage or support the assessment process and evaluate assignments is referred to as computer-assisted assessment (CAA). However, computer-based assessment refers to the use of digital tools to carry out assessment-related tasks. Laptops, tablets, and even smart phones can be used to conduct computer-based assessments. The majority of computer-based assessments are completed on a computer. Following a consistent set of instructions as well as being able to enter responses directly into the database contributes to efficiency and standardization of assessment.

Completely automated applications that present training components, instructions, and test items automatically, as well as collect pupils' responses automatically, improve standardized administration of assessment. This helps to eliminate any variation in

test scores, like what usually happens with tests of phonological awareness and mathematical problem solving, by eliminating potential sources of invalidity (Kuruvilla, 2018). The most frequently mentioned benefit of using technology-based assessments in the classroom is an increase in efficiency. Although automatic presentation and collection of pupils' responses is a well-known example, technology improves efficiency by other methods (for example, test scoring and analysis of results) (Neumann et al., 2019, p.6).

Kuruvilla (2018) further argued that the two common types of computer-based assessment are; i) the assessment embedded within e-learning modules: This type is the most similar to the original computer-based training. Online assessments are embedded within larger e-learning modules in this case, allowing learners to complete their learning activities on the computer. A learner might, for example, complete an entire e-learning module with a final test at the end. ii) Standalone online assessments: In this case, an instructor creates quizzes and tests using an online assessment creator, which learners take on an online platform. Learners can be engaged in the teaching-learning process where their progress in learning can be measured on a continuous basis using online or Web-based assessment. For example, after completing his or her lesson, a teacher may administer a brief quiz to learners via smartphones.

Online tablet testing has a number of advantages over (online) desktop computer testing. The tablets are small and portable, allowing them to be used in a variety of settings. Children can use them on their desks or while sitting on the floor, and they can carry them around the classroom, providing greater flexibility for test settings and more options for individual learner preferences. Teachers, on the other hand, will

need to support young children in order for them to properly engage with the computer (Hitchcock & Noonan, 2000; Ellis & Blashki, 2004).

It is becoming difficult to find schools that do not use ICT tools to develop their test items at least for end of term examination. However, not many schools administer test items using ICT tools. This is because of challenges such as inadequate ICT tools, inadequate knowledge to operate the ICT tools, lack of internet and electricity challenges among other things. Classroom teachers who are knowledgeable in the use of ICT tools can use personal computers, iPad or smart phones to develop and administer test items.

2.7.3 Use of ICT tools for test scoring

Test scoring is a means of marking answered test items. It involves assigning figures to responses as a means of measurement, which will be used consequently to take a decision on the learner. Manual test scoring requires a lot of attention on the part of the teacher in order to fairly and efficiently score his or her learners. With manual scoring, human errors can hardly be avoided. This is why it is significant to adopt the use of automated technology to reliably and efficiently score learners.

According to Neumann et al., (2019, p.6), one of the most significant advantages of technology-based assessment is the ability to automate the collection and scoring of assessment data in many instances. The computerized or digitized scoring system increases efficiency and accuracy. This is accomplished by eliminating the need for humans to enter data, calculate raw scores, pass scores, check for and locate suitable look-up tables, calculate domain scores, and perform various score conversions (e.g., raw score to age score, raw score to grade score, raw score to ability score, raw score

to norm referenced standard score). Aside enhancing the consistency and reliability of common scoring systems, technology-based assessments are the only way to take advantage of current psychometric models. Computerized scoring will weigh objects based on their discriminations, resulting in more accurate and approximate skill scores. Furthermore, only computerized scoring allows for the use of the most sophisticated psychometric models, which are becoming more popular in educational assessment (for example, three parameter logistic models and graded response models).

Psychometric item response models consider both precision and latency data in estimating student abilities; of course, only computerized scoring could do this. Scoring student evaluation data that takes into account both accuracy and latency of student responses can have different instructional consequences (Neumann et al., 2019, p.6). To produce a fair and accurate score on pupils' assignments such as multiple choice tests, as well as marking reports, projects, or oral tasks, a lot of time and effort is required. Teachers are frequently used as both test administrators and scorers but the availability of technology and computers can assist teachers in speeding up the scoring process, which can save a significant amount of time. However, it should be noted that in some cases, a computer cannot take the place of a teacher in terms of marking. Therefore when a computer is involved in the scoring process, it is preferable to have both the computer and the human contribute (Marina, 2015, p.29).

Though test scoring using ICT tools will require advanced hardware tools and software, its role in ensuring accuracy in terms of assigning figures to learners work cannot be undermentioned. Scoring test with ICT tools will also reduce the human

factor; which is an attempt to favor some specific learners or commit some human errors.

2.7.4 Use of ICT tools for data analysis and interpretation

Analysis and interpretation of learners' data, is a process of comparing available test results gathered through assessment processes to make deductions and pass judgement. Quite a number of ICT tools can be helpful in analysing pupils' assessment data (for example, Microsoft Excel); they can help ease the challenges teachers face when it comes to analysing and interpreting assessment data of learners. Jonassen et al. (2009) supported this view when they argued that analysis of test data can be done using computers. Rankin (2016) points out that teachers and educational administrators whose formal education does not usually require advanced coursework in calculation and analysis face some of the most daunting challenges in making sense of assessment data and using them correctly. Computer-assisted assessment (CAA), apart from being used to evaluate achievements of learners, can be used for analysing data gathered through test (Campbell, 2005).

Another field where technology-based assessments outperform traditional classroom assessments is in this area of analysis and interpretations of results. With tabular reports and graphical plots of an individual's learning rate compared to a number of similar comparison groups, emerging technology may help with analysis and interpretation of outcomes. However, data should be communicated to teachers in a way that maximizes their ability to interpret, taking into account the most recent research on educators' statistical literacy, such as adhering to existing standards (Rankin, 2016).

Technology provides a tool for assessment-related activities such as results analysis. If results are not already in electronic form, a variety of spreadsheets, statistical packages, and database packages (for example, Excel, Lotus 1-2-3, Database, SPSS, Minitab, Access) make it simple to enter data manually. However, when creating data files, caution must be exercised. With the aid of technological tools, results from multiple assessments, entrance tests, courses, or modules can be quickly compiled and analysed by teachers. Furthermore, any trends in the data can be thoroughly investigated, providing valuable feedback to an academic team (Kuruvilla, 2018, p.59).

ICT tools like SPSS and Microsoft Excel among other things can be used to analyze learner's assessment data. When the size of data is huge, the effective and efficient way to accurately analyze it is to use an ICT tool. The tools can be used to look out for all forms of variations in the data captured so that the teacher can take an informed decision.

2.7.5 Use of ICT tools to share test findings with stakeholders

Wilson, Clarke, Maley-Shaw and Kelly (2003, p.43) opined that ICT tools can be used to share children's learning with their parents or the children themselves. According to Neumann et al. (2019, p.7), school children' reports, when included in the user management system, may also be communicated electronically to parents. Otherwise, traditional parent reports may be scanned and emailed, distributed or interpreted at teacher/parent forums. It is possible to use ICT to further enhance the use of digital platform scanning by adopting user-friendly visualizing, statistical, and analytic methods to show long-term learning patterns. Teachers, parents, pupils, and schools will benefit from these individualized digital reports and records. Learners'

digital reports, for example, can be easily accessed if they change schools locally or nationally. Such digital enhancements will help inform the learner's new teachers and schools of their current competencies and learning needs. However, early childhood practitioners themselves can through online discussion communities, video conferencing or emailing share information or receive information from their colleagues or researchers, regarding children's learning.

In similar approach, telephones, emails or faxes can also be used by teachers and the learners to enhance correspondence with parents (Bolstad, 2004, p.6). "The Strategic Plan for Early Childhood Education" (Ministry of Education, 2002) cited in Bolstad (2004, p.58) indicates that collaboration or information between early childhood service centres and key services in New Zealand has promoted the quality of the Early Childhood Education program in the country. Meanwhile, in a survey on the use of ICT by teachers in New Zealand Early Childhood Education centres to share information with parents of school children, Bolstad (2004, p.66) found that only fourteen percent of the teachers do not use ICT to communicate pupils learning with their parents.

In assessment, one important thing is to share findings/outcomes with individuals and authorities concerned. This is difficult to do on regular basis but with the aid of ICT tools, all those who need to be given feedback can be reached within a shortest possible time. Email, text message and phone call are some of the means that can be used to disseminate information in this regard.

2.7.6 Use of ICT tools to individualize learning and assessment

The use of computer adaptive testing is a recent technological advancement that significantly improves the testing process. While a learner is being examined, the technology has the ability to adjust its level of difficulty. The technology analyses how a pupil answers the questions and how many mistakes the pupil makes; based on that concept, the technology adjusts the other questions accordingly. If the pupil answers incorrectly many times, the software will redo the previous question. Furthermore, the technology is capable of posing questions based on previously learned content. As technology grows in scope, computer adaptive test has become the most straightforward method to incorporate into educational settings (Toroujeni & Khoshsima, 2017). Computer adaptive testing (CAT) is a test administration method that adjusts its content to the ability of the examinee (Wainer, 1990).

CAT interacts with the learner being examined, by selecting items that maximize the test accuracy on the basis of a pupil's previous knowledge. The test items being administered are differentiated according to complexity, so that difficulty will increase or decrease in response counts following incorrect or correct answers. Item selection algorithms, such as multidimensional adaptive testing, are used to tailor items to the examinee's level of experience (Luecht, 1996; Segall, 1996). The item selection algorithm draws items from the item pools in each CAT test, and the difficulty level of the items is adapted to each individual examinee's level (National Council on Measurement in Education (NCME), United States, 2002).

According to Burgstahler (2010), computers can help people living with disabilities increase their independence, productivity, and capabilities. The computer, on the other hand, requires adaptive or assistive hardware and software to assist learners with

special needs. Features built-in accessibility to personal computers, such as voice or braille output, can make it standard. ICT in education, especially assessment, will greatly assist learners with special needs in performing their assessments tasks in an effective manner. It also aids teachers in avoiding discrimination and being fair so that each learner is assessed according to their strength.

Adaptive technology is adjustable to suit the learning abilities of individuals. If the learners' ability is high, the technology will adjust to suit that learner but will re-adjust if used to meet the level of a learner whose ability level is portrayed as lower. This is particular with assessment being administered with the use of technology; Computer Assisted Technology (CAT).

2.7.7 Use of ICT tools for learner's e-portfolio development

Electronic portfolios or e-portfolios are a set of art works and text records of evaluation of individual learners being digitally stored online (Kuruvilla, 2018). An electronic portfolio is a collection of e-evidence of pupil's learning, gathered and stored on the internet for the purposes of providing access to learners, their parents and stakeholders who may need to examine progress of learning continuously. Written text, multimedia, photographs, videos and hyperlinks are examples of e-evidence in the e-portfolios. The e-portfolios are primarily useful for assessing a pupil's skills. The learner who uses these online portfolios is aware of his or her own strengths and areas needing improvement (Majid, 2019, p.39).

According to Millea, Green and Putland (2005, p.42), an electronic (or digital) portfolio is a type of digital storage that allows a person to keep track of their work, accomplishments, awards, and assessments over time. The main purpose of an e-

portfolio is to enhance formative and summative assessment of individual children. However, it can significantly promote online collaboration as well as peer and self-assessment. An e-portfolio has four components; i) reflection on what is understood by learners, ii) the main concept of learning, iii) proposal for learning and iv) plans for the future. Descriptively, an e-portfolio is a product and a process at the same time. As a product, it displays a collection of pupils work, but as a process, it gives opportunity for pupils to regularly check the progress of their learning, so as to get feedback that will be useful in reflecting on their school performances (Kuruvilla, 2018).

An e-portfolio serves as a learning record for the individual, allowing him or her to evaluate his or her own or another person's accomplishments. To a large degree, these types of records are linked to a person's learning. We usually have two types of portfolios: traditional portfolios and e-portfolios. The biggest difference between traditional and e-portfolios is the sharing of progress online (Rodriguez-Donaire, Garcia and del Olmo, 2010). The e-portfolios used in classroom assessment of learners at the kindergarten levels, allow the children and their parents/guardians to access information about the learning progress of the child from wherever they may find themselves. This helps in ensuring that parents and their wards are aware of the achievements made in learning and the areas that need improvement.

Beaumont-Bates (2017) discovered in New Zealand that using e-portfolios increased teacher-parent collaborations and it was found to be generally better than the traditional ones. When parents of young children participate in their education, it is evident that the children's learning will improve (Nevski & Siibak, 2016; Pineda, Bender, Hall & Shabosky, 2018). Parents therefore will gain a better understanding of

their children's learning and contribute in ways of supporting them improve upon their learning.

E-portfolios are useful to learners and their parents/guardians. With the help of e-portfolios, parents can login from wherever they are to check how their wards are progressing in school. Areas where parents are digitally literate, e-portfolios help to improve parental participation in children's learning.

2.7.8 Use of ICT tools for storage of assessment data

One option for electronic test generation is the electronic selection of questions from a bank. A question bank is created by several staff members from various institutions who collaborate to share questions in the form of a question bank. A large number of different tests items can be produced as a result of this (Kuruvilla, 2018 p. 59). This pool of questions have to be stored electronically for safety and easy retrieval and reproduction of copies.

In a study on the use of Information and Communication Technology (ICT) for Knowledge Management in the Second Cycle Educational Institutions in Ghana, Gyaase, Anane and Armah (2015, p.10) found with regards to using ICT to store information, that 57% of teachers and 67% of school administrators use computers to store their data. No respondent reported storing information on the internet space, however. The practice of storing information just on computers does not allow access to information when away from the source of storage (for example, needing information on computers at the work place while one is outside the place of work).

It can be concluded that the use of ICT to store assessment data will ensure higher data safety and easy access. In modern times such data can be stored even on clouds

(eg. google drive). Data stored on clouds are safe from viruses and can be accessed from any other device by the account holder. Institutions should therefore encourage the storage of data either on electronic devices or on clouds for safety and ease of access.

2.8 Teachers' Level of Knowledge with the use of ICT tools in Classroom Assessment

Knowledge is the exhibition of some skilled characteristics resulting from some experiences acquired over a period of interaction or training. According to Nonaka and Takeuchi (1995), knowledge is a human process that changes in nature. It is a unique structure which allows for storage, processing and understanding of information (Plotkin, 1994). However, Prusak (1997) described knowledge as made up of skills, combination of experiences and relevant information.

Meanwhile, literature in ICT highlights the importance of teachers having well-developed comprehension of the various aspects of ICT's roles and its potentiality in promoting children's learning, as well as knowledge of how to utilize technology effectively in classrooms (for example, O'Hara, 2004; O'Rourke & Harrison, 2004; Patterson, 2004). Kadel (2005) argued that no matter how much technology is available in the classroom, the factor that drives its adoption is the teacher's attitude; therefore, teachers must have the requisite competence and mind-set to deal with it. ICT is effective in the classroom when utilized by well-trained and knowledgeable teachers.

In order that all of the challenges associated with integrating ICT into teaching and learning processes are dealt with, teachers must acquire different levels of ICT skills (Igbo & Imo, 2017). These skills will come as a result of training acquired. Therefore if teachers are to gain the needed knowledge in using ICT tools in their classroom assessment practices, school authorities must provide them with the requisite training for professional development (for example, in service training).

Kirschner and Woperies (2003) emphasized on some key ICT skills and knowledge that teachers must possess. These include the ability to use ICT personally, master a number of educational paradigms that use ICTs, use ICT as a mind tool, use ICT as a teaching tool, master a range of ICT assessment paradigms and understand ICT policy dimensions in teaching and learning (Robbins, 1998). Assessing the level of ICT skills of teachers in knowledge management, Gyaase, Anane and Armah (2015) found that teachers have different levels of skills; ranging from none, beginner, intermediate, to proficient. Out of 60 teachers, 28 were at the intermediate level, 15 were at the beginners' level, 11 were at the proficient level and 6 reported to have no skills all. Gyaase, Anane and Armah (2015) concluded that the ICT knowledge teachers in second cycle educational institution possess is low and therefore does not allow them to use the potential ICT tools offer. Singh and Chan (2014) also found that teachers were only knowledgeable in using some ICT tools and went on to rate the teachers' level of knowledge as moderate. Moganashwari and Parilah (2013) in an earlier study revealed that participants had high level of knowledge but only in the use of some ICT tools.

In the crusade for ICT integration into education and classroom assessment especially, the role of the teacher is so important. The teacher must have the needed skills to use the ICT tools. If teachers are not already knowledgeable or skillful in the use of ICT tools, in- service training will be required to equip them with the necessary skills.

2.8.1 Training of teachers in ICT

It is difficult for many teachers to implement ICT in the teaching process because they have not had enough training opportunities to do so. Teachers avoided technology in the classroom because most of them were not used to it; particularly the new technologies. They therefore need some initial training to acquire the appropriate skills and knowledge to develop the right attitude in relation to the effective use of computers for enhancement of education (Habibu, Abdullah-Mamun & Clement, 2012). Meanwhile, full integration of ICT into education, requires a high-quality, frequent training for professional development. Integration attempts will inevitably fail if regular training is not provided. Another "widespread problem," that exist in literature according to the majority of the researchers, is ineffective training of teachers (Adebi-Caesar, 2012).

According to Ogbomo (2011, p.10-11), professional development of teachers in the area of ICT is key to the use of ICT tools in education and has therefore suggested that teachers' capacity challenges be addressed during pre-service training and be built on while in actual service. Programs for professional development of teachers in the use of ICT in the classrooms according to Bolstad (2004) and Ogbomo (2011) should focus on teacher';

- Skills with the use of ICT tools and applications.

- Ability to effectively integrate ICT into the school curriculum (for example, as a pedagogical tool and as assessment tool).
- Understanding of the relationship between theories of ICT use and educational learning theories.

Cox, Preston and Cox (1999) submitted that ICT in teacher training should take pedagogical aspects into account. According to the findings of their study, when teachers received basic ICT training without taking into account the pedagogical aspects of ICT, they still did not know how to use ICT in the classroom. However, Trotter and Zehr (1999) supports basic skills training of teachers and therefore argued, that ICT integration training must be preceded by and accompanied by basic skills training. According to Gomes (2005), obstacles to the use of new technologies in classroom practice include a lack of digital literacy training, pedagogic and didactic training on how to use ICT in the classroom, and training in the use of technologies in specific subject areas. For Gomes (2005), training of teachers for the integration of ICT should go beyond just the basic skill training to include pedagogical knowledge on how ICT can be used to enhance learning, assessment and other related activities.

There are two forms of training teachers using ICT tools in schools or classrooms will require. They are the pre-service training and in- service training in ICT use. The in – services training, especially helps teachers to upgrade their ICT skills and increase their motivation to integrate ICT into classroom assessment. There should therefore be continues in-service trainings for teachers with regards to the use of ICT in classroom assessment of learners.

2.8.2 Developmental Appropriateness with respect to children's use of technology

In the use of ICT tools with children, not all the tools are fit or appropriate for children to use. Sometimes the (nature) size of the tool, the danger it could pose or the content it contains becomes an issue to be dealt with, with regards to developmental appropriateness. Teachers of young children should have adequate knowledge on which tool or content is developmentally right for children's use. In view of this, the American Academy of Paediatrics (AAP) recommends that children below 18 months and children between the ages of 2 and 5 restrict their time of viewing digital screens to 1 hour of high-quality programming daily (American Academy of Paediatrics, 2016). Research found that young children are prone to having difficulty with computer mouse handling as well as hand-eye coordination abilities and so, allowing kindergarten aged children to handle computer mouse is developmentally inappropriate. (Joiner, Messer, Light & Littleton, 1998; Hourcade, Bederson, Druin & Guimbretiere, 2004; Donker & Reitsma, 2007). Instead of using the computer with a mouse that turns to pose challenge to children's use of the computer, Woloshyn, Bajovic and Worden (2017) and Neumann & Neumann (2018) recommended the use of touch screen devices like children's tablet.

Although some researchers are a little worried about safety issues regarding the Kindergarten children's use of ICT tools in Early Childhood settings (Byron, 2008; Bolstad, 2004), many other studies revealed that ICT can be safely used in Early Childhood settings that have standard ICT tools for children with teachers skilled in ICT use (Wang & Hoot, 2006). Foundation stage curriculum of the United Kingdom for children between 3 – 5 years recommends the use of ICT tools by Kindergarten

children. The children are to be given the opportunity to identify and explore the use of everyday technology in their learning activities (Becta, 2004b). Talking about the role of ICT in Early Childhood Education, Van Scoter & Boss (2002) argued that ICT has a great power to enhance the development of literacy among the Early Childhood Education children if developmentally appropriate. Haugland (1999) also shares a positive view about the use of ICT in Early Childhood Education. Haugland thinks that opportunities should be provided for Early Childhood Education children to have a feel of the use of the ICT tools, especially to communicate with others and to retrieve information. In attempt to ensure developmental appropriateness and effective use of the ICT tools by the Kindergarten children, Learning and Teaching Scotland (2003) points out that the Scotland government came out with a usage guide to support teachers at the Early Childhood Education levels to use ICT tools appropriately. According to the Ontario Ministry of Education (2014, p.4), pupils should have access to a wide variety of educational resources, "including the ability to learn from efficient and acceptable use of technology in the classrooms".

Developmental appropriateness should be highly considered when it comes to younger children's use of technological tools. If developmental appropriateness of the individual learners regarding the use of ICT tool is not considered, positive result will not be realize, rather, there will be negative impact on the learner and the learning process. In this regard, there should be a lot of consideration regarding safety issue related to particular ICT tools and whether or not the tools can be used by early childhood children.

2.9 Challenges Teachers Face in using ICT Tools in Classroom Assessment Practices

The barriers or factors affecting the smooth use of ICT by teachers during the various processes of teaching and assessment are referred to as challenges. Absence or withdrawal of these barriers or challenges will make room for successful use of ICT in classroom assessment practices of teachers. Various researchers identified and reported on various challenges confronting teachers when using ICT in education. The variations in the identified challenges could be associated with the locations where the researches were conducted. This is so because, needs of a people vary from one place to another and from one person to the other. Adebi-Caesar (2012) stated that research has categorized the challenges in different forms. While Ertmer (1999) grouped the challenges as 'intrinsic' and 'extrinsic' challenges, Balanskat, Blamire and Kefala (2006) grouped the challenges as 'micro level' challenges (teacher attitude), 'meso level' challenges (institutional) and 'macro level' challenges (affecting wider system of education). Meanwhile, Pelgrum (2001, p.173), identified the top ten challenges affecting teachers in the use of ICT in education, including the following in their respective order with their corresponding percentages;

1. Inadequate number of computers 70%
2. Lack of knowledge/skills among teachers 66%
3. Difficulty to implement in instruction 58%
4. Scheduling computer time 58%
5. Inadequate peripherals 57%
6. Inadequate software copies 54%
7. Inadequate teacher time 54%
8. Inadequate simultaneous access 53%

9. Inadequate supervision staff 52%
10. Inadequate technical assistance 51%

According to Pelgrum (2001, p.173), those challenges listed in the top ten, scored above 50% in the response and are made up of non-material obstacles and material ones. The material obstacles in the top ten include, insufficient computers, insufficient peripherals, not enough copies of software and insufficient number of computers to simultaneously access the worldwide web (www). The non-material obstacles however include, teachers' insufficient knowledge and skill, difficulty to integrate ICT in instruction, scheduling enough computer time for learners, inadequate teacher's time, lack of supervision and inadequate technical assistance.

Apart from Pelgrum (2001, p.173) and Adebi-Caesar (2012), others including Organization for Economic Cooperation and Development (OECD) (2009), British Educational Communications and Technology Agency (BECTA) (2004a), Asante and Owusu-Ansah (2015), Buabeng-Andoh and Yidana (2015) and Ghavifekr et al. (2016) have reported on some challenges with teachers' use of ICT in the classrooms.

A 2009 study conducted by the Organization for Economic Cooperation and Development (OECD) confirmed the existence of a number of barriers or challenges to the use of ICT in education. Such barriers included a significant variation in the number of computers, a shortage of technical assistance, and inadequate computer skills/knowledge among teachers (OECD, 2009). However, a number of other significant barriers were identified in a 2004 research report conducted by the British Educational Communications and Technology Agency (BECTA). Lack of confidence, accessibility, time constraints, fear of change, a lack of understanding of the benefits

of ICT, and age were among the barriers reported by (BECTA, 2004a). Meanwhile, in another study, Asante and Owusu-Ansah (2015) found the supply of electricity, teacher expertise and inadequate ICT infrastructure as being the challenges associated with the implementation of the "One Laptop Per Child Policy of Ghana. In their study in Malaysia, on issues and challenges regarding ICT use in schools, Ghavifekr et al. (2016) identified challenges encountered by teachers. These challenges include limited accessibility to network and network connections, limited technical support, lack of effective training, inadequate time and lack of skill/competence.

These challenges though identified differently, have some commonalities. The inadequate number of computers by Pelgrum (2001, p.173) relates to the variation in the number of computers by OECD (2009) and access to computers by BETCA (2004a). Lack of knowledge/skills in (Pelgrum, 2001, p.173) relates to computer skills and knowledge among teachers in (OECD, 2009). Difficulty scheduling computer time in (Pelgrum, 2001, p.173) relates to time constraints by BECTA (2004a), among other things. Some of these challenges identified above, will be considered for discussions.

There is no doubt that teachers using ICT tools in their classroom assessment will face some challenges from time to time. These challenges can be addressed with a regular supply of ICT tools in adequate quantities, regular training of staff on the use of ICT tools and pedagogical knowledge on ICT and assessment. Supply of electricity and internet availability could also be a challenge teachers using ICT could face and all of these should be addressed to allow for effective use of ICT in classroom assessment.

2.9.1 Availability of computers /ICT infrastructure

The availability of ICT infrastructure/computers is another important issue affecting ICT integration in schools (Ogbomo, 2011). According to Tabassum (2004), one of the most significant obstacles to ICT integration in schools is a lack of computer infrastructure. Research reveals a strong link between technology access and usage. Teachers believe that access to ICT infrastructure is one of the most effective ways to integrate ICT in classrooms, according to Yildrim (2007). Meanwhile, according to Bybee, Taylor, Gardner, Van Scotter, Powell, Westbrook and Landes (2006), appropriate access to technology infrastructure is an important factor in the successful integration of technology. Toprakci (2006) discovered that a lack of computers, old or slow ICT systems, and a shortage of educational computer applications in Turkish schools were all barriers to successful ICT implementation.

In Pelgrum (2001), as high as seventy percent (70%) of teachers reported that insufficient number of computers in schools was their challenge. This was considered the highest challenge due to the response rate of participants. This discovery was supported by Albirini (2006) when the researcher found in a study of Syrian schools, that one of the most significant barriers to technology integration in the classroom was a lack of computer resources. Also, an SRI International survey of teachers in developing countries found that majority of teachers in African and Latin American countries reported that lack of adequate hardware and software, as well as unstable internet access, were significant barriers to their use of computers in education (Bjorn, Herren & Hallow, 2008).

In many schools today, it is common to find that computers and other ICT tools and infrastructure are in serious shortage. This shortage consequently impact negatively on usage by the teachers and learners. This particular challenge has been reported by many researchers and has been linked particularly to African and Latin American schools.

2.9.2 Insufficient teacher' knowledge and skills in ICT

Pelgrum (2001, p.173) identified lack of skills and knowledge in ICT on the part of teachers as the second highest obstacle to ICT use in teaching and learning. Many teachers lacked the knowledge and skills to use computers and were unenthusiastic about incorporating computers into their teaching practices (New house, 2002). Accordingly, Asante and Owusu-Ansah (2015) reported on teacher expertise in ICT as being a challenge to the successful implementation of the "One Laptop Per Child Policy" in Ghana. Meanwhile, a report on ICT use in European schools was produced by Korte and Husing (2006). The data used for the report was derived from the survey of Head Teachers and Teachers in 27 European countries. According to the findings, teachers who do not use computers in the classroom assert that a "lack of skill/knowledge" is a barrier to their use of ICT for teaching. Habibu et al. (2012, pp.4-5) found that because teachers did not have enough training opportunities, majority of them lack the knowledge to use ICT in the teaching-learning process.

Teachers in the classroom were seldom seen using ICTs, because most teachers were unwilling to use new technology. Owing to the need to integrate new technologies into the classroom, teachers must be trained to use these tools. Therefore, some preliminary training is required for teachers to develop appropriate skills, knowledge, and attitudes toward the effective use of computers to facilitate teaching and learning

(Habibu et al., 2012, pp.4-5). However, contrary to other studies, all 516 student teachers in the study (which was conducted by Albion in 2007) were found to be competent at finding information on the internet. As a result of their high ICT knowledge and familiarity, the respondents displayed high levels of confidence and competence, according to the findings. It is argued that when a person's skill and knowledge in information and communication technology (ICT) is high, they normally feel competent in their ability to use the technology (Albion, 2007).

When ICT tools are made available, one key thing that helps to utilize them purposefully is knowledge and skills of the user. So if teachers lack the knowledge and skills to use the tools manually and pedagogically, even when they are available in abundance, they will be left unused. Therefore regular pre-service and in-service training of teachers in ICT use should be encourage by educational authorities and policy makers.

2.9.3 Difficulty in integrating ICT into instruction and assessment

It is important to note that the ICT in education policy of Ghana does not clearly spell out how technology should be integrated into the school curriculum (instruction and assessment) at all levels of education, especially the kindergarten level. Guidelines and principles of integration have not been made known to teachers in any documentary form. This makes the issue of developmental appropriateness difficult to understand and apply by many teachers. It also makes integration difficult since teachers are not guided by policy on integration process of ICT into their practice. Many studies on the status of ICT integration into education also found a lack of integration into the existing context of school curriculum in many schools due to the difficulty teachers have with the whole concept of ICT integration. In their study,

Sarfo and Elen (2007) noted that, while instructors were innovative and easily overcome their challenges, technology was not consistently integrated both as a tool for learning and as a tool for teaching. Reynolds, Treharne and Tripp (2003) also mentioned the difficulties teachers have in adopting ICT into practice and the need for more research into how ICT can improve education.

The provision of proper in-service training for teachers to show them how to use these new tools in their daily teaching practices technically and pedagogically is a decisive factor in the efficient integration of computer use in the school curriculum. According to the IEA study in 1989, a fair number of teachers had some experience with in-service computer training, but most of the programs at the time emphasized on the need for technical rather than pedagogical and didactic aspects of computer use. The pedagogical and didactic aspects of using ICT in the classroom are not the focus of in-service training, but the technical aspects (Lai, Pratt & Trewern, 2001).

The curriculum was identified as the most significant barrier to ICT use in some studies. One of the most significant barriers to integrating ICT in the classroom, according to 81.4 percent of teachers, is the length of the curriculum. This explains the difficulties that many teachers face when attempting to integrate technology into the classroom practices. Particularly, participating teachers were concerned about two factors: the pressure to cover required content and the limited timeframe. During the interview, one of the teachers stated, that the completion of the entire curriculum is impossible in a school year. Besides that, there is lack of supporting materials for each learning unit because the current curriculum and school manuals do not specifically include ICT integration. As a result, teachers devote a significant amount of time to locating, evaluating, revising, and adjusting learning materials, activities, and tools to

meet the students' needs as well as the needs of the curriculum (Vrasidas, Pattis, Panaou, Antonaki, aravi, Avraamidou & Theodoridou, 2010, p.443).

The school curriculum encompasses teaching and learning and assessment. Therefore evidence of failure to integrate ICT in school curriculum should not be limited to teaching and learning but should include its integration into assessment of learners. When even teachers integrate ICT into their teaching and learning without integrating it into assessment, the integration cannot be considered as comprehensive. For teachers to be able to effectively integrate ICT into teaching and learning and assessment (curriculum), manual (integration guide) for integration should be provided by the education ministry to introduce teachers to what is required of them at each level; particularly on how to use ICT as both pedagogical tool, technical tool and assessment tool.

2.9.4 Difficulty scheduling computer time/teacher's time

The fourth highest challenge facing teachers in their use of ICT is scheduling of computer time for themselves and their learners. From the 24 participating countries in the study, including China, Japan, Norway, South Africa, New Zealand and Italy among others, fifty eight percent (58%) of the participating teachers reported that time was an obstacle to their use of ICT in education (Pelgrum, 2001, pp. 171-173). Significant number of recent studies have shown that many teachers have skills and confidence in using classroom computers, but still do not use them because they lack the time do so. A considerable number of investigators found time limitations and the difficulty in programming sufficient computer time for classes as a barrier to ICT use in teaching by teachers (Al-Alwani, 2005; Becta, 2004a; Beggs, 2000; Schoepp, 2005).

According to Becta (2004a), teachers face a lack of time problem in many aspects of their work, affecting their ability to complete tasks, with some of the teachers specifically stating which aspects of ICT use require more time. The time required by teachers in their use of ICT include the time to find guidance from the internet, prepare lessons, explore and practice the technology, address technical difficulties and receive adequate training. According to Vrasidas et al. (2010), time was mentioned by all of the teachers on several occasions in their study. In the large-scale survey, 71.7 percent of teachers cited time required to integrate ICT in the classroom as a key obstacle, while 60.4 percent cited the time required to prepare ICT-based activities as an obstacle. From the perspective of the teachers, planning lessons that incorporate ICT is a time-consuming activity. Teachers therefore do not use technologies in their classrooms because of time as a source of hindrance.

Every single activity, particularly in classroom is dependent on time. Already, the classroom activities for various lessons consume a lot of time, so adding ICT compounds the problem if the activities are not properly planned and followed by both teachers and learners. It is important therefore to relook comprehensively at the entire school program and reschedule the classroom activities to include the pedagogical use of ICT by all teachers.

2.9.5 ICT support services available to schools

ICT support or maintenance by ICT technicians, according to Korte and Husing (2006), will allow teachers use ICTs and computers without wasting time fixing issues. This allows teachers to devote more time to teaching the necessary ICT skills to their students. However, many researchers have identified technical support as one of the major challenges teachers face when attempting to adopt and use ICT in

classrooms or schools (Gomes, 2005; Pelgrum, 2001; Toprakci, 2006; Ghavifekr et al. 2016; Ogbomo, 2011). Pelgrum (2001, p.173) for example, identified lack of technical assistance as part of the top ten challenges discovered in the 24 nations' study conducted on challenges teacher face when using ICT in education. Technology users who want to learn how to use computers won't be able to overcome the obstacles if they don't have good technical support (Lewis, 2003).

According to Jones (2004), computer failure causes disruptions in the teaching process. Due to a lack of technical support, computers may not be repaired on a regular basis, resulting in teachers not using computers in the classroom activities. As a result, teachers will be hesitant to use computers for fear of equipment failure, as no one will be available to provide them with technical assistance if a problem arises. ICT integration in teaching, according to Gomes (2005), necessitates the presence of a technician, and if one is not available, there can be a barrier. However, Adebi-Caesar (2012, p.44) argues that schools must recognize the need to hire more highly qualified technical staff as computers become more sophisticated and the range of software used by schools expands. But, due to budget constraints and competition from the commercial sector for the best employees, schools may be finding it increasingly difficult to recruit and retain technical staff with the necessary skills and experience.

Since the use of technological devices can be disrupted by equipment failure, there is always the need to have someone who is technically inclined to help fix the fault or provide immediate assistance at the school level. The schools' ICT teachers can greatly play this role and ask for external support when it is necessary to do so. The school ICT support service personnel helps to ease the tension that will mount on the classroom teacher when his teaching activities are disrupted by equipment failure.

However, the ICT support service personnel also needs to be well equipped with the needed tools and skills to carry out their support duties.

2.9.6 Electrical power outage

Irregular supply of electricity refers to the frequent power outages that occur either as a result of technical fault, shortage in the supply of gas to power the thermal plants or reduction in water levels at the hydro power stations. According to Ogbomo (2011, p.14-15), unstable supply of electricity was identified as one of the challenges that hindered the use of ICT in Nigerian schools and institutions. This has resulted in the use of alternative power supply like batteries, solar panels and standby generators in some cases. The alternative sources of power come with undue cost, making the choice of any such alternatives unfavourable to the power users. Irregular supply of electrical power turned the whole ambition of enhancing education with use of ICT into a mere dream. Electrical power supply was also cited by Asante & Owusu-Ansah (2015) in a related study conducted in the Eastern Region of Ghana, on the implementation of the one laptop per child policy. A total of 41.6% (208 respondents) out 500 respondents reported power supply as a challenge to the use of the laptops and the implementation of the one laptop per child policy. Significantly, it was the highest challenge identified in the study among other challenges.

Since computers and most ICT tools and infrastructure depend mainly on electricity to operate, the absence or irregularity of its supply can hinder ICT usage in the process of enhancing teaching and learning. Ghana and Nigeria being located in the same sub region, could be the reason for the similarity in the findings by Ogbomo (2011) and Asante and Owusu-Ansah (2015) around the same period. The frequent power

outages can disrupt classroom activities that are supported with ICT tools and can in most cases cause damage to the ICT tools.

In Nigeria, irregular supply of electricity was cited as haven made the use of ICT tools difficult around the year 2011. In 2015 irregular supply of electricity was identified as a challenge to the use of ICT in schools in Ghana. To address this situation, alternative power supply should be considered though it may come with some financial cost.

2.10 Gender and ICT Tools

Literature proves the existence of differences in gender with respect to the use of ICT by learners (student/pupils) but not much is known about the teachers (Dawson, 2008).The difference in gender plays significant role when using ICT in education (Reinen & Plomp, 1997). Using 929 teachers in their study, Jamieson-Proctor, Burnett, Finger & Watson (2006) found male teachers use ICT in their teaching and learning often than their female counterparts. The reason being that the male teachers undertook programs of study in ICT. Issue associated with gender difference in the use of ICT, include the gender digital divide that can be witnessed by the way the digital tools are accessed and used (Morahan-Martin, 2000; Etta, 2005). However, Morahan-Martin (2000) indicates that when it comes to the use of internet, there is no difference between male and female. Morahan-Martin (2000) even concluded that the gender difference in the use of digital or ICT tools has disappeared.

In a study in Ghana, Natia & Al-hassan (2005) found a wide gap between male and female teachers regarding their adoption of ICT tools to conduct research and to teach. While 31% of female teachers at the Junior High schools teach using ICT, 50%

of their male counterparts also teach with ICT. In Primary schools however, more female teachers (69%) use ICT tools to teach as opposed to their male colleagues (50%). The percentage of male teachers using ICT to teach at primary school levels (50%) is equal to the percentage of male teachers using ICT to teach at the junior high school levels (50%), but fewer female teachers (31%) at the Junior High School levels teach with ICT tools while more female teachers (69%) in the Primary schools teach with ICT tools.

Apart from the disparity in terms of access and use of ICT tools, as opined by Morahan-Martin (2000) and Etta (2005), level of skills, attitude towards the use of the ICT tools as well as views about the use of ICT, are areas where the difference in gender with regards to use of ICT tools by teachers may manifest. Gebhardt et al. (2019) believe that although differences exist between male and female teachers when it comes to ICT adoption and integration, the differences are very little. Such differences may depend on countries of origin. Mahmood and Bokhari (2012) also stated that gender differences exist in experiences with ICT tools.

There seem to be no clear view about the role of gender on ICT use. Whilst some think significant form of differences exist, others think no significant differences exist. Nonetheless, whether or not significant differences exist between male and female teachers in their use of ICT tools, depends largely on the geographical location of the conduct of the study.

2.10.1 Influence of gender on teachers' access and the use of ICT tools

There are no regulations limiting the use of ICT on gender lines. Fomsi and Orduah (2017, p.90) opined, that as a result of in-discrimination on gender basis, teachers in a model school in River State, Nigeria, were provided with unbiased in-service training with respect to the use of ICT as a pedagogical tool. However, Teo (2008) argued that regardless of the non-discriminative training to teachers on ICT use, gender still influence the use of ICT, particularly as a pedagogical tool. In another study involving 25 male and 75 female teachers, on the issues and challenges from teachers regarding ICT use in teaching and learning, Ghavifekr et al. (2016) noted significant differences among male and female teachers in their use of ICT tools for teaching and learning in classrooms. More male than female incorporated ICT into their teaching and learning.

However, Fomsi and Orduah (2017, p. 93) found in their study that no differences exist between male and female teachers in the model primary school in River State, Nigeria, in their use of ICT but found some little differences among male and female teachers in local government schools of the same area, in the same study. The absence of disparities among male and female teachers in the model primary school was associated with the in service training received by the teachers prior to the study.

The 2006 study by SITES, conducted globally on pedagogical adoption and ICT use in schools, which focused on mathematics and science, reported a higher ratio of male teachers using ICT to teach. The disparity in gender may be linked to cultural, social, historical and other factors than specific differences in adoption of ICT (Law, Pelgrum & Plomp, 2008). It is obvious that most of the studies are reporting on existing differences between male and female teachers in their use of ICT (for example, Fomsi & Orduah, 2017; Teo, 2008; Ghavifekr et al., 2016; Law et al, 2008).

In a related study, Mahdi and Al-Dera (2013) also found that some differences exist between male and female teachers. Male teacher reported having access to internet but no female teacher reported any access to internet in their offices. A significant number of male teachers (90.6%) accessed and used computers in teaching as opposed to the female teachers (50%). The study however found no differences among male and female teachers when it comes to using ICT in language teaching.

There is no discrimination on gender lines on access to ICT tools. Equally, there is no discrimination on gender basis when providing training on ICT use to teachers. There is therefore no regulation that seeks to deny male or female teachers access to any form of training on ICT use.

2.10.2 Views of male and female teachers on the use of ICT

Gender is said to influence the use of ICT pedagogy (Teo, 2008). There are claims that male teachers spend more time exploring new technologies, especially electronic ones, compared to female teachers (Schumacher & Morahan-Martin, 2001; Yuen & Ma, 2002). Recent research, however, suggests that the differences are neither large nor consistent across countries (for example, Gebhardt et al., 2019). Ertner, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur (2012) noted the significance of teachers' views about teaching, as well as their interest in using technology to extend learning, and types of technology they use in classrooms. The questions in ICELS 2013 examined the role of ICT in education, for which reason, data was collected from participants to identify two orthogonal dimensions: optimistic views versus pessimistic views (Fraillon, Ainley, Schulz, Friendman & Gebhardt, 2014). This implied that one could share in both points of views at the same time. Teachers who believed that ICT could be useful in education had a higher use of ICT for

pedagogical purposes, whereas those who didn't believe ICT could be educationally purposeful tend to limit its use (Fraillon et al., 2014). However, Fraillon et al. (2014) did not seek to identify gender differences in this case.

There are two views when it comes to ICT use. The optimistic view and the pessimistic view and these views cut across gender lines. However the difference in the views between male and female is insignificant or inconsistent across countries.

2.10.3 Teacher's knowledge and confidence with the use of ICT tools

Results from different studies revealed that men on average develop self-efficacy quicker on computers than women. Significant variance was observed between genders in technical capability, and male outperformed female on situations of sustainability and consistency (Todman, 2000). According to the European Commission (2013), teachers who are comfortable with technology are more likely to use it in their classrooms. Meanwhile, Scherer and Siddiq (2015) examined ICILS 2013 teachers' data from Norway and discovered three aspects of teacher ICT self-efficacy: basic operational skills, a combination of advanced operational and collaborative skills, and computer use for instructional purposes. Male and female teachers had the same structure, according to Scherer and Siddiq (2015), though there were some differences in some aspects.

However, there were no significant gender differences in the confidence level of the teachers in using computers for instructional purposes, though male teachers had higher self-efficacy in both basic and advanced operational skills. Male and female pre-service teachers' self-reported technical ICT capabilities differed, according to Markauskaite (2006). Sang, Valcke, van Braak and Tondeur (2010), on the other

hand, found that after mediating variables were taken into account, gender had no effect on teachers' ICT self-efficacy, attitudes toward computing, or teacher prospective computer use. Self-report data has been used in the majority of studies that have looked at teachers' ICT skills. However, one of the few teacher performance assessments found three ICT skill factors: basic digital skills, advanced technical skills, and professional ICT skills (Kaarakainen, Kivinen & Vainio, 2018).

Male teachers usually show higher technical ability than their female counterparts but no significant gender differences exist between male and female teachers on their confidence levels when using ICT for teaching and learning. In short, gender influence on ICT use is insignificant and irregular. Training levels and geographical locations of individual may account for the level of difference that may arise and not necessarily gender.

2.11 Summary of Review of Related Literature

The Unified Theory of Acceptance and Use of Technology (UTAUT) was used to guide the study. This theory holds that the usage behavior of an ICT user is influenced by some four key determinants. These determinants include performance expectancy, social influence, effort expectancy and facilitating conditions. For literature on available types of ICT tools in kindergarten classrooms, personal computers, tablet, pen drives, mobile phones, radio and television among other things were cited as the ICT tools that can be found in the kindergarten classrooms and can be employed in classroom assessment practices of teachers. The literature reviewed on the various ways of using ICT tools in classroom assessment practices highlighted the key role of ICT tools with respect to classroom assessment practices. The various ways of ICT use in classroom assessment practices identified in the literature include sharing of

assessment findings, analyzing assessment data, constructing assessment tasks, administering assessment tasks on ICT tools, scoring assessment tasks, constructing e-portfolios on learning and storage of assessment data; these practices were thoroughly examined. For teachers' level of knowledge in the use of ICT tools in classroom assessment practices, the literature indicates that there are varied levels of knowledge, ranging from beginner, intermediate to proficient. However, in-service training of teachers on ICT use was identified as an important factor to addressing teachers' knowledge gap in ICT use in classroom assessment practices. For challenges on ICT use in classroom assessment, the literature accordingly identified inadequate ICT tools, lack of internet coverage, lack of technical support from experts, lack of electricity, inadequate knowledge in the use of ICT tools and inadequate time for ICT integration into classroom assessment among other things, as the challenges confronting the ICT user in the classroom. While some researchers point out that gender plays a significant role in ICT use by teachers, others have argued that the role of gender is insignificant. However, assessment of previous studies on ICT use in education revealed that previous researchers focused more on teachers' use of ICT tools in just teaching and learning with little or no attention on kindergarten teachers' use of ICT tools in classroom assessment practices. This gap was filled by this current study.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter explains the study's methodology. The researcher discusses the study's paradigm, approach, design, population, sample size and sampling technique, instruments used in the study for data collection, instrument validity and reliability, and ethical issues involved in data collection.

3.1 Research Paradigm

The research paradigm for this study is the positivist paradigm. Fadhel (2002) described the positivist paradigm as a world view of research that tries to establish the relationship that exist between the cause of an action and the resultant effect of that action by examining the facts collected using scientific methods. While Kuhn (1962) holds that paradigm is a philosophical view, Mackenzie and Knipe (2006) think that it is a description of a researcher's views about his world. Kuhn (1977) defined a research paradigm as a set of philosophical views, including assumptions that a group of researchers share which distinguishes them ideologically from other groups of researchers. Denzin and Lincoln (2000) also argued that paradigms in research are research principles that guide a researcher, show where the research belongs and give an understanding of the data gathered by the researcher.

Importantly, paradigms guide research in given disciplines by dictating procedures for the conduct of studies. It also portrays the philosophy the researcher aligns with (Denzin & Lincoln, 2000). Research paradigm is also important because Willis (2007) is of the view that it will serve as a framework to a study, showing researchers

how to carry out their research studies. There are about four different paradigms in educational studies. These paradigms are, the positivist paradigm, constructivist paradigm, transformative paradigm and pragmatic paradigm. The researcher chose the positivist paradigm. The researcher chose the positivist paradigm because, it relies on quantitative data which by nature is highly reliable (Cohen, Manion & Morrison, 2000). According to Cohen, Manion and Morrison (2000), conclusions drawn in research studies with this paradigm should be dependent on the research hypothesis formulated and the results realized. This paradigm, relying on experiment or survey as methodology can be used to collect data to check the cause and effect relationship between the variables under study (Smith & Heshusius, 1986).

Positivist paradigm also allows researchers to involve a broader number of participants and can cover broader situations within limited timeframe (Nel, 2016). However, Nel (2016) points out that one of the short falls of the positivist paradigm is that the findings do not give details of a situation or an occurrence, it only describes it.

3.2 Research Approach

The research approach used for this study was the quantitative approach. Quantitative approach involves the use of figures and statistical values. We have qualitative, quantitative and mixed method approaches to research (Creswell, 2014). Research approaches are detailed proposed plans and procedures used as methods for collecting, analysing and interpreting research data (Chetty, 2016). They serve as a guide for collecting data, analysing the data, interpreting the findings and reporting on the findings (Grover, 2015). The researcher chose quantitative approach because, Creswell (2014) stated that a quantitative research approach is an approach that aligns itself with testing of research objectives and hypothesis in order to establish the

relationship that exist between the variables being studied. In quantitative approach, experimental and survey strategies can be used (Creswell, 2003). The data gathered through quantitative approach are quantified and analysed statistically to confirm or disconfirm assumptions or claims made. Chetty (2016) argued that quantitative approach can be used to examine the relationship between variables in a study. Creswell (2014) is also of the view that quantitative approach provides protection to the researcher against bias; as the variables are measured using statistical tools (Chetty, 2016) and allows for generalization of research findings (Creswell, 2014). Findings from quantitative approach are communicated clearly using statistics and figures and that enables others to appreciate the findings in value terms (Chetty, 2016).

3.3 Research Design

Base on the phenomenon being investigated, the researcher chose the descriptive survey design. According to Shuttleworth (2008), a descriptive survey is a scientific technique used for collecting data from a population of interest, through observation or description of participants, without any form of manipulation. According to Kirshenblatt-Gimblett (2006), a research design is the overall strategy one chooses to integrate the different components of the study in a coherent and logical way. A research design lays out the steps that must be taken to carry out any investigation (De Vos, 1998). Katundu (1998) states that the purpose and the objectives of a research study determines the type of research design to adopt. The collection of data from a population or some of its members to be used to understand their present status using a variable or more variables is termed as descriptive survey (Gray, 2004). Descriptive research involves collecting data in order to have hypothesis tested or research

questions concerning the current status of the subject understudy answered (Gay, 1992, p.217). It involves the gathering of information about people on their previous experiences about something, their attitudes, their opinions regarding something and their characteristics among other things, using questions from which responses will be tabulated (Paul & Jeanne, 2015). The design is very suitable for educational studies that asses opinions of individuals, attitude, their background information, the procedure of doing things and status or condition of subjects or participants (Sincich, 1993). The main aim of a descriptive research is the description of phenomenon and the description of the characteristics of the subjects or participants, with a lot more focus on "what" than "why" and "how" certain things occur (Gall, Gall & Borg, 2007). Descriptive survey design allows researchers to collect data that allows them to give comprehensive description of a phenomenon than they could do using other research designs (Fox & Bayata, 2007, p45; Busha & Harter, 1980) because the design can be used to asses opinions of individuals, attitude, their background information, the procedure of doing things and status or condition of subjects or participants, all at a go (Sincich, 1993). Besides, a study conducted using the descriptive research design determines and alongside reports things exactly the way they are (Gay, 1992, p.217). Using this design, views, opinions and characteristics of participants are keenly recorded in details just as the camera captures details of an ongoing activity swiftly (Paul & Jeanne, 2015). It establishes the characteristics of participants and the relationship that exist between the characteristics and their experiences as well as their behaviour pattern (Zurmuehlin, 1981, p.54). In descriptive survey however, participants may not be truthful in responding to the questionnaire questions, but it is still chosen among others as being the best because of its

descriptions and interpretation of variables and the description of the relationship that exist between them (Gay, 1992).

3.4 Population

The population for this study was the entire Kindergarten 1 and Kindergarten 2 teachers of public schools in the Asikuma-Odoben-Brakwa district with a total number of 193 kindergarten teachers (37 male and 156 female) from 98 kindergarten classrooms. According to Polit and Hungler (1999), population refers to the entire group of people in whom the researcher is interested and to whom the findings can be generalized. Creswell (2012) emphasizes that population is a collection of people with traits in common.

The researcher used only kindergarten teachers in public schools in the district because the district directorate of education could not provide him with data on private schools and private school teachers in Asikuma Odoben Brakwa district. Further to that, job insecurity of the teachers in the private schools could affect the availability of some of them in the course of the study. That notwithstanding, a good number of them may not have acquired professional teacher pre-service training and training in pedagogical use of ICT.

3.5 Sample size

The researcher used the entire population of 193 kindergarten 1 and 2 teachers (37 male and 156 female), from the 98 public schools for the administration of the questionnaire. The researcher chose to use all the 193 kindergarten teachers because they form the total population of the kindergarten teachers of the public schools in the district and they are identifiable. The cost of reaching them was also within the means

of the researcher. Aside that, using the whole kindergarten 1 and kindergarten 2 public school teacher population of the district, will give the researcher a very accurate information (Lavrakas, 2008) on the teachers' use of ICT tools in classroom assessment practices. Fraenkel & Wallen (2000) recommended a 100 or more participants for a descriptive survey and the population for this study is within that recommendation. Meanwhile, according to Fricker (2008), an entire population of interest to a researcher can be used in a study if the researcher can identify all the members and has the means to withstand the financial constraint that comes with the technique. Aside that the population was heterogeneous (male and female) in nature. The researcher therefore used the entire kindergarten 1 and kindergarten 2 public school teachers in the study. The respondents were given questionnaire to respond to and their respective classrooms were also observed for available types of ICT tools.

3.6 Sampling Techniques

The researcher used census technique to select respondents for this study. Johnson and Christensen (2014) stated that census is the study of the whole group of a population of interest to the researcher. According to Fricker (2008) when the aim of a study is to include all units of the target population, it is conducted as census. The researcher chose census because Fricker (2008) points out that researchers can use census only when it is possible to identify the entire population of interest and when the time and financial constraints are within their means. Additionally, Lavrakas (2008) argued that in most cases, census is the only technique that can provide the researcher with very useful information on a population located in a small geographical area and finally Lavrakas (2008) posits that it is devoid of sample error and can give a more accurate information compared to sample survey.

Mugo (2002) defined sampling as the procedure for the selection of a suitable representation of a population, to determine parameters or characteristics of the entire group or population. The samples of a study are extracted from the population using sampling processes to enable the researcher to undertake an investigation of a relatively small section of the population targeted (Sarantakos, 2013 p.167). Findings from the sample can be generalized to the entire population of interest by the researcher (Johnson & Christensen, 2014). However, instead of choosing samples from a population, researchers can use an entire population of interest. This technique is called census.

3.7 Instruments for Data Collection

The researcher used both questionnaire and checklist to collect data for the study. The questionnaire for the study was adapted from Singh and Chan (2014), on knowledge level of teachers in using ICT, the obstacles teachers face when using ICT tools in teaching and learning and the use of ICT for teaching and learning by teachers. The checklist was also administered in the participants' classrooms by the researcher to identify the available types of ICT tools in the kindergarten classrooms in the district. The researcher collected data with the questionnaire alongside the checklist and analysed both quantitatively. Both instruments were used to complement each other in order obtain a richer data. Both the questionnaire and the checklist were self-administered by the researcher. While data on research questions 2, 3 and 4 were collected using the questionnaire, data on research question 1 was collected using the checklist.

Questionnaire: Questionnaire is an instrument used for data collection in which research participants provide self-report data as part of the research study to enable the researcher elicit the needed information. Questionnaires are used by researchers to gather information about participants' thoughts, feelings, attitudes, beliefs, values, perceptions, personalities, and behavioral intentions. To put it another way, researchers use questionnaires to try to measure a wide range of characteristics (Johnson & Christensen, 2014)**.** The questionnaire used was a Likert scale type of questionnaire. According to McLeod (2019), Likert scale questionnaire is a rating scale that allows respondents to express how much they agree or disagree with a particular statement. It can be used to measure variations such as "agreement ", "frequency ", "quality ", "importance" and "likelihood ".

The Likert questions are easy to understand. The alternatives allow respondents to be neutral if they choose to and the questionnaire can be sent to respondents without the researcher having to be there personally (Cleave, 2017); meanwhile Likert scale questions allow the researchers to quantify opinion-based items (Nandan, 2010). The researcher modified the adapted Likert scale questionnaire from Singh & Chan (2014) from 4 point Likert scale questionnaire designed to assess teachers' knowledge in the use of ICT tools for classroom instruction, assess ways of using ICT tool in the classrooms and assess the challenges teachers are confronted in their use of ICT tools to a 5 point Likert scale questionnaire designed to assess and collect data on teachers' level of knowledge in the use of existing ICT tools in classroom assessment practices, the various ways of using existing ICT tools in classroom assessment and the challenges teachers encounter regarding the use of the existing ICT tool in classroom assessment. This is because, studies have shown that in a 5 point Likert scale, the

statements or alternatives to select from are neither too long nor too short; as a result, it increases the rate of responses by participants and as well increases response quality, while it reduces the respondent's level of frustration. The 5 point Likert scale questionnaire allows respondents to remain neutral (rather than being forced to choose an option that does not reflect their thinking) and allows for a smaller error margin, as any scale without a neutral option can distort results and cause doubt as to how valid the survey results are. Meanwhile, it helps to provide reliable and relatively easy to analyze quantitative data. Because the 5-point scale is the most common (universal) method for data collection, the format aligns well with a vast library of scientifically validated questions and comparative external benchmark data (Newson, 2021).

The questionnaire used in the study was in four (4) sections; section A, section B, section C and section D. The four sections had thirty-three (33) items in all for the participants to respond to. Each section was used to elicit different form of information from the participants. Section A was used to collect background data of kindergarten teachers in the study, section B was used to determine how ICT tools are used in classroom assessment of teachers. Meanwhile, section C was used to elicit information from teachers on their level of knowledge in the use of ICT tools in classroom assessment practices. But section D was used to identify challenges teachers encounter when using ICT tools in their classroom assessment practices (see Appendix D).

Checklist: Checklist is a guide for data collection used in different fields with a number of items to be checked if found present or appropriate (Nicolas, 2021). Checklist helps users to ensure that all items outlined for consideration are indeed considered and completed. According to Reijers, Leopold and Recker (2017),

checklists are a type of information artefact used to conceptualize what users really want to carryout and the decision thereafter. Accordingly, checklists describe and guide data collection. Nicolas (2021) argued that checklists are useful in determining whether an individual item listed by the researcher for data purposes are available or not available.

However, the checklist used in this study was developed with a list of twenty (27) ICT tools used in the classrooms to enable the researcher identify the types of ICT tools that are available in various public school kindergarten classrooms in the district. The checklist' alternative items to be checked or marked in the columns included: "Available (2)" and "Not Available (1)" - (see Appendix C).

3.8 Trial Testing of Instrument (Questionnaire)

Trial testing of instrument in research, is the process of trying out a data collection instrument like questionnaire to determine if the instrument is able to do exactly the work it has been designed to do and whether the instrument can produce the same results repeatedly. For the researcher to ensure that the questionnaire (instrument) is reliable and valid, he carried out a trial testing of the instrument. According to Middleton (2019), validity relates to the accuracy with which a research method or instrument can do the work it is planned or designed for. Drost (2011) explained that when an instrument collects data exactly the way the researcher intends to use it, it is said to be valid. However, Middleton (2019) states that reliability relates to how a method or instrument is able to consistently produce the same result. For Drost (2011), reliability refers to having recurring findings even when a different set of individuals are to use different methods or instrument to collect and analyse the data. Colleague students were engaged to read through the questionnaire and the researcher

also engaged the services of an expert to have the questionnaire comprehensively reviewed prior to trial testing.

The trial testing was carried out in schools in Agona West district. Agona West district was selected because of its closeness to Asikuma-Odoben-Brakwa and the fact that the participants have similar characteristics of interest to the researcher (they are public school kindergarten teachers, have received training on ICT use during their professional training during the pre-service stage and are of male and female too. Above all, they are also involved in the implement of the standard base curriculum). The trial testing was conducted on 10 participants after which the needed review was done to improve validity and reliability in the use of the instrument. According to Johnson and Christensen (2014), it is a must to test questionnaire prior to using it in a research study to ensure that it functions properly. However, testing of instruments must be conducted with a minimum number of five to ten participants.

After the trial testing of the instrument, questions that needed to be reviewed or improved to allow for specific and accurate responses by participants were looked at. The need to scrutinize data gathering instruments, according to Nevell (1993), is to identify ambiguity and misleading questions, and as well suggest ways of improvement. The Cronbach Alpha Reliability Coefficient for the tested questionnaire was computed on section B, C, and D of the questionnaire questions using IMB SPSS version 20 and was found to be 0.825 (see Appendix E). According to George and Mallery (2003), a cronbach alpha reliability coefficient value of 0.80 or greater is considered good and therefore shows a higher level of internal consistency of the items in the given questionnaire.

3.9 Ethical Considerations

According to Payne and Payne (2004), ethical considerations are the embodiment of a moral stance that is involved in the conduct of research to achieve not only high professional standards of technical procedures, but also to respect and protect the participants in the study. Accordingly, the participants were assured that any data collected from or about them will be kept confidential (Fraenkel & Wallen, 2000). The consent of the respondents was officially sought through an introductory letter sent to the district directorate of Ghana Education Service. Approval was obtained before data was collected from the participants. Upon the receipt of approval from the district education directorate in Asikuma Odoben Brakwa on the 12th of July 2021, data collection started on Wednesday, the 14th of July, 2021 and ended on Thursday, the 23rd of September, 2021. The anonymity and the confidentiality in keeping and using the data provided by the respondents was assured them by the researcher. Significantly, the respondents were assured that the information provided by them to the researcher will strictly be used for the purpose of this study only. Johnson and Christensen (2014) hold the view that ethics should necessarily be made part of the development and implementation of all research studies.

3.10 Data Collection Procedure

The researcher, with an introductory letter from the University of Education, Winnebe, applied to the Ghana Education Service, Asikuma Odoben Brakwa district for permission to collect data from kindergarten teachers in the district for the study. When permission was granted the researcher, the researcher proceeded to the field with the permission letter to the 98 public basic schools in the district to collect the data.

The administration of the instruments was done by the researcher himself. Due to the scope of the study and school vacation around the period, data collection lasted for about 2 months. 193 copies of questionnaire and 191 copies of checklist were administered on the 193 participants and 191 kindergarten classrooms respectively. All the 193 (100%) questionnaire were responded to and returned to the researcher. Babbie and Mouton (2001) have argued that a return rate of 70% in questionnaire administration is good.

3.11 Data Analysis

Descriptive statistics (percentages, mean and standard deviation) was used to analyse and interpret data on research questions 1, 2, 3 and 4. Meanwhile, data on the research hypothesis was analysed using inferential statistics (Independent sample t-test). The results were presented in tables to enhance clarity of the findings.

The data was organized, coded and fed into the computer using the Statistical Product for Social Sciences (SPSS) version 20. The data on the use of existing ICT tools was computed and ran with Independent Sample T-test to respond to the research hypothesis raised in the study.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 Overview

This chapter presents the data collected in the study. Questionnaires distributed to respondents were 193 in number and all of them (100%) were returned. The data was analysed using Statistical Product for the Social Sciences (SPSS) software application (IMB SPSS versions 20). The data on research questions 1, 2, 3, and 4 were analyzed in the form of descriptive statistics. However, in analysing data to respond to the research hypothesis raised, inferential statistics (independent sample t-test) were employed. SPSS was chosen because Foley (2021) argued that it is the standard for social science data, it is user-friendly and has impressively thorough user manual. According to Bhatia (2018), descriptive statistics is the first level of quantitative data analysis used by researchers to summarize data and find patterns. The commonly used descriptive statistics include mean, median, mode, percentage, frequency and range. In the view of Bhatia (2018), descriptive statistics help researchers to find sequence or pattern of occurrences under study, provide absolute numbers and is most appropriate when the researcher does not intend to generalize the findings to the larger population. Inferential statistics however, is the analysis of research data to establish relationship between two or more variables so that researchers can predict outcomes and generalize their findings (Bhatia, 2018). Inferential statistics is used for comparing two or more samples/variables to find differences. It can be used to analyse data for the purposes of generalizing the findings to a wider population of similar characteristics (Tarek, 2019).

There are 6 sections in this chapter; first section is for background information, second section is on the first objective (the types of ICT tools available in the kindergarten classroom), the third section is on the second objective (how ICT tools are used in classroom assessment), the fourth section is on the third objective (kindergarten teachers' level of knowledge in the use of ICT tools in classroom assessment practices), the fifth section is on the fourth objective (challenges teachers encounter in the use of ICT tools) and finally, the sixth section is on research hypothesis (gender differences between kindergarten teachers in the use of ICT tools).

4.1 Background Information

The background information of respondents was collected on gender, age, professional qualification, teaching experience and length of ICT use in teaching kindergarten pupils. The information is presented in tables 1, 2, 3, 4, 5 and 6 below;

Table 1: Gender of respondents (n= 193)

Gender	Frequency	Percentage
Male	37	19.2
Female	156	80.8
Total	**193**	**100**

Source: Field Data; September, 2021

As shown in table 1, male respondents were 37 representing 19.2% of the population and the female respondents were 156 representing 80.8% of the population. This therefore means that there are more female teachers at the kindergarten level in Asikuma Odoben Brakwa district than male.

Table 2: Age of respondents (n= 193)

Age	Frequency	Percentage
20-29 years	59	30.6
30-39 years	97	50.3
40-49 years	29	15.0
50-59 years	8	4.1
Total	**193**	**100**

Source: Field Data; September, 2021

The ages of the respondents ranged between 20 to 59. From table 2, 59 teachers, representing 30.6% were between the ages of 20-29. 97 teachers, representing 50.3% were between 30 – 39 years; 29 teachers, representing 15.0% were between 40 – 49 years but only 8 teachers, representing 4.1% were between 50 – 59 years. There were more teachers (97=50.3%) in the 30 – 39 age bracket and (59=30.6%) in the 20 – 29 age brackets. This implies that most of the teachers are still young and could be more familiar with modern technology used in the classrooms.

Table 3: Professional qualification (n=193)

Professional qualification	Frequency	Percentage
Diploma	142	73.6
Degree	51	26.4
Total	**193**	**100**

Source: Field Date; September, 2021

From table 3, it can be observed that there are only two professional qualifications of teachers; diploma and degree. Teachers holding diploma were 146, representing 73.6%, while teachers holding degree were 51, representing 26.4%. There are more teachers holding diploma (146=73.6%) at the kindergarten level in the Asikuma Odoben Brakwa district than degree (51=26.4%). However, the indication is that all the 193 kindergarten teachers have professional teaching qualification and therefore

stand a better chance of knowing how to integrate ICT into education and classroom assessment for that matter.

Table 4: Teaching experiences at kindergarten level (n=193)

Teaching experiences at kindergarten level	Frequency	Percentage
Below 2 years	29	15.0
2-5 years	110	57.0
6-10 years	40	20.7
11-15 years	10	5.2
16-20 years	3	1.6
21 years and above	1	0.5
Total	**193**	**100**

Source: Field Data; September, 2021

From table 4, 29 teachers, representing 15% had less than 2 years of experience in teaching kindergarten children, 110 teachers, representing 57% had between 2 – 5 years of the experience, 40 teachers, representing 20.7% had between 6 – 10 years of the experience, 10 teachers, representing 5.2% had between 11 – 15 years, 3 teachers representing 1.6% had between 16 – 20 years and 1 teacher, representing 0.5% had the experiences of 21 years and above. This implies that there are more experienced teachers at the kindergarten level and therefore can provide rich information on their experiences with ICT use at that level.

Table 5: Length of ICT use in teaching kindergarten pupils (n=193)

Length of ICT use in teaching kindergarten pupils	Frequency	Percentage
Below 2 years	69	35.8
2-5 years	100	51.8
6-10 years	16	8.3
11-15 years	5	2.6
16-20 years	3	1.6
21 years and above	0	0.0
Total	**193**	**100**

Source: Field Data; September, 2021

As evident in table 5, the result shows that 69 teachers, representing 35.8% have been using ICT in their teaching of kindergarten pupils for less than 2 years. 100 teachers, representing 51.8% have been using ICT in teaching kindergarten pupils between 2 – 5 years. There were 16 teachers representing 8.3% who have been using ICT to teach kindergarten pupils between 6 – 10 years. For 11 – 15 years use of ICT to teach kindergarten pupils, 5 teachers were recorded, representing 2.6%. However, only 3 teachers, representing 1.6% have been using ICT to teach kindergarten pupils for 16 – 20 years. Finally, none of the teachers have been using ICT to teach kindergarten children for 21 years and above. This implies that the teachers have enough experience in using ICT tools in their teaching and could therefore use the tools to enhance their classroom assessment practices.

Table 6: Capacity building training in ICT use received yearly (n=193)

Capacity building training in ICT	Frequency	Percentage
More than thrice	1	0.5
Thrice	0	0.0
Twice	8	4.1
Once	29	15.0
Never	155	80.3
Total	**193**	**100**

Source: Field Data; September, 2021

The data as presented on table 6 shows that only 1 teacher, representing 0.5% received capacity building training in ICT use more than thrice yearly. No teacher (0=0.0%) received capacity building training in ICT use thrice yearly. 8 teachers, representing 4.1% also received capacity building training in ICT use twice yearly. Teachers who received capacity building training in ICT use once yearly were 29, representing 15.0%. Meanwhile, a total of 155 teachers, representing 80.3% never received capacity building training in ICT use. The data from table 6 therefore implies that majority of the teachers (155=80.3%) depend only on training received in ICT use during their professional training at colleges and universities. This suggests that the teachers may not have an up to date knowledge in the use of ICT in teaching and learning, since most of them did not receive in-service training in ICT use.

4.2 Analysis of the Main Data

4.2.1 Research question1: What are the types of ICT tools existing in the kindergarten classrooms?

Research question one was used to identify the types of existing ICT tools used in the public school kindergarten classrooms in the Asikuma Odoben Brakwa district. The data for the study was gathered using a checklist, analyzed and interpreted using percentages. The data is presented in table 7. In table 7, NA (Not Available) and was coded as 1, A (Available and was coded as 2).

Table 7: Types of ICT tools existing in kindergarten classrooms (n=191)

ICT Tools	A (%)	NA (%)
Tablet	4 (2.1)	187 (97.9)
Printer	21 (11.0)	170 (89.0)
Computer (desktop/laptop)	43 (22.5)	148 (77.5)
Pen Drive	50 (26.2)	141 (73.8)
Mobile Phone	191 (100)	0 (0)
Video game	71 (37.2)	120 (62.8)
Radio Cassette Recorder	26 (13.6)	165 (86.4)
Television	20 (10.5)	171 (89.5)
Television decoder	12 (6.3)	179 (93.7)
Bluetooth speaker	3 (1.6)	188 (98.4)

Source: Field Data; September, 2021

Table 7 shows the types of existing ICT tools in kindergarten classrooms in Asikuma Odoben Brakwa district. In table 7, tablet was available in 4 (2.1%) of the classrooms but not available in the remaining 187 (97.9%) classrooms studied. It was also found that printer was available in 21 (11.0%) of the classrooms studied but not available in 170 (89.0%) of the classrooms. Computer (desktop/laptop) was available in 43 (22.5%) of the classrooms but not available in 148 (77.5%) of the classrooms studied. Also, pen drive was available in 50 (26.2%) of the classrooms but not available in the remaining 141 (73.8%) classrooms. However, mobile phone was available in all the 191 (100%). Video game was available in 71 (37.2%) of the classrooms but not available 120 (62.8%) of the classrooms studied. Meanwhile, radio cassette recorder was available in 26 (13.6%) of the classrooms but not available in 165 (86.4%) of the classrooms studied. Television was available in 20 (10.5%) classrooms but not available in the remaining 171 (89.5%) of the classrooms. For television decoder, it was available in 12 (6.3%) classrooms but not available in the 179 (93.7%) of the

classrooms. Finally, Bluetooth speaker was available in 3 (1.6%) of the classrooms but not available in 188 (98.4%) of the entire classrooms studied.

Most of classrooms do not have most of the types of ICT tools available for use. The number of classrooms with computers especially, give an indication that Ghana government' one laptop per child policy has not seen continuity in its implementation. It can therefore be concluded that due to the fewer number of classrooms with available ICT tools, most of the kindergarten teachers may not have enough access to ICT tools for use in their classroom assessment practices.

In line with this study, Natia and Al-hassan (2015) found in an earlier study that mobile phones were available in most of the primary school classrooms in the Volta, Upper West, Upper East and Northern regions of Ghana. The study by Natia and Alhassan (2015) on the contrary, found computers and printers available in majority of the basic schools' classrooms but in much lesser quantities. Also, contrary to the findings of this current study that there were no printers and computers in the majority of the classrooms, the United States Energy Information Administration (2016) found that computers were available in all American schools and classrooms.

4.2.2 Research question 2: How are existing ICT tools used in classroom assessment practices of kindergarten teachers?

The research question was used to gather information from kindergarten teachers on how they use ICT tools in their classroom assessment practices for kindergarten learners. The data was analyzed and interpreted using percentages, mean and standard deviation. Given the use of a five (5) point Likert scale responses with the decision rule of 1+2+3+4+5=15÷5=3, the mean value of 3.00 and above indicates that majority

of teachers most of the time use ICT tools in their classroom assessment practices but a mean value of 2.99 and below will indicates that majority of teachers do not most of the time use ICT tools in their classroom assessment practices. Table 8 shows the data presentation. Meanwhile, in table 8, N (Never) and was coded 1, S = (Seldom) and was coded 2, SM (Sometimes) and was coded 3, O (Often) and was coded 4, A (Always) and was coded 5, M (Mean) and SD (Standard deviation).

Table 8: The use of existing ICT tools in classroom assessment practices (n=193)

Statement	N	S	SM	O	A	M	SD
I use ICT tools in classroom assessment for sharing assessment information with school administration, parents and other stakeholders	50(25.9)	26(13.5)	68 (35.2)	33(17.1)	16(8.3)	2.68	1.26
I use ICT tools to construct test items for kindergarten children	35(18.1)	28(14.5)	90(46.6)	33(17.1)	7(3.6)	2.73	1.06
I use ICT tools to administer test items to kindergarten children	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
I use ICT to tools mark/score test items given to kindergarten learners	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
I use ICT tools to analyze the test results of kindergarten learners	66(34.2)	26(13.5)	66(34.2)	29(15.0)	6(3.1)	2.39	1.19
I use adaptive technology to assess my learners differently (based on their levels of ability)	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
I use ICT tools like text magnifier, braille and others when assessing children with special needs at the kindergarten level	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
I use ICT tools to store test items and assessment data for future use	46(23.8)	21(10.9)	74(38.3)	38(19.7)	14(7.3)	2.76	1.22
I use ICT tools to create e-portfolios for pupils' learning	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
Total Mean/Std. Dev.						**14.56**	**4.73**
Mean of Means/ Std. Dev.						**1.62**	**0.53**

Source: Field Data; September, 2021

It can be observed from table 8 that majority (M= 2.68; SD= 1.26) of the participants do not most of the time use ICT tools to share classroom assessment information with school administration and parent of kindergarten learners. Majority (M= 2.73; SD= 1.06) of the participants reported that they do not most of the time use ICT tools to construct test items for their learners. Majority (M= 1.00; SD= 0.00) of the participants also indicated that they do not most of the time use ICT tools to administer test to their kindergarten learners.

Table 8 further reveals that majority (M= 1.00; SD=0.00) of the participants do not most of the time use ICT tools to mark or score test items given to their learners. Majority (M= 2.39; SD= 1.19) of the participants indicated that they do not most of the time use ICT tools to analyze the test results of their learners. Also, majority (M= 1.00; SD= 0.00) of the participants do not use adaptive technology to assess their learners differently. Majority (M=1.00; SD= 0.00) of the participants reported that they do not use text magnifiers and braille when assessing learners with special needs at the kindergarten levels.

In table 8, majority (M=2.76; SD= 1.22) of the participants indicated that they do not most of the time use ICT tools to store test items and assessment data. Finally, table 8 reveals that majority (M= 1.00; SD=0.00) of the participants do not use ICT tools to create e-portfolios of the pupils' learning.

Table 8 reveals that majority of the participants do not most of the time use ICT tools in their classroom assessment practices because, the mean means score of (M=1.62; SD= 0.53) showed that majority reported that they do not most of the time use the

ICT tools in their classroom assessment practices. The standard deviation score also shows that the participants responded similarly and clustery around the mean score.

The data in table 8 therefore suggest that majority of the kindergarten teachers of public schools in Asikuma Odoben Brakwa district do not most of the time use ICT tools in their classroom assessment practices to share information, construct assessment tasks, analyze assessment data and store assessment information. Meanwhile, the data shows further that all kindergarten teachers in public schools in Asikuma Odoben Brakwa district never used ICT tools to administer test, score/mark test items, assess learners differently (based on their abilities), assess children with special needs or create e-portfolios of pupils' learning. Since teachers do not most of the time use the existing ICT tools in classroom assessment practices, it goes to suggest that they either lack the needed skills or lack the needed ICT tools to be used. As such, it can be concluded that the lack of in-service training and inadequate ICT tools affected the teachers' use of ICT in classroom assessment practices.

In line with this study, Danniels et al. (2019) found in an earlier study that only few of the teachers they studied have begun using technology to enhance their assessment of learning, as learning and for learning. Meanwhile, Educational Broadcasting Corporation of America (2004) has argued that technology is significant in assessment, as it could be used to track learner's school progress, share assessment information, store assessment data and be used by the educators for the appreciation of their own work.

4.2.3 Research question 3: What is the teachers' level of knowledge regarding the use of the existing ICT tools in classroom assessment practice?

This research question was used to seek kindergarten teachers' views on their levels of knowledge in the use of ICT tools in classroom assessment practices. The data gathered on the research question was analyzed and interpreted with the use of percentages, mean and standard deviation. Given the use of a five (5) point Likert scale responses with the decision rule of 1+2+3+4+5=15÷5=3, a mean score of 3.00 and above means that majority of the kindergarten teachers have adequate knowledge in the use of ICT tools in classroom assessment practices with kindergarten children. Meanwhile, a mean score of 2.99 and below means that majority of the kindergarten teachers have inadequate knowledge in the use of ICT tools in classroom assessment of kindergarten learners. Table 9 below shows the data presentation.

Meanwhile, in table 9, NC (No capability) and was coded as 1, F (Fair) and was coded as 2, G (Good) and was coded as 3, VG (Very Good) and was coded as 4, E (Excellent) and was coded as 5, M (mean) and SD (standard deviation).

Table 9: Teachers level of knowledge regarding the use of the existing ICT tools in classroom assessment practices (n=193)

Statement	NC (%)	F (%)	G (%)	VG (%)	E (%)	M	SD
The use of ICT tools to give feedback on learners' assessment to the learners and their parents	5(2.6)	31(16.1)	89(46.1)	46(23.8)	22(11.4)	3.25	0.95
The use of ICT tools to construct assessment task for learners	24(12.4)	25(13.0)	75(38.9%)	49(25.4)	20(10.4)	3.08	1.14
The use of ICT tools to analyze learners' assessment data	31(16.1)	29(15.0)	68(36.2)	46(23.8)	19(9.8)	2.96	1.20
The use of ICT tools for scoring assessment tasks given to learners	193(100)	0(0)	0(0)	0(0)	0(0)	1.00	0.00
The use of ICT tools to store assessment data of learners for future use	25(13.0)	22(11.4)	67(34.7)	54(28.0)	25(13.0)	3.17	1.19
The use of ICT tools for administration of pupils' classroom test	191(99)	2(1.0)	0(0)	0(0)	0(0)	1.01	0.10
The use of ICT tools to communicate school performance of learners to the school administration for decision making on learners and learning processes	9(4.7)	22(11.4)	90(46.6)	52(26.9)	20(10.4)	3.27	0.96
The use of adaptive technology to rate the same group of learners differently (based on their abilities)	191(99.0)	0(0)	2(1.0)	0(0)	0(0)	1.02	0.20
The use of ICT tools to construct e-portfolio of pupils' learning	190(98.4)	2(1.0)	1(0.5)	0(0)	0(0)	1.02	0.18
Total Mean/Std.						**19.78**	**5.92**
Mean of Means/Std.						**2.20**	**0.66**

Source: Field Data; September, 2021

Table 9 reveals that majority (M= 3.25; SD= 0.95) of the participants in the study have adequate knowledge in using ICT tools to give feedback on learners' assessment results. Majority (M= 3.08; SD=1.14) of the participants have adequate knowledge in using ICT tools to construct assessment tasks for their learners. Meanwhile, majority (M=2.96; SD=1.20) of the participants have inadequate knowledge in using ICT tools to analyze learners' assessment data. Also, majority (M= 1.00; SD=0.00) of the participants have inadequate knowledge in using ICT tools to score learner assessment tasks. However, the data shows that majority (M=3.17; SD=1.19) of the participants have adequate knowledge in using ICT tools to store assessment data of learners. As for using ICT tools for administration of learners' classroom test, majority (M= 1.01; SD= 0.10) of the participants reported having inadequate knowledge. Majority (M= 3.27; SD= 0.96) of the participants reported to have adequate knowledge in using ICT tools to communicate school performances of learners to school administration for decision making on learners. With respect to using adaptive technology to rate learners differently, majority (M= 1.02; SD=0.20) were reported to have inadequate knowledge. Finally, majority (M=1.02; SD= 0.18) also reported having inadequate knowledge in using ICT tools to construct e-portfolios for learners. Meanwhile majority generally have inadequate knowledge in using ICT tools in classroom assessment practices because, the mean of means score of (M=2.20; SD= 0.66) gives an indication that majority of the participants have inadequate knowledge in using ICT tools in classroom assessment practices. The standard deviation score also shows that the participants' responses are similar and clustery around the mean of means score.

The study found that public school kindergarten teachers of Asikuma Odoben Brakwa district have varied levels of knowledge in the use of ICT; ranging from no capability, fair knowledge, good knowledge, very good knowledge and excellent knowledge. The results therefore show that, majority of the public school kindergarten teachers in the Asikuma Odoben Brakwa district have adequate knowledge in the use of ICT tools in selected areas like giving feedback on learners assessment, using ICT tools to construct assessment task, using ICT tools to store learners' assessment data and using ICT tools to communicate school performance of learners to school administration. On the contrary, majority of the kindergarten teachers have no adequate knowledge in the use of ICT tools to analyze learners' assessment data, score learners' assessment tasks, administer assessment tasks, rate learners differently (based on their abilities) and create e-portfolios of pupils' learning. These findings suggest that the workshops, conferences and seminars the teachers did not attend regularly whiles on the job, affected their acquisition of the comprehensive knowledge in using ICT tools in all the classroom assessment practices.

In line with this study, Gyaase, Anane and Armah (2015) found that teachers have different levels of ICT skills/knowledge; ranging from none, beginner, intermediate and proficient. Out of 60 teachers they studied, 28 were at the intermediate level, beginners' level 15, proficient level 11 and 6 reported to have no skills/knowledge at all. Still in line with this study, Singh and Chan (2014) found that teachers were only knowledgeable in using only some of the ICT tools. Meanwhile, Moganashwari and Parilah (2013) in an earlier study found that participants had high level of knowledge but only in the use of some ICT tools or applications.

4.2.4 Research question 4: How are teachers challenged in the use of the existing ICT tools in kindergarten classroom assessment practices?

The purpose of this research question was to enable the researcher determine how the kindergarten teachers are challenged with respect to ICT use in classroom assessment of the learners. The data gathered was analyzed and interpreted with the use of percentage, mean and standard deviation. Given the use of a five (5) point Likert scale responses with the decision rule of 1+2+3+4+5=15÷5=3, the mean value of 3.00 and above shows that majority of the teachers encounter the challenge stated most of the time but a mean value of 2.99 and below shows that majority of the teachers do not most of the time encounter the challenge stated. The data is presented in table 10. Meanwhile in table 10, N (Never) and was coded 1, S (Seldom) and was coded 2, SM (Sometimes) and was coded 3, O (Often) and was coded 4, A (Always) and was coded 5, M (Mean) and SD (Standard Deviation).

Table 10: Challenges teachers encounter when using the existing ICT tools in classroom assessment practices (n=193)

Statement	N	S	SM	O	A	M	SD
Inadequate knowledge in the use of ICT tools in classroom assessment of kindergarten learners	0(0)	33(17.1)	100(51.8)	41(21.2)	19(9.8)	3.24	0.85
Inadequate computers in the classroom	0(0)	0(0)	0(0)	17(8.8)	176(91.2)	4.91	0.28
Inappropriate ICT tools for kindergarten learners	0(0)	2(1.0)	48(24.9)	56(29.0)	87(45.1)	4.18	0.84
Lack of electrical power in the classroom to use the ICT tools	34(17.6)	44(22.8)	31(16.1)	4(2.1)	80(41.5)	2.76	1.24
Lack of technical support from experts regarding the use of the ICT tools	10(5.2)	6(3.1)	47(24.4)	50(25.9)	80(41.5)	3.95	1.12
Inadequate time for ICT use for classroom assessment	25(13.0)	27(14.0)	63(32.6)	27(14.0)	51(26.4)	3.27	1.34
Limited understanding of ICT integration into classroom assessment	1(0.5)	36(18.7)	95(49.2)	50(25.9)	11(5.7)	3.18	0.82
Lack of internet coverage for communicating with ICT tools in classroom assessment practices	48(24.8)	44(22.8)	62(32.1)	13(6.7)	26(13.5)	2.61	1.30
Difficulty in communicating with parents and school administrators using ICT tools	34(17.60)	34(17.6)	83(43.0)	31(16.1)	11(5.7)	2.75	1.10
Total Mean/Std.						**30.85**	**8.89**
Mean of Means/Std.						**3.43**	**0.99**

Source: Field Data, September, 2021

Table 10 reveals that majority (M= 3.24; SD= 0.85) of the participants encounter the challenge of inadequate knowledge in the use of ICT tools in classroom assessment practices most of the time. Furthermore, majority (M=4.91; SD= 0.28) of the participants encounter the challenge of inadequate computers in the classrooms most of the time. More so, majority (M= 4.18; SD= 0.84) of the participants reported that they encounter the challenge of inappropriate ICT tools for kindergarten learners most of the time.

From table 10, majority (M= 2.76; SD= 1.24) of the participants reported that lack of electrical power in the classrooms to use ICT tools is not a challenge they encounter most of the time. Majority (M= 3.95; SD= 1.12) of the participants encounter lack of technical support from experts regarding the use of ICT tools as a change most of the time. Additionally, majority (M= 3.27; SD=1.34) indicated that they encounter the challenge of inadequate time for ICT use for classroom assessment practices most of the time.

Table 10 also shows that majority (M=3.18; SD= 0.82) of the participants reported a challenge of limited understanding of ICT integration into classroom assessment most of the time. For lack of internet coverage, majority (M= 2.61; SD=1.30) of the participants do not encounter it as a challenge most of the time. Finally, majority (M= 2.75; SD=1.10) of the participants do not encounter difficulty in communicating with parents and school administrators using ICT tools as a challenge most of the time.

Generally, majority of the participants in the study encounter challenges in using ICT tools in classroom assessment practices most of the time because the mean of means score of (M= 3.43; SD= 0.99) shows that most of the participants most of the time

encounter challenges in using ICT tools in classroom assessment practices. The study therefore revealed in table 10 that the challenges kindergarten teachers encounter most of the time with regards to ICT use in classroom assessment practices include; inadequate knowledge in the use of ICT tools in classroom assessment practices, inadequate computers in the classrooms, inappropriate ICT tools for kindergarten learners, lack of technical support from experts regarding the use of ICT tools in classroom assessment, inadequate time for ICT use in classroom assessment and limited understanding of ICT integration into classroom assessment. Majority of the teachers most of the time have challenges because most of them have not received in-service training from educational authorities on ICT use and most of them have not been provided the needed ICT tools for practice. The standard deviation shows that the participants responded mostly similarly and clustery around mean of means score.

In line with the findings in this study, Pelgrum (2001, p.173) found inadequate computers, lack of knowledge/skills among teachers, inadequate teacher time and inadequate technical assistance as challenges to teachers' use of ICT in their classrooms. In another study, the Organization for Economic Cooperation and Development found variation in the number of computers, shortage of technical support and inadequate computer knowledge/ skills among teachers as challenges (OECD, 2009). Also in line with this study, Asante and Owusu-Ansah (2015) found teacher expertise and inadequate ICT infrastructure as challenges to the use of ICT and to the implementation of the One Laptop Per Child Policy of Ghana. However, contrary to the findings in this study that electrical power supply was not a challenge to majority of the teachers, Asante and Owusu-Ansah (2015) found the supply of electricity as a challenge to the use of computer and ICT in schools in their study.

4.2.5 Research Hypothesis

H_0. There is no statistically significant difference in the mean scores of Male and Female Teachers in the use of ICT Tools in Classroom Assessment Practices.

H_1. There is statistically significant difference in the mean scores of male and female teachers in the use of ICT tools in classroom assessment practices.

The main objective of this research hypothesis was to find whether gender is a significant variable that affects teachers' use of the ICT tools in classroom assessment. The statistical tool used for the test of the hypothesis was the independent sample T-Test. For table 11, N= Number of teachers, M=Mean, SD=Standard Deviation, df = degree of freedom, T = t-value and p = significance.

The Independent Sample Test for assumption (equal variances assumed and equal variances not assumed) was assessed. This was done prior to the actual analysis of the Independent Sample T-Test values to determine the level of significance of the differences in the mean score of male and female teachers in the use of ICT tools in classroom assessment practices. The assumption of homogeneity of variances showed that there was no violation of the assumption because Levene's test for equality of variance for the use variables was not significant {p=0.06 (Ways of using ICT tools)}. The assumption therefore is that there is roughly equal variances and so the assumption is tenable. The data underlying the assumption of Independence Sample T-Test shows that the analysis was also tenable. The results of the Independent Sample T-Test on the kindergarten teachers use of ICT tools in classroom assessment practices was presented in table 11.

Table 11: Independent – sample t-test on gender differences in the use of existing ICT tools in classroom assessment practices of kindergarten teachers (n=193)

Statement	Gender	N	Mean	Std. deviation	Df	T	Sig.
T- Ways of using ICT tools in classroom assessment	Male	37	21.89	3.17	191	0.567	**0.57**
	Female	156	21.53	4.77			

Source: Field data, September, 2021

From table 11, it was found that there was no statistically significant difference in the mean score of male teachers (M=21.89, SD=3.17, df=191, p=0.57) and female teachers (M=21.53, SD=4.77, df=191, p=0.57). It can be concluded from this result that there is no statistically significant difference between the mean scores of the male and female teachers in the use of ICT tools in classroom assessment practices. Thus the male and female teachers are similar in ICT use in classroom assessment practices. It is therefore concluded that gender of teachers is not a significant factor that affects kindergarten teachers' use of ICT tools in classroom assessment in Asikuma Odoben Brakwa district.

The statistically insignificance difference between male and female teachers in ICT use in classroom assessment practices can be because both the male and female teachers had equal access to the tools and training and as well used a common ICT curriculum during their pre-service trainings at the various teacher training institutions. Therefore the pre-service trainings in ICT that teachers received was effective and unbiased.

In line with this study, Morahan-Martin (2000) did not find any significant difference in male and female teachers' use of digital or ICT tools and even concluded that the differences have disappeared. Gebhardt et al. (2019) also pointed out that gender

differences exist among male and female teachers in their adoption and integration of ICT into their teaching, however, these differences are insignificant. On the contrary however, Reinen and Plomp (1997) found in their study that gender plays a significant role in the use of ICT in education. Still contrary to the findings in this study, Natia and Al-hassan (2015) found a significant gap between male and female teachers in the adoption of ICT tools to teach and conduct research. Jamieson-Proctor et al. (2006) in a related study, also found a significant difference between male and female teachers in their use of ICT for teaching and learning.

CHAPTER FIVE

SUMMARY O F FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter discusses the summary of the findings of the study, the conclusions drawn from the findings and the recommendations made on the basis of the findings.

5.1 Summary

In this study, a descriptive survey design was adopted to enable the researcher gather information from the population (respondents), to determine the present status of the population. The study considered all the kindergarten teachers in public schools (Male and Female) in the Asikuma Odoben Brakwa district. The researcher collected data from the respondents using checklist and a five point Likert scale questionnaire. The questionnaire was given to all the respondents to answer while the researcher administered the checklist in each of the 191 kindergarten classrooms. After trial testing of the questionnaire in Agona West district, its reliability was checked using the Cronbach Alpha Reliability Co-efficient. The Cronbach Alpha Reliability Co-efficient value realized was 0.825. The data on research question 1, 2, 3 and 4 were analyzed using descriptive statistics but data on the research hypothesis was analyzed using both descriptive and inferential statistics (Independent Sample T-Test).

Key Findings

There were findings on each research questions and the research hypothesis. For the research question 1 – the existing types of ICT tools in the kindergarten classrooms, the study found that the existing types of ICT tools in the kindergarten classrooms are,

tablet (found in 4 classrooms), printer (found in 21 classrooms), computer (found in 43 classrooms), pen drive (found in 50 classrooms), mobile phone (found in 191 classrooms), video game (found in 71 classrooms), radio cassette recorder (found in 26 classrooms), television (found in 20 classrooms), television decoder (found in 12 classrooms) and Bluetooth speaker (found in 3 classrooms).

The data on research question 2 – how are existing ICT tools used in classroom assessment practices, revealed that majority of the kindergarten teachers in public schools in Asikuma Odoben Brakwa district do not most of the time use ICT tools in their classroom assessment practices of sharing information, constructing assessment tasks, analyzing assessment results, and storing assessment data. It was also revealed that the kindergarten teachers never used ICT tools to administer test to learners, score test items, assess same group of learners differently, assess children with special needs and never created e-portfolios of pupils learning. Generally, majority of the participants do not most of the time use the ICT tools in their classroom assessment practices per the mean of means score.

With respect to research question 3 – the teachers' level of knowledge in the use of the existing ICT tools in classroom assessment, it was found that majority of the kindergarten teachers in public schools in Asikuma Odoben Brakwa do not have adequate knowledge in using ICT tools to analyze learners' assessment data, score learners' assessment tasks, administer learners' assessment, rate learners differently and create e-portfolios of pupils' learning. Generally, the mean of means score shows that majority of the teachers do not have adequate knowledge in using ICT tools in classroom assessment practices.

On research question 4 – how are kindergarten teachers are challenged in their use of ICT tools, it was revealed that majority of the public school kindergarten teachers in Asikuma Odoben Brakwa district had challenges such as inadequate computers, inappropriate ICT tools, lack of technical support from experts, inadequate time and limited understanding of ICT integration into classroom assessment. Lack of electrical power in the use of ICT tools, lack of internet coverage and difficulty communicating with parents and school administrators using ICT tools were not found challenging to the participants.

Finally, in finding response to the research hypothesis raised, it was revealed per the data in table 11 that no statistically significant difference exist in the mean scores of the male and female public school kindergarten teachers in Asikuma Odoben Brakwa district in their use of ICT tools in classroom assessment practices.

5.2 Conclusions

The results on research question 1 (existing types of ICT tools) showed that the existing types of ICT tools in the kindergarten classrooms are, mobile phone computer, printer, television, television decoder, pen drive, television, television decoder, radio cassette recorder and bluetooth speaker but in very few of the kindergarten classrooms studied in the Asikuma Odoben Brakwa district. Since ICT tools are available but only in few of the kindergarten classrooms in the Asikuma Odoben Brakwa district as per the data gathered, it can be concluded that the scarcity of the ICT tool in most of the classrooms could affect teacher access to most of the tools.

Findings on the how ICT tools are used in classroom assessment (research question 2) revealed that majority of the kindergarten teachers in Asikuma Odoben Brakwa district do not most of the time use ICT tools in their classroom assessment practices. It can be concluded that majority of the kindergarten teachers not using ICT tools most of the time in their classroom assessment practices is occasioned by the inadequate ICT tools available in their classrooms and other challenges such as lack of technical support, inappropriate ICT tools, inadequate time and limited understanding of ICT integration into classroom assessment.

On the kindergarten teachers level of knowledge in the use of ICT in classroom assessment practices (research question 3), it was revealed that majority of the kindergarten teachers had inadequate knowledge in using ICT tools to construct e-portfolios on pupils learning, score pupils assessment tasks, analyze the assessment data, rate learners differently and administer classroom assessment. Meanwhile, the mean of means score showed that teachers do not have adequate knowledge with respect to using ICT tools in classroom assessment practices. It can therefore be concluded that the teachers' lack the requisite in-service training to enable them acquire adequate knowledge in the effective use of ICT tools across all the areas of assessment practices.

On the challenges the kindergarten teachers face in their use of ICT tools in classroom assessment practices (research question 4) it was revealed that majority of the kindergarten teachers most of the time face challenges such as inadequate number of computers, inappropriate ICT tools, lack of technical support, inadequate time for ICT use and limited understanding of ICT integration into classroom assessment. It can also be concluded among other things, that Ghana Education Service and Ministry of

Education have still not put adequate mechanisms in place to ensure successful integration of ICT into education; particularly into classroom assessment.

5.3 Recommendations

As a result of the findings in line with objective 1 of this study, it is recommended that the government of Ghana through the Ghana Education Service, collaborates with other organizations like UNICEF to improve the situation regarding the availability of the ICT tools in the kindergarten classrooms in Asikuma Odoben Brakwa district by helping to provide the schools with the needed ICT tools in the classrooms for the teachers' classroom assessment practices. School heads should also appeal to NGOs to support their schools with the needed ICT tools.

Furthermore, based on the findings in line with objective 2 of this study, it is recommended that Ghana Education Service (GES) and its allied stakeholders put their resources together to help address the challenges faced by the teachers in their use of ICT tools in classroom assessment practices by providing them with the needed ICT tools and as well provide them with technical support at the school levels and possibly reschedule school time. This will help to ensure teachers' use of ICT tools in classroom assessment practices most of the time.

Also, for the findings relating to objective 3 of this study, it is also recommended that, the kindergarten teachers in Asikuma Odoben Brakwa district be given regular in-service training and as well be provided with technical support at the school levels by Ghana Education Service. This will help them improve upon their level of knowledge in using ICT tools in all the areas of classroom assessment practices.

Finally, based on the findings in relation to objective 4 of this study, it is recommended that educational seminars be organized for educational authorities (Ministry of Education and Ghana Education Service) by the researcher, to bring to their attention the challenges teachers face in their use of ICT tools and to charge the Ministry of Education and Ghana Education Service to continue to put in place mechanisms that will help to address the challenges and as well be informed by the findings of the study when formulating assessment policies for education.

5.4 Suggestions for Further Studies

1. A study needs to be conducted on kindergarten children' parents' perception about the use of ICT tools in classroom assessment practices of their wards.
2. A study also needs to be conducted on kindergarten teachers' perception about the role of ICT tools in classroom assessment practices.
3. This study should be replicated in other districts of the country to give a broader view of the kindergarten teachers' use of ICT tools in classroom assessment practice.
4. Where data on private kindergarten teachers is available, a study can be conducted to compare the public and private schools kindergarten teachers' use of available types of ICT tools in classroom assessment practices.
5. A study can be conducted to compare the rural and urban kindergarten teachers' use of available ICT tools in their classroom assessment practices.

REFERENCES

Acquah, B. Y. S. (2012). Status of implementation of the ICT curriculum in Ghanaian basic schools. *Journal of Arts and Humanities*, *1*(3). https://doi.org/10.18533/JOURNAL.V1l3.31

Adebi-Caesar, T. E. (2012, February 1). *Assessment of ICT Situation in Senior High Schools, a case study in Lower Manya Krobo District.* https://www.sematicscholar.org/paper/Assessment-of-I.C.T.-situation-in-senior-high-a-case-Adebi-Caesar/ede551f5ad745b39c3b3efc6

Agyei, D. D. (2013). Analysis of Technology Integration in Teacher Education in Ghana. *Journal of Global Initiatives*, 8*(1&2), 69-86*.

Al-Alwani, A. E. S. (2005). Barriers to integrating information technology in Saudi Arabia science education. Doctoral dissertation, the University of Kansas. *ProQuest Dissertations And Thesis, 66 (8), 202-2896*

Albion, P. (2007). *Student Teachers' Confidence and Competence for Finding Information on the Internet. In R. Carlsen, K. McFerrin, J. Price, R. Weber, & D. Wills (Eds.), Proceedings of SITE 2007-society for Information Technology & Teacher Education International Conference (pp. 1244-1249).* Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/24731/

Albirini, A. (2006). Teacher's attitudes towards information and communication technologies: the case of Syrian EFL teachers. *Computer & Education, 47 (4), 373-398.* https://www.learntechlib.org/p/66757/

American Academy of Pediatrics. (2016, October 21). *American academy of pediatrics announces new recommendations for children's media use.* https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/American-Academy-of-Pediatrics-Announces-New-Recommendations-for-Childrens-Media-Use.aspx

Asante Nsiah, J. (2014).The state of ICT integration in the early years in Ghana schools. *Literacy Information and Computer Education Journal (LICEJ), 3* (1). https:doi.org.10.20533/LICEJ.2040.2589.2014.0233

Asante, E., & Owusu-Ansah, S. (2015). One laptop per child policy in ghana: any impact on teaching and learning? *Library Philosophy and Practice (e-journal), 1290*. https://www.digitalcommunications.unl.edu/libphilprac/1290

Association of African Universities (2000, May 17-19). *Technical Experts Meeting on the use and Application of Information and Communication Technologies in Higher Education Institutions in Africa.* http://www.aau.org/english/documents/aau-ictreport-p3.htm.

Babbie, E., & Mouton, J. (2001). *The practice of social research.* Oxford University Press.

Baidoo-Anu, D., Acquah, M. M., Ansah, L. O., Ato-Davis, A. & Baah, V. N. (2019). Senior High School Teachers Knowledge in the Use of Information Communication Technology: A Survey in Asikuma-Odoben-Brakwa District. *Journal of Education and Practice, 10 (21).* https://www.doi.org/10.7176/JEP/10-21-15

Balanskat, A., Blamire, R. & Kefala, S. (2006, December 11). *The ICT impact report: A review of studies of ICT impact on schools in Europe*. *European Schoolnet: European Communities.* http://insight.eun.org/shared/data/pdf/impact_study.pdf.

Beatty, A. (2010). *State Assessment Systems: Exploring Best Practices and Innovations: Summary of Two Workshops*. The National Academies Press.

Beaumont-Bates, J. R. (2017). E-Portfolios: Supporting collaborative partnerships in an early childhood centre in Aotearoa/New Zealand. *New Zealand Journal of Educational Studies, 52 (2), 347 – 362.* https://www.eric.ed.gov/?id=EJ1181852

Becta (2004a, June 1) *A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers.* http://partners.becta.org.uk/page_documents/research/barriers.pdf.

Becta (2004b, June 30). *Video conferencing in the curriculum. Case study 2: Chalvey Early Years Centre, Slough. E-storytelling.* British Educational Communications and Technology Agency. http://www,itscotland.org.uk/earlyyears/casestudies.asp.

Bede, B. C. O., Termit, K. R. S. & Fong, S. F. (2015). Need of ICT integration for effective instructional delivery in Nigerian Colleges of Education. *Journal of Education and Practice, 6 (3), 51-56*

Beggs, T. A. (2000, April 9-11). *Influences and barriers to the adoption of instructional technology*. Paper presented at the Proceedings of the Mid-South Instructional Technology Conference, Murfreesboro, TN. https://eric.ed.gov/?id=ED446764

Bhatia, M. (2018, September 5). *Your Guide to Qualitative and Quantitative Data Analysis Methods*. Data Science, 7. https://humansofdata.atlan.com/2018/09/qualitative

Bjorn, E., Herren, M. and Hollow, D. (2008, February) *"Ethiopia Implementation Report", Eduvision, September - December 2007.* http://www.gg.rhul.ac.uk/ict4d/ethiopia.pdf

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice.5, (1) 7–74.* https://doi.org/10.1080/0969595980050102

Bochner, S., Krause, K., Duchesne, S. & McMaugh, A. (2010). *Educational psychology for learning & teaching: More definitions of ICT tools and devices for your teaching, (third edition).* Cengage Learning Australia.

Bolstad, R. (2004). *The Role and Potential of ICT in Early Childhood education: A Review of New Zealand and International Literature*. Ministry of Education.

Bonk, C. J. & King, K. S. (1998). Computer conferencing and collaborative writing tools: Starting a dialogue about student dialogue. Electronic collaborators: *Learner-centered technologies for literacy, apprenticeship and discourse, 3-23*

Braund, H., & DeLuca, C. (2018). Elementary students as active agents in their learning: An empirical study of the connections between assessment practices and student metacognition. *The Australian Educational Researcher, 45 (1), 65 – 85*. https://link.springer.com/article/10.1007%2Fs13384-018-0265-z

Brian, K. W., & Sawyer, C. S. (2003). *Using Information Technology (5th ed.).* McGraw-Hill.

Broadfoot, P. M., Daugherty, R., Gardner, J., Harlen, W., James, M., & Stobart, G. (2002). *Assessment for learning: 10 principles*. University of Cambridge School of Education.

Buabeng-Andoh, C., & Yidana, I. (2015). Teachers' ICT usage in second-cycle institutions in Ghana: A qualitative study. *International Journal of Education and Development using ICT*, *11*(2). https://www.semanticscholar.org/paper/Teachers%27-ICT-Usage-in-Second-Cycle-Institutions-in-Buaben-Andoh-Yidana/e0a80ef78b9b74df63c2e993d443c2f5520ee84c

Buldu, M. (2010). Making Learning Visible in kindergarten classrooms: Pedagogical documentation as a formative assessment technique. *Teaching and Teacher Education, 26 (7), 1439 – 1499.* https:doi.org/10.1016/J.TATE.2010.05.003

Burgstahler, S. (2010). *Working Together: People with Disabilities and Computer Technology.* University of Washington. http://www.washington.edu/doit/Brochures/PDF/wtcomp.pdf

Busha, C. H. & Harter, S. P. (1980). *Research methods in Librarianship: Techniques and Interpretations.* Academic Press Inc.

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J.C., Westbrook, A., & Landes, N. (2006). The BSCS 5E Instructional Model: Origins, Effectiveness and Applications. *Colorado Springs, Co: BSCS, 5, 88-98*. http://science.education.nih.gov/houseofreps.nsf/b82d55fa138783c2852572c9004f5566/$FILE/Appendix

Byron, T. (2008, March 27). *Safer Children in a Digital World: The Report of the Byron Review: Be safe. Be aware, have fun.* Department for Children, Schools and Families Publication. http://dera.ioe.ac.uk/id/eprint/7332

Campbell, A. (2005). Application of ICT and rubrics to the assessment process where professional judgment is involved: the features of an e-marking tool. *Assessment and Evaluation in Higher Education, 30(5), 529-537.* https://doi.org/10.1080/02602930500187055

Capraro, R. M., Roe, M. F., Caskey, M. M., Strahan, D., Bishop, P., Weiss, C., & Swanson, K. W. (2012, October 8). *Research Summary: Assessment Association for Middle Level Education, 1 - 6.* https://pdxscholar.library.ddx.edu/ci_fac

Carter, D., & Crichton, S. (2014). Empowering twenty-first century assessment practices: Designing technologies as agents of change. *Educational Media International, 51 (4), 295 – 309.* https://doi.org/10.1080/09523987.2014.977007

Chen, D.T., Hsu, J.F. & Hung, D. (2000). *Learning Theories and ICT: The Computer as Tool. In* M. D. Williams, (Ed.) (2000). Integrating Technology into Teaching and Learning-Concept and Applications, (pp.185 – 201). Prentice Hall.

Chen, J., & Chang, C. (2006). Using computers in early childhood classrooms: teachers' attitudes, skills and practices. *J. Early Childhood Research.4, 169–188*. https://doi.org/ 10.1177/1476718X06063535

Chetty, P. (2016, October 16). *Importance of research approach in a research*. https://www.projectguru.in/selecting-research-approach-business- studies/

Christensson, P. (2010, January 4). *ICT Definition.* https://techterms.com

Cleave, P. (2017, July 19). *Advantages of Using Likert Questions.* SmartSurvey Blog-UK's Leading Online Survey Software. https://www.smartsurvey.co.uk/blog?

Clements, D. H., & Sarama, J. (2003). Young children and technology: what does the research say? *Young Children.58, (6) 34–40.* https://www.jstor.org/stable/42729004

Cohen, L., Manion, L. & Morrison, K. (2000). *Research Methods in Education (5th Ed.).* Routledge Falmer.

Cox, M., Preston, C. & Cox, K. (1999).*What factors support or prevent teachers from using ICT in their classrooms?* Paper presented at the British Educational Research Association Annual Conference, University of Sussex, and Brighton. http://www.leeds.ac.uk/educol/documents/00001304.htm.

Creswell, J. (2003). *Research design: Qualitative, quantitative and mixed method approaches (2nd Ed.)*. Sage Publication.

Creswell, J. W. (2012*). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th ed.)*. Pearson

Creswell, J. W. (2014). *The selection of a research approach. Research design Qualitative, quantitative and mixed methods approaches*. Sage Publication.

Danniels, D., Pyle, A., & DeLuca, C. (2019). The Role of Technology in Supporting Classroom Assessment in Play-Based Kindergarten. *Teaching and Teacher Education*. https://doi.org/10.1016/j.tate.2019.102966

Dawson, V. (2008).Use of information communication technology by early career science teachers in Western Australia. *International Journal of Science Education,Vol. 30, pp.203-219.* https://doi.org/10.1080/09500690601175551

De Vos, A. S. (1998). *Research at grass roots*. J.L. Van Schaik Publishers.

Delclos, V. R., Vye, N., Burns, M. S., Bransford, J. D., & Hasselbring, T. S. (1992). *Improving the quality of instruction: Roles for dynamic assessment*. In H. C. Haywood & D. Tzuriel (Eds.), Interactive assessment (pp. 317–331). Spinger-Verlag.

DeLuca, C., & Klinger, D.A. (2010). Assessment Literacy development: Identifying gaps in teacher candidates' learning. *Assessment in Education: Principles, Policy & Practice, 17(4), 419-438.* https://doi.org/10.1080/0969594x.2010.516643

DeLuca, C., Pyle, A., Roy, S., Chalas, A., & Danniels, E. (2019). Perspectives on kindergarten assessment: Towards a common understanding. *Teachers College Record, 121 (3), 1 – 58.* https://eric.ed.gov/?id-EJ1200538

Denzin, N. K. & Lincoln, Y. S. (2000). *Handbook of qualitative research*. Sage Publication

Donker, A., & Reitsma, P. (2007). Drag-and-drop errors in young children's use of the mouse. *Interacting with Computers.19, 257–266.* https://doi.org/10.1016/j.intcom.2006.05.008

Drost, E. A. (2011). Validity and reliability in social science research. *Education Research and Perspectives, 38 (1), 105-124*. https://www.semanticscholar.org/paper/Validity-and-Reliability-in-Social-Science-Drost/081534bfe6cf8dd0da1f40704098366f368da3e8

Earl, L. M. (2013). *Assessment as learning: Using classroom assessment to maximize student learning.* Crown

Educational Broadcasting Corporation (2004). *How can technology be used with assessment, evaluation and Curriculum redesign?* Workshop: Assessment, Evaluation and Curriculum Redesign. https://www.thirteen.org/edonline/concepts2class/assessment/explor_sub4.html

Electronic Information For Libraries. (2015, December 11). *Ghana School Children Get Their First Experience of Computers Through EIFL*. https://www.eifl.net/news/ghana-schoolchildren-get-their-first-experience-computers-through-eifl-project

Ellis, K. A., & Blashki, K. M. (2004). Toddler techies: a study of young children's interaction with computers. *Information Technology in Childhood Education Annual, 2004, 77–96.* https://research.monash.edu/en/publications/toddler-techies-a-study-of-young-childrens-interaction-with-compu

Enu, J., Nkum, D., Ninsin, E., Diabor, C. A., & Korsah, D. P. (2018). Teachers' ICT Skills and Ict Usage in the Classroom: The Case of Basic School Teachers in Ghana. *Journal of Education and Practice. 9 (20).* https://www.researchgate.net/publication/333802555

Ertmer, P. A. (1999). Addressing first-and second-order barriers to change Strategies for technology integration. *Educational Technology Research and Development, 47(4), 47-61*

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education, 59(2), 423–435.* https://doi.org/10.1016/j.compedu.2012.02.001.

Etherington, D. (2013, February 28). *Apple has sold over 8M iPads direct to education worldwide, with more than 1B ITunes U downloads.* http://techcrunch.com/2013/02/28/apple-has-sold-over-8m-ipads-directly-to-education-worldwide-with-more-than-1b-itunes-u-downloads/

Etta, F. E. & Elder, L. (2005). *At the crossroads: ICT policy making in East Africa,* IDRC. East African educational Publishers Ltd & International Development Research Centre

European Commission. (2013). *Survey of schools: ICT in education*. *Benchmarking access, use and attitudes to technology in Europe's schools (final report).* European Union. https://doi.org/10.2759/94499

Eyal, L. (2012). Digital assessment literacy – the core role of the teacher in a digital environment. *Journal of Educational Technology & Society, 15 (2), 37 – 49.* https://www.semantischolar.org/paper/Digital-Assessment-Literacy-the-Core-Role-of-the-in-Eyal/ce82cfa38c7cfd73614521cc53f1a4a76ef43147

Fadhel, K. (2002). Positivist and Hermeneutic Paradigm. A Critical Evaluation under their Structure of Scientific Practice. *The Scotland Journal, 21-28*

Foley, B. (2021, May 21). *What is SPSS and How Does it Benefit Survey Data Analysis*. https://www.alchemer.com/resources/blog/what-is-spss/#:~:text=SPSS%20is%20short%20for%20Statistical,analysis%20...

Fomsi, E. F., & Orduah, S. E. (2017). Gender differences in the use of ICT among teachers in model primary schools in rivers state, Nigeria. *British Journal of Education*, *5*(4), 88-94.

Foorman, B. R., York, M., Santi, K. L., and Francis, D. (2008). *Contextual effects on predicting risk for reading difficulties in first and second grade*. Read. Writing 21, 371–394. https://doi.org/ 10.1007/s11145-007-9079-5

Fox, W. & Bayata, M. S. (2007). *A Guide to Managing Research*. Juta Publications.

Fraenkel, J.R.,Wallen, N.E. (2000). *How to design and evaluate research in education (4th ed.).* McGraw Hill.

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). *Preparing for life in a digital age: the IEA International Computer and Information Literacy Study international report. Cham, Switzerland:* Springer. https://www.springer.com/gp/book/9783319142210.

Fricker, R.D. (2008). *Sampling methods for web and e-mail surveys. handbook of online research methods.* SAGE Publication.

Fusic, S. J., Anandh, N., & Thangavel, M. (2020). *A case study on Improving Learner Engagement by Incorporating ICT Tools usage and Active Learning Strategies in Engineering Courses*. In Methodologies and outcomes of Engineering and Technological Pedagogy (pp.224-246). IGI Global. https://doi.org/10.4018/978-1-7998-2245-5.ch011

Gall, M.D., Gall, J.P., Borg, W.R. (2007). *Educational research: An introduction (8th ed.)*. Pearson.

Gay, R. (1992). *Educational Research: Competencies for Analysis and Application*. Charles E. Merrill Publishing Co.

Gebhardt, E., Thomson, S., Ainley, J., Hillman, K. (2019). *Teacher Gender and ICT In: Gender Differences in Computer and Information Literacy.* IEA Research for Education (A Series of In-depth Analyses Based on Data of the International Association for the Evaluation of Educational Achievement (IEA)), vol.8. Springer, Cham. https://doi.org/10.1007/978-3-030-26203-7_5

George, D. & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.).* Allyn & Bacon

Ghana Education Service, & UNICEF. (2018, November 29). *The Mobile School Report Card (mSRC): Research on the Use of the mobile School Report Card as a Management Tool*. https://www.unicef.org/ghana/reports/mobile-school-report-card-msrc

Ghavifekr, S., Kunjappan, T., Ramasamy, L., & Anthony, A. (2016). Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions. *Malaysian Online Journal of Educational Technology*, *4(2), 38-57.* https://eric.ed.gov/?id0EJ1096028

Ghavifekr, S., Razak, A. Z., A., Ghani, M. F. A., Ran, N. Y., Meixi, Y., & Tengyue, Z. (2014). ICT Integration In Education: Incorporation for Teaching and Learning Improvement. *The Malaysian Online Journal of Educational Technology, 2(2) 24 - 45*. https://eric.ed.gov//?id-EJ1086419.

Gomes, C. (2005). Integration of ICT in science teaching: A study performed in Azores, Portugal. In A. M. Vilas, B. G. Pereira, J. M. Gonzalez & J. A. Gonzalez (Eds), Formatex Research Center. *Recent Research Development in Learning Technologies*, *13* (*3), 63–71.*

Government of Ghana (2008). *ICT in Education Policy: Strategies and Work Programme.* Ministry of Education.

Government of Ghana (2015, August 30). *ICT in Education Policy. Ministry of Education.* https://planipolis.unesco.org

Graham, P. (2005). Classroom-based assessment: Changing Knowledge and Practice through pre service teacher education. *Teaching and Teacher Education, 21(6), 607-621.* Elsevier Ltd. https://doi.org/10.1016/j.tate.2005.05.001

Gray, D. E. (2004). *Doing Research in the Real World*. SAGE Publications.

Grover, V. K. (2015). Research Approach: An Overview. *Golden Research Thoughts 4, (8), 1-8.*

Gyaase, P. O., Anane, E.T. & Armah, I.N.A. (2015). The use of information and communication technology (ICT) for knowledge management in the second cycle educational institutions in Ghana. *International Journal of Computer Applications, 128 (7), 7 – 13*

Habibu, T., Abdullah-Al-Mamun, M., & Clement, C. (2012). Difficulties faced by teachers in using ICT in teaching-learning at technical and higher educational institutions of Uganda. *International Journal of Engineering, 1(7), 1-10.*

Harlen, W. & Deakin-Crick, R. (2003). *A Systematic review of the impact on students and teachers of the use of ICT for assessment of creative and critical thinking skills.* In Research Evidence in Education Library. EPPI-Centre, Social Science Research unit, UCL Institute of Education, University of London. https://eppi.ioe.ac.uk/CMS/ Default.aspx? tabid=462.

Hattie, J. & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77 (1), 81-112*. https://doi.org/10.3102/003465430298487

Haugland, S. W. (1999). What role should technology play in young children's learning? Part 1. *Young Children, 54(6) 26 – 31.* https://www.learntechlib.org/p/88445/

Heeks, R. (1999). *Development Informatics: Working paper series, Paper no. 5: Information and communication technologies, poverty and development.* Institute of development Policy and Management: University of Manchester. http://www.man.ac.uk/idpm/idpm_dp.htm#devinf_wp

Heitink, M. C., Van der Klij, F. M., Veldkamp, B. P., Schildkamp, K., & Kippers W. B. (2016). A systematic review of prerequisites for implementing assessment for learning in classroom practice. *Educational Research Review, 17, 50 – 62*.

Heritage, M. (2018). Assessment for learning as support for student self-regulation. *Australian Educational. Researcher45, 51–63.* https://doi.org/10.1007/s13384-018-0261-3

Hitchcock, C. H., and Noonan, M. J. (2000). Computer-assisted instruction of early academic skills.Top. *Early Childhood Special Education20, 145–158.* https://doi.org/ 10.1177/027112140002000303

Hourcade, J. P., Bederson, B. B., Druin, A., and Guimbretiere, F. (2004).Differences in pointing task performance between preschool children and adults using mice. ACM Trans. *Computer Human Interaction 11, 357–386.* https://doi.org/ 10.1145/1035575.1035577

Igbo, H. U., & Imo, N. T. (2017). Electronic Information Resource Sharing among University Libraries in Southern Nigeria: Opportunities and Challenges. *African Journal of Library Archives and Information Science, 27(1), 77-91.*

Jackson, A. A. (2015, October). *Assessment of ICT utilization in senior high schools in Asikuma-Odoben-Brakwa District (University of Cape Coast).* https://ir.ucc.edu.gh/xmlui/handle/123456789/3523

Jamieson-Proctor, R. M., Burnett, P.C., Finger, G., & Watson, G. (2006). ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools. *Australasian Journal of Educational Technology, 22, (4), 511-530*

John, D. (2021, December 11). *What is Data Analysis? Research Types, Methods, Techniques*. https://www.guru99.com/what-is-data-analysis. html

Johns, K. Troncale. J., Trucks, C., Calhoun, C., & Alvidrez, M. (2017). Cool tools for school: Twenty-first-century tools for student engagement. *The Delta Kappa Gamma Bulletin, 84 (1), 53 – 58*

Johnson, R. B. & Christensen, L. (2014). *Educational Research: Quantitative, Qualitative, and Mixed Methods Approaches (5th Ed).* SAGE Publication India Pvt Ltd

Joiner, R., Messer, D., Light, P., and Littleton, K. (1998). It is best to point foryoung children: a comparison of children's pointing and dragging. *Computer Human Behaviour 14, 513–529.* https://doi.org/ 10.1016/S0747-5632(98)00021-1

Jonassen, D., Howland, J., Marra, R. M., & Crismond, D. (2009). *Meaningful Learning with Technology*. Pearson Education Inc.

Jones, A. (2004). *A review of the research literature on barriers to the uptake of ICT by teachers.* UK: British Educational Communications and Technology Agency (BECTA) ICT Research. http://dera.ioe.ac.uk/1603/1/becta_2004_barrierstouptake_litrev.pdf

Kaarakainen, M., Kivinen, O., & Vainio, T. (2018). *Performance-based testing for ICT skills assessing: A case study of students and teachers' ICT skills in Finnish schools*. Universal Access in the Information Society, 2, 349–360. https://link.springer.com/article/10.1007/s10209-017-0553-9

Kadel, R. (2005). How teacher attitudes affect technology integration. *Learning & Leading with Technology 32 (5), 34 – 47.*

Katundu, D. R. M. (1998). *The use and sustainability of information technology (IT) in academic and research libraries in Tanzania* (Doctoral dissertation). https:www.ukzn-dspace.ukzn.ac.za

Kibble, J. D. (2017). Best practices in summative assessment. *Advances in Physiology Education, 41, 110 – 119*

Kirschner, P. & Woperies, I.G.J.H. (2003). Mind tools for teacher communities: a European perspective. *Technology, Pedagogy, and Education, 12(1), 127-149*. http://doi.org/10.1080/14759390300200148

Kirshenblatt-Gimblett, B. (2006). *Part 1, What is Research Design? The Contex of Design Performance Studies Methods Course Syllabus.* In W. M. K. Trochim (Ed.), Research Methods Knowledge Base. New York University. https://www.oise.utoronto.ca

Klinger, D. A., Volante, L., & DeLuca, C. (2012). Building teacher capability within the evolving assessment culture in Canadian education. *Policy Futures in Education, 10(4), 447-460.* https://doi.org/10.2304/pfie.2012.10.4.447

Koech, D. (2021, January 12). *List of ICT tools for teaching and learning: Tech devices for teachers and student.* https://kenyayote.com/list-of-ict-tools-for-teachers-and-students/

Korte, W. B. & Husing, T. (2006) Benchmarking access and use of ICT in European schools 2006: Results from Head Teacher and A Classroom Teacher surveys in 27 European countries. *E-Learning Papers, 2(1), 1–6.* https://www.empirica.com/publication/documents/No08-2006_learnlnd.pdf

Kuhn, T. (1977). *The Essential Tension: Selected Studies in Scientific Tradition and Change*. University of Chicago Press.

Kuhn, T.S. (1962). *The structure of scientific revolutions. (1st Ed.).* University of Chicago Press.

Kuruvilla, E. (2018, July 10). *Unit-11ICT and Assessment. ICT and Pedagogy*. http://egyankosh.ac.in//handle/123456789/46312

Kwache, P. Z. (2007). The Imperatives of information and Communication technology for Teachers in Nigeria Higher Education. MERLOT *Journal of Online Learning and Teaching, 3 (4) 395 -399.* https://www.semanticscholar.org/paper/The-Imperatives-of-Infprmation-and-Communication-in-Kwache/046c4eece4eb7c10fb6ce2108aa9f1ce11233492

Labbo, D. L., and Reinking, D. (2003). *"Computers and early literacyeducation," in Handbook of Early Childhood Literacy*, eds N. Hall, J.Larson, and J. Marsh. SAGE, 338–354. https://doi.org/10.4135/9781848608207.n28

Lai, K. W., Pratt, K., & Trewern, A. (2001). *Learning with technology: evaluation of the Otago secondary schools technology project*. Dunedin Press.

Lavrakas, P. J. (2008). *Encyclopedia of Survey Research Methods (vols. 1-0).* Sage Publications, Inc. https:/doi.org/10.4135/9781412963947

Law, N., Pelgrum, W. & Plomp, T. (Eds.). (2008). *Pedagogy and ICT Use in schools around the world: Findings from the IEA SITES 2006 study. (Vol.23).* Springer Science & Business Media.

Learning and teaching Scotland (2003). *Early learning, forward thinking: the policy framework for ICT in early years.* Learning and teaching Scotland. http://www.itscotlland.org.uk/earlyyears/files/ict_framework.pdf

Lewis, S. (2003). Enhancing teaching and learning of science through use of ICT: Methods and materials. *School Science Review, 84(309), 41–51.*

Lim, C. P. & Lee, C. B. (2002). Exploring WAP technologies: meditating e-discussions in learning communities. *Journal of Instructional Science and Technology, 5 (1)* https://hdl.handle.net/10497/910

Luecht, R. M. (1996). Multidimensional computerized adaptive testing in a certification or licensure context. *Applied Psychological Measurement, 20, 389–404*. https://doi.org/ 10.1177/014662169602000406

Luhamya, A., Bakkabulindi, F. E. K. & Muyinda, P. B. (2017). Integration of ICT in Teaching and Learning: A Review Theories. *Makerere Journal of Higher Education, 9(2), 21-36.* https://doi.org/10.4314/majohe.v9il2

Mackenzie, N. & Knipe, S. (2006). Research dilemmas: paradigms, methods methodology. *Issues in Educational Research, 16, 1-15.*

Maddux, C.D., Johnson, D.L. & Wills, J. W. (2001). *Educational computing: Learning with tomorrow'stechnologies, 3rd ed.* Allyn and Bacon,

Mahdi, H. S., & Al-Dera, A. S. A. (2013). The Impact of Teachers' Age, Gender and Experience on the Use of Information and Communication Technology in EFL Teaching. *English Language Teaching*, *6*(6), 57-67.

Mahmood, A & Bokhari, N. H. (2012) Use of Information and Communication Technology: gender differences among students at tertiary level. *Journal of Educational and Instructional Studies in the world. 2* (4), 100 - 108 http://www.wjeis.org/FileUpload/ds217232/File/12.mahmood.pdf

Majid, I. (2019). ICT in Assessment: A Backbone for Teaching and Learning Process. *United International Journal for Research and Technology, 1(3)*, *38-40*

Marina (2015). Information and Communication Technology (ICT) and Its Role in Educational Assessment. *Englisia, 3(1), 23-37.* https://www.doi.org/10.22373/ej.v3i1.664.

Markauskaite, L. (2006). Gender issues in preservice teachers' training: ICT literacy and onlinelearning. Australasian *Journal of Educational Technology, 22(1), 1–20*.

Mawia, H. L. (2021). *ICT tools for teachers.* https://www.academia.edu/31653767/ICT_TOOLS_FOR_TEACHERS

McAfee, O., Leong, D., & Bodrova, E. (2004). *Basics of Assessment: A Primer for Early Childhood Education Professionals.* National Association for the Education of Young Children.

McCormick, R. (2010). ICT and Pupils Assessment. *The Curriculum Journal, 15(2), 115- 137*. doi:https://doi.org/10.1080/0958517042000226793

McLeod, S. (2019, August 03). *Likert Scale Definition, Examples and Analysis.* https://www.simplepsychology.org/likert-scale.html

McNair, S., Bhargava, A., Adams, S., & Kypros, B. (2003). Teachers speak out on assessment practices. *Early Childhood Education Journal, 31 (1)* 23 – 31

Middleton, F. (2019, July 3). *Reliability vs validity: what's the difference?* https://www.scribbr.com/methodology/reliability-vs-validity/

Mikre, F. (2011). The Role of Information Communication Technologies in Education: Review Article with Emphasis to the Computer and Internet. *Ethiopian Journal of Education & Science, 6 (2) 109-126.* https://www.ajol.info/index.php/ejesc/article/view/73521

Millea, J., Green, I. & Putland, G. (2005). *Emerging technologies: A framework for thinking: ACT Department of Education and Training: final report* https://www.voced.edu.au/10707/54114

Ministry of Education (2002). Pathways to the future: Nga huarahi Arataki. A 10 – year strategic plan for early childhood education. Learning Media

Moganashwari, K. & Parilah, M.S. (2013). Knowledge, attitude and use of ICT among ESL teachers. Proceedings of the Global Summit on Education. *GSE Journal of Education, 11-12.* https://slidelegend.com/knowledge-attitude-and-use-of-ict-among-esl-teachers_59bb91a91723dd53e8e84080.html

Mona, L. (2004). *New e-Learning services based on mobile and ubiquitous computing: Ubi-learn project*. CALIE-04, International conference on Computer Aided Learning in Engineering Education, 16-18 February 2004, Grenoble, France. https://seahipaj.org/journls-ci/sept-2021/IJISSER/full/IJSSER-S-12-2021.pdf

Morahan-Martin, J. (2000) Women and the Internet: Promise and Perils. *Cyber Psychology and behaviour Volume 3(5) 683-691*

Mugo, F. W. (2002, September 6). *Sampling in research.* http://erepository.uonbi.ac.ke/handle/11295/54895

Murray, J. (2011, December 18). *Cloud network architecture and ICT - Modern Network Architecture.* http://itknowledgeexchange.techtarget.com/modern-network-architecture/cloud-network-architecture-and-ict.

Nah, K., & Kwak, J. (2011). Child Assessment in Early Childhood Education and Care Setting in South Korea. *Asian Social Science, 7(6), 66*. https://doi.org.10.5539/ASS.V7N6P66

Nandan, S. (2010). Determinants of customer satisfaction on service quality: A study of railway platforms in India. *Journal of public transportation, 13(1), 6.*

Natia, J. A., & Al-hassan, S. (2015). Promoting Teaching and Learning in Ghanaian Schools through ICT. *International Journal of Education and Development Using Information and Communication Technology, 11(2), 113-125.* https://files.eric.ed.gov/?d=EJ1074173

National Council for Curriculum and Assessment (NaCCA). (2019). *Teacher Resource Pack: Primary 1 - 6.* Ministry of Education, Ghana.

NCME. (2002). *Item and Tes Disclosure for Computerized Adaptive Tests*. In C. N. Mills, M. T. Potenza, J. F. John & W. C. Ward (Eds.), Computer-Based Testing-Building the Foundation for future Assessment. Lawrence Erlbaum Associates

Nel, J. P. (2016, July 16). *The Research Paradigms: positivism.* https://www.intgrty.co.za/2016/07/19/the research-paradigms-positivism/#:n:text= the%20%E2%80%9(discovered%%E2%8).

Neumann, M. M., and Neumann, D. L. (2018). Validation of a touchscreen tablet assessment of literacy skills and a comparison with a traditional paper-based assessment. *International Journal of Research and Method in Education 42, 385–398*. https://doi.org/10.1080/1743727X.2018.1498078

Neumann, M.M., Anthony, J.L.,Erazo, N. A., & Neumann, D.L. (2019). *Assessment and Technology: Mapping Future Directions in the Early Childhood Classrooms*. Frontiers in Education. https://doi.org/10.3389/reduce.2019.00116

Nevell, R. (1993). *Questionnaire. In Gilbert, W. (Ed.) Researching Social Life.* Sage Publication.

Nevski, E., & Siibak, A. (2016). *The role of parents and parental mediation on 0–3-year olds' digital play with smart devices: Estonian parents' attitudes and practices*. Early Years, 36(3), 227–241.

Newhouse, P. (2002). *Literature review: The impact of ICT on learning and teaching.* Department of Education.

Newson, P. (2021, January, 28). *12 Reasons Why the 5-Point Likert Scale is a Universal Sentiment Measurement*. https://worktango.com/2021/01/28/12-reasons-why-the-5-point-likert-scale-is-a-universal-sentiment-measurement/

Nicolas, A. (2021, September 21). *Quantitative Observation in Research.* https://www.researchprospect.com

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press

Noor-Ul-Amin S. (2013). An Effective Use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research and Experience: ICT as a Change Agent for Education. Department of Education. *Scholarly Journal of Education, 2 (4), 38-45.*

OECD (2009) *Education At a Glance 2009: OECD Indicators*. OECD Publishing.

Ogbomo, E. F. (2011). Issues and challenges in the use of Information Communication Technology (ICTs) in education. *Information impact: journal of information and knowledge management*, *2*(1), *1-15.* https://www.ajol.info/index.php/iijikm/article/view/144579

O'Hara, M. (2004). *ICT in the early years*. A & C Black.

OME (2014). *Achieving excellence: A renewed vision for education in Ontario*. Ontario Ministry of Education. htt://www.edu.gov.on.ca/eng/about/renewedvision.pdf

OME (2016a). *Growing success the kindergarten addendum: Assessment, evaluation and reporting in Ontario schools*. Ontario Ministry of Education. http://www.edu.gov.on.ca/eng/policyfunding/growing successAddendum.pdf

OME (2016b). *The kindergarten program 2016*. Ontario Ministry of Education. https://files.ontario.ca/books/edu_the_kindergarten_program_english_aoda_web_march28pdf

O'Rourke, M., & Harrison, C. (2004). The introduction of new technologies: New possibilities for early childhood pedagogy. *Australian Journal of Early Childhood, 29 (2), 11-18*. http://www.ansn.org.au/uploads/ORourke_Harrison.pdf

Parshall, C. G., Davey, T., and Pashley, P. J. (2000). *"Innovative item type for computerized testing," in Computerized Adaptive Testing: Theory and Practice*, eds W. J. van der Linden and C. A. W. Glas (Norwell, MA: Kluwer), 129–148. https://doi.org/10.1007/0-306-47531-6_7

Patterson, M. (2004). How can ICT enrich the learning environment in early childhood centres? *Computers in NZ Schools, 16 (1), 25-30.*

Patterson, M. (2000). How can ICT enrich the learning environment in early childhood centres? *Computers in New Zealand Schools, 16 (1), 25-30*

Paul, D. L. & Jeanne, E.O. (2015). *Practical Research: Planning and Designing, (11th Ed.).* Pearson Education Limited.

Payne, G., & Payne, J. (2004). *Key concepts in social research*. Sage Publication.

Pelgrum, W. J. (2001) 'Obstacles to the Integration ICT in Education: Results from a Worldwide Educational Assessment', *Computers and Education, 37(2), 163-178.*

Pineda, R., Bender, J., Hall, B., Shabosky, L., Annecca, A., & Smith, J. (2018). Parent participation in the neonatal intensive care unit: Predictors and relationships to neurobehavior and developmental outcomes. *Early Human Development, 117, 32–38.*

Plotkin, H. (1994). *Darwin Machine and the Nature of Knowledge*. Harvard University Press. https://www.doi.org/10.1177/027046769601600l108

Poehner, M. E. (2007). Beyond the test: L2 Dynamic assessment and the transcendence of mediated learning. *The Modern Language Journal,* 91, 323–340. https://doi.org/10.1111/j.1540-4781.2007.00583.x

Polit, D. and Hungler, B. (1999). *Nursing Research: Principle and Method (6th ed.).* Lippincott Company

Price, J. K., Pierson, E. & Light, D. (2011, March). Using Classroom Assessment to promote 21st century learning in emerging market countries. In *Global Learn Asia Pacific (pp.419-429).* Association for the Advancement of Computing in Education(AACE).https://cct.edc.org/sites/cct.edc.org/files/publications/using%20classroom%20Assessment.pdf

Prusak, L. (1997). *Knowledge in Organizations, (1st ed.).* Routledge. https://doi.org/10.4324/9780080509822

Prusak, L. (1997). *Knowledge in Organizations, (1st ed.).* Routledge. https://doi.org/10.4324/9780080509822

Pyle, A., & DeLuca, C. (2017). Assessment in play-based kindergarten classrooms: An empirical study of teacher perspectives and practices. *The Journal of Educational Research, 110 (5), 457 – 466.*

Ramsay, M. C. & Reynolds, C. R. (2000). *Development of a scientific test: A practical guide. G. Dans & M. Hersen, (Eds), Hand book of psychological assessment (3rd ed.).* Elsevier Science.

Rankin, J. G. (2016). *Standards for Reporting Data to Educators: What Educational Leaders Should Know and Demand*. Routledge.

Redecker, C. (2013).*The use of ICT for the assessment of key competencies. Joint Research Centre of the European Commission Scientific and Policy*. European Union. https://doi.org/10.2791/87007

Reeves, J. L., Gunter, G. A., & Lacey, C. (2017). Mobile learning in pre-kindergarten: using student feedback to inform practice. *Educational Technology & Society, 20 (1), 37 – 44*

Reijers, H., Leopard, H. & Recker, J. (2017). *Towards a science of checklists. In Proceedings of the 50th Hawaii International Conference on System Science (pp.5773-5782).* University of Hawaii. https://doi.org/10.24251/HICSS.2017.696

Reinen, I. A. M., & Plomp, T. (1997). Information technology and gender equality: A contradiction in terminis. *Computers in Education, 28, (2), 65–78.*

Reynolds, D., Treharne, D. & Tripp, H. (2003). ICT – the hopes and the reality. *British Journal of Educational Technology, 34 (2), 151 – 167*

Riley-Ayers, S. (2014). *Formative assessment: Guidance for early childhood policy-makers (CEELO policy report).* Center on Enhancing Early Learning Outcomes (CEELO).

Robbins, V. (1998). The development of information technology skills in trainee teachers for further education sector. *Research in Post-Compulsory Education, 3(2): 240-251*

Rodriguez-Donaire, S., García, B. A., & del Olmo, S. O. (2010, January 1). e-Portfolio: a tool to assess university students' skills. In *2010 9th International Conference on Information Technology Based Higher Education and Training (ITHET) (1ed. pp. 114-124). IEEE.* https://doi.org/10.1109/ITHET.2010.5480050.

Rosencrance, L. (2021, March 4). *Software*. https://searchapparchitecture.techtarget.com/definition/software

Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processesand ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education, 54(1), 103–112*. https://doi.org/10.1016/j.compedu.2009.07.010.

Sarantakos, S. (2013). *Social Research (4th Ed.)*. Palgrave Macmillan.

Sarfo, Q. & Ellen, J. (2007). Developing technical expertise in secondary/technical school: The effect of 4C/ID learning environments. *International Journal of Learning Environments, 30(25), 27-41.*

Scherer, R., & Siddiq, F. (2015). Revisiting teachers' computer self-efficacy: A differentiated view on gender differences. *Computers in Human Behavior, 53, 48–57*. https://doi.org/10.1016/j.chb.2015.06.038.

Schmid, R. F., Miodrag, N., and Francesco, N. D. (2008). A human-computer partnership: the tutor/child/computer triangle promoting the acquisition of early literacy skills. *Journal of Research Technology in Education 41, 63–84.* https://doi.org/10.1080/15391523.2008.10782523

Schoepp, K. (2005). Barriers to technology integration in a technology-rich environment. *Learning and Teaching in Higher Education: Gulf Perspectives, 2(1), 56-79.* https://doi.org/10.18538/lthe.v2.n1.02

Schogen-Phelan, B. & Keegan, B. (2016) Case Study on Performance and Acceptance of Computer-Aided Assessment. *International Journal for e-Learning Security, 6(1)*, https://www.doi.org/10.20533/ijels.2046.4568.2016.0061

Schumacher, P., & Morahan-Martin, J. (2001). Gender, Internet and computer attitudes and experiences. *Computers in Human Behavior, 17(1), 95–110*. https://doi.org/10.1016/S0747-5632(00)00032-7.

Segall, D. O. (1996). Multidimensional adaptive testing. *Psychometrika 61,331–354*. https://doi.org/10.1007/BF02294343

Sezer, B. & Yilmaz, R. (2019). Learning management system acceptance scale (LMSAS): A validity and reliability study. Australasian journal of Educational Technology

Shepard, L. A. (2000, February 1). *The Role of Classroom Assessment in Teaching and Learning. CSE Technical Report 517*. https://crest.org/wp-content/uploads/TECH517.pdf

Shuttleworth, M. (2008). *Descriptive research design: Observing a phenomenon*. Pearson Education, Inc.

Sincich, T. (1993). *Statistics by example (5th ed)*. Dellen.

Singh, T. K. R., & Chan, S. (2014). Teacher readiness on ICT integration in teaching-learning: A Malaysian case study. *International Journal of Asian Social Science*, *4*(7), 874-885.

Siraj-Blatchford, J., & Siraj-Blatchford, I. (2002). Developmentally appropriate technology in early childhood: 'video conferencing'. *Contemporary Issues in Early Childhood: Technology Special Issue, 3 (2), 216-225.*

Smeets, E. (2005). Does ICT contribute to powerful learning environments in primary education? *Computers & Education, 44 (3), 343-355.*

Smith, J. K. & Heshusius, L. (1986). Closing down the conversation: The end of qualitative/ qualitative debate among educational inquirers. *Educational Research, (150), 4-12.*

Sundararajan, A. (1999). Software Fundamentals. *C20.0001 Information Systems for Managers – Fall 1999*. http://www.oz.stern.nyu.edu/fall99/pdf/software.pdf

Tabassum, R. (2004). *Effect of computer assisted instruction (CAI) on the secondary school student achievement in science.* PhD Thesis, Rawalpinda. University of Arid Agriculture. https.prr.hec.gov.pk/thesis/235.pdf.

Taras, M. (2005). Assessment summative and formative some flection. *British Journal of Educational Studies, 53(4), 466 – 478*

Tarek, T. A. (2019, March 19). *Inferential Statistics.* https://doi.org/10.13140/RG.2.2.62725

Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology, 24(4), 413–424.*

Todman, J. (2000). Gender differences in computer anxiety among university entrants since 1992. *Computers & Education, 34(1), 27-35*. https://doi.org/10.1016/S0360-1315 (99)00036-6

Tondeur, J. Valcke, M., & van Break, J. (2008)."A multidimensional approach to determinants of computer use in primary education": Teacher and school characteristics. *Journal of computer Assisted learning, 24, 494-506.*

Toprakci, E. (2006). Obstacles at integration of schools into information and communication technologies by taking into consideration the opinions of the teachers and principals of primary and secondary schools in Turkey. *Journal of Instructional Science and Technology (e-JIST), 9(1), 1–16.*

Toroujeni, S. M. H. and Khoshsima, H. (2017). Computer Adaptive Testing (Cat) Design; Testing Algorithm and Administration Mode Investigation. *European Journal of Education Studies, 3(5), 764-795*. https://doi.org/10.5281/zenodo.576047.

Trotter, A., & Zehr, M. (1999). Preparing teachers for the digital age. *Education Week, 19 (4), 37-43.*

UNESCO's International Institute for Educational Planning (2021, July 13). *Information and Communication Technology (ICT) in Education. BRIEF4*. https://learningportal.iiep.unesco.org./on/issue-briefs/improve-learning/information-and-communication-technology-ict-in-education

United States Energy Information Administration (2016, February 03). *Computer and technology use in education buildings continues to increase.* https:/www.eia.gov/todayinenergy/ detail.php?id=24812.

Van Scoter, J. & Boss, S. (2002). *Learners, Language and Technology: Making Connections that Support Literacy. Creating Communities of Learning & Excellence.* Northwest Regional Educational Laboratory. http://www.netc.org/earlyconnections/pub/index.html

Venkatesh, V., Moris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Towards a Unified View. *MIS Quarterly, 27(3), 425-478*. https://doi.org/10.2307/30036540

Vlachou, M. A. (2018). Classroom practices in middle school science lessons: A study among Greek science teachers. *Cogent Education, 5 (1)* https://www.doi.10.1080/2331186x.2018.1455633

Volante, L. & Fazio, X. (2007). Exploring teacher candidates' assessment literacy: Implications for teacher education reform and professional development. *Canadian Journal of Education, 30(3), 749-770.*

Vrasidas, C., Pattis, I., Panaou, P., Antonaki, M., Aravi, C., Avraamidou, L., Theodoridou, K. & Zembylas, M. (2010). Teacher use of ICT: Challenges and opportunities, In: L. Dirckinck-Holmfeld, V. Hodgson, C. Jones, M. de Laat, D. McConnell, & T. Ryberg, (Eds.). *Proceedings of the 7th International Conference on Networked Learning, 15, 439-445.* http://www. lancaster. ac. uk/fss/organisations/netlc/past/nlc2010/abstrac ts/PDFs/Vrasidas. pdf.

Wainer, H. & Thissen, D. (2001). *Test Scoring*. Lawrence Erlbaum Associate Publishers.

Wainer, H. (1990). *Computerized Adaptive Testing: A Primer.* Lawrence Erlbaum

Wang, C. & Hoot, J. (2006). Information and Communication Technology in Early Childhood Education. *Early Education and Development, 17 (3) 317 – 322*

Weiser. C. & Jay, B. (1996). Noteworthy projection equipment for schools and libraries. *Media and Methods, 32, 10 – 13*

Willis, J. W. (2007). *Foundations of qualitative research: interpretive and critical approaches*. Sage Publications.

Wilson, G. B. (2008). *First course in ICT literacy (1st ed.).* Wilbay publishers.

Wilson, M. (Ed.) (2004). *Towards Coherence between Classroom Assessment and Accountability. National Society for the Study of Education yearbook. Vol. 103, Part II.* University of Chicago Press.

Wilson, P., Clarke, M., Maley-Shaw, C., & Kelly, M. (2003). "Smile, you're on digital camera!" Collaboration between communities, children, and computers. *Early Education, 33, 39-46.*

Woloshyn, V. W., Bajovic, M., and Worden, M. M. (2017). Promoting student-centred learning using iPads in a grade 1 classroom: using the digital didactic framework to deconstruct instruction. *Interdisciplinary Journal of Practice, Theory and Applied Research, 34 (3), 152–167.* https://doi:org/10.1080/07380569.2017.1346456

Wortham, S. C. (2014). *Assessment in Early Childhood Education. Sixth Edition.* Pearson Education Limited

Yildrim, S. (2007). Current utilization of ICT in Turkish basic education Schools: A review of teacher's ICT use and barriers to integration. *International Journal of Instructional Media, 34(2), 171-86.*

Yuen, A., & Ma, W. (2002). Gender differences in teacher computer acceptance. *Journal of Technology and Teacher Education, 10(3), 365–382.* https://www.learntechlib.org/p/15142/

Zurmuehlin, M. (1981). Working Papers in Art Education. *Iowa Research Online, (1) 54-63.* https://doi.org/ 10.17077/2326-7070.1025

APPENDICES

APPENDIX A

INTRODUCTORY LETTER

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF EARLY CHILDHOOD EDUCATION
P. O. Box 25, Winneba, Ghana
ece@uew.edu.gh
+233 (020) 2041072

FES/DECE/S.6

June 22, 2021

The Director,
Ghana Education Service,
Asikuma-Odoben-Brakwa District
Winneba

Dear Sir/Madam

INTRODUCTORY LETTER

I write to introduce to you **Mr. Saibu Belo** with index number **200022096** who is an M.Phil student in the above department. He was admitted in 2018/2019 academic year and has successfully completed his course work and is to embark on his thesis on the topic: ***"Kindergarten Teachers' use of existing ICT tools in Classroom Assessment Practices in Asikuma-Odoben-Brakwa District".***

Mr. Saibu Belo 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,

Yayra Dzakadzie, Ph. D
Ag. Head of Department

APPENDIX B

Permission Letter from Ghana Education Service

GHANA EDUCATION SERVICE

In case of reply the
Number and date of this
Letter should be quoted
My Ref: GES/AOB. 91/3
Your Ref:

Republic of Ghana

DISTRICT EDUCATION OFFICE
ASIKUMA-ODOBEN-BRAKWA
P. O. BOX 29
BREMAN ASIKUMA

12th July, 2021

THE AG. HEAD OF DEPARTMENT
DEPARMENT OF EARLY CHILDHOOD EDUCATION
UNIVERSITY OF EDUCATION, WINNEBA

Dear Madam,

RE: INTRODUCTORY LETTER
MR. SAIBU BELO

The Directorate writes to acknowledge receipt of your letter introducing Mr. Saibu Belo, an M.Phil student to our district.

Permission has been granted to undertake the exercise and hope the student will comport himself well.

The Directorate is prepared to offer him any assistance.

Congratulations.

.....
ROBERT KWAMINA ASOMANING
DISTRICT DIRECTOR OF EDUCATION
ASIKUMA-ODOBEN-BRAKWA

District Director
Ghana Education Service
Asikuma-Odoben-Brakwa

APPENDIX C

OBSERVATIONAL CHECKLIST

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF EDUCATIONAL STUDIES

DEPARTMENT OF EARLY CHILDHOOD EDUCATION

CHECKLIST FOR TYPES OF ICT TOOLS AVAILABLE IN THE KINDERGARTEN CLASSROOMS

Key: "Available = 2 "Available" and "Not Available = 1 **Tick the appropriate box for each item in the list**

Names of ICT Tools	**Available (2)**	**Not Available (1)**
Tablet	☐	☐
Photocopier	☐	☐
Printer	☐	☐
Computer(desktop/laptop)	☐	☐
Projector	☐	☐
Digital Photo Camera	☐	☐
Popplet	☐	☐
Pen Drive	☐	☐
IPod	☐	☐
Ipad	☐	☐
Webboard	☐	☐
Scanner	☐	☐
Flash disc	☐	☐
Microphone	☐	☐
Text Magnifier	☐	☐

Mobile Phone	☐	☐
Video Game	☐	☐
DVD & CD Players	☐	☐
Interactive White Board	☐	☐
Video Camera	☐	☐
Keyboard for Cerebral Percy	☐	☐
Audio Books	☐	☐
Typing Aid	☐	☐
Braille	☐	☐
Radio Cassette Recorder	☐	☐
Television	☐	☐
Any other (specify) ……	☐	☐

APPENDIX D

QUESTIONNAIRE

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF EDUCATIONAL STUDIES

DEPARTMENT OF EARLY CHILDHOOD EDUCATION

QUESTIONNAIRE FOR TEACHERS IN PUBLIC SCHOOLS IN ASIKUMA ODOBEN BRAKWA DISTRICT

This questionnaire intends to seek views of kindergarten teachers on the use of ICT tools in their classroom assessment practices. The information gathered will be used to provide recommendations on how kindergarten assessment can be enhanced with technology. Participants are assured that their information will be confidentially kept and used only for this purpose. Anonymity of participants in this study will strictly be ensured.

The questionnaire is in four sections; A, B, C, & D. Each section requires different set of information. Participants should kindly read and carefully respond. Thank you for your participation.

SECTION A: BACKGROUND INFORMATION

Please provide a **tick** where appropriate.

Gender:

Male ☐

Female ☐

Age (in years):

20 - 29 ☐

30 - 39 ☐

40 - 49 ☐

50 - 59 ☐

Professional Qualification:

Teachers Certificate 'A' ☐

Diploma ☐

Degree ☐

Post Graduate Degree ☐

Other (Specify) …….. ☐

Teaching Experience at kindergarten level (in years):

Below 2 years ☐

2 - 5 years ☐

6 - 10 years ☐

11 - 15 years ☐

16 - 20 years ☐

21 years and above ☐

Length of ICT use in teaching kindergarten pupils (in years)

Below 2 years ☐

2 - 5 years ☐

6 - 10 years ☐

11 - 15 years ☐

16 - 20 years ☐

21 years and above ☐

Capacity building training in computer use received yearly

More than thrice ☐

Thrice ☐

Twice ☐

Once ☐

Never ☐

Please rate each item in section "B" using the following key by providing a **tick** in the appropriate box;

Always = 5 Often = 4 Sometimes = 3 Seldom = 2 Never = 1

SECTION B

Various ways of using ICT tools in classroom assessment.

How do you use ICT tools in your classroom assessment practices?

I use ICT tools in classroom assessment for sharing assessment information/report with school administration, parents, learners and other stakeholders.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to construct test items for kindergarten children.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to administer test to kindergarten children.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to score/mark test items given to kindergarten learners.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to analyze the test results of kindergarten learners.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use adaptive technology to assess my learners based on their level of ability.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools like text magnifier, braille and others when assessing children with special needs at the kindergarten level.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to save/store test items and assessment data for future use of reference.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

I use ICT tools to create e-portfolios for pupils' learning.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

The key (Rating Scale) below represents the items in section "C". Kindly **tick** the appropriate box for each question.

Excellent = 5 Very Good = 4 Good = 3 Fair = 2 No Capability = 1

SECTION C

Teachers level of knowledge and competence in the use of ICT tools in classroom assessment practices.

What is your level of knowledge in the following activities?

The use of ICT tools to give feedback on learner's assessment to them and their parents

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT tools to construct assessment task for leaners.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT tools to analyze and interpret learner's assessment data.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT for scoring assessment tasks given to learners.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT tools to store/save assessment data of the learners for future use of reference.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT tools for administration of pupils' classroom test.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT to communicate school performance of learners to the school administration for decision making on learners and learning processes.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of adaptive technology to rate the same group of learners based on their abilities.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

The use of ICT tools to construct e-portfolios of pupils' learning.

Excellent ☐

Very Good ☐

Good ☐

Fair ☐

No Capability ☐

Please rate each item in section "D" using the key below by providing a **tick** in the appropriate boxes.

Always = 5 Often = 4 Sometimes = 3 Seldom = 2 Never = 1

SECTION D

Challenges teachers encounter in the use of ICT tools in their classroom assessment practices.

How do you face the following challenges in the use of ICT tools in classroom assessment practices?

Inadequate knowledge in the use of ICT tools in classroom assessment of kindergarten learners.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Inadequate computers and other ICT tools in the classrooms.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Developmentally inappropriate ICT tools for kindergarten learners.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Lack of/unstable electrical power in the school/classrooms.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Lack of technical support from experts.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Inadequate time for ICT use for assessment.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Limited understanding of ICT integration into classroom assessment.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Lack of internet coverage.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

Difficulty in communicating with parents and administrators through electronic means.

Always ☐

Often ☐

Sometimes ☐

Seldom ☐

Never ☐

APPENDIX E

ALPHA RELIABILITY COEFFIENCIENT

```
RELIABILITY
  /VARIABLES=Use_of_ICT_tools_to_give_feedback Use_of_ICT_tools_to_give_const
ruct_assessment_task Use_of_ICT_tools_to_analyze_learners_assessment_data Use
_of_ICT_tools_to_score_assessment_task Use_of_ICT_tools_to_store_assessment_d
ata
Use_of_ICT_tools_for_test_administration Use_of_ICT_tools_to_communicate_scho
ol_performance_of_learners Use_of_adaptive_technology_to_rate_learners Use_of
_ICT_tools_to_construct_eportfolios Use_of_ICT_tools_for_sharing_assessment_i
nformation
Use_of_ICT_to_costruct_test_items Use_of_ICT_tools_to_administer_test Use_of_
ICT_tools_to_score_test_items Use_of_ICT_tools_to_analyze_test_results Use_of
_adaptive_technology_to_assess_learners Use_of_ICT_tools_like_text_magnifier_
when_assessing_children
Use_of_ICT_tools_to_store_test_items Use_of_ICT_tools_to_create_eportfolios I
nadequate_knowledge_in_the_use_of_ICT_tools Inadequate_computers_in_the_class
room Inappropriate_ICT_tools_for_kindergarten_learners
Lack_of_electrical_power_in_the_classroom_for_ICT_use Lack_of_technical_suppo
rt_from_experts_on_ICT_use Inadequate_time_for_ICT_use Limited_understanding_
of_integration_into_assessment Lack_of_internet_coverage_to_communicate_asses
sment_information
Difficulty_in_communicating_through_ICT_tools
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE CORR COV
  /SUMMARY=TOTAL MEANS.
```

Reliability

```
[DataSet1] C:\Users\SAMSUNG\Desktop\Reliability testing - Copy.sav
```

Page 1

Warnings

Each of the following component variables has zero variance and is removed from the scale: The use of ICT tools for administration of pupils' classroom test, The use of adaptive technology to rate the same group of learners (based on their abilities), The use of ICT tools to construct e-portfolios of pupils' learning, I use ICT tools to administer test to kindergarten learners, I use ICT tools to score test items given to kindergarten learners, I use adaptive technology to assess my learners based on their levels of ability, I use ICT tools like text magnifier, braille and others when assessing children with special needs at the kindergarten level, I use ICT tools to create e-portfolios for pupils' learning , Inadequate computers in the classroom

The determinant of the covariance matrix is zero or approximately zero. Statistics based on its inverse matrix cannot be computed and they are displayed as system missing values.

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.825	.744	18