INTEGRATION OF INFORMATION COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN EARLY LEARNING: A CASE OF BUNGOMA COUNTY, KENYA

BY

DOUGLAS PATRICK BARASA

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DECLARATION

Declaration by Candidate

This research is my original work and has not been presented for any degree award in any other University. No part of the research may be reproduced without prior permission from the author and/ Moi University.

Signature_____Date _____

Douglas Patrick Barasa

EDU/D.PHIL.CM/1009/14

Declaration by the Supervisors

This thesis has been submitted for examination with our approval as Moi University supervisors.

Signature_____Date _____

Prof. Peter L. Barasa

Professor of Language Education,

Department of Curriculum, Instruction and Educational Media,

Moi University.

Signature_____Date _____

Prof. Carolyne Omulando

Professor of Language Education,

Alupe University College.

DEDICATION

I dedicate this work to my family for their encouragement, love and support throughout my studies.

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I want to acknowledge the Almighty God for His love and good health throughout my entire studies may His name is highly elevated.

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ABSTRACT

Integrating Information Communication Technology into curricula with the intent of positively influencing teaching and learning has been in a state of evolution over the past 20 years. The purpose of the study was to establish the integration of Information Communication Technology (ICT) into teaching and learning in early learning in Bungoma County, Kenya. The objectives of the study included; to analyse teachers' competency in integration of ICT, to examine the integration of ICT in planning for instruction in early learning, to investigate the integration of ICT in teaching and learning methods, to analyse the integration of ICT in teaching and learning materials and to examine the integration of ICT in the assessment for early learning. Technological Pedagogical Content Knowledge Framework (TPACK) by Punya Mishra and Matthew J. Koehler has guided the study. The study population included Early Childhood Development (ECD) teachers, education officers in charge of ECD in the county and public primary school headteachers. Simple random sampling was used to obtain 177 ECD teachers, which is 10% of 1,768 ECD teachers from 884 public primary schools in Bungoma County. The study sampled all the nine officers and nine headteachers. The study adopted a descriptive research design. Questionnaire and interview schedules were the main primary data tools for data collection. Quantitative data were analyzed using descriptive statistics and presented in both graphical and tabular formats while qualitative data were analysed using thematic analysis. Findings indicate that ECD centers in Bungoma County have more female teachers than male teachers. The central issue in the integration of ICT into early learning is pegged on the instructors having the requisite ICT training. The findings indicated that most of the ECD teachers in Bungoma county respondents 69.0% of the have not undergone training in ICT training in the past two years. Majority of ECD teachers in Bungoma county 94.4% did not own computer devices and very few schools have computers 26.0% and majority of 74.0% of schools do not have computers for ECD instructors. Findings show that ECD instructors require the integration of ICT components in order to pre-plan and post-plan for instruction (Mean = 3.614, SD = 0.952). Based on interviews, Head Teachers and ECD Education Officers perceived technology as very important in the planning of early year's education. However, the interview revealed that most teachers were concerned about competing educational responsibilities and their efforts to integrate technology. The findings indicate that ECD teachers in Bungoma County perceive that integration of ICT influences selection of teaching method to be used in the classroom. (Mean = 3.759, SD = 0.919). Findings from this study shows that Schools in Bungoma county do not use diverse set of ICT tools to communicate, create, disseminate, store, and manage information (Mean = 3.904, SD = 1.048). Majority of ECD teachers in Bungoma county 38% use Smartphone in instruction followed by 26% using computers. Other devices such as interactive whiteboard, tablets, video cameras and data projectors are not utilized at all. ECD teachers in Bungoma county indicated that teachers don't use ICT to store learners assessment records (Mean = 4.615, SD = 1.017) and very few of the teachers send learners performance to parents via emails and text messages (Mean = 4.090, SD = 1.035). The study recommends that the government improve the numbers of ICT devices in school to improve on the ratio of the ICT devices per pupil, should facilitate ICT training for teachers and lastly, ensure development of local content to support learning.

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ABBREVIATIONS AND ACRONYMS

CK	Content Knowledge
CSCL	Computer-Supported Collaborative Learning
CT	Communication Technology
FERPA	Family Educational Rights & Privacy Act
FSSE	Faculty Survey of Learner Engagement
ICT	Information and Communication Technology
ICT	Information Communication Technology
PK	Pedagogical Knowledge
SKAs	Skills, Knowledge, and Attitude
SPSS	Statistical Packages for Social Sciences
T/L	Teaching and Learning
TK	Technological Knowledge
TPAK	Technological Pedagogical Content Knowledge Framework
VLE	Virtual Learning Environments

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The potential benefits that technology brings to the improvement of overall learning outcomes cannot be overstated especially in the face of increasing evidence from educational researchers that suggests the use of ICT devices enhances the learning experience for young learners significantly (Glaubke, 2007; McCarrick & Li, 2007).

Children are being exposed to ICTs earlier in their lives with the increasing global proliferation of digital devices, therefore, making it increasingly important that they be equipped with the tools necessary to help them navigate the digital world more healthily and profitably (Parikhi, 2012). It is particularly important as the world continues to face an increasing rise in innovation in criminal activities of which children are especially vulnerable because of their naivety and impressionable natures (Funnell, 2011).

This chapter therefore, presents a general background to the study, the statement of the problem, purpose of the study, research questions, and assumptions of the study, significance of the study, scope and limitation of the study, theoretical framework and definition of terms. The aim of the chapter is to understand the implications of integrating ICTs in pedagogic systems in early learning development.

1.2 Background of the Study

ICTs refer to the tools that allow individuals and companies to manage their knowledge loads and communication needs digitally through the use of programmable devices (such as computers, cellphones, digital cameras) and networked infrastructure (such as the internet and other local communication network infrastructures like

LANs and WANs) (Booker, 2003). Their ability to increase the ease of communication and enhance collaboration is what makes them so flexible in the development and delivery of learning programs and material, but is also what complicates their integration particularly in early childhood education (Bray, Gray and White, 2004).

It is important that the integration be more holistic and take into account student's previous interactions with technology, the learning outcome goals the system intends because of the importance this has on performance evaluation, and the role that all the pieces in previous traditional learning processes play in the new system. In this way, it should enhance overall ICT competence among learners' way into their lives after school by ensuring that there is a continuity in their safe and healthy interaction with technology in and out of their institutions of learning (Clements, 2002)

Most of the recent literature on the topic also indicates that learners who start their interactions with ICTs early in their learning development improves their aptitude for the use of the different systems they encounter outside of school, and more so those they interact with in the work place (Stephen and Plowman, 2002). And, they also suggest that the involvement of more adults involved in the lives of young learners in the process of their education results in significantly higher learning outcomes especially when they involve contextual subjects, such as ICTs. And, while ICT integration in education has been advancing for the past 20 years, most of the development has been geared towards the improvement of the technical aspects of the venture (hardware and software) to make them more accessible (Dunn *et al*., 2011). As a result, there has been a significant increase in the number of instructional resources that allow learners to indulge at their own pace (Dunn and Stowell, 2011).

There is consensus on undertaking technology in education as a platform rather than as a stand-alone subject because of the convergence effects it has on increasing the ease of their delivery (Kang, Heo and Kim, 2011). As a result, it promises to help teachers and learning institutions to improve the learning outcomes of their learners significantly by providing them with the tools to take learning into their own hands and to move at their own pace (Drent, 2015). Also, it allows parents and guardians to take on more active roles in the learning development of their children by allowing them increased access to learning materials, and also allows them to contribute to their development and enhancement and increase learning outcomes further (Grabe and Grabe, 2011).

There are three facets involved in ICT integration in education are dependent on the goals one intends to achieve. First, learning institutions and teachers can develop curricula that teaches learners the different tools and how to leverage their features and powers to make their work easier and increase their outcomes. For example, understanding how to use word processors and spreadsheets can help learners to make their work more presentable and enhance the accuracy of their computations (Severin, 2010). Second, different institutions have created learning resources for different applications and operations involving the development and management of both hardware and software resources to create the technical capacity necessary to drive innovation in the sector. For example, major ICT corporations like Microsoft and Cisco have proprietary certification processes to ensure that they have impeccable support structures for their systems allover the globe. Last, schools can use ICTs to deliver learning material and programs to learners remotely through structured systems such as online learning management systems or through email or document repositories that allow learners to download notes and assignments and upload

answers and other documents (Drent and Meelissen, 2017). All in all, it is important to note that training teachers in these features of ICTs in education first should be a prerogative of any meaningful integration because of the critical role they play as the lynchpin in the education system (Plomp *et al*., 2015).

In many developed nations, incorporating ICTs in education has been receiving a lot of attention and investment over the recent past although the rate of development has been relatively slow especially because of the legal and ethical considerations that it creates (Pelgrum, 2015). On the one hand, ICTs promise to revolutionize the education sector and improve both access to learning resources and their overall outcomes, and on the other, there is the issue of placing ICTs in the hands of children. However, countries like the United Kingdom have demonstrated significant progress and success with incorporating technology in education (OECD, 2004). Their success can be attributed to their understanding of the distinction between integrating ICTs in education and e-learning because of the fundamental differences between these two concepts. While the former advises a more holistic approach to the approach by ensuring that both learners and teachers understand the features of different ICTs and how they can enhance the learning experience, the latter only looks at the use if ICTs as a delivery mechanism for learning materials (Stockley, 2013).

As a result, these countries have managed to create interactive learning environments that generate more than 5 times the feedback apparent in traditional systems that have worked to advise the improvement of learning outcomes through the active development of features that enhance the effectiveness of learning processes (UNESCO, 2015). Their development processes acknowledged the importance trainers had on the success of learning systems and made adequate provisions for their

comprehensive training and has resulted in them being able to handle different eventualities pretty effectively (Unwin, 2014). The skills they acquire increase their flexibility to develop and adapt teaching strategies to suit the evolving needs of their learners at the individual level, therefore, ensuring that no student is left behind. The resulting increase in learner transition into the net class or into the job market not only increases learners' confidence and morale, but also works to increase overall their learning outcomes and proficiency in the work place and in life (Iding *et al*., 2010; Wong, 2013).

ICTs capacity to create immersible environments have proven to instrumental in increasing learning outcomes especially in technical topics such as engineering and sciences (Kulk, 1994). Using design and rendering software, teachers can create intricate models of the functioning of different machine systems and organs in the body to help learners grasp the interrelationships between the various components that make them (Kulk, 2012). As such, they increase learners' capacity to grasp concepts by leveraging on their most abundant resource, their imagination, therefore, allowing them to be more analytical and critical in their thought processes (Kosakowski, 2015).

The ease of communication that ICTs bring to any process or system is probably its most valuable feature with regard to education because of the synergy that collaboration brings to both growing the body of knowledge and to its understanding (Singh, 2017). Collaboration enhances understanding significantly by giving learners the opportunity to interact with different perspectives by bringing them in contact with people with diverse backgrounds and experiences. For example, it makes it easier for learners from the tropics to understand theories related to glaciers by making it possible for them to interact with their counterparts from the poles, and vice

versa. As a result, not only can these interactions create new knowledge by widening the lenses through which learners look at the world and the problems that face it, but also make it possible to scale innovations in education and learning by generating actionable information (DFID, 2014). It does this by providing schools with inadequate facilities with the means to provide their learners with access to resources such as laboratories and other specialized equipment that they might not have in their institution of regions.

Despite the future of global work and life gearing towards digitization, it is disheartening to note that Africa and most other developing parts of the world are lagging behind with regard to access to and knowledge of how to exploit ICTs (OECD, 2006). And, while most of these countries are increasingly investing a significant amount of resources into enhancing their overall ICT capacities, the approach that many are taking is doing very little to make the transition strategic. As a result, most find themselves in situations that reduce their capacity to leverage their capital and labor resources effectively as they find themselves with billions worth of computer system resources that are at the brink of going obsolete.

Many studies argue that this inefficiency can be attributed to the failure of these countries to carry out feasibility studies relevant to their specific contexts especially with regard to their education systems (Keiyoro, 2010). He argues that in order for them to realize meaningful and lasting outcomes from harnessing the power of ICTs in different aspects of their economy and functions, they need to invest first in developing sound frameworks that take into account the extent of their circumstances and contexts (Gakuu *et al.*, 2009). The intricacies of the education sector especially

necessitate a lot of consideration with regard to the planning and execution of ICT integration plans because its implications cuts across their other functions.

The high interest the subject is generating among stakeholders in the education sector, especially in Kenya, is encouraging in part because of the financial resources that it continues to generate and largely because of the paradigm shifts it continues to create in education modelling (Keengwe, 2007; Cuban 2001; Oppenheimer 2003). As a result, the country has witnessed a tremendous increase in the ownership of personal computers and internet devices, especially among learners in institutions of higher learning and professionals of all ages, which promises to help bridge the divide between the current low rate of teachers employing technology in their teaching (Judson, 2006). That children are interacting with technology at home already is also a factor that is working to drive up its inclusion in education as they are demanding to be equipped with ICT skills and knowledge (Debell and Chapman, 2003).

Parents are also expressing a lot of interest and support for the venture because despite them investing in ICTs for themselves and their children, they rarely have the time to use them how to use them or oversight their usage (Kook, 1997). The active involvement of guardians in the process creates significant legal and ethical leeway because they take care of the issues raised by minors lacking the capacity of consent (Wang and Hoot, 2006). Therefore, it gives the initiative a much-needed boost by allowing teachers and institutions to focus their efforts and energies on developing the frameworks that guide the process of developing high performing programs and material, and evaluating their performance. Therefore, not only does this approach increase the utility that institutions get from ICTs, but also helps to equip learners with the know-how to help them increase the ROI they get from the investments they

and their parents will make in ICTs (Bialo, 2000). As a result, they should also improve the overall strategic position of the country significantly, and possibly work to safeguard the future of its labour supply.

So far, computers are reported to have tremendous impact on improving learners' ability to take control of the progress of their learning development and on their overall performance (Sivin-Kachala and Bialo, 1994). This aspect makes technology an important tool in enhancing the evolution of the education function for any country because of its versatility (Clements 1994; Haugland and Wright 1997). As such, not only have they proven to be instrumental components in enhancing the participation of learners in the education process, but also provides learners with the opportunity to hone other equally important soft skills that can help them in their personal and professional lives (Kleiman, 2000). Also, the largest impediment to the effective rollout of ICT integration in education remains to be the unwillingness of teachers to use them in their processes despite their understanding of the benefits (Bauer and Kenton, 2005). However, this might be indicative of deeper problems in education systems that have resulted in teachers being overworked and underpaid, while facing mounting pressures from other stakeholders continuously (ISTE, 2000). It is especially a tall order for teachers involved in early childhood development (ECDE) because of the added burden that socializing children brings to their day-to-day work load (Haugland, 1992). Therefore, these reforms need to take on a multidisciplinary approach if they are to be effective in the long term, because technology only works to their advantage if all the underlying frameworks are operating optimally (Bredekamp and Rosegrant 1994; Clements, 1994). In addition, this approach promises to ensure that the training learners receive early in their lives sparks enough

interest that they pursue the acquisition of further knowledge and skills, and ways to integrate them to improve their lives and their environment.

1.3 Statement of the Problem

There is a growing recognition of the many different ways that ICT can contribute to, or transform, the activities, roles, and relationships experienced by teachers and in early childhood education settings. Bray, Brown, & Green, (2004) suggests three reasons why ICT matters in early childhood education. First, ICT already has an effect on the people and environments that surround young children's learning. Second, these technologies offer new opportunities to strengthen many aspects of early childhood education practice. Third, there is support and interest across the whole education sector for the development and integration of ICT into education policy, curriculum, and practice. However, there is a clear consensus in the literature that the introduction and use of ICT in early childhood education should be grounded in a clear understanding of the purposes, practices, and social context of early childhood education.

Other recent international literature reviews of ICT in early childhood education have focused mainly on children'suse of ICT in early childhood education (Stephen & Plowman, 2002). This review includes information about children's use of ICT, but takes a much broader view of the role and potential of ICT in the early childhood education sector. According to Keiyoro (2010), there have been concerns raised within the Education sector about how ICT could be integrated into teaching and learning methodology to enhance the acquisition of knowledge and skills in Science. He further notes that no previous research has been carried out on the effective use of computers in teaching and learning the Science curriculum within Kenyan education

system; this view is shared by Gakuu *et al*., (2009). For this reason, Keiyoro recommends (for future research) development of guidelines for ICT integration in teaching and learning; of course, early learning institutes are no exceptional.

In addition, the integration of educational technology into classroom instruction to enhance learner learning is of increasing interest to stakeholders such as policymakers, administrators, educators, learners, and parents (Keengwe, 2007). Therefore, technology is not really a culprit if we use it wisely and it also should solve the problems and fill the gap in the education system as expected. Since literature has shown that integrating technology into curricula with the intent of positively influencing teaching and learning has been in a state of evolution. Therefore,the main purpose of the study is to establish the influence of the integration of Information Communication Technology onto teaching and learning in early learning in Bungoma County, Kenya.

1.4 The Purpose of the Study

This study aims to establish the implications that integrating technology in education can have on learning outcomes and making the country more strategic with regard to the development of its talent supply and solutions to its challenges and problems. It does this by looking at the perceptions and conversations surrounding the paradigm shift necessary to help the country increase the competitiveness of its education system.

1.5 Objectives of the Study

This study was guided by the following objectives:

i. To analyse teachers' competency in integration of Information Communication Technology in early learning in Bungoma County, Kenya.

ii. To examine the integration of Information Communication Technology in planning for instruction in early learning in Bungoma County, Kenya

iii. To investigate the integration of Information Communication Technology in teaching and learning methods in Bungoma County, Kenya

iv. To analyse the integration of Information Communication Technology in teaching and learning materialsin Bungoma County, Kenya

v. To examine the integration of Information Communication Technology in the assessment for early learning in Bungoma County, Kenya

1.6 Research Questions

This study was guided by the following research questions:

i. What competencies do the teachers have in integrating of Information Communication Technology in early learning in Bungoma County, Kenya?

ii. How is Information Communication Technology integrated in planning for instruction in early learning in Bungoma County, Kenya?

iii. How is Information Communication Technology integrated in teaching and learning methods in Bungoma County, Kenya?

iv. How is Information Communication Technology been integrated in teaching and learning materials in Bungoma County, Kenya?

v. How is Information Communication Technology integrated in the assessment for early learning in Bungoma County, Kenya?

1.7 Significance of the Study

It is hoped that the findings of this study will benefit early learning institutions management, learners, policymakers, governments, scholars, researchers and other relevant stakeholders.

This study aimed at educating the institutions of early learning about how to handle the application of information communication technology in teaching and learning, as well as techniques that can strengthen teaching and learning.

This research will also assist institutions of early learning by researching learners' most widely used methods and technologies in information communication and technology, as well as the most effective ways and techniques to attract and interact with future foreign learners. This study also aims to propose successful ways and incorporation of information communication and technology in teaching and learning which can boost the academic achievement of learners. Early learning institutions are not enough to merely establish a link with their prospective learners; it is also necessary to attract their interest and engagement and to create a constructive link.

This study will benefit learners in terms of informing them on effective usage of Information Communication and Technology in teaching and learning that can enhance their academic achievement. Most learners in early learning institutions come from different backgrounds. Apart from relying on traditional communication sources, or even travelling from one place to the other, they can rely on Information Communication and Technology for academic and other related information.

This study will help policymakers to make decisions on whether to recognize the integration of Information Communication and Technology in teaching and learning which can be introduced in the curriculum.

1.8 Justification of the Study

While numerous studies have examined and studied the integration of ICT in education, only a few studies centered on the integration of ICT in teaching and

learning inearly learning. This study contributes to teaching and learning communication technology techniques by implementing new communication technology techniques that can be used by institutions of early learning, and further explored by researchers and scholars.

Again, this research focused on filling the gaps in practical literature relating to challenges and strategies for incorporating information communication technology into teaching and learning, as most literature offers theoretical rationale for integrating information communication technology into teaching and learning, and there are not as many primary studies or pedagogical perspectives as possible.

1.9 Scope of the Study

The scope of this study refers to the parameters under which the study will be carried out. The main aim of this research was to investigate the integration of information communication technology into teaching and learning in early learning in Bungoma County. The study restricted itself to the integration of information communication technology into the teachers' competence, the instruction planning in early learning, the teaching assessment and learning, teaching and learning methods and teaching and learning materials.

The study was conducted among teachers and head teachers of early learning schools in Bungoma County.The study used questionnaires and interview schedules in data collection and adopted descriptive design using a mixed method approach.

1.10 Limitations of the Study

Limitations are the faultiness, circumstances or the influences not controlled by the researcher who placed restrictions on methodology and conclusions. In addition,

limitation is an aspect of the research that may negatively influence results and have an impact on the generalizability of the results, but which the researcher has definitely no control over (Mugenda & Mugenda, 2003).

Since there are a number of institutions of early learning, it was difficult for each institution to address the scope of this research. The limitations of the data collected makes it difficult to generalize across early learning institutions, however, the sampling technique was used to obtain the required samples.

The study report was also carried out on a small-scale study in which a small sample was used to enhance the richness of qualitative data. Consequently, the effects cannot be extended to all members. Nevertheless, the methods followed in this study have was used to adapt learners to learning environments that allow them to be responsible for making sense of what is being taught.

1.11 Assumptions of the Study

The study made several assumptions as listed below:

i. Teachers of early years use communication ICT strategies to not only share content but in teaching and learning.
ii. Teachers of early years and head teachers were truthful in their responses.
iii. Teachers of early years and head teachers responded to the best of their ability.
iv. Head teachers did not answer the interview items they find unclear.
v. A sufficient amount of data was received for research validation and analysis.

1.12 Theoretical Framework: Technological Pedagogical Content Knowledge Framework (TPACK)

Technological Pedagogical Content Knowledge Framework (TPACK) by Punya Mishra and Matthew J. Koehler's (2006) focuses on technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK), offers a productive approach to many of the dilemmas that teachers face in implementing educational technology (edtech) in their classrooms. By differentiating among these three types of knowledge, the TPACK framework outlines how content (what is being taught) and pedagogy (how the teacher imparts that content) must form the foundation for any effective edtech integration. This order is important because the technology being implemented must communicate the content and support the pedagogy in order to enhance learners' learning experience.

According to the TPACK framework, specific technological tools (hardware, software, applications, associated information literacy practices, etc.) are best used to instruct and guide learners toward a better, more robust understanding of the subject matter. The three types of knowledge – TK, PK, and CK – are thus combined and recombined in various ways within the TPACK framework. Technological pedagogical knowledge (TPK) describes relationships and interactions between technological tools and specific pedagogical practices, while pedagogical content knowledge (PCK) describes the same between pedagogical practices and specific learning objectives; finally, technological content knowledge (TCK) describes relationships and intersections among technologies and learning objectives. These triangulated areas then constitute TPACK, which considers the relationships among all three areas and acknowledges that educators are acting within this complex space.

TPACK model resonates with this study since it helps teachers consider how their knowledge domains intersect in order to effectively teach and engage pupils with technology. Also the theory illustrates how a teacher can combine knowledge of content, pedagogy, and technology for innovative teaching and learning. A teacher capable of negotiating these relationships represents a form of expertise different from, and (perhaps) broader than, the knowledge of a disciplinary expert. TPACK is an essential part of the education system today as it incorporates the growing demand on the use of technology in the classroom as well as continuing the focus on the content and how we teach it. Therefore, it sets up education for the future as well as setting up the learners for their future.

1.13 Conceptual Framework

The research was based on the following paradigm, which conceptualizes the introduction of information management systems into early learning by emphasizing independent variables and dependent variables. Since technology has the ability to increase the quality of education when implemented correctly, the research promotes the use of technology in classrooms and provides promising findings on children's learning experiences enabled by electronic tools. Kids who are familiar with technical technologies at an early age in professional education services may have the benefit of technology-enhanced existence. Teachers are therefore looking for innovative ways to use technological materials in early childhood education (Barron *et al*., 2011).

Dependent variables based on teaching and learning in early years. These includes; the usefulness of ICT in teaching and learning, access to ICT devices and ability to use ICT devices. On the other hand, independent variables focused on teachers' competency based on skills, knowledge and attitude, planning for instruction that

comprise organizing, design in instruction, and based on assessment of teaching and learning. Apart from, the independent and dependent variables, the reascher identified interveving variables, which includechildren background, support staff and learning environment. The reasercher minimized the effect of intervening variables by obtaining large sampe of respondents and triangulation of reaserch instruments. Figure 1.1 illustrates the conceptual framework and the intertwining of independent and dependent variables.

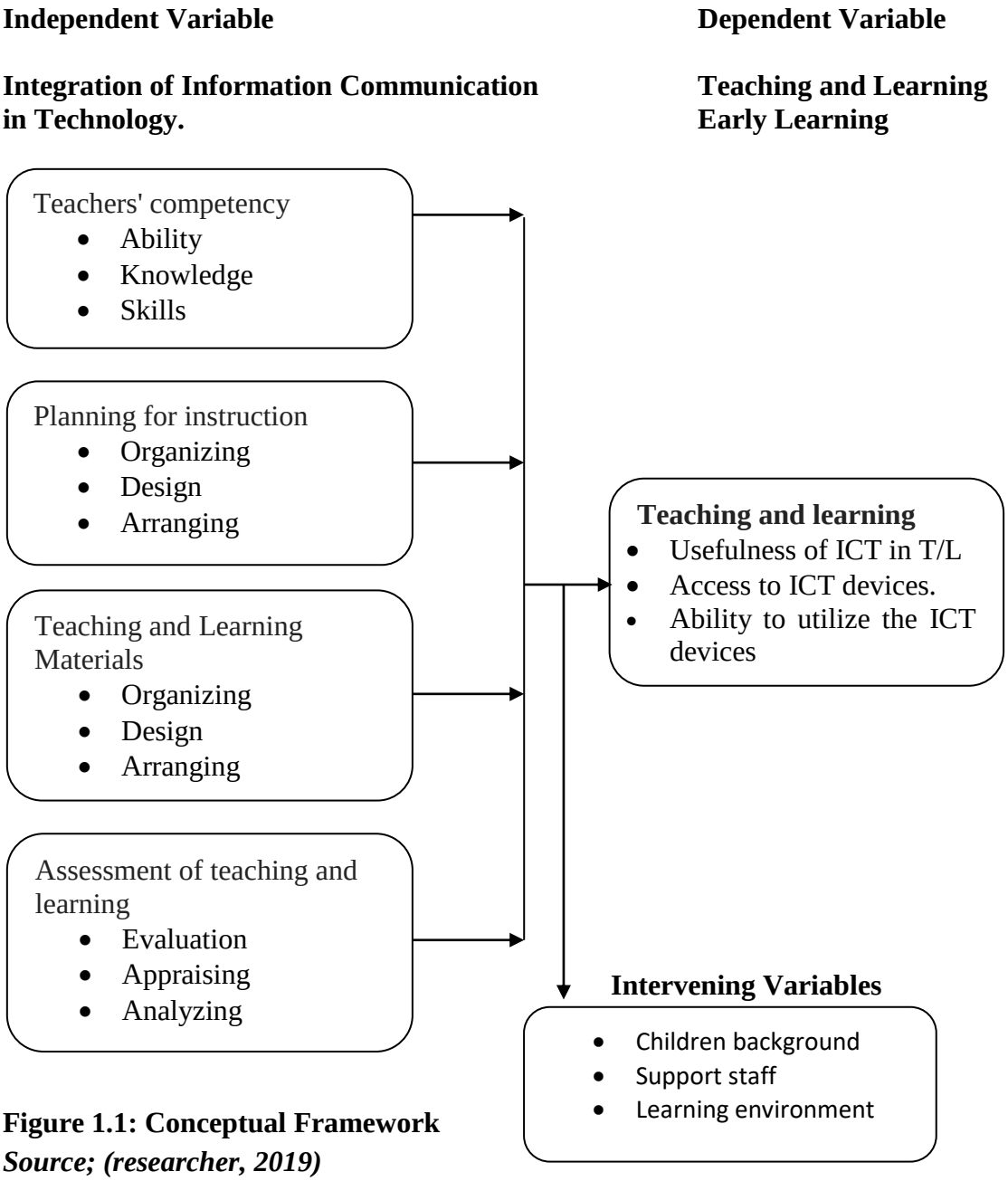

Figure 1.1: Conceptual Framework
Source; (researcher, 2019)

1.14 Operational Definition of Terms

The terms used could have different meanings in other contexts, or, could be written differently. Therefore, the researcher explains what the terms mean as used in this study.

Assessment In this study assessment is the process of defining, selecting, designing, collecting, analyzing, interpreting, and using information to increase childrens' learning and development.

Early learning: Early learning refers to programs that provide education for children between the age of 3 years and 8 years old outside their own home and before primary level.

Information Communication Technology. Use of communication technologies in instructuction. This includes the Internet, wireless networks, cell phones, and other communication mediums.

Integration Is the process of synthesizing multiple models (or representations) into a common model (representation) or simply the act or process of uniting different things.

Integration of Information Communication and Technology refers the embedding of the ICT into teaching and learning environments as a tools set to create a more effective teaching and learning process.

Learning Refers to theprocess of gaining knowledge and expertise in utilizing information communication and technology.

Planning for Instruction is the process where the teacher assesses the curriculum standards and develops subsequent lesson content matching the standards.

Teachers' competency is the skills and knowledge that enable a teacher to be able to utilize ICT to a prescribed standard in teaching and learning.

Teaching and Learning materialsrefers to a spectrum of educational resources or tools that teachers use in the classroom to support specific learning objectives, as set out in lesson plans.

Teaching and Learning methods Involves set of techniques put together in presenting instructional materials or conducting instructional activities.

Teaching Is the process of imparting knowledge to or instructs children as to how to do something or learn or understand something by example or experience.

1.15 Summary of the Chapter

This chapter has presented the historical background of the study that leads to the statement of the problem and the purpose of the study. The chapter also presents the objectives of the study and the research questions. The assumptions, rationale and significance of the study have also been illustrated. The scope, limitations theoretical framework that guides this study has also been discussed. The conceptual framework of the study and definition of key terms used in the study have been presented at the end of this chapter. The succeeding chapter presents a review of literature that guided the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review section reviews the works of previous similar studies empirically to highlight the knowledge gaps apparent in the integration of Information Communication Technologies in education especially with regard to the strategies different institutions, countries and regions develop and employ. As a result, it also helps in establishing the role that all stakeholders play in ensuring the success of the paradigm shift that results from the evolution of learning from traditional passive model to the more progressive active model. Therefore, it also makes the investigation more holistic and highlights possible challenges and problems that might reduce the realization of the shift and the advantages it promises.

2.2 Integration of ICT in Teaching and Learning in Early years

Information Communication Technology (ICT) is a collective term used to refer to the electronic devices and communication infrastructure that allows them to communicate with each other autonomously or as tools in the hands of individuals. The term replaced the formerly common moniker IT that remains synonymous to the description of feature-rich gadgets (especially computers and computer devices) and the internet. This shift came about as a result of the expansion of the concepts of information and communication prompted by the diversity in their definitions based on the field in which they are applied and the purposes for which they are intended. As such, the world has come to view information as a tool much as it views ICTs with the product being knowledge because of its contextual nature that makes it valuable (Siraj-Blatchford & Siraj-Blatchford, 2003). Learning is the process through which individuals and groups combine the information and tools available to them to

develop actionable and meaningful insights that make their work and lives easier and solve challenges and problems they face.

As such, ICTs hold the promise of revolutionizing education because the function's core purpose is to facilitate knowledge management by providing a structured environment that equips learners with the skills to promote learning, especially as the world grows increasingly digital. And, given the intricate interconnectedness of the world, the tools that technology provides make it possible for people to develop solutions and interventions that are more practical and sustainable, by broadening their perspectives of their implications both locally and in the greater region. As a result, it promises to make a country or institution more strategic by increasing its surveillance capacity over more aspects in its operating environment.

The increased capacity technology brings to the understanding and management of the various elements of a system also works to improve learning outcomes significantly (Kang, Heo & Kim, 2011). It does this by giving learners the aptitude to take active command of their own learning development and develop evaluation strategies that help them to bridge gaps in knowledge that keep them from achieving higher outcomes (Dunn *et al*., 2011). In addition, it provides them with the tools to communicate with their peers, network with subject matter experts and access diverse knowledge repositories to grow their understanding of the concepts they want to study. Also, because technology also increases the ease of editing and adding to the body of knowledge, it also allows learners to contribute to making information easier to consume and understand by using the numerous suites of tools available to create more effective delivery modes like videos (Voogt and Roblin, 2010).

In Thailand, the government took on an ambitious project to improve its education system and secure the quality of talent the function produces that involved developing interventions to hedge the country from the increasing risk globalization continues to pose. As a result, the country has managed to improve learning outcomes by creating guidelines that have seen the enrichment of the learning environments of its schools and encouraged institutions to leverage the country's growing technological advances to improve their service delivery especially to young learners. Also, by linking these strategies with their national technology strategic plan, the country has positioned itself to create perpetual high performing talent to run its digitization agenda and help to create additional revenue streams in its economy in the long term.

Aligning education goals with the country's long-term goals improves learning outcomes tremendously by creating a closed-loop system between learning institutions and industries and the job market. Increasing the interrelationship between these two principle elements of economic development and growth further improves the country's capacity to ensure that they remain competitive globally. It does this by increasing their capacity to track the evolution of challenges and problems facing different regions, therefore, giving them the foresight to nurture the skills and talents needed to solve them. In addition, it generates significant volumes of information actively that helps to inform the development of policies and frameworks that are flexible enough to evolve with the changing circumstances and contexts of the global environment (Pelgrum, 2001). As a result, Thailand boasts the capacity to ensure that its education and talent supply development remain strategic which has worked to create employment opportunities for its people and reduce unemployment rates considerably.

The use of computers and ICTs in the classroom has undergone a lot of transformation over the years as different institutions and countries have worked to develop adoption strategies that offer them higher returns. Their use started out as standalone courses with dedicated labs to teach learners the different features of computing devices and how to exploit them to increase their capacity to manage knowledge, but has since evolved to the use of ICTs as auxiliary tools in the learning process. As such, there also exists a vivid trend in the evolution of policies and framework guiding the development and management of curricula, with countries and institutions in the same regions exhibiting a convergence in their development patterns. Sound procedures set the tone that allows institutions to get the most out of the integration of ICTs by taking advantage of its processing and communication features to enhance the performance of all stakeholders (Pelgrum and Voogt, 2005). Also, they increase the levels of accountability in the system by increasing the ease of analyzing the large volumes of performance data sets that the different elements and processes of the systems generate (Peacock and Jesson).

For learners, existing evidence suggests that ICT integration increases morale and translates to higher performance (Boyd, 2013, Machell, McHugh, Passey, Rogers). For teachers, the increased performance of their learners coupled with them taking on active roles in their learning process not only eases their workload, but also improves their motivation significantly by giving them more time to focus on providing their learners with more value. These advantages further work to enhance the learning environment and create synergies that improve the relationship between teachers and learners resulting in both increasing their understanding of course materials. For institutions and their management, ICTs have helped to increase accountability by increasing the ease of access to all the information generated by their processes. The

time savings that it makes possible also allows them to focus more time and resources to improving processes and systems so that they offer more value to stakeholders, especially their learners and teachers. Also, using technology allows schools to save significant amounts of money in printing and postage costs for student report cards, and also increases their assurance that they will reach guardians.

However, since technology is very dynamic and new devices and platforms are created every other day, focusing on understanding what combinations, especially of soft of software, bring the most advantages to digital learning strategies is fast becoming the most important aspect of ICT integration (Clements, 2002). Currently, and probably going forward, as technology brings about the convergence of the processing capabilities of most devices, the choice of software is fast becoming the only variable that policymakers can leverage to increase the success of their strategies. In addition, studies have shown that the ease of use of software plays a large role in influencing the perceptions and attitudes of its users and, therefore, further increasing their importance in the conceptualization of technology integration in education. It is especially an important consideration when selecting and preparing instructors because of their importance in creating healthy attitudes in learners, which is instrumental in giving them the tools to create sustainable effective learning habits. And, when the attitudes of both instructors and learners converge, they are able to make significant contributions that work to improve the efficiency and outcomes of the whole system.

Besides, since children already encounter and interact with ICTs everywhere they go, and in most cases have access to a wider range of services and applications, the role of instructors should be to help them understand how to best use those tools to

improve their capacity to understand new concepts and use the knowledge they develop contextually to solve the challenges they encounter. It is especially important because of the large number of applications and information that enters the market each day that can be overwhelming unless one understands how to curate them efficiently (NAEYC, 2009). Also, the fact that there is at least twice as much corruptible and malicious content being created, teaching children how to stay safe also helps to safeguard the integrity of the computer systems they own and those of others to which they have access. The Albert Shanker Institute (2009), also echo these sentiments in their recommendation that technology exposure should occur as early as in kindergarten not only because of the benefits it has on learning outcomes, but also because of the feelings of self-esteem and self-efficacy they instill in young learners increases their capacity to take on more complex concepts later while also equipping them with the skills to help them in discerning malicious intent in their systems (Epstein, 2007; Pianta, 2003).

Also, there is a lot of evidence that suggests that strong preparatory foundation prepares individuals to higher academic performance in their later years. In the same vein, it stands to reason that early exposure also holds the possibility of creating lasting healthy learning habits that should increase learning outcomes significantly in learners' later years (Camilli, 2010, Carneiro & Heckman, 2003; Chambers, 2006; Coghlan, 2009; Karoly, 1998, 2005; Waldfogel & Washbrook, 2010). Because of the added burden of anxiety that comes with the learning process, a solid foundation should also improve the overall health and wellness of learners; which is increasingly becoming a worrying concern in education (Campbell, 2012). In addition, the increased capacity learners gain with regard to withstanding the pressures associated with knowledge management increases their ability to stay with the process longer

(meaning most of them went on to join and even finish education at a tertiary level) (Grant, 2003). In fact, according to Bose (2005), the increasing digitization of teaching and learning has resulted in the transformation of a lot of fundamental resources including how the alphabet is taught to include ICTs, such as C for computers. However, despite the numerous studies carried out on the subject, ICT integration is still slow especially in the developing countries and regions of the world greatly because it is not a priority. In more developed nations, the compromise between the advantages that are inherent in digitization and the risks that come with a digital world is what is keeping them from realizing a total integration.

According to Ertmer (2005), institutions looking to increase the benefits they draw from integrating technology into their learning programs should take a holistic approach such as the one Thailand undertook. He further argues that it is only by developing strategies that bring about the integration at the lowest levels of their operations that they can create a significant enough shift in how they deliver content and how their learners assimilate this information into meaningful knowledge. Therefore, this means that they might also have to contract experts to help them in designing adequate structures to guide their teachers on how to merge their traditional teaching plans and materials with the new digital platform. It might also mean that in the early stages they might have to have the same contractors, or others, convert existing material so as to ensure the continuity of their learning processes because of the workload implications that the combination should have on their staff.

Just like any other technical concept, learners develop higher abilities when exposed earlier in their learning development in part due to the effects it has on increasing their learning curves, and largely because of the stigma that is associated with not

understanding some things as an adult that might compromise an individual's ability to learn them. Therefore, integrating ICTs in education, and especially in the formative years, holds the promise of increasing the outcomes institutions can reap both in the improvement of working conditions for teachers, and in increasing the performance of their learners (Van Scoter & Boss, 2002). In addition, learning ethics earlier has proven long term benefits because it becomes engrained in the character of the learners. That is to say that if introduced to learners earlier on in their lives, they should grow to be responsible users of the tools at their disposal, and also make them unwitting policing agents that work to make the digital space safer for all users.

2.2.1 Early Childhood Education in Kenya

Early childhood education in Kenya serves the critical purpose of preparing young children for primary education. Notwithstanding the associated benefits for society as a whole, the government of Kenya is involved minimally. Because early childhood programs are essential, the government should be involved actively in the developpment and implementation process (Lydiah W. N.,2009).

In 2006, the Kenya government adopted a policy on Early Childhood Development (ECD). The policy document outlines a comprehensive framework that encompasses policies for early childhood services and programs for children from conception to age eight years. Also, it outlines an ECD policy system and provides a frame of reference in the provision of services for infants and children. Further, it provides a basis to strengthen, develop, and review policies related to health and nutrition, education, water and sanitation, and social services. According to a 2006 policy document, the Republic of Kenya sector policies are central in providing standards

and guidelines for ensuring provision of quality services for all children in their earliest years.

The Government of Kenya acknowledges the importance of early childhood education as a pillar for accelerating Sustainable Development Objectives (Republic of Kenya, 2006). To ensure quality Education and learning environment during a child's formative years, Education for All first goal stipulates that it is the responsibility of every Government to expand and enhance comprehensive Early Childhood Education. It is imperative for all children to have a worthy start to life (Githinji& Kanga, 2011).

To ensure access to basic Education, currently many developing and developed nations all over the world have been developing and implementing policies to ensure that they achieve Education for all (Kang'ethe, Wakahiu & Michael, 2015). This has spurred several nations, especially in in the sub-Sahara, into confronting their historically low access to quality education and children's holistic development (Lewin, 2009). This has brought a remarkable success in attracting several young children into learning institutions (UNESCO, 2008). Unfortunately, the 2010 UNESCO report indicate that not all preschool age children are attending ECDE centres, there has been a relatively low parental involvement among preschool children, very few countries provides free preschool education and many preschool learning centres have poorly established learning environment in most subSaharan Africa counties, Kenya inclusive.

Despite the difficulties fronting Early Childhood sub sector in many parts of the world, the early years are internationally recognized as the greatest critical years for the lifetime development of a person (Kang'ethe, Wakahiu& Michael, 2015). In this regard, there is an evidence of a positive correlation between the child's quality of

early childhood nurturing, health, environment, learning and future holistic development and academic achievement in subsequent grades in primary, secondary schools and colleges (Bradbury, 2007). In fact most founders of early childhood education have also emphasized on the same fact for instance Froebel, Pestalozzi and Dewey constantly showed that early years are crucial stage of growth of mental and physical capabilities and progress at an astonishing degree (Murunga, 2015).

To ensure quality basic education, many developing nations like Kenya have dedicated significant amount of resources to expand of pre-school Education in currently. The expansion is thought to contribute to the improvement in enrolment and access to quality education in ECDE centre. However, the efforts have not been impressive and significant over the last two decades.

Officially, in Kenya learners aged 4 to 5 years are anticipated to be registered in preschools. By the age 6 pupils are expected to enrol in standard one. In spite of the Government guidelines, presently 65 % of the preschool children in Kenya are not attending preschool education exclusively (MDG's, 2005). Kenya's enrolment is even much lower than some Sub-Saharan countries (MDG's, 2005).

To address the problems inherent in preschool education in Kenya, the Constitution of Kenya (2010) established government administration at two levels, l County and national level. In essence Kenya transited from a central administration to devolved government. The devolution process presaged the devolution of preschool among other transferred functions. In this regard, Article 43 of the 2010 Constitution declares that each individual has a right to education including that of the preschool children.

Currently in many counties preschool educational programme operates on the basis of partnership. The effort by the government to introduce free primary education has

made some parents to take children direct to primary school without going through preschool education (Ngaruiya, 2008). Worse still, parents do not understand why primary schooling have to be free and not preschool; they have consequently resisted paying school levies, hence denying preschool a vibrant source of funding. With the devolution of early childhood education to county government there are still challenges in the implementation of early childhood education.

Currently there are disparities in the 47 counties on their priorities in the Implementation of Early childhood education where some counties have employed ECDE teachers while others have not. Even those counties which have employed ECDE teachers, majority of these teachers are employed on contract basis and other are paid by parent. In this regard, there is no clear programme on funding and there is also lack of coordination mechanism facilitating involvement of the stakeholders, County government and national government in the implementation of early childhood education. This has occasioned multiplicity of practices in a number of county government and stakeholders compromising quality preschool programme this necessitated the current study.

2.2.2 Technology and child development

Technology has created tools that make it possible for people to run simulations that would otherwise be impossible or difficult to run in the real world (Seng, 1998). As a result, they are very effective in teaching younger children and learners with learning disabilities because they learn better with visual cues or a complementary delivery style that uses both visual and language. It is this feature that makes it an especially effective mode for teaching young learners socialization and language skills.

Knowledge comes from the contextual understanding individuals develop from assimilating the information they gain using their experiences and their shared connections arising from their physical and emotional connections with their communities. And, because ICTs make these connections and experiences easier to achieve, and increase the ease with which people can curate and organize information so that their relationships and interrelationships become more apparent, they enhance the vividness of storytelling, therefore, enhancing the learning environment and outcomes (Clements & Nastasi, 2013). Now, while some an argue about the prohibitive nature of the associated costs, institutions can be innovative in their roll out and develop strategies that provide for the introduction of fewer devices over time and increase student collaboration by having them share (Clements, 1999). This approach allows them to kill two birds with one stone and has been proven to be effective in enhancing the rates of verbal acuity and teamwork among learners, therefore, increasing their learning outcomes significantly (Clements, 1994; Haugland & Wright, 1997).

Children learn better through play because of the immersive experience it offers them to discover their bodies and abilities in relation to all the stimuli that their environment provides (Novick, 1998). The freedom that play gives leaners allows them to undertake learning incrementally while developing their capacity to handle larger or more complex operations, similar to the experience and environment that technology helps to create (IRA and NAEYC, 1996). As a result, studies have shown that it should have significant implications on their language performance and cognitive abilities, and even help them to develop their critical thinking ability and increase their capacity to comprehend and solve problems. Also, because of the gamification of most application development processes, educational management

programs promise to promote social interactions by providing learners with challenges that encourage them to collaborate with their peers to solve, or ask for hints in the least (Cordes & Miller, 2000; Healy, 1998). It also creates an environment that encourages learners to play with several settings, therefore, adjusting the difficulty of the tasks they undertake (Clements, Nastasi, & Swaminathan, 2013). For example, they can toggle the timing on tests to help them work on their solution speed.

The advancements in research and development are also increasing the ergonomics of device design that make them more user friendly and reduce their risks to user physical wellbeing. Better screen technologies that reduce blue light emission reduce the incidence of eye problems and help younger users to maintain their circadian rhythms, therefore, boosting their learning and growth outcomes from the resulting good sleep patterns and rest times (Davis & Shade, 1994). In addition, early childhood learning programs should incorporate regular breaks and longer recess times to promote the wellbeing of their learners by giving them time to decompress from the high volumes of stimuli that bombard their senses in a digital environment. Instructors can develop video tutorials that make learning the motor skills associated with penmanship and other artistic operations (such as painting and drawing) in education more enjoyable and immersive (Roberts, Foehr, Rideout, & Brodie, 1999). These materials can also be used to replace television time by providing families with more practical alternatives that provide children with both entertainment and education, in an environment that maximizes their capacity to retain more knowledge. It is especially important as it is becoming more and more difficult to regulate screen times since parents are often at work when their children get back from school, and

busy on the weekends with other familial responsibilities (American Academy of Pediatrics, 2000; Healy, 1999).

Through the simulations they make possible because of their digital foundation, technology makes it possible for educators to create unique experiences that work to promote learning that could have otherwise been impossible to achieve in the real world. For example, changing the colors of different shapes allows instructors to teach both colors and shapes at the same time, and also helps them to build their capacity to build linkages between different sets of information (Clements 1999; Seng, 1998). These variables can be changed depending on the level of learning and the age of learners to reflect their current learning stage and the content they are supposed to cover. Also, computerized devices increase the ease of access to volumes of information at the touch of a button making it possible for learners to increase their knowledge base of current events in their regions, and gaining a more intimate understanding of the concepts they are introduced to in class (Haugland, 1992). A broader knowledge base further increases learners' capacity to comprehend different situations and analyze the implications of their contexts, therefore, increasing the arguments and need for the digitization of education (Clements & Natasi, 2013). Finally, technology provides tools that help educators to bridge real life and fantasy, therefore, encouraging creativity in their learners (particularly those in the formative years of their education journey) and encouraging higher creative problem-solving capacity.

There are a lot of factors to be considered in the journey to revolutionize the education sector using technology (Brooker, 2003; Downes & Fatouros, 1995; O'Hara, 2004; Sheridan & Pramling Samuelsson, 2003; Siraj-Blatchford &

Whitebread, 2003). These factors are stakeholder specific and vary depending on the level of interaction with the system and its elements, and the output and outcomes they expect from the system. However, with regard to reading and logic operations aptitudes, the outcomes are dependent on instructors' level of aptitude on how to carry out these operations effectively even without the use of ICT tools because of the effect this has on children's attitudes towards devices. Otherwise, these systems stand the risk of not meeting the expectations of their stakeholders and resulting in significant losses from the purchase of technologies that become obsolete before they generate any ROI.

And, with the growth of mobile devices and communication, children are more exposed to technology in all facets of their lives both at home and outside. In fact, there are some devices that interact with people and their devices passively, such as traffic lights and cameras, and understanding the implications of these gadgets on their lives can help them interact with them better (Siraj-Blatchford & Siraj-Blatchford, 2003). These devices can also help to bridge the gaps inherent in digitizing education because of the benefit of the increasing low prices of these devices making them more affordable and available.

ICTs provide very versatile tools that can enhance the lives of users in and out of their personal and professional contexts if they understand their features and exploit them to increase the realization of their goals and objectives (Siraj-Blatchford and Whitebread, 2003). As such, they are fast becoming part and parcel of the fabric of homes and public spaces so much such that it is becoming increasingly difficult to imagine a world without them, or to fathom living without the conveniences they provide. And, because children are integral parts of these environments, and probably

interact with more systems that their adult counterparts because the nature of their activities predisposes them to interacting with different kinds of spaces each day, it is important that they understand how they work so that they can get the most out of them (Becta. 2004). It is especially important because of the increased exposure to risk factors these movements create especially with regard to their physical safety, and the integrity of the devices and systems they use. For example, using a free internet access point, criminals can use pineapple devices to attract young users and obtain information their personal information, or infect their devices with malware that corrupts the systems with which they come in contact. The former can make it easy to abduct children while the former might increase the risks of kidnapping more kids or compromising larger systems and devices for a payout or just out of malice (Sheridan & Pramling Samuelsson, 2003).

In addition, understanding how communication works in the information age helps kids to keep their devices safe from exploitation by other third parties in the commission of crimes using proxy techniques (Downes and Fatuoros, 1995). The digital revolution has made it possible for individuals to combine different media into a single file by embedding code into photos, documents, music and other popular media to force alternate outcomes in systems, and in some cases alter the psychology of their viewers subliminally. Also, the large volumes of data that digital has made possible to create also affects consumption by increasing the difficulties associated with cutting through the noise and getting the information that is useful. Therefore, understanding how to use ICTs effectively not only provides young learners with the ability to curate information more efficiently, but also increases their capacity to contribute more meaningfully to the betterment of the global body of knowledge by creating better more impactful material. It is especially important as social media

continues to be more widespread because of the impact that these far-reaching technologies have.

Knowledge development is an immersive experience especially in young children because of the interactions between their new senses and the billions of stimuli in their environment that excite their curiosity. However, because of their inexperience and their suggestibility that makes them reliant on the adults in their lives for guidance and answers, the proficiency of these people in the use of ICTs and their implications on the different areas of their lives makes a world of different largely because of the attitudes they inform (O'Hara, 2004; O'Rourke & Harrison, 2004; Patterson, 2004; Siraj-Blatchford & Whitebread, 2003). Also, ensuring that the adults around these children are conversant with the use of these devices and platforms increases their ability to monitor usage and the integrity of the security of the devices their children use (Brooker & Siraj-Blatchford, 2002; Downes, 2002). As such, it is also important that institutions that introduce technology integration have an understanding of the ICT environment in their homes because of the importance of continuity in the learning development process. Parents can work to enhance this experience by working with teachers closely to understand their children's proficiency in the use of different tools and make efforts to encourage them in areas they show promise and guide them to overcome the challenges they face, just in the same way as they would or do in traditional learning programs (Lee, Hatherly, & Ramsey, 2002; Whalley & Pen Green Center Group, 2001).

Researchers are increasing drawing the conclusion that poor teacher attitudes towards the mainstreaming of technology in the learning process might be the result of their misgivings about the disruptions their ownership and usage within schools cause

rather than because of the previous consensus that it is the result of their incompetence in their understanding and use (Cooper, Farquhar, & McLean, 2001; Downes *et al*., 2001; Kankaanranta & Kangalasso, 2003; O'Hara, 2004; Learning and Teaching Scotland, 2003a; Bain, 2000). And, given the increasing incidences of cyber bullying and trolling among teenagers, these arguments seem to hold water. In addition, devices also inform biases among learners based on fads and perceptions of what is in vogue, and might encourage delinquent behaviors that might, and often does, affect the learning environment negatively (Dawes, 1999). These devices have become status symbols in modern day society and even cause learners to look down upon their teachers since some of these devices are so expensive as to be outside the instructors' purchasing abilities, further reducing the conduciveness of the learning environment.

However, the most practical reasons for the low adoption and support among teachers in early childhood education seem to be systemic and structural because of how frameworks influence the capacity of the human elements involved in it (O'Hara, 2004). As such, it stands to reason that taking steps to bridge the systemic shortcomings in education should promote positive outcomes in the enhancement of the overall learning environment and improve resource allocation and expenditure. This approach might require an overhaul of the programs and materials used in training teachers, and in the criteria employed in evaluating the outcomes of learning development processes. Also, it should definitely include the consideration for lessening the pressures of teachers' workloads, especially with regard to the instructors in charge of younger learners (preschool, kindergarten and nursery level). Teaching children socialization, language and logic skills is a tall order even for the best trained instructors, and they need as much time (if not more) in between their day

to rest and recuperate greatly because of the difference in energy levels that the age difference between them creates. Enhancing teacher development programs to help instructors to increase their knowledge about new developments in society, such as technology, and their implications on both learning and life, should go a long way in ensuring that they continue to build their capacity to handle their learners and workloads better. Understanding how these developments affect their service delivery and the environments in which they operate, helps to create a culture that improves the overall conditions for all stakeholders and increase the utility they draw from the system (Downes and Fatouros, 1995).

2.2.3 Impact of ICT on teaching and learning

There are as many arguments as there are studies on the implications of digitization on learning outcomes and environments that are dependent on the scope and area where the studies are carried out. What is certain, is that both sides can come up with compelling arguments and reasons to support their claims, and counterarguments to disprove the opinions their opponents create (Mikre, 2011; Newton and Rogers, 2001). Also, given the unique nature of the features of technology and the versatility they bring to ease of access and communication work to create advantages for users while increasing the risks they face. Therefore, can be made for the teaching of ICTs from the formative stages of learners' development because of the importance that higher understanding brings to enhancing their capacity to remain safe and increase their output in the long term (Devadason, 2010).

The digital space is a rabbit hole that holds millions of fascinating worlds currently, and has the potential of holding billions more which makes it a rich hunting ground for criminals and other delinquents (Mikre, 2011). As a result, the amount of

information it generates is limitless and its virtual environment makes increases the flexibility with which content originators and creators can display and present information making it easier for them to target specific groups of people. Therefore, users have to have high maturity rates to be able to cut through the noise and focus singly on finding the information that is relevant to their needs otherwise risk wasting significant time and resources (Devadason, 2010). Also, users run the risk of being attracted by sites with corruptive content, such as pornography, that can cause them to develop antisocial behaviours that make them unproductive in the classroom and in life, and increase the supervisory burden on teachers. In addition, the tools it provides are a source of a lot of distractions for users, especially young ones, and can affect their output significantly, even when studying is done under the strict supervision of an instructor. For example, a student can be logged in to a video streaming site without the knowledge of the teacher and either use earphones or watch content without sound, and toggle between the applications when the teacher is in close proximity. They can also be on social sites chatting away the day and miss the delivery of important course material from the instructor.

The quick fix nature of solutions that digital platforms provide, particularly when they are connected to the internet, further dilute learning and reduce the contributions learners make to increase the body of knowledge (Mikre, 2011). This loss in learners' critical thinking capacity affects their long-term ability to solve the problems and challenges facing their societies, and affects countries' ability to remain strategic with regard to their labour development. Also, overreliance on digital sources of information denies children the advantages that come from doing research from traditional books, or the notes their teachers take a lot of time to prepare. Not only is some information hard to come by on the internet because their origins are in older

and rarer books and manuscripts that have not been archived in digital repositories, but the increased craze for academic qualifications and certificates fuelled an increase in predatory publication sites that cared little about the quality of the papers authors submitted as long as they could meet the costs charged.

Still, technology remains the most practical tool to enhance the capacity of learning institutions that are strained for resources, allowing them to reach more learners more efficiently (Kozma, 2003; Isaacs, 2007). The advantages that integrating ICTs in education brings to service delivery and learning outcomes in the interim also gives policy makers more time to come up with more sustainable systems and structures without affecting the continuity of learning (Peter, 2010). Technology further provides a platform that helps learners to get an intimate understanding of industry relevant skills and scenarios, therefore, increasing their ability to solve problems affecting companies. It does this by making it possible to create vivid simulations of different operation models and processes, and gives subject matter experts with the tools to create immersive training programs and materials to help improve the quality and quantity of skills in their field. With these resources, learners can teach themselves valuable skills that can help them secure well paying jobs while they are still in school or if they fail to excel in academics.

The evidence supporting the effectiveness of ICTs in STEM training is overwhelming with Balanskat (2007:16), Kulik (1994) and van Ark (2011), being especially supportive of their use in schools. Their findings indicate that more than three quarters of teachers are open to the use of ICTs in the classroom and agree that their introduction and use should have significant benefits both to them and their learners. They further indicate that technology tools increase the effectiveness of teaching

technical skills and subjects by at least two times and result in significant improvements in learners' performance because of the realness they bring to abstract thoughts and concepts. For example, learners understand fractions and the operations involving them faster when they are presented as parts of items they are familiar with, such as fruits and foods.

The same results are reported for reading and comprehension aptitudes, where learners who used computerized devices and programs during their practice sessions scored higher and performed better than their counterparts who relied on traditional materials only (Kulik (1994, 9-34). These programs increase learners' performance by subjecting them to real life examples, such as the pronunciation of words or reading of texts, in an exciting environment that excites their brains and creates biochemical reactions that enhance memory and pave the way for better understanding with practice.

Newman (2002) and Wheeler (2000), argue that ICTs promote learning outcomes by increasing the ease with which learners can collaborate among themselves, therefore, enhancing competition and taking advantage of social dynamics to encourage higher learning. With digital leader boards, ICTs also make it possible for teachers and learners to benchmark their performance with other learners and programs from across the globe, therefore, generating high volumes of actionable information that can help them in improving their structures. Also, the social aspect of collaboration makes it possible for learners to share different perspectives and improve their understanding of concepts from worlds they have never been, such as learners in a desert can see and experience how construction can be carried out in large bodies of water by their counterparts taking and sending videos of such structures. Learners and

their teachers can also document their processes especially when carrying out experiments in the lab or when demonstrating artistic techniques such as handwriting, drawing or mechanical operations, and help other programs that do not have their capacity.

Digital resources can further be used to increase the flexibility of learning spaces and increase the carrying capacity of learning programs, therefore, allowing learners in developing areas of the world to access world-class learning resources seamlessly (Mdletshe, 2013). In addition, by increasing the flexibility of content delivery, they give learners more autonomy on their learning development by giving them more control over how they consume content (Riel, 2000; Wheeler, 2000). It is also possible to integrate interactive applications into these learning platforms that facilitate the communication among learners, and between learners and the creators of the content or their instructors further increasing their ability to internalize and retain more knowledge. This feature is of particular importance in ensuring the diversity of skills available to drive industries and solve problems because it allows learners to pursue the subjects they are passionate about alongside their compulsory reading lists. As a result, it can be argued that introducing ICTs early in a person's education development can have a significant impact in their overall success and performance in the later years of their education and in life (Forsyth, 1996:31). Also, it should reduce the pressure on teachers by making their role supervisory, therefore, giving them more time to focus on enhancing the systems and structures that guide education.

These tools, therefore, can become great agents of change and help education systems transform from passive instruments of knowledge management, to more effective systems that encourage active learning (DoE, 2003). However, schools and countries

need to take a multifaceted approach towards their introduction and implementations if they are to increase the advantages they reap from technology. Also, they need to involve all their stakeholders to ensure that they build both the capacity to use these tools and the goodwill among users otherwise risk losing significant amounts of times and resources on a process that does little to improve the performance of their education sectors (Kruger, 2010).

The opinions of teachers should be particularly taken into consideration because they are the active caregivers and service delivery agents in the education sector (Evoh, 2007, p.10-11). Also, teachers are the primary monitoring and evaluation agents and can ascertain learner capabilities that the learners and their guardians have not yet seen, therefore, putting them in the unique position to guide learners through content that should improve their overall learning development. Their understanding of their learners' backgrounds also puts them in the unique position to suggest more affordable means of learning, such as remote access to content, to ensure that they enjoy the continuity of content coverage despite any financial challenges that they might be facing back home.

For this process to work, there is an immediate need to create frameworks that help under resourced institutions to develop strategies that help them to bridge the gaps in their technology inventory capacity (Beyers, 2000). These approaches can include declassifying the equipment dedicated to computer labs and training so that they are available to other learners, and creating classroom layouts that make it possible for several learners to share the same equipment. It can also help to create applications that can run seamlessly on mobile devices to enable learners to continue accessing

class material at home, since mobile devices are becoming cheaper as innovation in technology continues to move further forward.

2.2.4 Kenya ICT policy

One of the main priorities of the Government towards the attainment of Kenya Vision 2030 development goals and objectives for wealth and job creation is the achievement of an industrialised information society and knowledge economy. The objective is to facilitate the creation of dignified jobs that provide financial security and independence to allow greater innovation and future thinking. By providing local and international connectivity across the country and region, and developing in-country solutions, the Government will enable creation of online and digital jobs, markets, and quality skills allowing Kenyans to embrace the shared economy. In this way, citizens will transition from traditional ways of working to innovative, digitally enabled forms of work.

This review of the Information and Communications Technology (ICT) Policy of March 2006 is inspired by, first, the need to align the Policy with the new constitutional dispensation in Kenya, and Vision 2030. This review specifically aims to incorporate the lessons learned from the Vision 2030 Medium Term Frameworks and takes into account the three underlying pillars of Vision 2030, (Economic, Social and Political) and the United Nations Sustainable Development Goals (UN SDGs). The overarching focus will be to provide access to ICTs, especially broadband, to all Kenyans and seamless connectivity to the East African Community member states with proactive collaboration at regional and international levels, leveraging our leading position in Fintech and our capital markets. Secondly, the review is meant to provide a proactive framework that is in tandem with current technological realities

and dynamics, and one that will guide the orderly development of the ICT sector so as to ensure maximum developmental impact for the benefit of all Kenyans.

In reviewing this policy, the Government has taken into account the tremendous impact of globalisation and the rapid changes in technology. These changes have invariably affected the traditional approach to the management of public affairs and service delivery, and increasingly inform the need for an adaptive policy and regulatory response. This revised Policy provides a clear and compelling vision to drive social, economic, cultural and political transformation through the effective use of Information and Communications Technology (ICT) in the years ahead. The Policy provides many of the key strategies essential for achieving Kenya's national development targets. Going forward, the Government will concentrate on speeding up the development of new generation mobile, high-speed, secure and ubiquitous ICT infrastructure, developing a modern technology-enabled industrial system, implementing the national big data strategy and enhancing national cyber-security.

By harnessing the power of ICTs, private and state-owned enterprises are expected to improve their sourcing, sales and logistics systems; streamline operations, track market trends and boost their marketing, research and innovation capabilities. Enterprise operations will become more efficient, translating into productivity gains and the creation of new markets for innovative products and services. The strategies and action plans developed as a result of this policy will continue to bring about the rapid transformation of Kenya. In conclusion, it is my conviction that this Policy will continue to set the pace and give the right direction to further the development of our economy in general and the ICT sector in particular for the benefit of all stakeholders.

The National ICT policy was last reviewed in 2006. Since then, the sector has experienced rapid technological advancement, changes to the legal and administrative framework and many emerging issues. The latter include increased IT enabled services, increased demand on bandwidth and for Quality of Service (QoS), challenges of cyber-security, integration projects and harmonization of ICT policies regionally and internationally. This policy is a product of an all-inclusive, participatory and consultative process. It is guided by the following principles; Putting ICT at the centre of the national economic agenda, Improving access to ICT especially broadband, efficient public service delivery and maintaining an open government, Putting the private sector first and Leveraging on ICT to promote Sustainable Development Goals.

The main policy objectives are to (1) Create the infrastructure conditions for use of always-on, high speed, wireless, internet across the country. Provide enabling infrastructure and frameworks that support the growth of data centres, pervasive instrumentation (Internet of Things), machine learning and local manufacturing whilst fostering a secure, innovation ecosystem; (2) Grow the contribution of ICT to the economy to 10% by 2030, by using ICT as a foundation to the creation of a more robust economy, providing secure income and livelihoods to the citizenry; (3) Leverage regional and international cooperation and engagements to ensure that Kenya is able to harness global opportunities; (4) Position the country to take advantage of emerging trends such as the shared and gig economy by enhancing our education institutions and the skills of our people, and fostering an innovation and start-up ecosystem that is able to lead on a global scale; and (5) Gain global recognition for innovation, efficiency and quality in public service delivery. Services

will be delivered in a manner that ensures we have a prosperous, free, open and stable society.

These objectives will be actualised through four thematic focus areas: Mobile first; which will ensure that every Kenyan can access inexpensive Internet and reasonable access to locally produced devices; Market; designed to increase the overall size of the digital and traditional economy to 10% of GDP by 2030; Skills and Innovation; which outlines a careful plan designed to jump-start a self supporting ecosystem that will produce world-class research, technology products and industries; Public Service Delivery; requires that all government services are available online, that every Kenyan has online access and that government services are delivered quickly and fully at the time and place that they are needed.

The government will also continue to play its role in promoting broadcasting and telecommunication services through: provision of infrastructure to enable expansion of digital TV coverage in unserved and underserved areas; encouraging development of high quality, easily accessible, relevant local content; development of a National Language Policy to encourage use of local languages in developing content; ensuring that the radio frequency spectrum is managed in equitable and transparent manner with specific and clear conditions; encouraging sharing of infrastructure and enforcement of quality of services regulations to ensure availability of reliable services by service providers and realization of an effective postal and courier ecosystem to drive the development of e-commerce and the digital economy. The implementation of the policy will necessitate institutional reforms in some Semi-Autonomous Government Agencies that will result in a more vibrant sector. Finally, to implement this policy effectively, the current legal, institutional and regulatory

framework will be reviewed and aligned to the strategic policy focus. A robust monitoring and evaluation system will be put in place to track its implementation and the reviews will be shared annually.

2.3 Teachers' Competency in Integrating ICT in Early Learning

The dynamism of the ICT sector coupled with the evolving goals and needs of education functions make technology integration in learning development a long-term project to ensure that the systems remain effective through the changes in the environment out of which they operate. Teachers and learners being the integral pieces of the system need to be able to understand how to leverage the tools these platforms make available to make their work easier and the processes they work with more flexible and efficient. And, because technology operates like the central nervous system, linking the different systems and functions operating in different societies, teaching it in schools promises to help countries improve the wellbeing and productivity of their populations for the increasingly digitized societies and economies of the future (Abbott, Blakeley, Beauchamp, Rhodes, Cox, Webb, 2006).

In fact, if the education system is to remain strategic in building learners' capacity to thrive in the increasingly volatile world in which they live, it is important that policymakers develop structures that empower teachers with the foresight to adopt the material available to suit the prevailing circumstances of their environment. In so doing, they will also be helping their learners to develop contextual situational analysis skills organically, that are useful in helping them build on the knowledge they have acquired by testing it in new scenarios and environments. As a result, it should also help them to spur the evolution of learners into active change agents in learning processes by empowering them with the capacity to ask thought provoking

questions that challenge the status quo and advise the improvement of course material.

According to Boyd (2003), the advantages that technologies bring to any process or function should be apparent enough today given the numerous studies and information available on the subject. As a result, he concludes that any skepticism can only be the result of ignorance on the part of the sceptic or disdain for the process or technology in general. All sectors and functions that have introduced technology tools into their systems and processes have recorded efficiencies, some of which they had not and could not have forecasted because of how they work to enhance the abilities of their users. As such, it stands to reason that while their use in the classroom should increase the outcomes in learning outcomes significantly, it also has the potential of helping learners and their institutions to discover and develop platforms and tools that make them a lot of money, or make their environments more comfortable and safer. Many Silicon Valley tech companies are a great example of that last point.

Capital resource constraints are also a major impediment to the widespread adoption of technology in the classroom especially in areas where the education system is already operating without much support (Sheldon, Byers, Zhao, Pugh, 2002). The wider the gaps these entities have to cover, the harder it is that they will follow through with the endeavor and that the process will be sustainable because of the amount of time and resources such projects demand. It is also important that the systems incorporate continuous ICT trainings to ensure that teachers competence and knowledge remains current, therefore, increasing their ability to both exploit these resources to increase their overall effectiveness, and give them the capacity to create a learning environment and materials that increase learners' curiosity of technology and

the possibilities it unlocks (Eurydice, 2011). This strategy should be of particular importance to schools that do not have dedicated ICT teachers on their roster and have to rely on their science and mathematics instructors to handle the subject. Primary schools in developing countries are the most numerous in this group. Between the few computer resources they have at their disposal and their reliance on generalist teachers to head their technology initiatives and training, they record lower learning outcomes and computer systems manipulation competence in the long term.

In learning programs for young learners, the onus of how efficiently they employ the ICT tools at their disposal lays with their teacher. As such, for the project to be successful, institutions must take steps to ensure their instructors are proficient users of the tools technology provides because it has significant implications on their attitudes towards ICTs and in turn those of their learners. According to Clements and Sarama (2002), users' knowledge of, and preference for, certain types of tools influences how they perceive other tools and their quality, especially when they are tasked with training others on their usage or importance. The principles related to ICT training for teachers are similar to those that guide traditional learning programs and content. That is to say that first, teachers must have a higher command and understanding of course material if they are to be successful at passing on this information to their learners. In addition, the course material they use must have been developed following rigorous processes and standards to ensure that it is both effective in increasing learner aptitudes, and also systematic enough to promote improvements and their suitability in increasing learners' skills. That is to say that they must follow a standard curriculum because of the advantages they bring to ensuring that content and processes promote inclusivity. Furthermore, this also works to quality check that content is appropriate for the audiences for which it is intended.

Therefore, for countries to ensure the effectiveness of their education systems moving into the future, they should take a holistic approach towards the development of their teachers. Incorporating computer training in teacher training institutions, and certification programs thereafter should increase their ability to increase and ensure the effectiveness of their staff in dealing with the developments in both the education and technology sectors. In addition, they can carry out sensitization programs that encourage a shift in how people view technology, therefore, increasing support for it and encouraging more investment in them from the public. Having more devices outside school should further boost the continuity of the learning experience and increase overall learning outcomes (Newburger, 2001).

2.3.1 Teachers' attitudes towards technology

Teachers' attitudes towards the subjects they teach and their learners play a key role in shaping how their learners relate with both them and the content they deliver (Ajzen & Fishbein, 2005). That is to say that learners are likelier to perform better in subjects whose teachers they have a good rapport, or in subjects whose instructors are enthusiastic enough that it becomes infectious and causes their audiences to have the same level of interest in the subject. As such, understanding these dynamics and developing strategies to help instructors to be mindful of the energy they project on their audiences can work to improve learning outcomes significantly by limiting the effects of negative bias on learners' attitudes on subjects, particularly in the more challenging subjects such as STEM (Albion & Ertmer, 2002; Bai & Ertmer, 2008; Jakopovic, 2010; Loyd & Gressard, 1986; Park & Ertmer, 2007). Also, teachers' attitudes affect their own understanding of course materials that also affects learners' perceptions on their competence (Loyd & Gressard, 1986; Hew & Brush, 2007). That is to say that teachers who have a diminished command of the content they deliver

because they do not like the subject, cause learners to have negative attitudes towards those subjects when they are unable to answer student queries or cannot explain the content well (Lumpe and Chambers, 2001).

These arguments are instrumental in helping policymakers to understand how to address the human aspects of the ICT integration process to ensure that their attitudes promote more widespread adoption and increase overall learning outcomes (Albion & Ertmer, 2002). This understanding also helps them to develop objective monitoring and evaluation structures that work to help institutions and implementing bodies develop reasonable milestones and expectations that promote higher stakeholder acceptance and support (Kol, 2012). Furthermore, the advantages that these insights bring to enhancing the social environment and contracts involved in the learning process increase the outcomes learners get from the process. For example, a study in Turkey established that teachers who had undergone sufficient training in the use and implications of technology in the classroom, exhibited better attitudes towards ICTs in the classroom and fostered healthier attitudes among their learners (Yılmaz & Alıcı, 2011). These results have increased the understanding of the importance of active talent development strategies through the establishment of continuous training programs that ensure that teachers have the capacity to deal with the evolving makeup, constitution and contexts of the communities out of which they work. And, because attitudes are qualitative in nature, anticipating them helps to prepare scenarios for triggers to ensure that instructors can ensure the effectiveness of the process, since it is difficult to forecast human reactions accurately.

However, the initiative can benefit from more research into the specific interactions between ICTs and early child education programs because most of the existing

literature focuses on the advanced stages of learning development predominantly (Bayhan, Olgun, and Yelland, 2002). The major concern among educators revolve around the antisocial behaviors that technologies are fast creating that contradicts one of the pillars of their service, the socialization of children. Without understanding how to interact with others, children will grow into selfish individuals that can neither learn from others, nor respect divergent views. Also, too much reliance on tools reduces learners' ability to develop the mental capacity and fortitude to solve complex problems and challenges that require higher contextual reasoning (Cetingul & Dulger, 2006). As a result, it is important that policymakers and strategists develop frameworks that strive to strike a balance between the social and the cognitive development of their learners. Also, starting learners out early enough in their education journey promises to improve their ability to make their learning development and experience more holistic by helping them to understand the importance of both these aspects in their overall growth and development.

Despite the ongoing developments in education reforms across the globe, the integration of technology is still slow and faced with a myriad of challenges, institutions and nations can increase their overall effectiveness by developing strategies to improve the capacity of their teachers actively (Du, Havard, Yu, & Adams, 2004). As a result, they should encourage higher outcomes from the increase in positive attitudes among both teachers and learners that work to encourage uptake and support and generate a lot of actionable feedback that should help in improving the overall success of learning programs and facilities.

2.3.2 Factors influencing teachers' adoption and integration of ICT

ICT integration is a complex process because of the uncertainties arising from the interplay between the different systems involved and their users that create unforeseeable and unprecedented reactions more often than not (Rangaswamy & Gupta, 2000). As a result, adoption has continued to plague policymakers over the years because of the influence it has over both encouraging higher investment in novel ideas, and in fostering higher acceptance and support among users (Rogers, 2003). The low adoption rates among instructors further limits the proliferation of technology in education because of how it influences their perceptions, and in turn that of their learners.

The success of ICT integration, therefore, relies on the ability of education strategies and structures to achieve an optimal mix of process integrity and the elements/ resources that are necessary for the effectiveness of learning development programs (Earle, 2002). The former works to ensure that the quality of content increases learning outcomes while the former works to ensure that the delivery mechanism for knowledge enhances the continuity of the learning process (Williams, 2003). The tools that technology provides can only be effective if the underlying structures handling delivery are robust enough to handle the learning development holistically. Otherwise, institutions and systems risk losing significant amounts of money and time developing interventions that have little ROI and that are not sustainable in the long term. Also, because of the tailspin effect that the resulting confusion causes, the losses from the disruption in the continuity of learning processes further reduce overall learning outcomes and affect stakeholder perceptions negatively.

Studies have established that the elements involved in ICT integration in the classroom can be divided into three major categories depending on the level of system users they affect or with whom they interact (Rogers, 2003; Stockdill and Moreshouse, 1992). First, teacher level aspects refer to the elements involved in advising teachers' proficiency in the use of technology both in their lives and in teaching because of the influence this has on their overall attitudes towards technology tools (Balanskat, Blamire & Kefalla, 2007). Second, school level aspects refer to the ability of institutions to provide adequate technology tools (computers and learning programs and platforms) for use in the classrooms (Chen, 2008, Tondeur; van Braak & Valcke, 2008). Last, system aspects speak to the appropriateness of the structures and policies guiding education with regard to their ability to encourage technology use in schools, because of regulatory and policy conformity (Lim & Chai, 2008; Clausen, 2007).

As such, Sherry and Gibson argued that the introduction of ICTs in the classroom must be approached using a multidisciplinary approach to increase the flexibility of the initiative and make it more robust, especially with regard to the identification of problems and challenges in their 2002 study. Neyland (2011), also argues that the interactions between technology tools and the various stakeholders involved in the larger education function creates millions of relationships and interrelationships that if not managed well can lead to poor integration and adoption, or reduce the quality and quantity of outcomes that are probable.

Schiller (2003), argues that poor conceptualization of ICT adoption and integration projects often have a counterproductive effect on the evolution of the education sector because of the skepticism that they encourage. They do this by reducing investor and

user confidence in their viability because of the low returns they record and the significant amount of resources and effort they demand (Jones, 2001). The low returns can also affect general attitudes and perceptions of technology in schools and further reduce stakeholder support and acceptance. However, it is also important to note that general attitudes of the venture influence the effectiveness of integration and adoption by affecting the willingness of teachers, and in turn learners, to use them actively in the classroom. Russel and Bradley (1997), echo these sentiments by arguing that human emotions are instrumental elements in determining their level of commitment to a venture especially when they create anxiety or excitement.

Teachers are the lynchpin that hold the education system together because of their central role they hold allowing them to evaluate the performance of both the education system and processes, and their learners (Hew and Brush, 2007). Their positioning, therefore, makes their attitude towards subjects and tools very instrumental in advising their learners' attitudes and perspectives towards the same things. Also, their position of authority increases the ease with which they transfer their values to their learners (Keengwe and Onchwari, 2008). As such, technology implementation programs need to allocate enough resources to ensure that teachers have the skills necessary to carryout their roles effectively, especially when these roles evolve to include more responsibilities that are novel.

According to Demici (2009), overall attitudes have a higher weighted impact on users' willingness to adopt and integrate new tools into their processes than any other factor, including the availability of adequate capital resources to purchase said new tools. Computer literacy is still a novel concept in many parts of the globe, especially in developing nations and regions of the world (van Braak *et al*., 2004). As such,

teachers in these areas are often opposed to the integration of ICTs because they themselves lack the skills to use them, therefore, making them unable to teach learners how to use them effectively on the one hand, and because of the increase in workload that the new responsibilities threatens to add on their already bloated workday (Berner, 2003; Na, 1993; Summers, 1990; Bordbar, 2010). Coupled with the didactic reservations that these teachers harbor against technology use among young people and children, further diminishes their willingness to adopt technologies and integrate them into their processes (AlOteawi, 2002, p.253; Bordbar, 2010). Most schools in developing areas of the world struggle with limited resources that often leave them understaffed and, their teachers underpaid and often overworked (Peralta & Costa, 2007). Therefore, most of these teachers cannot even afford to own some of the devices that are proposed for use in the revolutionized education systems being proposed. As such, it is also hard for them to improve their overall understanding and proficiency in their use.

The main issues teachers have raised through the years on how to strengthen the integration of technology in the classroom surround developing training programs that increase teachers' understanding of the uses and implications of technology tools in their personal and professional lives (Peralta & Costa, 2007). There is a lot of evidence that suggests that teachers with greater control over the content they teach, as a result of understanding it more intimately, have the confidence to deliver it more emphatically and with higher outcomes than their counterparts who do not understand their content that much (Jones, 2004).

As such, policies need to take these factors into consideration because they are critical aspects of the success of the endeavor (Bandura, 1997). That is to say that there is a

need to develop robust training programs that help teachers to increase their computer skills significantly enough that they can handle queries from their learners and peers in a manner that is both profound and absolute, and also allows them to increase their overall effectiveness in handling tasks (Peralta & Costa, 2007). Otherwise, they will handle questions from learners poorly and cause them to develop negative attitudes toward the subject and in turn the entire process, therefore, defeating the advantages that the integration targets in education (Compeau & Higgins, 1995). The rationale behind these arguments lies in the fact that tools are an extension of the skills of their users and cannot, therefore, bring about any change by themselves (to Liaw, Huang and Chen, 2007). It, therefore, goes without saying that the importance of training trainers cannot be overstated.

Countries that have experienced smooth transitions in technology integration in education, such as Hong Kong, attribute their success to the proliferation of technology tools and their use among their people already (Yuen & Ma, 2008). With their teachers already having a high proficiency in the use of technology, and learners being active users of technology tools and services, these countries and their institutions had a relatively smaller gap to cover to get their users ready for the new system (Christensen and Knezek, 2006). Also, most of these countries have a large number of active application developers who create programs for different uses and functions that also made it easier for them to create educational platforms and systems, and to build the capacity of their institutions through the development of training videos and explainers (Peralta and Costa, 2007). These countries also had the benefit of well-developed ICT sectors and infrastructure that placed them at a unique position to have well-structured policies and frameworks guiding their use. As such, they also had a relatively smaller gap to bridge between adapting these frameworks

for use in education, therefore, making the process shorter and costing fewer resources, and increasing adoption. These frameworks also facilitated curricula development by highlighting areas where these countries needed to strengthen in their population, and the younger population in particular, to enhance their capacity to remain strategic with regard to technology in the long term. As the world grows increasingly digital, aligning the strategies for developing this capacity and the strategic plan for the sector offers countries the best chance to ensure their success in the long term.

And, given that technology is very dynamic, it is important that strategies take steps to increase their ability ensure that teachers skills match up to these changes and evolutions or at least not fall so far behind as to impact their capacity to handle their roles effectively (Jones, 2004). The compromise of a teacher's ability to deliver content effectively creates feelings of imposter syndrome and inadequacy that affects their confidence and decreases their overall ability to perform their tasks (Balanskat *et al*., 2007). As such, it stands to reason that developing robust structures to create continuity in the skills development of the pedagogic talent should pay a lot of dividends in the long term because of the benefits it brings to ensuring the process remains effective, and the insights it will provide both teachers and learners to discover how to apply the knowledge they acquire (Becta, 2004).

Attitudes also affect the level of adoption of ICTs between male and female teachers, with the former showing more propensity towards the acquisition and use of gadgets than the latter (Volman & van Eck, 2001). As such, female teachers are also less likely to pursue computer related trainings or look to integrate ICT tools into their content delivery processes or in their lesson preparation processes (Kay, 2006;

Wozney *et al*., 2006). And, since female teachers and ten time more likely to go into early childhood education, particularly in developing parts of the world, it presents a present challenge to the full realization of technology integration in the classroom at the formative levels (Markauskaite, 2006). Female teachers are more predisposed to the traditional setup and definitions of the learning environment and experience and prefer to have more direct contact with their learners and the content they deliver (Burnett, Finger and Watson, 2006). However, female teachers are also more likely to use technology in their processes and in the classroom more effectively in the long term because they are more flexible to change and adopt to the evolution of technology more efficiently as evidenced in studies in elementary schools in the US (Breisser, 2006).

In the long term, however, the effects of gender on the adoption and integration of technology in the classroom is less pronounced, particularly as the ownership and use of the tools that technology develops becomes more widespread (Adams, 2002; Yukselturk and Bulut, 2009). In fact, studies show that female users are more prolific and diverse in how they employ these tools to make their work easier and to improve the efficiency of the systems of which they are a part than their male counterparts (Kay, 2006; Norris, Sullivan, Poirot & Soloway, 2003). Therefore, this evidence suggests that creating frameworks that promote higher ICT skills development should increase the reduction of the gaps between the attitudes that are apparent in male and female users, and improve their adoption and acceptance of their use in the classroom.

There is also evidence that experience also plays a critical role in influencing the attitudes towards the use of technology in the learning process (Niederhauser & Stoddart, 2001). Older teachers seem to have more negative attitudes towards

technology and its appropriateness in the classroom as compared to their younger counterparts (Wong & Li, 2008; Giordano, 2007; Hernandez-Ramos, 2005). The reasons for these differences are many, but most converge on the difficulties associated with breaking traditions and accepting new ways of looking at, and doing, things (Gorder, 2008). Experience further often reduces the flexibility of more seasoned teachers to accept that new methods can improve learning outcomes because of the fear that this new realization might invalidate their beliefs and accomplishments (Baek, Jong & Kim, 2008). In the same way, since most younger instructors have a lot of experience using ICTs already, and so do majority of their learners, they are more open to its use in the classroom (U.S. National Center for Education Statistics, 2000). Also, their curiosity in innovations help them to stay current with the evolutions in both hardware and software, and allows them to develop more intimate understanding of their implications on the accomplishment of their roles and responsibilities.

Furthermore, because older teachers grew up in an era that had few sophisticated technologies, they are sued to handling tasks through traditional means and rely on their own intellect and networks to enhance their ability and capacity to solve the challenges and problems they face. They, therefore, often lack the capacity to comprehend how using high tech tools in education does not constitute cheating and the watering down of the quality of education.

However, there are also studies that indicate that the high understanding of the pedagogic structures and processes that more mature teachers have, places them in the unique position to understand how the features of these tools can help to increase learning efficiencies and outcomes (Lau & Sim, 2008). These results are similar in countries, such as Malaysia, that have invested a lot of resources and time into

increasing the convergence of the long-term ICT goals of their different functions and systems. As such, ICTs hold the promise of revolutionizing education because the function's core purpose is to facilitate knowledge management by providing a structured environment that equips learners with the skills to promote learning, especially as the world grows increasingly digital. And, given the intricate interconnectedness of the world, the tools that technology provides make it possible for people to develop solutions and interventions that are more practical and sustainable, by broadening their perspectives of their implications both locally and in the greater region. As a result, it promises to make a country or institution more strategic by increasing its surveillance capacity over more aspects in its operating environment.

The increased capacity technology brings to the understanding and management of the various elements of a system also works to improve learning outcomes significantly (Kang, Heo & Kim, 2011). It does this by giving learners the aptitude to take active command of their own learning development and develop evaluation strategies that help them to bridge gaps in knowledge that keep them from achieving higher outcomes (Dunn *et al*., 2011). In addition, it provides them with the tools to communicate with their peers, network with subject matter experts and access diverse knowledge repositories to grow their understanding of the concepts they want to study. Also, because technology also increases the ease of editing and adding to the body of knowledge, it also allows learners to contribute to making information easier to consume and understand by using the numerous suites of tools available to create more effective delivery modes like videos (Voogt and Roblin, 2010).

In Thailand, the government took on an ambitious project to improve its education system and secure the quality of talent the function produces that involved developing interventions to hedge the country from the increasing risk globalization continues to pose. As a result, the country has managed to improve learning outcomes by creating guidelines that have seen the enrichment of the learning environments of its schools and encouraged institutions to leverage the country's growing technological advances to improve their service delivery especially to young learners. Also, by linking these strategies with their national technology strategic plan, the country has positioned itself to create perpetual high performing talent to run its digitization agenda and help to create additional revenue streams in its economy in the long term.

These findings also indicate that despite younger teachers having a higher bandwidth for understanding and adopting technology in their lives and work, they were more rigid when it came to using these skills in the classroom or training these techniques to their learners probably as a result of tunnel-vision specialization (Russell, Bebell, O'Dwyer, & O'Connor, 2003). Some studies also attribute this discrepancy with the challenges that teachers face during onboarding once they enter into real life classroom settings, and the time it takes them to adjust and find their rhythm.

However, there seems to be little consensus over the extent to which the teaching experience of instructors has on their propensity to adopt and support the integration of technology in the classroom currently. There are as many that claim that it does, such as Russell, O'Dwyer, Bebell and Tao (2007), that found the relationship between these two variables to be significant in their sample, and others that claim it does not, such as Granger, Morbey, Lotherington, Owston and Wideman (2002), whose sample in Canada did not indicate a significant relationship between these variables. These

variations can indicate that there are many factors in play in the integration of technology in the classroom, and understanding them requires a more holistic approach.

Teacher workloads are, however, an increasingly compelling factor in determining whether instructors are enthusiastic about adopting technologies to improve the classroom environment and support their integration into learning systems and structures (Samarawickrema & Stacey, 2007). It is especially true for teachers who are also pursuing the advancement of their own education in programs that require them to invest significant amounts of time, energy and resources. The advantages that these tools bring to their own experience makes them more likely to want to use them with their learners so that they too can enjoy the resulting conveniences, or at least provide insights into how they can develop more practical and sustainable strategies for the use of ICTs to improve learning outcomes.

The issue of being overworked in becoming an increasingly widespread phenomenon affecting teachers across the globe, and its effects are the cause of the continued decline in their overall efficiency and in overall learner outcomes (Neyland, 2011). It also makes them more reluctant to take on additional responsibilities because of it would only stretch them thinner and reduce their capacity to offer more value to their clients. And, coupled with the rapid changes that have become characteristic of the education system and curricula, in a bid to help countries remain strategic with regard to the development of their talent supply, it is important that strategies also have the capacity to be patient with the people involved in the process.

These same sentiments are echoed through Abuhmaid's study of 2011 that established that Jordanian teachers were also overwhelmed with the responsibilities they are

shouldering currently, and that expecting them to handle anything extra was neither realistic nor feasible. He noted that it is especially difficult for these teachers to take on the complexities involved with technology integration in learning programs, particularly given the characteristic lack of structures because of the still novelty of the endeavor (Fullan, 2003). As a result, it mostly falls on the same teachers to help in developing the resources to teach learners how to use computers and the implications the digital tools they make available have on their personal and professional lives and growth. Therefore, for these initiatives to be successful, it is becoming increasingly important that policymakers ensure that their strategies promote the reduction of the workload teachers handle.

Vannatta and Fordham (2004), argue that institutions stand to benefit from the improvement of their internal structures and systems by training its teaching staff in the effective use of ICTs. The interactions between their knowledge and experience of pedagogic processes and systems give them insights into how technology can help to improve their overall efficiency. In addition, their understanding of child psychology is instrumental in helping them to understand how their learners are taking on the changes that come with the introduction of technology in the classroom (Norris, Poirot & Soloway, 2003). Tracking the progress children make is also instrumental in ensuring the effectiveness of the rollout, and helps to identify challenges and problems in the process.

To increase teachers' adoption and acceptance of technology in education, it might help if new frameworks include strategies that reward them when they undertake ICT training, or get involved in the integration process (Bauer & Kenton, 2005; Franklin, 2007; Wozney *et al*., 2006). Not only can such strategies work to increase the

realization of the overall integration process, but they can also increase the evolution of the education system to increase its overall effectiveness, and help to improve learners' learning outcomes (Hew and Brush, 2007; Keengwe and Onchwari, 2008).

The capacity to understand and exploit technology tools remains the greatest determinant of teachers' willingness to adopt the use of these tools and support their integration in the classroom (Muller, 2008). As teachers look to increase their knowledge of technology and the implications its features can have on their processes and outcomes, they gain intimate insights into the relationships and interrelationships between the different systems that make up the overall education function, therefore, helping them to be critical agents in its evolution and improvement (Sandholtz & Reilly, 2004). Teaching and learning being procedural, ensuring that there are adequate procedures in place to guide the development of materials, programs and procedures goes a long way in ensuring the success of the process.

Continuous professional training programs have been known to increase teachers' willingness to be more open to the use of ICTs to improve education methods, especially given the fact that the dynamism of technology and the innovations surrounding it make the tools they develop iterative (Brinkerhoff, 2006; Diehl, 2005; Lawless and Pellegrino, 2007). Combining these changes with the learning development learners undergo, therefore, necessitates that policymakers have the foresight to make trainings in the same way as well, and increasing the ability of participants to absorb and retain more information by breaking down the incredible volumes of information these systems generate into more manageable smaller modules.

Also, strategies have to make provisions for the engagement of subject matter experts to help to increase teachers' capacity to understand the challenges and problems they face in the integration process (Plair, 2008). Having a higher understanding of how to exploit the tools that technology provides to improve their efficiency encourages users to accept and support for the novel modes of production and new knowledge they help to create (Lawless & Pellegrino, 2007). Evidence shows that vocational training programs have higher success in bridging the gaps in skills that keep teachers from pursuing higher adoption of ICT in the classroom and improve their overall outlook on the implications of the entire process (Chen, 2008).

However, at the end of the day, the outcomes of these programs are dependent on the attitudes and the goals of the learner, much in the same way that the outcomes of their learners depend on how they perceive the learning process and the elements that it constitutes (Wepner, Tao & Ziomek, 2006). To increase the effectiveness of these programs, it is also important that facilitators create chances and opportunities for their learners to use and interact with the tools that they will be using in their own processes in the classroom (Levin & Wadmany, 2008). It also makes them understand how to integrate more than just their teaching with technology, which further improves their capacity to understand the implications its features and tools have on life and work on a meta level.

The adequacy of ICT infrastructural capacity is also a crucial aspect affecting the realization of the widespread inclusion of technology in the classroom because of the practical aspect that using technology entails (Plomp, Anderson, Rule, & Quale, 2009). Users need a lot of training and interaction with different devices and platforms to increase their ease of using them and understanding their implications in

different scenarios and processes. Also, the more time a user has using technology, the deeper the understandings they form of the uses of the different features and devices that are available to improve their productivity (Yildrim, 2007). Therefore, in education ensuring that teachers have enough facetime with the tools that they are expected to use in the delivery of content in the new system of education. Also, it is important that the devices they use during their training be the same, or at least similar, to those they will find in the workplace. Differences, especially in platforms, can reduce learning curves and increase the time the teachers need to learn these new systems (Usluel, Askar & Bas, 2008).

According to Albirini (2006), only about half of teachers own computers and only a third have access to computers in their schools which affects their ability to use these devices effectively, especially in the classroom. Availability of computer resources affects technology integration on a meta level because of how it affects everything from attitudes, to investment and outcomes (Afshari, Bakar, Luan, Samah, & Fooi, 2009). And, because these elements influence each other in ways that it is difficult to say where one begins and the other ends, it becomes very important that policymakers are very conscious about ensuring that the systems they are conceptualizing have adequate resources allocated for setting up the necessary infrastructure. However, there are also some studies that have established that the inadequacy of computer infrastructure does not have a significant association with the effectiveness of technology integration. It is especially true in most higher institutions of learning across the world that currently encourage the use of computers by both faculty and staff to increase the efficiency of their learning processes by making it easier and cheaper for learners to communicate with their lecturer and submit assignments and tasks.

However, in their pursuit to make available adequate technological resources, policymakers should make sure that they take both the hardware and software components of the system because their relationship is instrumental to promoting teaching and learning outcomes (Tondeur, Valcke, & van Braak, 2008). These two components work together in the same way that a car and its fuel function. That is to say that one would not buy a supercar and proceed to use fuel meant for tractors to run it as it would breakdown, or perform suboptimal (Friedhoff, 2008; Chen, 2010, p.3). Also, the integration process should endeavor to ensure that there are enough ICT resources for both teachers and learners, and that both these groups have unfettered access to the use of these resources (Dexter & Reidel, 2003). It also helps if these resources are of the same quality because of the higher learning outcomes that come from the resulting continuity.

Jones (2004), argues that incorporating general computer systems maintenance training in teachers' ICT training programs should further increase the continuity of the use of these systems because it gives both teachers and learners confidence in their perpetuity. Computer systems breakdown regularly and can disrupt learning indefinitely if their users lack the skills to troubleshoot and fix them, or have significant cost implications that might affect the feasibility of the program in the long term because of the need to engage costly repairmen (Becta, 2004). These uncertainties increase user fears on the adoption and use of technology tools, particularly in developing areas of the globe whose people have little disposable income. The resulting negative attitudes and perceptions that these problems are an impediment to the complete realization of the integration of technology in learning processes.

The National Council for Technology in Education in Ireland echoed these sentiments in their 5-year ICT strategic plan for three years 2008-2013 that indicated that around 9 in every 10 schools had reported encountering technical breakdowns in their computer equipment that crippled learning processes. These schools also complained about the lack of support during the breakdowns and argued that because of the increasing integral role that technology held in their education processes, it would be better if their trainings included basic knowledge of how to restore their systems to their operational states. Yilmaz (2011), also came to the same conclusions when carrying out similar studies in Turkey arguing that institutions must expand their definition of ICT infrastructure to include the skills and know-how of how to manage and maintain them because of the cost and process efficiencies that this capacity adds (Tong & Trinidad, 2005). Similar studies in Britain and the Netherlands indicated that incorporating the technical skills needed to perform basic maintenance and management of computer systems increased adoption and support for digital learning resources and platforms significantly, regardless of whether it was done directly in user training or if the framework made provisions for external technical resources (Korte & Husing, 2007).

However, despite the importance all these elements have on the overall implementation of technology integration in the classroom, the initiative cannot make any meaningful headway if the leadership in schools does not support the move (Anderson & Dexter, 2005). According to Yee (2000), the active participation and support from the leadership in schools plays an instrumental role in promoting ICT adoption and integration. It is probably the most important factor because of the overarching role it plays in ensuring the other factors work optimally and in concert with others to increase the effectiveness of learning processes and outcomes (Lai &

Pratt, 2004). Also, sound leadership helps in rallying up the troops in times of hardships which should be many given the novelty of the introduction of technology in pedagogy, particularly in less developed countries.

In a nut shell, the availability of adequate computer resources, comprehensive ICT training programs, sound regulatory frameworks and policies, appropriate curricula that guides learning processes and support for the integration process by schools' leadership are the major factors that make the endeavor successful (Lai & Pratt, 2004, p. 462). These factors interplay with each other so intricately, on a meta level, that their overlaps make it difficult to tell where the effects of one begin and those of others stop. However, the leadership aspect in both the larger picture of the integration, and locally in individual schools acts as a compass that leads the implementation process and provides guidance when the process encounters challenges and problems. In addition, sound leadership also acts as a beacon that keeps the process focused on the big picture even as it undergoes changes to increase its effectiveness in the different contexts in which they are executed. Also, since leadership's main concern is the development of goals and the means to increasing their achievement, sound leadership in learning institutions should increase the function's capacity to understand the nuances involved in their structures and processes, and the elements and features of different technologies and how they work to help increase the effectiveness of the former. These arguments are supported by studies carried out in Hong Kong (Wong and Li, 2008) and Singapore (NG, 2008).

In Tehran, Afshari *et al*. (2009), found that school heads' capacity to exploit and understand ICT resources is instrumental to the success of the integration process because of the effects it has on influencing support from the top. Their position at the

helm of their institutions coupled with their understanding of the functioning of ICTs places them at the unique position to understand the relationships and interrelationships that these two aspects create in a holistic perspective. In Hong Kong, Yuen, Law and Chan (2003), established that head teachers were the major agents of change in education structures and systems because of the high impact their recommendations have on policy, and the finality that their decisions have on the continuity of processes. As such, the more they understand the features and uses of the tools technology provides, the likelier they are to support the introduction of innovations that enhance the creativity and productivity of users. These studies also indicate that simplicity in leadership made decision making more agile while hierarchical leadership models reduced adoption rates of new models because of the difficulties it brings to consensus building (Anderson & Dexter, 2005). Management and leadership styles also play an integral part in ensuring the success of mainstreaming technology in education because they affect the level of acceptance and support all stakeholders have on the venture.

Technology has a ton of benefits on any process that incorporates it and affects the attitudes users and potential users might have on their adoption and integration (Rogers, 2003). These benefits work to improve the cost and process advantages individuals and companies enjoy if they align their adoption processes with their overall goals and objectives. A clear understanding of the firm's end goal encourages higher adoption among staff because of the clear relationship they can draw between their current state and the implications technology has on bridging the difference (Watson, 2006). By adopting ICT tools in their processes, teachers themselves become innovators and their actions work to increase both their understanding of how

to exploit them to increase their productivity, and contribute to their contextual development to increase their efficiency (Groff & Mouza, 2008).

There is evidence from many studies carried out on different stages of the adoption and integration process in different regions and institutions. They include studies done in the planning and conceptualization stage of ICTs in institutions of higher learning (Parker, Bianchi & Cheach, 2008), those done on the attitudes of the users particularly those charged with delivering and improving content (Cope and Ward, 2002), those investigating the expectations of online message forums (Ajayi, 2009), and those that look into understanding users' understanding of the implications that ICTs bring to their productivity and to the structures they use (Mark and Ward, 2002).

Jebelie and Reeve (2003), established that secondary school principals are an integral part of ensuring that their institutions and users benefit from the advantages that technology promises to add to their effectiveness and productivity. Smarkola (2007), argues that stakeholder attitudes had significant influence on the rate of adoption and support for the process because of the direct relationship it draws between technology and the overall goals of the institution. On the other hand, Tella, Tella, Toyobo, Adika and Adeyinka (2007), established that understanding the implications ICTs have on enhancing the learning environment and increasing learning outcomes has a positive impact on teachers' support for the use of technology in the classroom.

Askar, Usluel and Mumcu (2006), reported that there was a correlation between the use of ICT tools and the creativity users exhibited when carrying out and completing tasks. They attributed this increase in creativity to the increase in the number of tools that digital platforms provide, that give users a variety of methods to go about the solution of the problem they face. However, despite the flexibilities it added to task

completion, users' choice to use them relied heavily on how well they understood the features of these tools and the implications that using them could have on their overall productivity. As such, these authors concluded that learners' support for technology in the classroom is the result of the difficulty they associate with the use of the tools they provide, while teachers' support depends on the benefits they forecast the tools will add to their outcomes.

Usluel, Askar and Bas (2008), argued that the success of technology adoption and integration depends on an institution's ability to develop strategies that increase their ability to achieve an optimum mix between the technical competence of their users and the best computer systems. The former increases users' ability to exploit the latter and to understand the implications that their use could have on their overall productivity, while the latter works to increase the effectiveness of the effort users put into accomplishing their tasks. Yi *et al*. (2006), reiterates these sentiments in their study that established that in the preparation stages, teachers undergoing ICT training will have as much enthusiasm and interest in the program and its overall goals depending on the benefits they believe they can accrue from their use.

Dillon and Morris (1996, p.6), argue that the reliability and validity of the systems developed for education programs play an instrumental role in advising users' decisions to adopt them and integrate them in their processes. Reliability speaks to a system's capacity to produce similar results when used in other situations that are similar (such as in other schools of the same category), and validity refers to a system's capacity to have established procedures and guidelines that help to increase the attainment of specific goals and increase users' ability to achieve their set objectives. There are also several studies on the subject that approach the subject from

the perspective of understanding the barriers that increase non-consumption of technology in education.

Balanskat *et al*. (2007), established the reasons for non-consumption of technology among teachers could be categorized into those affecting integration at the instructor level, those affecting integration at the institution level, and the overarching policy and framework problems that reduce integration in general. The major factors resulting in failure at the teacher level mostly revolve around their lack of ICT training and low technology awareness. As a result, they uncertainties that technology presents to their roles creates fears and reduces their support for, and adoption of, ICT tools in the classroom. Infrastructure adequacy is the major impediment of ICT integration at the school level, and lack of sound policies and curricula are the major impediments at the general level.

According to Yildrim (2007), although most teachers use ICTs actively to create and manage their teaching resources, they seem to lack the foresight of increasing the scope of device usage to include their use in the teaching process. He attributes this mainly to the lack of structures and infrastructure to facilitate the successful rollout in classrooms that are mostly overpopulated and schools that have little computer resources. Also, he notes that the curricula of most education systems are so rigid that it cannot accommodate the integration of digital tools, and also reduces the willingness of instructors to push for wider integration or exhibit higher adoption.

Slaouti and Barton (2007), established that low ICT integration in schools had its roots in the poor leadership of the education functions of the countries that recorded the lowest outcomes. These sentiments are also echoed in Chigona and Chigona's (2010) study that concluded that South African schools still had a long way to go in

their ICT integration journey primarily because the venture had little support from leaders at both the government and school levels. The resulting poor support from decision-makers had created gaps in implementation by causing lapses in the development of sound policies and frameworks to guide the process, and converge these two systems together such that they operate seamlessly.

According to Peralta and Costa (2007), overworked and underpaid teachers, overcrowded classrooms, and underequipped schools that are the hallmarks of many education sectors across the globe, and in under developed regions in particular, did little to inspire the growth of the digitization of education. They argued that these factors worked to increase the time constraints that teachers had to overcome, and reduced their willingness to take on extra responsibilities or support initiatives that could increase their workload. As a result, their resistance to the changes technology brings to their lives often affects their attitudes for ICTs in pedagogy which affects the attitudes of their learners, and reduces their ability to understand the concepts of technology in the learning process (Becta, 2004).

The advances in technology further increase the difficulties that teachers have with the integration of ICTs in their teaching processes in part because their iterative changes happen so fast and make more difficult to keep up, and largely because these advances create so much information and increases the volume of noise through which users have to cut. These iterations also increase the difficulties policymakers have to overcome to ensure that their frameworks can promote higher adoption of technology in schools while protecting the safety of learners. As such, these arguments bring to light the need for harmony between the politics, frameworks and technical understanding surrounding ICT integration in the classroom.

Teachers' understanding of technology and its implications on their ability to increase their productivity features as a major theme in most studies on the subject. Its importance is founded in the increasing understanding of its capacity to inform users' attitudes which in turn informs the importance they attribute to the tools it provides to the accomplishment of their overall goals and objectives (Huang & Liaw, 2005). User attitudes also affect their ability to work on improving the tools and processes they work with by providing feedback on the effectiveness of the structures and instructions for carrying out different functions, and by creating shortcuts and macros that reduce the time taken to complete a variety of tasks.

Like in any other industry, the effective use of technology in the learning environment requires that learning institutions device strategies and programs to increase the competencies and skills of their staff to use these devices effectively, first in their own roles and processes, and then in the classroom (Bauer & Kenton, 2005; Franklin, 2007; Wozney *et al*., 2006). Vocational training is important because of the synergies that it should create between teachers, the content they are charged with delivering and their learners that should create an environment that encourages creativity and innovation, and make learning a mutual experience (Keengwe and Onchwari, 2008). That is to say that the increase in ease of access to learning resources and the variety of tools digital platforms provide that increase the ease of manipulation and presentation of information should increase learners' overall investment in their own learning progress (Plair, 2008). As a result, it should create an environment where learners and their teachers communicate better and understand their challenges more intricately, therefore, making it easier to develop interventions that address learning disabilities and challenges more practically and sustainably.

2.4 Integration of ICT in Planning for Instruction in Early Learning

Most teachers are wary of the introduction of technology in the classroom because they do not have a lot of faith in the ability of the government to follow through with its implementation to ensure successful rollout. Institutions are also hesitant to pump in the considerable capital investment that the venture requires at the expense of the many more pressing needs that they have currently. These fears stem from the many previous improvements that most governments have intended to make in their education systems but failed to follow through leaving institutions in ruin after spending significant sums of money, and teachers with the impossible tasks of turning around the resulting low learning outcomes of their learners (Bredekamp and Copple 1997). Also, the skepticism is advised by the poor structures that governments have used in the past to manage the performance of new projects in education that often sees people wo are not involved actively in the process making unilateral decisions that are neither practical nor sustainable. It is especially frustrating when these changes are not accompanied with curriculum revisions which increases the burden on teachers to pursue an end they do not know using methods they do not have.

As such, to ensure the success of the integration of such programs, strategies should involve all the stakeholders that stand to benefit and hold a stake in the success of education processes and systems (Ertmer, 2005). Also, the implementation processes should take on a top-down approach which increases its ability to develop the user attitudes it needs to ensure process success, and reduces the costs it has to incur in training because of the resulting lower number of people who undergo training. By training teachers, or trainers of teachers, the process also increases its capacity to transmit ICT knowledge to more teachers across more schools exponentially, therefore, ensuring that it build enough capacity in a relatively shorter time

(Rodriquez and Knuth, 2000). At the same time, it ensures that the process does not disrupt normal learning activities too much, which ensures the continuity of learning and works to improve overall learning outcomes, and works to help teachers in developing insights into how to merge traditional learning styles with the new digital tools. Also, they help to provide actionable insights into the gaps in both teachers' competence and preparedness to handle the responsibilities of their evolving roles, and in how best to close the infrastructural gaps present in most learning institutions. Moreover, this approach also gives instructors real-life experience in developing contextual integration plans that allow their schools and learners to get the most out of the rollout of technology in the classroom.

According to Labbo, Sprague, Montero & Font (2016), proper planning of the process and training of teachers prepares them to anticipate and solve learners' challenges especially where their institutions suffer from a lack of sufficient computer resources. Otherwise, they run the risk of wasting considerable parts of their lessons managing quarrels and fights (referred to as mouse fights) among their learners, and not getting much work done. Also, it reduces their ability to enhance equity in the learning environments they are in charge of, therefore, reducing the overall effectiveness of their processes and increases the disruptions learners have to overcome to increase their learning progress. These challenges increase with the reduction of learners' ages, meaning that teachers in the more formative institutions of learning (such as kindergartens and nursery schools) have a heavier burden.

A survey on the use of games to increase learning outcomes indicated that incorporating pictures in the process had more than twice the impact in improving learners, performance. It also established that incorporating games into the learning

process improved learners' ability to grasp concepts and retain the knowledge they acquire (Meyer, 2010). Also, it increases their flexibility to assimilate their knowledge contextually and increase their overall capacity to develop practical and sustainable ways to learn. And, since digital platforms provide an easier way to bring these two elements, and so much more, together, it makes a pretty compelling argument for their use in education.

Vocational training also helps teachers to understand the psychology of the different categories of learners they interact with and encounter, and helps them to customize their approaches to increase learning outcomes for all their learners. For example, understanding that children's concentration spans increase as they grow older, increases teachers' latitude to customize their content delivery to accommodate the abilities of all their learners, and ensure that they get the most out of their learning experience (Clements & Nastasi, 1993).

In another study on the influence of technology on math aptitudes, Herron (2010), discovered that learners that used online learning resources showed significant improvements in their ability to solve problems they were unable to previously, and even to discuss the procedures involved. He attributed this shift in performance to the setup of online resources that allows learners to consume content at their own pace and speed, unlike the setup of traditional classrooms. These resources also give learners the flexibility to replay, pause, and in some cases even the ability to interact with other learners and the course creator or facilitator, and increase their overall capacity to understand the content more intimately. These resources also give learners the ability to control variables such as volume and speed of speech, therefore, making them more effective for slower learners or those with learning disabilities.

According to Coffey (2012), technology has created tools and platforms that have increased learners' ability to understand new concepts and to assimilate knowledge better by giving the tools to interact with information in real life and in real time. Also, because of the networking feature that is the basis of most devices connected to the internet, learners can communicate and interact with other learners from other parts of the globe, therefore, leveraging innate emotions such as pride and competition to further increase their determination to learn and excel. The paradigm shift that these technologies create, reduces the workload teachers have to contend with by increasing learners' investment in their own learning progress.

Baytak and Ayas (2011), established that learners are increasingly understanding the benefits that technology brings to their learning progress and experience, and how the improvements it brings to communication help them to find answers and benchmark their progress against those of their peers across the globe. They also observed that the structure of online learning platforms offers learners a more engaging environment because the design incorporates gamification principles that makes learning challenging enough that it encourages higher learning outcomes, but also detailed enough that it improves learners' ability to scale their understanding of concepts.

The self-paced feature of online learning programs increases their capacity to accommodate more categories of learners by giving them more control over how and when they consume content. This feature also makes technology-based pedagogy more suitable for use with learners with learning problems, or other challenges that make it difficult for them to excel in normal settings. Also, the almost limitless space digital platforms provide users, coupled with the abundance of tools they hold

increases content creators' latitude to develop several tutorials for a single problem or concept, therefore, giving learners a variety of perspectives from which to learn. These benefits were reported at a school district in California that reported an increase in the learning outcomes from its institutions that host children with special needs (Courduff, 2011).

2.4.1 Technology in the curriculum

Curricula work to ensure that learning programs are beneficial to the overall growth and development of children. They achieve this by testing content and their delivery systems thoroughly to ascertain if they promote high understanding of their surroundings and the greater world among learners. And, since technology is fast becoming a mainstay of the world in which we live, it makes sense that the structures guiding education should work to incorporate them both in their management and in the learning process itself. However, it is important that there are sound frameworks in place to guide the development of appropriate course materials and structures to increase the benefits that the users of these tools derive from their use (The Kleiman, 2000).

Curricula also lays down structures that ensure that pedagogic processes and resources address learners' evolving needs and predisposition, and increase their level of engagement and interest in the process. Like traditional book-based learning environments and experiences, curriculum for technology-based learning should provide for more mandatory teacher-student interactions in the formative stages, then reduce them as learners grow and become more adept at taking charge of their own learning progress. This technique encourages guided exploration of their environment for younger children and allows them to understand the relationships between objects

they see and themselves in the formative years, and encourages more autonomy in the latter years, therefore, giving teachers more time to concentrate on packaging information in ways that make it easier for all learners to assimilate (Bredekamp & Rosegrant, 1994).

Psychologically, children have limited attention spans and get tired of activities that are less engaging or harder to accomplish faster that their more mature counterparts in higher classes. Teachers, therefore, provide much needed guidance and act as a beacon that helps children focus on tasks longer by being an authority figure and socializing them to understand responsibility, and by clearing up any challenges and problems they might encounter to help them proceed (Clements & Nastasi, 1993). The same approach should be taken with the teaching and use of ICT in the classroom especially because computer systems are sensitive and can only produce outputs that are as good as the input commands (Davidson & Wright, 1994). As such, teaching them how to be patient when issuing commands prepares children for more beneficial exploitation of computer resources in the future, much in the same way as teaching them to develop healthy learning habits prepares them to consume more knowledge better in their later days. These strategies are especially effective and appropriate for learners in kindergartens and nursery schools or who are between the ages of 3 and 5.

As learners become older and advance into primary school, the role of teachers focuses more on creating an environment where these learners can use their growing communication and reading skills to acquire higher level information and understand how to convert it to knowledge. Learners at this stage can handle a diversity of learning resources and welcome the challenge of longer passages and volumes without a lot of visual cues. The same applies to ICT training and allows teachers to

give learners more freedom to explore applications on their own and discover deeper functionalities with little instruction and need for active teacher engagement. Easy word processors, for example, are valuable instructional devices when children play with written words. The task of the teacher is to set up the atmosphere and events, to adapt the use of technology to the program as well as to the needs and desires of the child. Teachers are less interested in performing activities and more active in tracking the actions of learners, acting as appropriate to lead and raise questions that stimulate learning (Baytak, Tarman, & Ayas, 2011).

The problems that the increase in the number of tools technology provides does not affect learners only. In fact, the challenges they create affect instructors more by increasing the difficulties they have to go through in curating information and selecting the most appropriate tools that promote inclusion among their learners (Lapadat, 2015). As such, if teachers are equipped poorly, not only will they waste a significant amount of time and develop low impact course material at best, but they can also confuse their learners and lower their attitudes toward technology and contribute to their low learning outcomes.

ICTs increase the flexibility with which institutions and teachers can tailor learning programs to increase individual student learning outcomes or create activities and tasks that encourage the cooperation (Kuiper, 2014). Because technology increases the autonomy of functions, it also promotes the evolution of learning styles from the traditional teacher-led-and-dependent types, to the more modern learner-driven models. However, it is important that these developments happen under the strict guidance of sound frameworks to ensure that the processes and rationales advising them are well documented to enhance their replication in other cases, and also to

make it easier for review and audit in case something goes wrong or does not go according to plan.

There are four main categories of computer systems that learners and teachers use in their learning processes, and they include informational resources, location systems, constructive tools, and contact systems (Tay & Lim 2003). Informational resources are systems that archive and present a variety of information in all types and formats, and mostly constitute digital repositories. Location systems are platforms that provide immersive content that lets users interact with items in another world, and include games and most recently augmented reality platforms. Constructive tools are the resources that increase users' ability to manipulate data and generate meaningful information that helps them to achieve their goals faster and more efficiently. They mostly include analytics and graphics tools. Contact systems are applications that allow users to communicate among themselves or seek out each other either for social or professional purposes.

Understanding how to use these different tools effectively increases users' ability to develop new insights from ordinary data, and increases the contributions they make to the growth of the body of knowledge (Tay & Lim 2003). They do this by providing users with the means to present the results of the higher-level thinking they achieve from developing effective learning habits and consuming and assimilating a lot of data. Teachers are instrumental resources in learners achieving this level of mental operation because of the experience and knowledge they have on developing healthy learning habits and their capacity to evaluate learners' progress effectively.

According to Hogle (2012), the choice of tool should depend on the need and overall goals learners want to achieve. However, he noted that interactive applications, such

as games, recorded higher rates of engagement among learners and increased learning outcomes especially as concerns organization and memory. The immersive environment they create increases learners' capacity to relate with the elements and concepts that make up the learning exercise, and increased their cognitive abilities in the process. Nevertheless, these gains are highly dependent on the reasons these interactive applications are developed and the overall learning goals for which they are employed. Otherwise, their effectiveness is not guaranteed and their use might actually be counterproductive and affect learners negatively, resulting in the reduction of their learning outcomes. The emerging pattern seems to support the idea that the tools that increase users' ease to manipulate and present information work to enhance their overall cognitive abilities and bring them into higher-level thinking, and those that increase their ease of communication promote the development of more artistic abilities and skills, such as communication and debate (Lapadat, 2015).

Whitebread and Hayes (2013), established that the use of ICTs in the classroom could be broadly categorized into uses aimed at improving cognitive tasks and those aimed at increasing communication. They also argued that since these two features of learning worked in tandem with each other, it was important that learners worked on developing both competencies simultaneously if they wanted to increase their overall performance significantly. Their results indicated that there was high convergence between these two and that they both contributed to the effectiveness of the other in that they increased a learner's capacity to develop great insights, and gave them the ability to communicate these insights effectively such as to create or inspire change in how others operate or think. For example, given a large data file, a skilled learner will use his knowledge of relationships to generate contextual information on different aspects of the population he or she is studying, then use his or her skills in

communication to present this information in a format that increases his or her audiences' capacity to assimilate and understand.

According to Schibeci, Cummings, Phillips, Lake, Lowe, and Lee (2010), it is important to train learners on how to establish healthy and high performing learning habits so that they are not distracted by the volumes of content available online. It should also help them to develop the resilience necessary to avoid the temptations created by immoral content and also help them to understand how to protect the computer resources they own and use from attacks. These skills also improve their capacity to focus on their tasks regardless of the distractions that their environment throws at them, which increase significantly when users are connected to the internet. These skills are important and help these learners to be responsible users of technology even when they are out of school and later on in their lives as they work and bring up their own families. They improve users' quality of life by increasing the ability to manage these tools effectively to enhance their social wellbeing instead of being sources of anxiety as they struggle to create plans that enhance balance. This understanding also promotes inclusion by creating platforms where teachers and learners can make mutual decisions on whether or not to incorporate these tools into the classrooms and encouraging meaningful contextual discussions about the implications of either decision (Merchant, 2010).

2.5 Integration of ICT in Teaching and Learning Methods

Teachers must make informed choices of the tools they will use in their lessons depending on the outcomes they desire to increase, and their evaluation of their learners' abilities (Lapadat, 2015). In most cases, the tools they choose will not necessarily be the most efficient in carrying out the intended tasks, but should be the

ones that allow them to increase learners' engagement and understanding of the procedures involved the most. Understanding the right way to carry out tasks promotes learners' capacity to grasp and remember procedures, and carry them out successfully.

It is important that teachers understand that ICTs are not a curriculum on their own but just a delivery mechanism that allows them to engage with their learners on a deeper level, and also provide both groups with the tools to increase their ability to solve problems and develop insights (Kuiper, 2014). As such, it is important that institutions develop vocational programs to encourage teachers' skills development alongside their ICT training, otherwise they might substitute the latter for the former and reduce learners' learning outcomes and competence significantly.

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2.5.1 Approaches toward learning using ICT

Technology provides new opportunities to understand and illustrate learning. Computers may uncover latent abilities for those children who have particular learning styles. Through the screen, children can learn from a variety of viewpoints and take different directions to the target (Clements, 1999). Bad performance and attention issues may be solved by toggling device settings to timeout and allow children time to rest and play in between learning exercises. These same settings can also work to make devices less distractive especially to learners with attention disorders or other social and learning limitations that might unnerve them when startled or distract them completely from the task at hand. They can also work to ensure that learners enjoy a more balanced and holistic experience that allows them to develop their cognitive and social skills simultaneously, while ensuring they receive as much physical activity as possible. As such, it is evident that the tools technology provides can increase learning outcomes significantly if managed well.

Alexander (2001), argued that despite the overall goal of all learning programs being to encourage learners to consume and assimilate information efficiently, only technology-based delivery systems have been able to create sustainable paradigm shifts that put the onus of learning on learners. However, even though learners enjoy

more autonomy on how and when the consume available content, the enhanced communication capabilities inherent in these systems enable them to communicate with instructors and their peers at any time (Bates, 1995). As a result, it reduces the incidence of learners being unable to move forward because of being stuck on a difficult section, and allows teachers to focus more of their energy on developing and curating content and information, and on helping the learners with severe learning handicaps (Underwood, & Underwood, 1999; Mason & Rennie, 2008).

Some researchers have also adopted the perspective of the relationships between and among the elements that create the learning system or environment to further the understanding of the importance communication has on overall learning outcomes and learning environments. According to Mason (2008), the major relationships existing in learning include those between learners and their instructors, learners and their content, and those between the learners themselves. He argues that these relationships overlap to create the learning environment and influence learning outcomes. Garrison and Anderson (2003), improved on these arguments by adding the relationships between teachers and content and that between teachers and their colleagues. The resulting model was more effective in explaining the relationships between all the levels and stages of the learning process and can be helpful in understanding the weak links in the system, and highlight insights into how to remedy them (Dron, 2007). It also emphasizes the importance of the social links that the different users form within and across their groups and levels in enhancing improvements to both the outcomes and the frameworks governing them.

The relationship between learners and content involves the learners interacting with the content available on the learning platform on their own. This content might have

been developed by instructors or other user of a combination of both, but this is not very important in the context of understanding these interactions (Hrastinski, 2009). In learner-instructor relationships, learners use communication systems to collaborate with their teachers directly, either through the asking and answering of questions, or on seeking advise on how to approach a problem or challenge. Learner-learner interactions occur more informally that that between learners and instructors because they are peers (Dron, 2007). These interactions often pursue the understanding of course material or elements that make up the learning environment and work to enhance the social structures that learners have formed and on which they rely. These interactions create collective understandings of concepts and happenings that advise the attitudes of their subscribers and can create biases in the development of content of the frameworks to regulate them.

The advancements in technology continue to increase the ease with which these different groups can communicate with each other (Bouwen & Taillieu, 2004). The advent of social media and improvements in mobile telephony are especially making it easier for these groups to communicate within and among themselves and in some cases to interact with each other's environment through the use of specialized web tools or by allowing users to create videos of the operations they are carrying out on their end and send them to their friends or supervisors for review and troubleshooting (Hrastinski, 2007). In group communications, it is now possible for users to respond to specific queries directly or ask a question to a specific user to alert him or her that his or her action is required, and also reduce the time one has to spend reading through all responses (which can be numerous) (Hrastinski, 2009; Stephenson, 2001).

Margaryan and Littlejohn (2008), established that communication channels depended on whether the users were in the same group or one was subordinate to the other. In the latter, they discovered that communications often were formal and used more formal channels such as email, and the former was characterized by the use of informal channels and means. Also, the former recorded faster response times and generated a lot of discussions between the interacting parties unlike the latter. Dillenborg (1999) also argued that since communication between these groups was essential to increasing learning outcomes, it could increase the effectiveness of these platforms if they could be builts with communications ready tools. Involvement in events such as learning path and participation in formal projects, flow and inspiration, and constructive interaction with materials (Stephenson, 2001).

2.5.2 Constructivist pedagogy

This is an active learning approach that encourages learners to develop knowledge from their interactions with their environment, and enhances the development of contextual knowledge (Novak, 1998). Teachers take on a more laid-back role in this model and only function to provide guidance on how learners can increase their understanding of different phenomena by varying their perspectives but it is up to the learners to do all the heavy lifting (Gallant, 2000). To succeed, this approach relies on the development of immersive environments and the enhancement of communication channels between teachers and learners to ensure that challenges and problems are identified and remedied early to enhance the continuity of learning processes (Jonassen, 2000). Teachers point learners in the right direction by assigning them tasks relevant to bridging the gaps they identify in their cognitive or communication skills, and it is up to the learners to discover the knowledge on their own and grow their understanding and reasoning capacity (Sharp 2006).

According to Sadker *et al*. (2008), teachers in this model only have an oversight responsibility to their learners, and only ask questions that provoke their learners to think deeper and look at problems from a variety of lenses in order to develop new insights and knowledge. With the introduction of technology into the learning process, this role becomes increasingly important because it allows learners to develop their own aptitude for curating content and learning how to ascertain what is noise and what is useful in the shortest time possible (Novak 1998). In so doing, it also helps them to develop their own structures and systems that help them to manage their lives holistically, therefore, working to enhance their wellbeing in the long term and enhancing their flexibility to remain resilient to learning pressures (Keengwe and Onchwari, 2008). As such, they not only get to benefit from the advantages that technology offers them, but they also get to contribute to the enhancement of the system and improve the benefits them, and others, derive from it (Gooden, 1996). The insights they develop should also work to enhance the effectiveness of other learners understanding how to develop their own styles of learning so that they can increase their abilities when they apply the use of the tools technology provides (Jonassen, 2000; Becker, 2000; Forcier and Descy, 2002).

The increasing importance of technology in modern-day societies necessitates that teacher's look for ways of understanding how to use them effectively and integrate them into their processes (ISTE, 2000). They should also initiate and hold meaningful conversations with their learners on the implications of owning and using these devices and the emerging trends across the globe, because more often than not these young people understand these things more than their teachers. Once they have this information, teachers can understand better how and where to engage with their learners more meaningfully should they decide to adopt the use of these tools in the

classroom. However, these tools should only be used to complement sound teaching and content delivery mechanisms that must follow the guidelines provided by regulatory agencies and institutions (Anderson and Becker2001). According to Zisow (2000), instructional style is the most critical aspect impacting whether a teacher uses technology in the classroom or not. Technology is just a device. Whether or not it is used depends on the enthusiasm of the instructor and the ability to learn new resources.

Smeets (2015), argued that integrating technology in classrooms has the potential of increasing the realization of overall education and technology goals because of the overlaps between its objectives and those of other national level strategies. He further contends that given the future of the world being digital, starting sooner rather than later should make countries and their talent more strategic in the long term. It is especially important because of the upcoming technologies that want to leverage augmented realities to create immersive environments where people can interact with content, and threaten the ability of people to discern what is real from what is in virtual reality (O'Dwyer *et al*., 2004). It should also help learners to be more conscious of promoting inclusion in learning platforms and their development, and when developing content to encourage higher literacy especially among poorer communities.

2.6 Integration of ICT and Teaching and Learning Materials

One of the most critical factors contributing to the efficient and productive implementation of IT in all subjects and for all learners is exposure to an appropriate and sufficient ICT network. Once again, certain fundamental concerns remain, preventing the application of emerging technology in education and research

(Clements, 2002). The availability of ICT in schools is a crucial precondition for the effective introduction of new educational approaches and strategies. Using digital resources and content on-line can boost learning experiences and empower learners. According to Eurydice 2011, European education systems and policy studies do not have an unusual gap in the accessibility of ICT supplies between schools, but the lack of educational software and the lack of teacher support still have an impact on the level of ICT usage in schools.

ICT technology cannot just enhance learning practices and include new approaches, but can also be used to strengthen the administration of schools and their tasks. This can be noted that the introduction of ICT into schools has strengthened classroom operations and practices. Among the educational practices in which the proportion of computers and IT will increase and benefit from the computerization of school libraries and school administration, it is possible to differentiate the use of ICT for extracurricular activities and better communication between teacher and parent, as well as enhanced engagement between teacher and learner (Clements, 2002).

When it comes to the use of computers, different decisions are taken about how to handle ICT equipment in classrooms. It is advised that ICT equipment be installed in a number of school locations according to education plans from most European countries. Workstation laboratories require ICT to be used as a financially understandable part of the teaching system. But this can lead to the use of ICT to learn more about ICT than about ICT (Clements, 2002). Easily accessible workstations, either in a number of places or in the classroom, can be used more frequently in the course of the day and for various uses and learning experiences. ICT accessible in classrooms can be appealing, in particular for guidance setting and task analysis.

Widespread availability of ICT in schools can broaden individual preferences and can help adapt to the specific needs of particular learners by incorporating individualized learning programs and strategies that are important to the learners' level of experience. However, the free use of ICT by learners is not so widespread, based on the study of Eurydice 2011. In most cases, particularly when computers are placed in computer labs or classrooms, it is shown that ICT use is often performed under teacher supervision and during specific hours.

The internet is used as an instructional content source. The incorporation of teaching and learning in information and communication technology will have some advantages. Second, the pupils will play a more active role, allowing them to hold more information. Second, follow-up talks should include more information about whether learners can become more independent. Last but not least, the pupil can access new learning opportunities easily and improve their skills (Tutkun, 2011).

Computers can provide a private place for learners to practice while learning, without fear of public failure, particularly when children are required to master mathematical material, and computer literacy can serve as a resource for those children with more than average achievements (Bredekamp & Rosegrant, 1994).

Classroom research suggest that children's cognitive gains from the use of appropriate technology are considerably greater when computers are installed in the classroom than when they are in computer laboratories (Davis & Shade, 1999). Reasons cited include limited computer exposure when it is installed in labs. In a laboratory the inclination to use drill and practice software, while in classrooms more tool-oriented software is used. More collaboration in laboratory environments, and peer tutoring. Some findings give further proof of the role computers play in the classroom. It forces

kids out of their usual setting using a computer lab and takes away other rich choices. Use a program as a group-wide instruction, which is common in laboratory environments, ignores a computer's power as an independent teaching resource. In-room computers allow children to use them as they wish, or not to use them.

While the relationship between learning and technology integration has a positive trend, some scholars may suggest that the use of technology can affect the social, mental, physical and cognitive growth of children (Ozgur & Seyhan, 2010). Early childhood specialists would not be disadvantaged, however, with adequately managed practices and a wide variety of technology incorporated into the classroom. Early childhood teachers have to be responsible for shaping events that impact the daily lives of children and families. Since no comparable research has been conducted for a longitudinal review of the technological impact of the approach to the classroom, the primary objective of this study is to examine how technology implementation can enhance young children's social skills, the role of teachers in evaluating the correct use of technology, and the role of teachers and parents as advocates.

The Albert Shanker Institute (2009) and NAEYC (2009) illustrated the importance of providing children in kindergarten with a variety of developmentally related activities that enhance their self-esteem, trust, personality and individual skill. Developing effective methodology requires teachers to move their focus from traditional methods of instruction to providing activities that are consistent with children's interests, skills and learning enjoyment (Epstein, 2007; Pianta, 2003).

Technology should be used as a tool for bringing practical initiatives into practice and engaging learners in critical thinking and problem solving. Technology should be used to restructure and redesign the classroom to create an environment that will

promote the development of cognitive skills at a higher level (Kurt, 2010). Technology also promotes learner collaboration. Collaboration is a learning tool which is highly effective. Working together, the learners either build projects or learn from each other by reading their peers' work (Keser, Huseyin, & Ozdamli, 2011).

It can be overwhelming the amount of engineering tools and methods which can be used in education. The multiplicity of options doesn't always help teachers find the right help. The choice of teaching aids should be considered carefully, and the option should be suitable for the learning tasks planned for. Using technology may not always be useful for this. In other cases this can cause quite the opposite outcome. Inappropriate use of the technology can lead both the learner and the teacher to misunderstanding and overuse. Learning sponsored by ICT may be entity or community, as well as learner or teacher-driven (Kuiper, 2014). Using ICT in education will speed up the individualisation of research strategies and promote learning processes within a study community. To be able to fully promote these types of learning, the successful introduction of ICT in schools should focus on general arrangements of resources, lessons, tasks, meaning and content as well as on all specific connections that arise when using ICT. The ICT should be tailored specifically to the context of use and to the specific conditions to be used. In primary schools, ICT is used to teach and learn to develop the learning of literacy, numeracy, science and the skills of the 21st century (Kuiper 2014).

Considering how ICT tools are used in classrooms, it is possible to divide ICT tools (Tay & Lim 2003) into four categories: 1. Information tools-these are applications which provide information in a variety of formats, such as text, graphics, sound, or video. Styles of useful methods may include, for example, interactive encyclopedias

and Web sites. 2. Location tools-these combine systems that placed learners in an environment they might play with. This includes simulations, games, and augmented reality. 3. Building tools-these tools are general purpose tools used for manipulating information, creating new knowledge or visualizing one's understanding. These software types may be mind maps or social networking apps to help learners organize their awareness, emotions, and reactions. 4. Contact devices-these devices promote communication between teachers and/or learners. E-mails, calls, forums, teleconferences and interactive whiteboards can be examples of communicative tools. These methods are designed to involve learners in higher-level thought (e.g., rationing rather than knowledge gathering). Some studies show that higher-order thinking skills were best acquired for structured research when learners built knowledge instead of consciously absorbing information (Tay &. Lim 2003).

Informational methods alone may not serve to engage learners in higher-order thinking, according to Lim and Tay. However, these tools would enable learners and educators to achieve their goals with the necessary assistance and guidance of educators. Hogle (2012) in his research examined the effect of video games on learner engagement, motivation, and retention. The findings of these studies found that some of the cognitive learning strategies including interpersonal, memory and countervailing strategies could be improved by simulation and games. Although, in this situation, it is also important to note that there are major positive effects from games. Communicative methods can improve learner success in learning. It's also about public involvement.

According to Lapadat (2015), communication methods will contribute to changes in analysis, comprehension, perception and assessment. Hayes and Whitebread (2006)

The definition of schooling and ICT usage areas overlaps to some degree with the four definitions suggested by Lim and Tay (Tay. & Lim 2003). Hayes and Whitebread agree that, in order for ICT to be able to make a difference in particular fields, learners should use ICT resources in ways that help the situation and context in which learners gain more. The fields suggested by Hayes and Whitebread for the uses of ICT in education are:

- ICT and literacy
- ICT and mathematical understanding
- ICT and science
- Creativity, problem solving and playful uses of technology
- Visual literacy and painting
- Media education (digital animation)
- Learning of music

ICT tools can affect educational achievements positively, as well as involve learners with higher-order thinking. However, it should be noted that while ICT is considered a powerful and adaptable instrument in the hands of educators, it requires care, knowledge and experience in order to use it suitably for context and activities. ICT services which are inadequate or poorly chosen may impact learners and teachers. That is why it is equally important to teach and address topics such as ethics and honesty, at the same time as incorporating technology into schools. These issues can not be ignored, and should be addressed as part of the application of ICT in education. Additionally, while positive effects of ICT use in education have been reported in several studies, there are still known ICT disadvantages which need to be considered. Computer software may be of benefit to learning literacy, but programs may also exist

that are either not as good as others, or that may be insufficient or ineffective for a particular community in a given context. Moreover, technology can't replace teachers, particularly with informative devices, and their presence and support is indispensable (Kuiper 2014).

According to Lowe, Cummings, Phillips, Hill, Lowe & Lee. (2010) where additional distracting information is available; learners tend to overlook important information. There are also legitimate questions about Internet use. Apprentices who may openly use computers to access the Internet may be subjected to offensive or inappropriate content not suitable for their age. Educators need to ensure that learners are tracked by access to the Internet and other information accessible during most of the in-class activities. The same inference can be reached by the use of all kinds of multimedia. If they are not adequately used, adapted or planned, the use of multimedia may result in uncertainty rather than improved concentration and learning outcome. Additionally, some psychological variables, e.g. anxiety, can have a detrimental effect on learners. Dependent merchant. (2010) study, pupils may not be able to share with the technology what they have learned through real-world experience. Educators will need to be able to distinguish whether pupils choose to use technology or use conventional teaching materials. Issues surrounding the implementation of ICT in early childhood education have been thoroughly studied, and health problems can be identified.

Other problems which need to be discussed are children's motivation and concentration. Computers offer a wide range of possibilities that can be seen as useful to a greater part. Technology can, however, bring multiple temptations and also cause disruption. When searching the Internet and looking for information relevant to a

specific task, the child is exposed to many content and tempting possibilities such as sports, social media or other types of leisure behaviours. The school must be properly prepared and sufficient restrictions must be placed in place to avoid such disruption. Lack of motivation or decrease can be caused by, for example, the tasks wrongly chosen, misbehavioral or counterintuitive equipment or insufficient skills and experience of the learner.

2.6.1 Selecting ICT Materials for Early Learning

Effective pedagogy and the sound learning goals should guide the materials choice and tools, including the technology, to be used in activities of learning (Bredekamp & Rosegrant; 1994; Davis & Shade 1990). "Whatever materials or devices are suited best for the role should be used; sometimes, the right tool for the job are computers while sometimes they are not; the trick is to know the difference" (Davis & Shade, 1999, p. 237). Computers are effective tools which, like all technology, are most useful when used as a regular part of the learning process.

Studies indicate that child development benefits from the use of correct technologies when computers are installed in the classroom are substantially greater than in computer laboratories (Davis & Shade, 1999). Reasons cited include: limited access to computers when placed in laboratories, a tendency to use drilling and practicing technology in laboratories, albeit a more tool-oriented approach

Some previous studies provide more support for the computers placement in the classes: computer lab usage takes children out of their normal environment and excludes other ridiculous choices (Bredekamp & Rosegrant, 1994). Using a whole group instruction program, popular in a lab setting, rejects the power of the machine as an independent tool for teaching (Bredekamp & Rosegrant, 1994).

To enable children be able to reap the greatest technology benefits, the software must be developmentally appropriate, i.e. consistent with the ways the children learn and develop and endorses or expands their curriculum (NAEYC, 1996). Choose software that: is accessible and allows for active learning by learners through decision making. It includes several senses and contains sound, music or voice.

To add to computers, many other forms of ICT technology are effectively used by children. The environment, main purpose, and stages of developing by children can help determine the options that are best for particular circumstances. Also, the available technologies and that are commonly used in the community will definitely influence the option available.

Cameras, films, videos, or electronically capturing student activities while at class, as well as presentations and events that are special. Children will also tell a story in pictures, write or decide on the use of captions. Images Sharing in learning with other learners, friends, and community leaders. Images will also introduce new learners and families to teachers and staff leaders during home visits.

2.6.2 Developmentally appropriate use of ICT in Early Learning

Developmental appropriateness of early childhood education is a guiding principle in many of the ICT literature. Application appropriateness is highly highlighted by two frequently cited sets of recommendations: the DATEC (creation of suitable early childhood technology) program in the United Kingdom (Siraj-Blatchford & Siraj-Blatchford, 2002; Siraj-Blatchford & Whitebread, 2003); and the Declaration of Intent of the American National Association for Young Children's Use DATEC (Early Childhood Developmental Appropriate Technology) provides a useful, general framework for teachers with eight general principles on what constitutes the

appropriate developmental use of ICT. These concepts include: maintaining an educational objective; encouraging collaboration; the integration with other curriculum aspects: that is, if ICT is to be understood by children, they definitely need to witness it being used in a context that is meaningful and for purposes that are real. This also includes ICT allowance to appearing in children's play; the child should also be in control: that is, the ICT framework should not regulate the interaction of the child by programming the learning process or any other system of behaviour, preferring simple and intuitive applications. Drag-and-drop on a screen of a computer is an example that is good on how to prevent abuse or stereotyping, health awareness and issues of safety and parents' encouragement in taking part in the education (Siraj-Blatchford & Siraj-Blatchford, 2002; Siraj-Blatchford & Whitebread, 2003)

The word "developmental fitness" can be defined in a variety of ways, depending on the type of views or beliefs embraced by an individual about childrens' development and learning. Development of children is sometimes described as a step-by - step "stages" sequence (Luke, 1999). Different activities or thinking habits that largely require an advanced development stage than the child has attained in this respect are not considered appropriate for growth. O'Rourke and Harrison (2004) consider that sometimes the emphasis of strict developmentalist interventions is on childlessness. Downes *et al*. (1995) recommend that resurrected understandings of developmentally acceptable activities take a broader view of Vygotsky, 8 encouraging educators to design experiences that measure children in their "proximal development zone" – an area of disparity in success between what a learner can do without assistance and what they can do with the guidance of a more experienced person.

Over time, theoretical understandings of child development remain redefined (Clements, 2002; Luke, 1999). For example, Luke argues that children's social, behavioral, and emotional growth can no longer be expected to plunge unproblematically into the traditional developmental lock period. Today electronic media are increasingly shaping early childhood literacy and interactive interactions (Luke, 1999).

In other words, Luke, (1999) suggested that experiences in early childhood with Information and Communications Technology and other media can also affect childhood growth and experiences. So some of our assumptions about growth and what is ideal for children in terms of development will need to be changed accordingly. For example, using a mouse to manipulate a device may have been deemed incompatible with young children's cognitive abilities in the past. Kids who have practiced using a computer at home, however, can gain skills and abilities to control and manipulate the mouse at a younger age than children who do not. "Ecological" analyzes of the ICT experience of young children in early childhood education indicate the need to see the growth of children in a dynamic interplay of physical , biological, social , economic and cultural factors including sensitivity to the experiences of children in their home and family life (Clements, 2002; Luke, 1999).

2.6.3 ICT and children’s play

Play is often seen as a key component of early childhood development as part of children's social, emotional, cognitive and motor development. The study suggests a variety of different ideas mostly on role and future benefits of ICT in children's play. Recall the concept discussed in the introduction that childhood development of children should start by learning about technology (that is, what it is, how it works,

and also the roles it plays in their very own and other lives) as well as learning through technology. Training should be seen as a crucial component of both aspects of teaching. O'Hara (2004) outlines a variety of early childhood examples of English ICT academic settings in children's play, including socio-dramatic roles. It is important to keep in mind that O'Hara considers both functional and nonfunctional ICTs to play an important role in motivating children's learning about technology. Examples which O'Hara mentions include:

A fun role-play with a kid using a working Laptop, a photocopier and a printer;

- An indoor/outdoor spontaneous game that originated when an adult introduced a pair of walkie-talkies to six children;
- A full-class in karaoke concert while using a CD player, microphone, amplifier, video camera and a television screen;
- An inventive role is played by going to a travel agent and booking for a holiday abroad, then on a holiday plane. A Computer that was not functioning, telephone, catalogs and the globe were included in the “Office of the Travel Agent." The "Aeroplane" had a Computer inside the cockpit that was functioning, displaying cloud pictures as the "flew" plane. A tape player / listening station with several headphones was used in the "cabin" as an in-flight entertainment center. A simple battery-operated "fasten seatbelt" sign was installed by the classroom assistant that the "cabin workers" could turn on and off;
- Closed-circuit surveillance system and TV monitor mounted in a sandbox in an early childhood classroom known as the "sea side café";
- A group of children that is small and a sitting in a circle instructor and learning how to operate a programmable Pixie vehicle, each child taking a turn to program the vehicle to fly to another child through the carpet.

Examples from O'Hara's (2004) illustrate some of the important topics of quality ICT work for young children. These include: kids using ICT in "realistic" yet imaginative socio-dramatic role-play; kids learning to use the right vocabulary to describe the various related technologies and activities (for example , kids thinking about "typing,""printing" or "seeing flight times" using a computer); and kids using different forms of ICT, both indoors and outdoors. Many of O'Hara's examples indicate that children are trusted and supported in managing technology (for example, children are supported to run themselves a video camera, CD player, device, or programmable toy).

The actual or possible learning advantages of children's video games are widely debated in literature (Clements, 2002; Linderoth *et al*., 2002; Yelland, 2002). Verenikina, Harris, and Lysaght (2003) suggest that video games may have a specific or special significance for children's play, and that their developmental importance should be investigated if they are to become a part of children's lives that is significant. In their view, understanding the variety of ways video games may or may not contribute to children's development will allow early childhood educators to make informed choices when selecting appropriate applications for their settings (Verenikina, Harris, & Lysaght, 2003). Verenikina *et al*. propose that early childhood educators can use traditional and modern approaches and theories. The table below shows some of the questions that teachers might use to do this, referring to the various perspectives and theories of play.

2.6.4 Using ICT to Support Language Development

Van Scoter and Boss (2002) explore how ICT can make a major contribution to the growth of children's literacy in four interrelated fields of speech, listening, reading

and writing. For example, word processors "talking" allow young children to explore when they're playing with a language. Word processors also provide children with the ability to compose and write without having to practice manual letter processing. Computers may contribute to a "print-rich" atmosphere in the classroom or in the early childhood education centre.

Van Scoter and Manager, 2002, suggest using computers and printers to help children produce posters, banners and other props to pretend to be playing. Toys bring excitement to children's play and basic literacy skills, and the choices they make – what size, what color, what words – give children a better chance of using language. Using and displaying signs helps create an atmosphere that provides children with printing that has meaning to them (Van Scot & Boss).

ICT also provides children with a variety of ways to combine words and images. Van Scoter and Boss describe a class in which teachers often send digital images of children's activities and field trips to their homes. Working with children to put lyrics on these pictures provides an opportunity to develop children's written language skills, whereas photographs with intentionally abandoned lyrics will strengthen children's oral language skills, as children use their own words to describe what the pictures depict. This technique is considered particularly useful in homes where English is a second language in the Head Start kindergarten in Oregon, with the goal of encouraging the development of oral languages for children in their native language. There are many ways ICT can help children relate stories. Children who have not yet written can choose words to go with their images, or they can record their story-telling voices, or they can be videotaped as they say the story and show the picture (Van Scoter & Manager, 2002).

2.6.5 Using ICT to support mathematical thinking and problem-solving

Computers and several other forms of ICT also have the potential to promote the development of complex thought among young children. Clements (2002) discusses research on mathematics teaching for small children in conjunction with different forms of computer-mediated training, such as the use of drill-and - practice mathematical software, as well as the discovery of shapes, patterns, and numerical relationships through general-purpose graphics programs or advanced computer-manipulative programs in which children can participate.

Clements suggests that there is evidence that computers can help even the really young children develop mathematical ideas, provided that teachers can choose and then use those tools in a way that helps to sustain and spreads young children's thought, especially their higher-level thought. Computers' specific advantages in promoting higher-order thinking include: enabling children to develop, modify, save and recover ideas; encouraging reflection and engagement; connecting ideas from different areas, such as mathematics and art; providing circumstances with a simple, flexible means-end framework, certain constraints and suggestions that learners can understand on their own; and For example New entrant learners are introduced to basic tortoise geometry in this simplified version of the logo with a simplified set of keyboard commands, e.g. f, b, l, r for forward, backward, left and right. Other services allow young children to build and explore patterns and forms.

2.6.6 Supporting children from diverse cultural or language backgrounds

ICT may offer unique opportunities for young children with special educational needs or children from a culturally or culturally different context to scaffold and support. Good software may allow learners to participate in self-exploration and adapt the

software to their personal needs in a way that is not inherently compatible with conventional printed material. For example, Castellani and Tsantis (2002) investigated how teachers in the US used 5–12 year-old software in the ESOL Summer School Learning Program. The curriculum offered opportunity to experience basic concepts such as color, numbers and shapes in children's mother tongues, and also to provide the translation of these concepts to the English language, thereby providing teachers with the opportunity to coordinate educational experience in culturally appropriate ways. Brooker and Siraj-Blatchford (2002) examined the experiences of children aged three and four years. They described bilingual children's use of computers as "particularly useful." Visual indications and animation incorporated in the programs allowed ESOL children to use English words to communicate about what they were doing (e.g. "Look! Go home!").

Scientists witnessed cases of language acquisition on a daily basis and children repeated terms and phrases in response to computer prompts. In addition, the machine also offered a shared focus and understanding for children who did not have the same spoken language and this certainly contributed to the development of a highly optimistic, engaging and language-enriched multicultural learning environment (Broker & Siraj-Blatchford, 2002).

ICT can also be used as a way of introducing home culture and children's knowledge to the Early Childhood Education Centre. For example, Whalley *et al*. (2001) describes the UK Early Childhood Center where parents had the opportunity to borrow a video camera from the Center to document children's interactions at home. This could then be used and discussed between parents and early childhood educators as a way of enabling parents to be interested in the learning of their children.

2.6.7 Supporting Children with Special Learning Needs

Bray, Gray, and Green (2004) discussed the services technology provides to support learners with a variety of individual needs or characteristics, including ESOL learners, children were found to be having learning disabilities, learners with either physical or cognitive challenges, and children who are identified as gifted and talented ones. They split technology into two broader categories with an aim of supporting diverse learners: Assistant/Adaptive and Learning Support. Assistant/adaptive technologies make anything physically or tangibly accessible which would otherwise not be accessible (e.g. screen magnifiers, apps for voice-recognition, changed mouse or keyboards), whereas learning support technology may assist the learners through remediation, rewarding them, or allowance. According to Haugen (1998), one of the most unique advantages of technology is on the several ways in which it can "provide a level field for children with needs for special learning through the promotion of their attempts to interaction, exploration, work independently or collaboration with peers." Haugen cites many studies in America which children and children with disabilities have shown participation more actively.

A number of case studies in the literature support the idea that when properly used, technology can be a powerful tool to support children with a variety of learning needs individually. For example, Labbo *et al*. (2000) explains they used techniques to support children with learning difficulties in their kindergarten with computers. Five-year old Joey, though able to make sense of words and read basic documents, struggled with many aspects of literacy. Joey was observed in the "window shop" when using the kindergarten machine, by quietly switching from screen to screen. Joey's teachers decided to try using "talking" to involve him in highly focused computer activities.

2.7 Integration of ICT in Assessment of Early Learning

The Assessment and Teaching of 21st Century Skills (ATC21S, 2013) distinguishes the likelihood of teaming up with others and the capability to connect through the use of technology as an essential skill of the 21st century. ATC21S, 2003 defines and categorizes the skills of the 21st century into four broad categories:

- Ways of thinking-including innovation, logical thinking, problem-solving, decision-making and understanding.
- Ways of work-Communication and collaboration as one of the most important assets.
- Working tools-Information and Communication Technologies (ICT) and Information Literacy.
- Life skills in the world-Citizenship, life and career, personal and social obligations.

Using the two skills which connect all the four categories, namely collaborative problem-solving and ICT literacy, these categories can be represented. These skills should be accepted by teaching activities and encouraging learners to develop their competencies.

Recent Ezza EY studies show that a teacher is tasked with various roles which were not viewed as important before ICT was implemented into education. It is very clear that the ICT-based world does not focus solely on the dispersal of knowledge compared to the traditional roles of educators.

A common focus, when integrating technology as a tool, is to increase learner achievement. Teachers and Policymakers are renewing their commitment to programs and training practices that enhances the impact on learning outcomes and instruction.

Due to the widespread use of technology in the world in which we live, the use of technology in teaching and learning is crucial if we want to have a positive impact on pupils' learning. Today, with the introduction of the Common Core Standards and their focus on technology, the use of technology in schools will become an even higher priority (Cristen, 2009).

Computers and programs of writing can be used also to explore written language with preschool-age children, and their use can be effectively incorporated into process-oriented writing software as early as the first grade or kindergarten classes (Clements & Nastasi, 2013). Such software provides the young writers with the critical support, or framework. Enabling them in performing activities they would not capable in performing on their own. Facilitates positive attitudes in writing and word processing among children from kindergarten through primary grades, encouraging children to write longer and more nuanced stories and to think less about errors. Encourages learners to communicate more efficiently, more fluently and more efficiently. Helps children to gain confidence in writing and inspire them to write more when using computers than when using paper and pencil.

For young children computers are fundamentally convincing. Sounds and graphics are getting the attention of children. Various types of applications have been developed, such as I MyTalk, Look2learn, and Easy Lexia, to support communication, understanding, recognition and literacy skills for children. The research on dyslexia patients conducted by the Department of Software and Systems Design Technology, Aegean University, Greece (Skiada, Soroniati, Gardeli, & Zissis, 2014) shows that children with dyslexia concentrate and keep them focused by concentrating their attention on the touch screen monitor.

Technology is an important learning tool if used to deepen the learners' dedication to a substantive and scientifically credible curriculum. Technology is an instrument to this end. When it's the right learning method for learners it should be picked. Technology can be an especially useful tool for English learners and can increase the involvement of disabled children. In elementary school children can begin by using common technology resources as part of their day today academic program. Teachers should also model the use of technology to assist in the curriculum so that children can also see the effective use of technology and the benefit from the exposure of the more advanced technologies, which they can also use independently when they are old enough (DePasquale, *et, al.*, 2003).

Technology has become more common in the early care and environments in education, building on the belief that technology can be used to enhance program execution and, ultimately, the learning and growth of children (Barron, Kemker, Harmes, & Kalaydjian, 2003; Diamond, Justice, Siegler, & Snyder, 2013; NAEYC, 2012). Unfortunately, little is understood about the feasibility, accessibility, and technology criteria that are available for early childhood programmes. Fostered by this knowledge gap and the growing prevalence of technology in early childhood settings, the Office of Planning Research and Evaluation (OPRE) of the Administration for Children and Families (ACF) has collaborated with NORC at the University of Chicago to conduct a literature review and expert workshops to better understand how technology can be used to encourage and enhance quality.

A well-designed appraisal approach will inspire learners and assist teachers and institutions in promoting deep learning. On the other hand, incorrect forms of evaluation will encourage surface learning and thus will not help the real educational

goals. Latest theories of learning stress the importance of dialogue, negotiation and feedback. Learning is seen to occur within the communities of practice where participants work together to develop an understanding of their field of study. Evaluation of such groups can help provide input and common definitions necessary for membership. The best aspects of evaluation can be supported by information and communication technologies (ICTs) (DePasquale, McNamara & Murphy 2003).

2.8 Challenges Related to Technology Integration in Early Learning

Majority of the teachers are unable to effective use technology in their own classrooms with regard to the established literature, whereas others are basically unable to make an effort due to fear, lacking interest and also motivation (Duhaney 2001; Keengwe 2007). Many teachers often cite inadequate methods for technical leadership at their schools as a major obstacle to attempts to incorporate technology (Duhaney 2001; Krueger *et al.,* 2000). Teacher skills and attitudes (Bitner and Bitner 2002) and scares resources backing, and the relations between curriculum training and technology (Dvorak and Buchanan 2002) have also been viewed as part of obstacles to the introduction of teaching technology in classrooms.

Teachers of Early childhood education participating in the workshop reflected on numerous difficulties encountered in the process of technological use and adoption, including: lack of personal technological expertise, lack of administrative assistance, difficulty in implementing the curriculum and lack of technical assistance. Harris (2000) argues that "the tremendous potential of technology can only be appreciated if we develop a fresh perspective of how technology will change the way we view education and how we believe that learning will take place" (p. 1). The authors will

briefly examine two issues relating to constructivist teaching and technology-based learning in the following section.

Schools plays a significant role in addressing the social inequities and help in establishing a level playing field so that all the learners can recognize their full potential and develop the foundation for future life success. The National Association for Young Children's Education reports that "a decade of research into the educational use of computers in schools has shown computers perpetuate and exacerbate inequalities" (NAEYC, 1996). Tackling these gaps in early childhood was an important consideration in deciding when and how to add technology to the curriculum. Three major areas of possible inequity are discussed in the literature: access, usage form and curriculum (Warren-Sams 1997).

Access to technology in education varies widely in terms of quantity and consistency. Funding differences mean that many low-income and ethnic-minority children have restricted access to computers and are often limited in software types and the purposes for which they use a computer. Children must be advised that the opportunity to use technology is important and readily available to all learners (Kleinman, 2000).

Various learner groups often use technology in a variety of ways and the types of learning environments they are looking for are very unique. Learners in underserved communities (poor, urban, and rural) are more likely to use drill-and - practice applications and integrated learning systems that monitor computers and direct learners through lessons. In other groups, learners in project-based, research-based, and collaborative learning are more likely to use computers for their own purposes (Kleinman, 2000). Low-achieving learners may have insufficient computer time to work on basic skills and lack access to programs that encourage more imagination and

critical thought. Girls may get unequal incentives and opportunities to become a fluent technology consumer. All learners deserve the opportunity to take advantage of the use of apps and other types of technology that challenge and offer rich experience. The use of software should be part of the curriculum, not only used by certain children or as a reward for good behaviour (Kleinman, 20000).

Software may help the program but there may be a range of prejudices in it. Teachers should stop using certain systems or point them out as an instructional tactic to defend against them. As with other learning materials, classroom software should: introduce children to a wide variety of people who differ in traditions , languages and skills Reflect society and portray different cultures Display and depict diverse characters in key roles Convey the abundance of identities and options available to both boys and girls. Purposeful plan for equal access for all children, irrespective of gender, level of competence, race or socio-economic status Choose software programs that make children feel included Choose software that allows for different learning styles and accommodates different levels of ability to track children effectively or manage computer use with young children

The integration of ICT into teaching and learning according to Bingimlas (2009:235) is a difficult and challenging process. Literature, among other factors: a lack of teacher confidence, lack of teaching skills, lack of efficient teachings, resistance against change and negative attitudes, lack of technical help and lack of infrastructure (Korte & Hüsing, 2007), tends to highlight the common challenges of successfully achieving ICT integration.

The use of ICT in educational, education and operational institutions, as well as any other development, obviously implies a new set of competences, attitudes and

pedagogical approaches which require continuous training programmes, so as to enable learners, developers, educators and administrators to develop sufficient capacity. That means that while computer-based access to the Internet and more sophisticated equipment such as interactive Whiteboards and powerful e-learning are now available in most schools, particularly in developed countries and increasingly urban areas in developing countries, much more is required than installing classroom equipment (van Rij & Warrington, 2010:8). To make it possible for teachers to use these ICT tools to adopt an integrated approach to the use of ICT and new approaches (Bialobrzeska & Cohen, 2005).

There is thus an increasing need for accelerating teacher education in the current scenario, characterized by a lack of capacity (Beyers, 2000). Mikre (2011) and Oladosu (2012) say educational practices are a key element in computer-based teaching and Internet access. According to Wheeler (2000), some have technology with a passion (like computers), but others welcome it warmly whilst others reject it (Wheeler, 2000). The main emphasis on "the possibility for teachers to lose control of the principles and guidance of teaching in the teaching community" is the resistance to ICT adopted in schools (Chan 2003).

However, it is very important to note that resistance to change is not an inherent obstacle, but may also involve a much deeper problem (Bingimlas, 2009). The deeper problem of Cox *et al* (1999) appears to be a lack of awareness, skills and attitudes to react to changes that will inevitably lead to technological training. Therefore, only through access to ICT equipment and the required ICT competencies can the encouragement and confidence in the inclusion of ICT in education and learning come (Mikre, 2011).

Besides the lack of teacher capability or mentality to use ICT, in many developing countries, poor infrastructure is still a major obstacle (Howie, Muller & Paterson 2005). Based on a study by the National Center for Education Statistics in the United States (NCES, in 2000) using the Quiet Response Survey Method (FRSS), a Makewa, Meremo, Position & Function (2013) reported that 99 percent of full-time teachers in their classrooms have access to computers or the Internet.

2.9 Related Studies

The problems listed above are considered research gaps related to the development of ICT skills for the incorporation of teaching practices into teacher education, based on results from current studies and literature. The gaps found provide a basis for research concerns and problems related to the re-planning and re-shaping of early learning ICT integration.

From the review of literature, it was established that ICTs offer numerous possibilities for teachers. Research and experience have demonstrated that computers have the potential to play a powerful role in enhancing the environment of learning as well as in preparing students to acquire skills, competencies and attitudes essential for competing favourably in the emerging global 'knowledge' economy (MOEST, 2005).

According to Betty T., Eunice K., Rachel K. and J.K. Too. (2014), computers allow the teacher to prepare learning tasks that are authentic, challenging and multidisciplinary and to use assessments that are performance-based, generative, ongoing and equitable. They also provide learning contexts that are collaborative, knowledge building and empathetic, where the teachers serve as facilitators, guides or co-learners.

Curriculum management in the school is based on how teachers and educational managers allocate time as a framework upon which the structure of the whole school is built (Kindiki, 2008), and to this end computers can also be used for timetabling and daily rota. The computer also allows the teacher to prepare effectively for teaching since they can type up their schemes of work, lesson plans, lesson notes and examinations with great ease.

In January 2006, Kenya put in place a National ICT Policy, whose aim is to advance the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and reasonably priced ICT services (Kenya Ministry of Information, 2006). Although, Kenya has made remarkable progress in promulgating an ICT policy framework and implementation strategy, little progress has been achieved in the consideration of the tremendous amount of money spent by the Government and other stakeholders in the early learning sector on ICT integration in Kenya.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Methodology refers to the collection of methods or procedures used to analyze and gather data needed for specific study. In every area of expertise the concepts of methods and procedures for data collection are also applied (Kothari, 2007). This section explains research architecture, methodological model, field of study, targeted population, the sampling procedure and the sample size, methods of data collection, research instruments validity and reliability, data collection procedures data processing techniques and ethical considerations.

3.2 Philosophical Paradigm

Creswell, (2007) defines the term "philosophical paradigm" as looking at the world and interpreting what is being studied. Willis, (2007) explains: 'Therefore, the paradigm is a systematic set of values, a world view, or a structure that directs study and practice in the field.

The philosophical paradigm of the study was pragmatism. Pragmatist researchers focus on the 'what' and 'how' of the research problem (Creswell, 2011). While pragmatism is seen as the paradigm that provides the underlying philosophical framework for mixed-methods research (Tashakkori & Teddlie, 2003; Somekh & Lewin, 2005) this paradigm places “the research problem” as central & applies all approaches to understanding the problem (Creswell, 2011).

This research paradigm is relevant to this study because it is concerned with consequences of actions, its problem-centered, pluralistic, real-world practice oriented

and applicable with the use of mixed model. The data collection tool may include interviews, questionnaire, observations, testing and experiments.

3.3 Research Design

A research design, according to Bryman (2008), is a structure for the collection and analysis of data used in a research project or study. This study used a descriptive research and adopted a mixed method.

The descriptive survey design was employed in carrying out this study. A descriptive survey design describes a situation, as it exists (Kombo& Tromp, 2006; Best & Kahn, 1993). Data was collected concurrently from different respondents and the results triangulated.

3.4 Study Area

The study was conducted in Bungoma County, three counties are bordering it namely: Kakamega in the South, Trans Nzoia in the North, and Busia in the West. It also enjoys a wide shared international border with Republic of Uganda. Bungoma County has nine (9) electoral districts and forty five (45) county councils. The nine electoral districts that also serves as sub-counties include; Bumula, Kanduyi, Kabuchai, Kimili, Webuye East, Webuye West, Sirisia, Tongaren, and Mt. Elgon. Bungoma County is covered by a comprehensive network of roads, also with two airstrips (in Bungoma and Webuye) and a railway system with a freight train. The main economic strength of Bungoma County is agriculture: maize, sugar cane, tobacco, coffee, onions, vegetables, sunflower and dairy cattle. Bungoma has records heavy rainfall throughout the entire year and is the home to several big rivers used for small-scale irrigation.

3.5 Target Population

Zikmund *et al*. (2010) describes a population as any set of particular groups of individuals or non-individuals, such as artifacts, educational institutions, time units, geographical areas, wheat prices or salaries for individual; a list of the elements from which a sample can be drawn. In research, the most critical stage is the selection of a population. The term population in a statistical context refers to the number of the individuals or objects under analysis (Babbie, 2001).

The research target group was teachers of early learning in public primary schools, headteachers and educational officers. In Bungoma District, there are 884 basic education centers in public primary schools and 1,768 teachers in public primary school. There are 884 headmasters and 9 junior education officers in the public schools (Bungoma District, 2018). The research included this group because it specifically included the introduction of ICT into teaching and learning. Apart from that, this demographic strongly affected the future lives of the pupils.

Table 3.1: Target Population

Respondent	Public Primary Schools	Target population
Primary schools	**884**	**884**
Teachers in ECD	1,768	1,768
Head teachers	884	884
Education officers	9	9

Source: Bungoma County ECD centres (2018)

3.6 Sample and Sampling Procedure

Sampling involves making conclusions about populations from the samples using a certain part of the population (Zikmund *et al*., 2010, Depoy & Gitlin 2011). Kothari (2008) notes that the researcher should select the sample size one that is capable of giving enough population information and that it is easy to analyze.

The study used cluster samples, which consisted of the population classification and then the selection of groups or clusters instead of individual items. It consists of a number of random unit samples, in which the researcher begins with large units or clusters containing smaller sampling units. This technique allows the investigator to make a random sample without a complete listing of each individual or unit and the cluster sample application was because the population of the study area was largely expanded. The clustering approach can, however, relatively simplify the sampling process and increase fieldwork efficiency (Kothari, 2006).

The analysis unit was considered as public primary ECD schoolteachers, head teachers of public elementary schools and sub-county education officials. The study has been used as a sample of 10 percent of the total population of less than 10,000 since Yount (2006) suggested a descriptive design. This study therefore used the simple random samples used to obtain 177 ECD teachers from clusters in nine subcontractors in Bungoma County (10% of 1768). A total of nine sub-country education officials and nine leaders, one from each cluster, were selected in each sub-country.

Table 3.2 Sampling Frame

Sub-County (Clustered) 9 sub-counties	Public primary schools	Proportionately selected schools 10%(simple random sampling)	Proportionately selected ECD teachers-10%(simple random sampling)	ECD education officers (Purposively selected)	Headteachers (Simple random sampling from each cluster)
9	884	88	1,768	9	9

Source: Bungoma County ECD centres (2018)

3.7 Data Collection Instruments

The tools used in the collection of the data from selected samples are the research instruments. This study used multiple tools since pragmatic paradigm gives the opportunity for a mixed methodological research to develop various worldviews as well as various forms of data collection and analysis (Creswell, 2003).

Self-regulated questionnaires and semi-structured interviews were the main sources of data. Using triangulation, the researcher was able to capture a more thorough, holistic and contextual representation and reveal the different dimensions of the phenomena under study. Bias was minimized and validity improved with the use of triangulation. The selection of these tools depended on the nature of the data to be collected, the time for the study, and the study goals.

3.7.1 Questionnaire

The structured questionnaire was a key tool for collecting primary data during the study. The questionnaire was both open-ended and closed-ended to increase its efficacy. The structured questionnaire was a primary data collection tool and was self-governing. The instrument was preferred because the researcher was able to obtain a response from a large cohort within a short timeframe and was able to perform a statistical analysis. Furthermore, the questionnaire works best with standardized questions and is best used for descriptive or explanatory research.

A questionnaire (see Appendix I) with closed-ended questions was used as one of the tools for collecting data from teachers in this study. The closed-ended questions were constructed on the basis of a five-choice Likert scale response system. The questionnaire was divided into sections, each of which examined a specific variable of the study. Section A sought to define the demographic information of respondents,

Section B included questions on the integration of information communication and technology into early learning skills. Section C addressed concerns on the application of information communication and technology into early learning curriculum preparation. Section D included questions on the integration of information communication and technology in the assessment of teaching and learning. Section E looked at the integration of information communication and technology into teaching and learning methods, while Section F raised questions about the integration of information communication and technology into teaching and learning materials.

3.7.2 Interviews

The interview schedule is a set of questions the interviewer asks while interviewing the respondent. The use of a semi-structured interview in a study gives the researcher the opportunity to ask specific questions, depending on the specific organizational context, and to ask additional questions that address research questions and objectives, considering the nature of the events within that particular organization. Interviews were used to collect data from the teachers in charge and the headmaster for an in-depth analysis of the study variables. It also allowed additional questions to be asked which explore research questions and objectives, given the nature of the events in that particular context.

Interviews were conducted to gather in-depth information from the teachers in charge with a view to obtaining the critical information necessary to meet the exact objectives of the study (Orodho, 2012). This information included the various ways in which the integration of information communication and technology in teaching and early learning is carried out.

This tool was used to collect qualitative data by setting up an interview that allowed respondents the time and scope to express the opinions of the respondents. General simple questions were asked to the subjects before they started to put them at ease. Information obtained from the respondents will be recorded using a structured format interview schedule where the researcher has employed a note-taking approach. It will be flexible as there will be no rigidity; the respondents felt part of the study. A copy of the questions on the interview schedule was provided in Appendix II.

3.8 Pilot Study

A pilot study is a small-scale research project that collects data from respondents similar to those used in the actual study (Zikmund *et al*., 2010). It may also be a pre-test or 'test' of a specific research instrument (Baker, 1994). A pilot study was carried out prior to the actual research to determine the reliability of the instruments used in this study. The instruments were pre-tested in a pilot study prior to the actual data collection. This made it possible to revise the tools prior to the actual collection of data in terms of their content. Piloting was also carried out to determine whether the respondents had the same understanding of the items, thus providing the required information and to identify any problems related to the layout, content, language and relationship of the items in the instruments to the objectives of the study.

The pilot study was conducted in 4 schools in the same district, each school in each sub-county using a test-rest process. These schools have been selected for the purpose of ensuring that they have the same characteristics as the schools in the study area. The feedback from the piloted school helped the researcher to revise the tools to ensure that the objectives of the study were adequately addressed. Schools used for piloting have been omitted from the actual sample.

In piloting, the test retest method was used to determine the reliability index. The instruments were taken to selected schools and, after two weeks, the researcher returned the tools and collected the data. The piloting of the instrument was to identify faults hence improve its reliability. The pilot study generally helped to uncover the challenges that would arise from the instruments. This helped the researcher to revise the instruments layout, content, language in relation to the objectives of the study.

3.9 Validity and Reliability of the Instruments

The section presents the standardization of the instruments through reliability and validity. These are measures of the “relevance” and “correctness” of the instruments. Reliability and Validity is important because it determines the quality of research (Mugenda & Mugenda, 1999).

3.9.1 Validity

Validity addressed the critical issue of the relationship between the concept and the measurement of the concept. It also dealt with the question of the authenticity of the cause-and - effect relationship (internal validity) and its generalization to the external environment (external validity). Validity tests are grouped under a number of broad headings, including content validity and construct validity. Frankel and Wallen (2000) state that. "…it is appropriateness, significance and usefulness in the specific inferences that researchers make on the basis of the data they gather." Moser and Kalton (1992:355) define validity as: "success of the scale in calculating what is intended to be measured. Mugenda and Mugenda (2003) note that validity has to do with the accuracy of the data collected in the empirical analysis. Only then would the inferences based on such data be accurate and meaningful.

Content validity was obtained through the specification of the domain of the concept through a thorough literature search and the submission of the constructed items or draft for a review by a university panel (Depoy & Gitlin, 2011). Content validity was determined by presenting the research instruments to the respondents in the piloted ECD centres whose advice was used to make necessary changes on several items. In addition, to ascertain validity of the questionnaire and interview schedules the researcher consulted experts, supervisors and experienced personnel in the research methodology from Moi University to make criticism and comments on the format of the instruments. Their comments were incorporated in the questionnaires before the final administration of the instruments on the participants of the study.

3.9.2 Reliability

Reliability is described by Creswell (2003) as the accurate or precision of a measuring instrument. Reliability is basically an indication of the stability and consistency with which the instrument measures the concept and helps to assess the quality of the measure (Sekaran & Bougie, 2010). The study used Cronbach's alpha coefficient with a minimum cut-off criterion of 0.70, which is considered to be adequate for explanatory purposes as shown in Table 3.3 (Garson, 2013).

Table 3.3: Reliability Coefficients for the Study

Variables	Reliability coefficient
Teachers' competency	0.7471
Planning for instruction	0.8009
Teaching and learning methods	0.7065
Teaching and learning materials	0.771
Assessment of teaching and learning	0.8809

Source: Field Data (2019)

The statistical values for the Cronbach's Alpha coefficient ranged from 0.747 to 0.880 and were well above the set threshold of 0.7, affirming that the study instrument had an acceptable level of measurement and scale.

Reliability of interviews had also been achieved through recording interviews that were then transcribed. Recording interviews helps respondents and contributes to the reliability of the data they have received, because they are not engaged and distracted by the conversation's transcription of the interview, but can do so subsequently, so that they can hear replies again and examine the question of the leading questions. As all interviews were recorded with the consent of the respondents, this study's reliability increases.

3.10 Data Collection Procedures

This is the collection by which certain facts are collected or proved (Kombo & Tromp, 2006). First, the researcher sought approval for research from the School of Education in Moi University and then obtained research approval from NACOSTI (National Council of Science and Technology) before collecting the data. The researcher also took the time to familiarize himself with the field before going for data collection. The researchers met the selected individuals who responded to the data collection tools on the field. The researcher distributes the questionnaires to the teachers in their workplace the day before and picked up the questionnaire during the interview process in the learning centers.

3.11 Data Analysis Method and Presentation

This refers to the critical examination and inference of coded data (Kombo & Tromp, 2006). This involves ordering, structuring and giving meaning to the amount of data collected (Mugenda and Mugenda, 2003). The study used both a quantitative and a

qualitative approach to data collection and analysis. Data from the two instruments were analyzed, interpreted and discussed at the same time on the basis of the objectives and conclusions reached. Quantitative data were analyzed through descriptive statistics, while qualitative data was analyzed thematically.

Data preparation was carried out in several significant steps, including the editing, coding and entry of data using the Social Sciences Statistical Package (SSPS). Data has been transformed from raw form to simplified and categorized types that are more appropriate for analysis (Cooper & Schindler, 2014. Descriptive analysis was the fundamental transformation of data in a way that represented basic characteristics such as central tendency, distribution and variation. Nominal and ordinal measured data was analyzed using the social science statistical package. Interval and ratio of scaled data were analyzed using measures of central trend, such as mean and standard deviation. The findings were presented in tables and charts.

Qualitative data analysis was performed by sorting, grouping into three main types of processes: summarization (condensation) of meanings; categorization (grouping) of meanings; and structuring (ordering) of narrative meanings. Once the data were transcribed, summarized, categorized and structured, qualitative data was analyzed using a combination of deductive and inductive approaches. Deductive analytical techniques used include pattern matching and explanation building, while inductive analytical techniques include template analysis and narrative analysis (Saunders *et al*., 2009).

3.12 Ethical Considerations

Ethical measures are principles that the researcher should bind himself or herself to when conducting his or her research (Schulze, 2002). Ethical issues will be strongly

emphasized in order to protect the rights of respondents and researchers. The ethical principles that the researcher adhered to while conducting this research are as follows;

1) Permission to conduct research: In this study, the researcher requested permission from the School of Education to apply for a research permit from the Ministry of Education, Science and Technology. An introductory letter was also sent to the relevant office in order to carry out the research.
2) Informed consent: the participants were provided with sufficient information on the study prior to the administration of the research instrument. The potential benefits and value of the study were also explained to the participants. De Vos, (1998) postulates that informed consent concerns the communication of all possible research information to the participants as accurately as possible. As a result, the researcher provided the participants with information on the purpose of the study. This was done by attaching a cover letter to the questionnaire setting out the purpose of the study. Issues related to research, such as objectives, investigation procedures and possible advantages or disadvantages, were shared with the participants.
3) Confidentiality and Anonymity: the researcher must be responsible at all times and vigilant, mindful and sensitive to human dignity. The confidentiality of participants in this study was not compromised, as their names were not used or appearing in the data collection. No private or secret information has been disclosed since the confidentiality rights of the participants have been respected.
4) Report: In order to establish a good working relationship with the participants, the researcher sought to develop a relationship with them. The researcher took on the individual responsibility for the conduct and consequences of the research by adhering to the timeframe agreed with the Chief Teachers and Teachers.

5) Voluntary participation: the respondents agreed to participate in the research on a voluntary basis, without any coercion or promise of benefits that would not likely result from participation (Hucker, 2005; Best & Kahn, 1992). Participation was strictly voluntary, with respondents at any time free to withdraw. This was explained to them before the research began.
6) Respect: All research participants were treated with respect (Grasso & Epstein, 1992). No teacher was forced to participate in the study. Participants had the right to refuse to participate in the study, and that right was respected.
7) Since this study involved prolonged observation and interviews in the sampled schools, the researcher was aware of their impact. In order to minimize the intrusion into the flow of school activities, all focus group discussions were conducted after classes (Creswell, 2011).

3.13 Chapter Summary

This chapter has focused on the various details concerning research design and methodology that the study employed. Details on specifics such as the study area, the target population and data collection methods have been outlined. Data analysis and ethical considerations have also been presented.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study based on the data obtained from the respondents. The purpose of this mixed method study was to explore the integration of Information Communication Technology into teaching and learning in early learning in Bungoma County, Kenya. Data collection was done using triangulation of two tools; questionnaires for ECD teachers and interview schedule for headteachers and ECD education officers. The study managed to capture data from 104 ECD teachers representing about 90% of the sample size. Data presentation, analysis interpretation, and discussion are organized under the following headings;

i. Demographic Characteristics of the ECD teachers
ii. Teachers' competency in integrating ICT in early learning
iii. Intergration of ICT in Planning for Instruction
iv. Intergration of ICT in Instructional Methods
v. Intergration of ICT in teaching and learning Materials
vi. Intergration of ICT in Assessment of early learning
vii. Qualitative Analysis from Headteachers and Education officers interviews

4.2 Demographic Characteristics of the ECD Teachers

This section discusses the demographic characteristics of the respondents based on Q1 (what is your gender?), Q2 (what is your age), Q3 (what is your highest level of education?) and Q4 (what is your level of experience). The findings would help to categorize the respondents in Bungoma County. Demographic characteristics such as educational level, age, gender and teacher experience have an impact on technology

adoption, Schiller (2003). Teachers are urged to adopt and integrate ICT into teaching and learning activities, but the willingness of teachers to integrate ICT into teaching is determined by the efficiency of technology and not by its sheer existence in the classroom (Jones, 2001). It is therefore important to understand the personal characteristics that influence the adoption and integration of ICT by teachers in teaching. The distribution of demographic statistics is shown in Figures 4.1, 4.2 and 4.3.

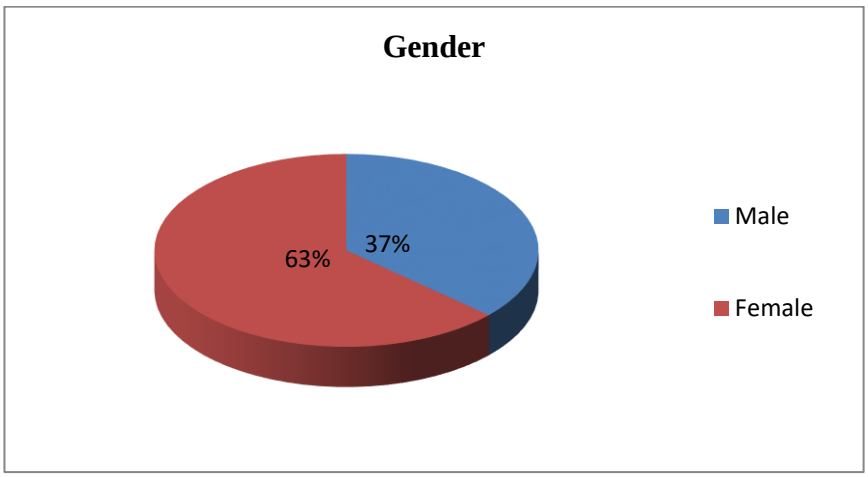

Figure 4.1: Gender Distribution
Source: Research Data (2019)

Figure 4.1 shows that 37% (65) were male teachers, while 63% (112) were female teachers. The gender of the respondents was sought as their findings would help the study to categorize gender-based respondents and their perception of the integration of information communication technology into early learning teaching and learning in Bungoma County, Kenya.

Gender differences and the use of ICT have been reported in a number of studies. However, studies on the gender of teachers and the use of ICT have cited low levels of computer use among female teachers due to their limited access, skills and interest

in technology (Volman & van Eck, 2001). Research studies have shown that male teachers use more ICT in their teaching and learning processes than their female counterparts (Kay, 2006; Wozney *et al*., 2006). Similarly, Markauskaite (2006) investigated gender differences in self-reported ICT experience and ICT literacy among first-year graduate trainee teachers. The study found significant differences between males and females in technical ICT capabilities and situational and longitudinal sustainability. The male scores were higher. Jamieson-Proctor, Burnett, Finger and Watson (2006) conducted a study on the integration of ICT in schools in Queensland. This study shows that ECE centers in Bungoma County have more female teachers than male teachers, and therefore, according to the literature, female teachers have a low level of computer use due to their limited access, skill and interest in technology.

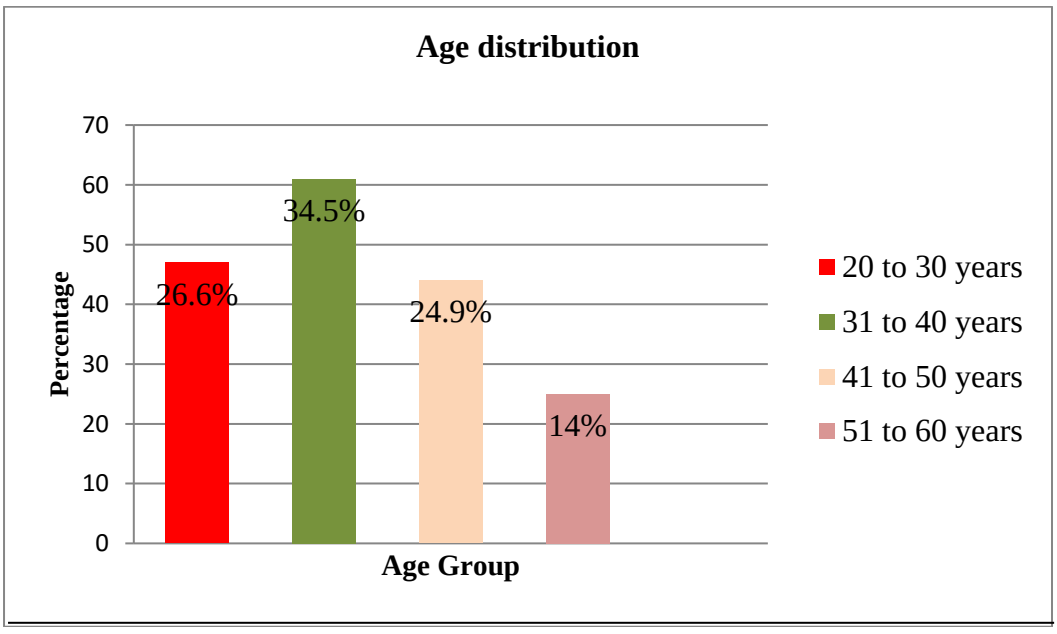

Figure 4.2: Age Distribution
Source: Research Data (2019)

The distribution in Figure 4.2 relates to the age distribution of the respondents and it shows that 26.6% (47) of the respondents were aged between 20 and 30 years, 34.5% (61) were aged between 31 to 40 years, a further, 24.9% (44) were between 41 to 50 years while 14.1% (25) fell in the age category of 51 to 60 years. The findings indicate that there are a higher number of respondents in Bungoma County aged between 31 to 40 and 41 years due to the long period taken before they are employed after college.

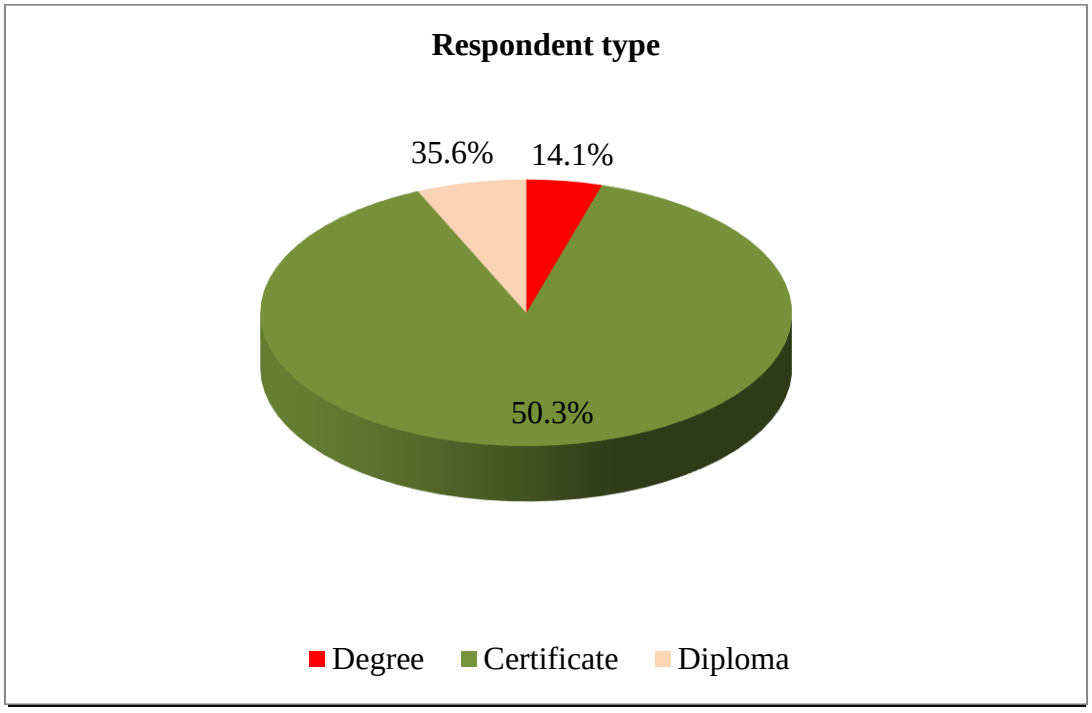

Figure 4.3: Education Levels
Source: Research Data (2019)

Figure 4.3 concerns the distribution of the respondents as per the level of education. As indicated from the figure, over 50.3% (89) of the respondents had certificate level of training in early learning, 35.6.% (63) had a diploma in early learning while a further 14.1% (25) had a graduate level of early learning. The distribution shows that the study area is populated by individuals who hold certificate level of training in ECD and can be considered to be the basic qualification requirement for teaching

ECD centres in the county. This information is useful as it shows that majority of ECD teachers in Bungoma County don't have basic training in ICT since the training does not offer any course in computer and ICT related skills

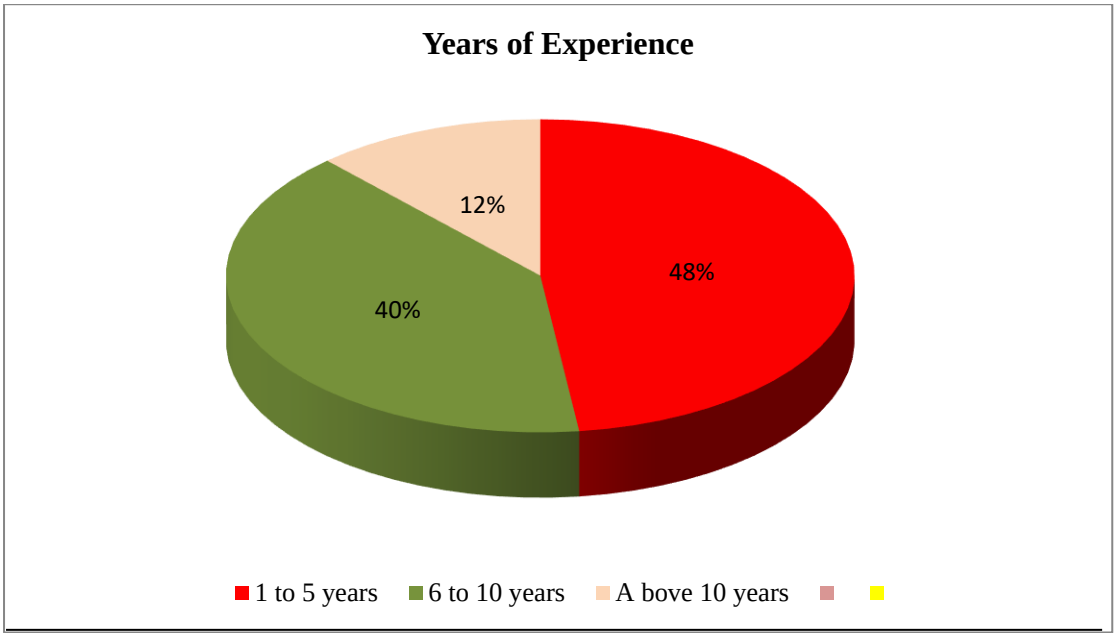

Figure 4.4: Years of Experience
Source: Research Data (2019)

The distribution in Figure 4.4 displays teachers' years of experience and it indicates that majority of the instructors 48.0% (85) having between 1 to 5 years of experience, 40.1% (71) had between 6-10 years of experience while 11.9% (21) had above 10 years in instructing early learners in Bungoma County.

Although some research has reported that the teaching experience of teachers has not influenced their use of computer technology in teaching (Niederhauser & Stoddart, 2001), most research has shown that teaching experience influences the successful use of ICT in classrooms (Wong & Li, 2008; Giordano, 2007; Hernandez-Ramos, 2005). Gorder (2008) reported that the teaching experience is significantly correlated with the actual use of technology. In her study, she found that effective use of a computer related to the level of technological comfort and the freedom to train a teacher-

perceived learner's needs. Baek, Jong & Kim (2008) also argued that experienced teachers are less willing to integrate ICT into their teaching. Based on these findings, the majority of ECD teachers in the county of Bungoma taught between 1 and 5 years, therefore according to literature they are likely to integrate ICT into their teaching.

4.3 Teachers' Competency in Integrating ICT in Early Learning

The study sought to identify the characteristics of the information communication technology resources i) being accessed, ii) their usage frequency, iii) perceptions and satisfaction levels. The study adopted these features based on the notion that it would help in defining the attributes of the integration of information technology into early learning in Bungoma County. The results were reported in frequencies and percentages and aided in interpreting descriptive results of the study.

Table 4.1: Teachers' Competency in Integrating ICT in Early Learning

Variable	Categories	N	%
ICT training	Yes	55	31.0
	No	122	69.0
	Total	**177**	**100.0**
Basic computer literacy levels	Advanced	14	7.9
	Intermediate	47	26.6
	Basic	94	53.1
	None	22	12.4
	Total	**177**	**100.0**
Computer ownership	Yes	10	5.6
	No	167	94.4
	Total	**177**	**100.0**
Computers in schools	Yes	56	31.6
	No	121	68.4
	Total	**177**	**100.0**
Computer access and usage at school	Frequently	5	2.8
	Occasionally	21	11.9
	Rarely	30	16.9
	Never	121	68.4
	Total	**177**	**100.0**
Changes in the role of the teacher	Very much	21	11.9
	Somehow	35	19.8
	Partially	51	28.8
	Not at all	70	39.5
	Total	**177**	**100.0**
Does ICT make your work easier?	Yes	104	58.8
	No	73	41.2
	Total	**177**	**100.0**
The usefulness of ICT in learning/teaching	Content generation **(Useful**)	132	74.6
	(Not useful)	45	25.4
	Instruction planning **(Useful)**	147	83.1
	(Not useful)	30	16.9
	Content management	112	63.3
	(Useful)(Not useful)	65	36.7
	Classroom management **(Useful)**	128	72.3
	(Not useful)	49	27.7

Source: Research Data (2019)

The distribution in Table 4.1 shows that majority of the respondents 69.0% (122) of the have not undergone training in ICT training while the remaining 31.0% (55) have undergone ICT training in the past two years. Their basic computer literacy levels showed that 7.9% (14) had advanced skills in the usage of computers, 26.6% (47) had

an intermediate level, 53.1% (94) had basic skills for operating computers with the remaining 12.4% (22) having little or no skills in computer usage.

Less than 10% (5.6) of the study owned a basic computer device however, majority of 94.4% (167) of the respondent instructors did not have computer devices. Also very few schools have computers 26.0% (46) and majority of 74.0% (131) of schools don't have computers for ECD instructors.

The findings indicate that very few teachers 2.8% (5) regularly access and use computers, with 11.9% (21) occasionally able to access and use computers while 16.9% (30) of the respondent rarely access and use computers in schools. The remaining majority of 68.4% (121) never access and use computers while in school.

Concerning the role of ICT in teachers' roles, 11.9% (21) of the teachers admitted that ICT changes the role the teacher in a big way. 19.8% (35) indicated that somehow and 28.8% (51) said ICT partially changes the role of the teacher. However, the majority of the teachers 39.5% (70) indicated that ICT does not change the role of the teacher.

When the respondents were asked whether ICT makes their work easier, majority of 58.8% (104) admitted that ICT makes their work easier while 41.2% (73) said ICT does not make their work easy. In addition, concerning the usefulness of integrating ICT in teaching and learning in early years, 74.6% (132) of the respondent affirmed that ICT is useful in content generation, 83.1% (147) confirmed that ICT is useful in instructional planning, 63.3% (112) of the respondent said ICT is useful in content management and 72.3% (128) of the teachers informed that ICT is useful in classroom management.

From the study, majority of the teachers 69.0%(122) have not undergone training in ICT training while the in the past two years. Lack of technology training of teachers (Dvorak and Buchanan 2002) have also been cited as barriers to technology integration into classroom instruction. Other contextual factors to explain teachers' competence in ICT include computer literacy level whereby this study shows majority of ECD teachers 53.1% in Bungoma county have basic computer literacy. However, the study indicate that many of the teachers don't own computers and also majority of the schools don't have computers hence computer access and usage of by ECD teachers in Bungoma county is minimal.

4.4 Integration of ICT in Planning for Instruction

The study sought to identify characteristics of integrating information communication and technology resources into planning for instructions. The study adopted these features based on the notion that it would help in identifying the areas in which ICT is useful in aiding the instructors to develop instructions for learning in early years. The study used a 5 – point Likert type scale of Likert-type scale with a scale:1 - Not at all (N); 2 – Lesser Extent (LE); 3 - Neutral (N); 4 – Larger Extent (L); and 5–Very Large Extent (VLE). The results were reported in frequencies and percentages and aided in interpreting descriptive results of the study.

Table 4.2: Use of ICT in Planning for Instruction

Variable	NA %	LE %	N %	L %	VLE %	Mean	SD
ICT helps the teacher pre-plan for instruction before going to class and post-plan for instruction	2.9	5.7	37.1	35.7	18.6	3.614	0.952
Use of ICT makes preparation of learning records such as lesson plan and scheme of work more easy	1.4	12.7	32.4	38.0	15.5	3.535	0.953
Technological tools make the early childhood teachers more effective.	2.9	5.7	28.6	38.6	24.3	3.757	0.984
Technological tools decrease teacher-learner interaction.	1.4	5.8	29.0	40.6	23.2	3.782	0.921
Technological tools help the learner retain new knowledge longer.	4.2	5.6	30.6	36.1	23.6	3.694	1.03
The instructional activities supported by technological tools help improve young children's developmental levels.	2.8	11.1	36.1	31.9	18.1	3.514	1.00
The use of technology positively contributes to young children's development.	4.3	10.0	27.1	48.6	10.0	3.500	0.96
Technological tools are influential in making abstract concepts concrete.	1.4	9.7	27.8	36.1	25.0	3.736	0.99

Source: Research Data (2019)

Table 4.2 sought to determine the integration of ICT into instruction planning by the ECD teacher. The statistics show that instructors require the integration of ICT components in order to pre-plan and post-plan for instruction (Mean = 3.614, SD = 0.952). However, the respondent instructors affirmed that the Use of ICT makes preparation of learning records such as lesson plan and scheme of work more easy (Mean = 3.535, SD = 0.953). Further, the use of technological tools tends to improve the effectiveness of the teachers in delivering instructions (Mean = 3.737, SD = 0.984).

Regarding the issue touching on how ICT can improve learning activities, the respondent instructors affirmed that the integration of ICT can help in new knowledge retention (Mean = 3.694, SD = 1.03). Further, the use of technological tools to support instructional activities can help in enhancing a child's developmental needs (Mean = 3.514, SD = 1.00). Thus, the respondent instructors affirmed that the integration of

ICT into early learning centres can positively contribute to the development of the young child (Mean = 3.500, SD = 1.00). Lastly, the respondents affirmed that the integration of ICT in learning can aid in making abstract concepts concrete (Mean = 3.736, SD = 0.99)

From the findings, teachers in Bungoma County affirm that the use of ICT is helpful in pre-planning and post-planning of instruction and the use of ICT helps to make learning concepts more concrete. In addition, the teachers indicated that utilization of ICT helps in preparation of teaching records such as lesson plan and scheme of work. However, the teachers perceived that use of ICT in planning for instruction reduced teacher-learner interaction the classroom.

Figure 4.5 indicate that majority of the respondent do not use ICT in instruction. This is reflected by 25% of respondent use ICT in actual interaction in classroom activities (instructional phase), 30% use ICT in pre-instruction phase (planning for instruction), 15% use ICT during post-instruction phase.

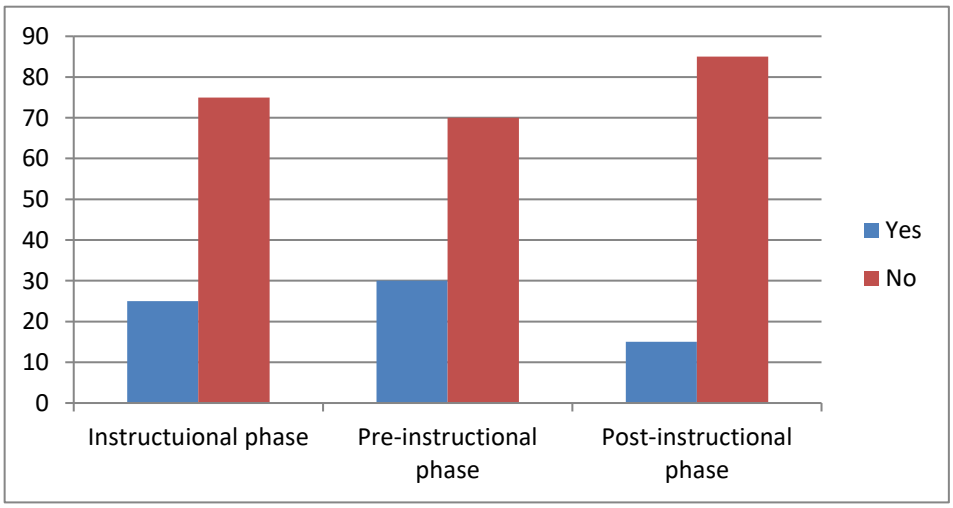

Figure 4.5: Use ICT in Instruction

4.5 Integration of ICT in Instructional Methods

The study sought to identify characteristics of integrating information communication technology into methods of teaching and learning in early years. The study used a 5 – point Likert type scale of Likert-type scale with a scale:1 - Not at all (N); 2 – Lesser Extent (LE); 3 - Neutral (N); 4 – Larger Extent (L); and 5 – Very Large Extent (VLE). The results were reported in frequencies and percentages and aided in interpreting descriptive results of the study.

Table 4.3: Integration of ICT in Teaching Methods

Variable	NA %	LE %	N %	L %	VLE %	Mean	SD
Integration of ICT influence selection of teaching method to be used in the classroom.	1.9	11.5	10.6	60.6	15.4	3.759	0.919
Integrating ICT in learning leads to innovative methods of teaching	1.9	1.0	8.7	53.8	34.6	4.183	0.785
Learner centered methods are used when using technological devices	3.8	10.6	19.2	49.0	17.3	3.654	1.012
Use of technological makes it easy to utilize variety of teaching methods	25.0	21.2	10.6	34.6	8.7	2.808	1.373
Technological tools highly motivate young children	2.9	3.8	1.9	50.0	41.3	4.231	0.895
Teaching methods that adopt ICT promote a friendly co-operative environment in the classroom.	2.9	14.4	17.3	49.0	16.3	3.615	1.017
Technological tools distract young children's attention	1.9	22.1	13.5	50.0	12.5	3.490	1.033
Technological tools are suitable for instructional methods used in early childhood education	1.9	21.2	7.7	29.8	39.4	3.890	0.913
Technological tools are essential for teaching and learning	1.0	18.3	16.3	42.3	22.1	3.664	1.048

Source: Research Data (2019)

Table 4.3 sought to establish the integration of ICT as a platform for instructing early learners. The data show that the respondent instructors affirmed Integration of ICT influence selection of teaching method to be used in the classroom. (Mean = 3.759,

SD = 0.919). Furthermore, the respondent instructors perceived that Integrating ICT in learning leads to innovative methods of teaching (Mean = 4.183, SD = 0.785). Learner centered methods are used when using technological devices (Mean = 3.634, SD = 1.012). However, according to the respondent instructors, the use of technological tools does not increase the quality of early childhood education (Mean = 2.808, SD = 1.373) but it is seen to motivate the young learners (Mean = 4.231, SD = 0.895).

As indicated by the respondent instructors, the technological tools promote a friendly co-operative environment in the classroom (Mean = 3.890, SD = 0.913), however, in some instances, they distract the learners' attention (Mean = 3.409, SD = 1.033). Lastly, the respondent instructions asserted it is essential to integrate ICT into learning and teaching (Mean = 3.664, SD = 1.064).

The findings indicate that ECD teachers in Bungoma county perceive that integration of ICT influences selection of teaching method to be used in the classroom. Furthermore, the teachers perceived that Integrating ICT in learning leads to innovative methods of teaching and earner centered methods. However, according to the teachers, the use of technological tools does not increase the quality of early childhood education but it is seen to motivate the young learners. This emphasised as indicated that technological devices promote a friendly co-operative environment in the classroom although the teachers seemed to agree that in some instances, they distract the learners' attention Lastly, the ECD teachers asserted that it is essential to integrate ICT into teaching methods used in ECD in Bungoma county.

4.6 Integration of ICT in Teaching and Learning Materials

The study sought to identify characteristics of integrating information communication technology resources in instructional medium. The study used a 5 – point Likert type scale of Likert-type scale with a scale:1 - Not at all (N); 2 – Lesser Extent (LE); 3 - Neutral (N); 4 – Larger Extent (L); and 5 – Very Large Extent (VLE). The results were reported in frequencies and percentages and aided in interpreting descriptive results of the study.

Table 4.4: Application of ICT in T/L materials

Variable	NA %	LE %	N %	L %	VLE %	Mean	SD
Schools use diverse set of ICT tools to communicate, create, disseminate, store, and manage information	3.8	11.5	13.5	50.0	21.2	3.904	1.048
Teachers have access to ICT devises in schools	1.9	4.8	12.5	52.9	27.9	4.067	0.987
Teachers have the knowledge and confidence of using the ICT devises in schools	2.9	5.8	10.6	52.9	27.9	4.000	0.881
Teachers utilize ICT devices in and out of class activities	3.8	9.6	11.5	56.7	18.3	3.971	0.939
The technological tool requires visual and manipulative skills to effectively illustrate concepts	4.8	10.6	5.8	50.0	28.8	3.759	0.990
Using Technological tools take a lot of time hence making instruction cumbersome	3.8	12.5	10.6	44.2	28.8	3.875	1.094
Technological tools improve the delivery of content during class time	5.8	5.8	7.7	53.8	26.9	3.817	1.103

Source: Research Data (2019)

Table 4.4 sought to establish the integration of ICT T/L materials in early learning by ECD teachers in Bungoma county. The findings show that Schools use diverse set of ICT tools to communicate, create, disseminate, store, and manage information (Mean = 3.904, SD = 1.048). Further, the respondent instructors said that teachers have access to ICT devises in schools (Mean = 4.000, SD = 0.881), which indicates that most teachers don't have access to utilize ICT devices in schools. In addition, the

findings show that teachers don't have the knowledge and confidence of using the ICT devises in schools (Mean = 3.971, SD = 0.939).

Teachers also agreed that technological tool requires visual and manipulative skills to effectively illustrate concepts. The technological tools also improve learning in that visual aids are effective in illustrating learning concepts (Mean = 3.759, SD = 0.990). Through the application of the ICT platform, the instructors felt that using technological tools take a lot of time hence making instruction cumbersome (Mean = 3.875, SD = 1.094). According to the instructors, the technological tools are also helpful in improving the delivery of content during class time (Mean = 3.817, SD = 1.103).

Figure 4.6 indicate teachers responses on the form of ICT devices used. Majority of the respondent 38% use Smartphone in instruction followed by 26% using computers. Other devices such as interactive whiteboard, tablets, video cameras and data projectors are not utilized at all.

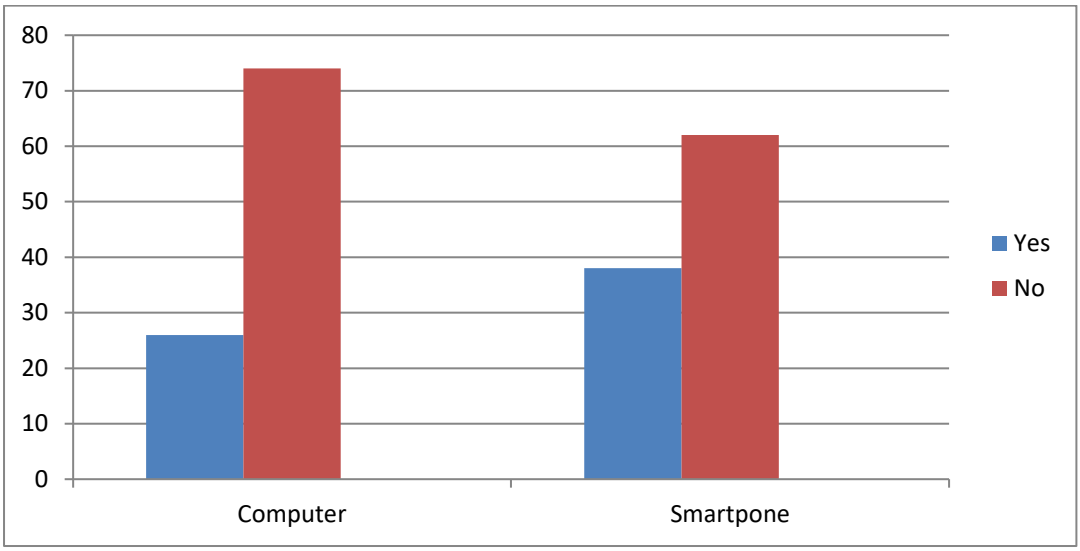

Figure 4.6: Forms of ICT devices

4.7 Integration of ICT in Assessment of Early Learning

The study sought to identify how integrating information communication and technological resources can aid in the assessment of learning in early years. The study adopted these features based on the notion that it would help in improving learning assessment in the primary schools. The study used a 5 – point Likert type scale of Likert-type scale with a scale:1 - Not at all (N); 2 – Lesser Extent (LE); 3 - Neutral (N); 4 – Larger Extent (L); and 5 – Very Large Extent (VLE). The results were reported in frequencies and percentages and aided in interpreting descriptive results of the study.

Table 4.5: Integration of ICT in Assessment of Learning in ECDE

	NA %	LE %	N %	L %	SA %	Mean	SD
Using ICT in actual instruction has a positive influence on children performance	2.9	3.8	1.9	50.0	41.3	4.231	0.895
Teachers use ICT to store learners assessment records through applications such as word and excel.	2.9	14.4	17.3	49.0	16.3	3.615	1.017
Teachers send learners performance to parents via emails and text messages.	1.9	22.1	13.5	50.0	12.5	4.090	1.035
By utilizing computers and smart phones, teachers develop innovative tests for learners	1.9	21.2	7.7	29.8	39.4	3.836	1.215
Integrating ICT in assessing learners helps to deliver traditional assessment formats more effectively	1.0	18.3	16.3	42.3	22.1	3.663	1.048
The workload in assessment is decreased with the introduction of ICT	3.8	11.5	7.7	55.8	21.2	3.860	0.897

Source: Research Data (2019)

The data in Table 4.5 sought to establish the integration of ICT in assessment of learning in early learners. The results show that using ICT in actual instruction has a positive influence on children performance (Mean = 4.231, SD = 0.895). The

respondent instructors further asserted that by utilizing computers and smart phones, teachers develop innovative tests for learners (Mean = 3.836, SD = 1.215) and also integrating ICT in assessing learners helps to deliver traditional assessment formats more effectively (Mean = 3.663, SD = 1.048). ECD teachers in Bungoma also affirmed that the workload assessment has decreased with the introduction of the ICT (Mean = 3.860, SD = 0.897).

However, the teachers indicated that teachers don't use ICT to store learners assessment records through applications such as word and excel (Mean = 4.615, SD = 1.017) and very few of the teachers send learners performance to parents via emails and text messages (Mean = 4.090, SD = 1.035).

ECD teachers in Bungoma county perceive that ICT can be used to deliver traditional assessment formats more effectively and efficiently and also to change the way competences are assessed and develop formats that facilitate the assessment of competences that have been difficult to capture with traditional assessment formats. ICT can be used to develop tests. Although majority indicated that theydon't use ICT to store learners assessment records through applications such as word and excel and very few of the teachers send learners performance to parents via emails and text messages.

4.8 Qualitative Analysis from Headteachers and Education officers

Bungoma county has nine sub-counties from which one ECD education officer and one headteacher were purposively sampled totalling to 9 ECD education officers and 9 headteachers. Interview sessions were conducted with headteachers and ECD education officers. They were asked to respond on the following issues pertaining integration of ICT in early learning in Bungoma County; What are the benefits of ICT

in early learning?, Are ECD teachers trained in utilizing ICT?, How often do you conduct ICT training for the teachers?, If yes, briefly describe the training?, Do you think the ICT program is relevant for the early learning? If yes, how?, Do you think the ICT program is adequate for the early learning? If yes how?, In your opinion, what is the impact of ICT in early years learning?, How confident are teachers in utilizing ICT devices during instruction?, Do teachers possess the required technical skills for integrating ICT in early learning?, Do you have computer access in schools? If yes, do teachers have access to the computers?, Do you have access to the Internet in school?, Which ICT device do teacher use?, What challenges hinder integration of ICT in early learning?

Majority of the respondent affirmed that ICT was beneficial to the learners in that it helped the learners explore more options during learning and also introduce them to critical thinking.

One respondent (HT 1) said,

> *"The ICT resources provide practical lessons to the learners and thus they are able to retain knowledge for longer periods".*

While another respondent (EO 1) observed that,

> *"The ICT offers new perspectives into learning as it is an instructional medium as well as a content generator. Due to these, learners are able to pursue learning with the aid of the teachers".*

When the respondent instructors were asked whether ICT programs were relevant for early childhood learning,

One instructor (HT2) said that

> *"learners must be able to learn life skills early enough as this will confer with more capabilities that those who have not used the ICT device".*

(EO 2) said,

> *"ICT is relevant because it sharpens children thinking and helps in the visualization of content and simplify learning."*

(HT 3) said,

> *"ICT devices can be used in Christian Religious Education where a video presentation of Moses is more visual and easier to understand than storytelling".*

Concerning the adequate of ICT to early learning, interviewees unanimously agree that there is a great desire among the teachers, to use computers more with the learners, but it the county has not provided these devices for schools.

(HT 4) said that

> *"Fewer computers are being supplied to the public schools"*

Further, (EO 5) said that,

> *"The county does not provide funds for providing computers and other devices to schools".*

Regarding the use of ICT in instructions;

(HT 6) said that,

> *"ICT enables the teacher to access lots of material for teaching, exposure to learning on ICT platforms and the view that learners are able to see and conceptualize what they are learning".*

(HT 7) had reservation on using ICT for instruction and he said that,

> *"Most schools lack power supply, lack of exposure to ICT devices and many other reasons"*

Concerning technical skills on ICT utilization most headteachers and education officers affirmed that teachers don't have the required technical skills to use ICT devices.

(HT 8) said that,

> *"Teachers don't have skills such as typesetting, presentation and many other computer programmes skills".*

When the headteachers and education officers were asked to specify the challenges facing the integration of ICT into early childhood learning, several challenges were identified and this included the infrastructural and structural issues. The infrastructural issues include consistent power supply, insufficient number of computers for the learners, security issues and many other reasons, while the structural issues ranged from lack of ICT training and preparedness and language barriers. This indicates that there are significant challenges that have impeded the full integration of ICT into early learning.

4.9 Discussion of the Findings

This section presents discussion of both quantitative and qualitative findings concurrently. This was organized under the following headings; teachers competency in integrating ICT in early learning, integration ICT in planning for instruction in early learning, integration of ICT in teaching and learning methods, integration of ICT in teaching and learning materials and integration of ICT in the assessment of early learning.

Demographic characteristics such as educational level, age, gender, educational experience, ICT experience for educational purposes and the attitude to computers can influence technology adoption, Schiller (2003). Teachers are encouraged to embrace and incorporate ICT into teaching and learning practices, but the ability of teachers to implement ICT into teaching is dictated by the effectiveness of technology and not by its mere presence in the classroom (Jones, 2001). It is therefore necessary to consider

the specific characteristics that affect the adoption and application of ICT by teachers in teaching.

The gender of the respondents was pursued as their results would allow the analysis to categorize gender-based respondents and their understanding of the introduction of digital communication technology into early learning teaching and learning in Bungoma County, Kenya. Gender gaps and the usage of ICT have been identified in a variety of studies. However, research on the role of teachers and the usage of ICT reported low rates of computer use by female teachers due to their restricted exposure, expertise and involvement in technology (Volman & van Eck, 2001). Study findings found that male teachers use more ICT in their teaching and learning processes than their female colleagues (Kay, 2006; Wozney *et al*., 2006). Similarly, Markauskaite (2006) examined gender gaps in self-reported ICT knowledge and ICT comprehension among first-year graduate trainee teachers. The analysis identified substantial gaps between males and females in technological ICT skills and situational and longitudinal resilience. The male grades were better. Jamieson-Proctor, Burnett, Finger and Watson (2006) conducted a study on the integration of ICT in schools in Queensland. This research indicates that ECE centers in Bungoma County have more female teachers than male teachers, and thus, according to the literature, female teachers have a low degree of computer usage owing to their restricted exposure, ability and involvement in technology.

As shown in Figure 4.3, over 50.3 per cent (89) of respondents had a certificate level of early learning, 35.6 per cent (63) had a diploma in early learning, while another 14.1 per cent (25) had a graduate level of early learning? The distribution shows that the study area is populated by individuals holding an ECD training certificate and can

be considered to be a basic qualification requirement for ECD training centers in the county.

The distribution in Figure 4.4 applies to years of experience and indicates that 48.0 per cent (85) of teachers with between 1 and 5 years of experience, 40.1 per cent (71) had between 6 and 10 years of experience, while 11.9 per cent (21) had more than 10 years of early learning experience in Bungoma County.

While some work has indicated that the teaching experience of teachers has not affected their usage of digital technology in teaching (Niederhauser & Stoddart, 2001), most work has shown that teaching experience affects the effective use of ICT in classrooms (Wong & Li, 2008; Giordano, 2007; Hernandez-Ramos, 2005). Gorder (2008) reported that the teaching experience is significantly correlated with the actual use of technology. Throughout her research, she noticed that successful usage of a machine contributed to the degree of technical ease and the ability to educate a teacher-perceived learner's needs. Baek, Jong & Kim (2008) have suggested that seasoned teachers are less likely to incorporate ICT into their teaching. On the basis of these results, the plurality of ECD teachers in the county of Bungoma taught between 1 and 5 years, so according to literature they are likely to incorporate ICT into their teaching.

4.9.1 Objective One: To Establish Teachers' Competency in Integration of ICT in Early Learning

The study sought to identify the characteristics of the information communication technology resources being accessed, their usage frequency, perceptions and satisfaction levels. ICT Competence is defined as being able to handle a wide range of varying computer applications for various purposes (van Braak *et al.*, 2004).

According to Berner (2003), Bordbar (2010), teachers' ICT competence is a major predictor of integrating ICT in teaching. From the study, majority of the respondents 69.0%(122) of the have not undergone training in ICT training while the remaining 31.0%(55) have undergone ICT training in the past two years. Their basic computer literacy levels showed that 7.9%(14) had advanced skills in the usage of computers, 26.6%(47) had an intermediate level, 53.1%(94) had basic skills for operating computers with the remaining 12.4%(22) having little or no skills in computer usage.Lack of technology training of teachers (Dvorak and Buchanan 2002) have also been cited as barriers to technology integration into classroom instruction. Other contextual factors to explain teachers' competence in ICT include computer literacy level whereby this study shows majority of ECD teachers 53.1% in Bungoma county have basic computer literacy. However, the study indicate that many of the teachers don't own computers and also majority of the schools don't have computers hence computer access and usage of by ECD teachers in Bungoma county is minimal.

Head Teachers and ECD Education Officers in Bungoma also agreed that they have not trained ECD teachers for the integration of ICT in teaching and learning in the last two years. In fact, interviews revealed that most schools do not have computers, printers or other ICT devices, and therefore teachers do not have knowledge and ability to control ICT devices. Jones (2004) reported that the performance of teachers is directly related to trust. Teachers' trust often relates to their expectations of their abilities to use computers in classrooms, especially in relation to the perceived skill of their learners.

However, if more equipment or training is to be provided to teachers, this support must also recognize the views and beliefs of teachers about children's learning and

development and place them at the forefront of ICT support and the provision of professional development for the sector. Most current ICT research in early childhood education takes a "positive" view of teachers, who find teachers to be educators with a critical role in decision-making and to promote young children's ICT interactions, which therefore require support in developing ICT capabilities and literacy. Developing the capacity of ICT teachers and literacy does not simply mean providing them with the skills to use different forms of ICT. It also means providing teachers with opportunities to learn more about the opportunities ICT offers for new ways of communicating, seeking and managing information, and interacting with the environment and others; what research shows about the role and impact of ICT use in children's learning, play and development; and examples of how other early childhood education settings have been used. Developing the capacity of ICT teachers and ICT literacy also means providing them with opportunities to identify how ICT can be used to support or extend their practice in their own early childhood education setting (Downes & Fatouros, 1995).

Cummings, Phillips, Lake, Lowe, Lee (2010) studies, there are also legitimate concerns about Internet use. Learners who can freely use computers to access the Internet may be exposed to offensive or inappropriate information that is not appropriate for their age. It is also important for educators to be able to distinguish whether learners want technology to be used or whether they prefer the use of traditional teaching materials.

With regard to the role of ICT in teacher roles, 11.9% (21) of teachers admitted that ICT changes the role of teachers in a large way. 19.8% (35) indicated that somehow and 28.8% (51) said that ICT partially changed the role of the teacher. However, 39.5

per cent (70) of the teachers indicated that ICT does not change the role of the teacher. However, Ozgur & Seyhan, 2010) suggests that the need to change the role of teachers is irreversible and inevitable because, together with the introduction of ICT into schools, certain educational assets have become obsolete. It is the responsibility of the teacher to adapt both themselves and the learners, as well as the lessons to the new technologies and possibilities it offers. It is no longer sufficient for teachers to be the only educational authority to transfer knowledge to the learners. Teachers must encourage critical thinking skills, promote information literacy and support collaborative work in order to prepare learners for the 21st century. In addition, the identification, grouping and confirmation of electronic data sources should be one of the main tasks for educators.

Past studies have further elaborated on the positive developments in the use of computers by teachers in the classroom. Thus, depending on the country and type of school, there are different levels of competence and skills among teachers to use computers in the classroom (Korte & Hüsing, 2006).

When the respondents were asked whether ICT makes their work easier, majority of 58.8%(104) admitted that ICT makes their work easier. In addition, concerning the usefulness of integrating ICT in teaching and learning in early years, 74.6%(132) of the respondent affirmed that ICT is useful in content generation, 83.1%(147) confirmed that ICT is useful in instructional planning, 63.3%(112) of the respondent said ICT is useful in content management and 72.3%(128) of the teachers informed that ICT is useful in classroom management. Empirical results indicate that teachers used computers most often for preparing tests and course handouts and preparing homework assignments, grading and performing administrative tasks. Very few

teachers reportedly used for instructional software to enhance their classroomteaching (Yildirim, 2014).

The findings indicate that ICT is very relevant and has a number of benefits when integrated into early learning. As a result of the study, the integration of ICT into teaching is beneficial to children's learning and development. These benefits are reflected in many aspects, including language and emerging literacy, mathematical thinking, creativity, problem-solving, personality, communication and collaboration, as well as positive attitudes towards learning (Umayahara, 2014). On the other hand, some researchers are also discouraging the integration of ICT in early childhood teaching, especially for very young children.

The literature suggests that there is a clear potential for ICT use, including computers, to enrich the early childhood learning environment. Technology adds to the set of tools available to children to be used and adapted, to feel at home, to be part of their repertoire, and to help them express themselves verbally, visually and emotionally. New technologies provide additional resources for teachers to use as they plan to meet a range of levels, learning styles and learners' individual needs (Van Scoter & Boss, 2002). Like any educational resource, new technologies can be used well or badly (Siraj-Blatchford & Whitebread, 2003). The value that ICT can add to the learning environment of young children clearly depends on the choices that teachers make about which tools to choose and when and how to use them; and on their understanding of how these tools can support children's learning, development, participation or play.

Interviews with ECD Education Officers and Head Teachers revealed some challenges that affect the integration of ICT into early learning in Bungoma County.

The majority of respondents pointed out the following challenges: limited training opportunities for teachers in the use of ICT; insufficient equipment or resources to purchase equipment; lack of on-site technical support; or lack of time to develop ICT-integrated teaching or learning activities. However, if more time, equipment or training is to be provided to teachers, this support must also recognize the views and beliefs of teachers about children's learning and development and place them at the forefront of ICT support and the provision of professional development for the sector. Most current ICT research in early childhood education takes a "positive" view of teachers, who find teachers to be educators with a vital position in decision-making and to promote young children's ICT interactions, and also require help in improving ICT skills and literacy. Developing the capacity of ICT teachers and literacy does not simply mean providing them with the skills to use different forms of ICT (O'Hara, 2004).

This also includes presenting teachers with resources to know more about the possibilities ICT provides for innovative forms of communication, finding and handling knowledge, and engaging with the community and others; what evidence indicates regarding the role and effect of ICT usage in children's learning, play and development; and examples of how other early childhood education environments have been utilized. Developing the potential of ICT teachers and ICT comprehension often requires supplying them with resources to understand whether ICT can be used to help or expand their work in their own early childhood education environment (Downes & Fatouros, 1995).

4.9.2 Objective Two: To Examine Integration of ICT in Planning For Instruction in Early Learning

Findings in table 4.2 show that instructors require the integration of ICT components in order to pre-plan and post-plan for instruction (Mean = 3.614, SD = 0.952). However, the ECD teachers affirmed that the use of ICT makes preparation of learning records such as lesson plan and scheme of work more easy (Mean = 3.535, SD = 0.953). Further, the use of technological tools tends to improve the effectiveness of the teachers in delivering instructions (Mean = 3.737, SD = 0.984).

Regarding the issue touching on how ICT can improve learning activities, the respondent instructors affirmed that the integration of ICT can help in new knowledge retention (Mean = 3.694, SD = 1.03). Further, the use of technological tools to support instructional activities can help in enhancing a child's developmental needs (Mean = 3.514, SD = 1.00). Thus, the respondent instructors affirmed that the integration of ICT into early learning centres can positively contribute to the development of the young child (Mean = 3.500, SD = 1.00). Lastly, the respondents affirmed that the integration of ICT in learning can aid in making abstract concepts concrete (Mean = 3.736, SD = 0.99)

From the findings, ECD teachers in Bungoma County affirm that the use of ICT is helpful in pre-planning and post-planning of instruction and the use of ICT helps to make learning concepts more concrete. In addition, the teachers indicated that utilization of ICT helps in preparation of teaching records such as lesson plan and scheme of work. However, the teachers perceived that use of ICT in planning for instruction reduced teacher-learner interaction the classroom.

Figure 4.5 indicate that majority of the respondent do not use ICT in instruction. This is reflected by 25% of respondent use ICT in actual interaction in classroom activities (instructional phase), 30% use ICT in pre-instruction phase (planning for instruction), 15% use ICT during post-instruction phase. Providing opportunities for a seamless integration of technology into instruction requires teachers, school administration, technology coordinator, and parents to play an active role in determining the importance of technology integration in classroom. Ertmer (2005) suggests that in order to affect teacher beliefs, research needs to be conducted where teachers have first-hand experiences with technology, where teachers observe successful implementation, and where change occurs through professional learning communities.

Basing on the interviews, the headteachers and ECD education officers in Bungoma county perceived that technology is very important for planning for instruction in early years education. However, the interview revealed that most teachers expressed concern about competing instructional responsibilities and their technology integration efforts. Teachers need time to plan lessons, time to teach and time to assess and provide feedback to learners. When a teacher creates intellectually engaging technology activity using any piece of software or object, it will promote children's learning and development (Bredekamp and Copple 1997).

4.9.3 Objective Three: To Investigate Integration of ICT in Teaching and Learning Methods

Table 4.3 sought to establish the integration of ICT as a platform for instructing early learners. The data show that the respondent instructors affirmed Integration of ICT influence selection of teaching method to be used in the classroom. (Mean = 3.759, SD = 0.919). Furthermore, the respondent instructors perceived that Integrating ICT

in learning leads to innovative methods of teaching (Mean = 4.183, SD = 0.785). Learner centered methods are used when using technological devices (Mean = 3.634, SD = 1.012). However, according to the respondent instructors, the use of technological tools does not increase the quality of early childhood education (Mean = 2.808, SD = 1.373) but it is seen to motivate the young learners (Mean = 4.231, SD = 0.895).

As indicated by the respondent instructors, the technological tools promote a friendly co-operative environment in the classroom (Mean = 3.890, SD = 0.913), however, in some instances, they distract the learners' attention (Mean = 3.409, SD = 1.033). Lastly, the respondent instructions asserted it is essential to integrate ICT into learning and teaching (Mean = 3.664, SD = 1.064).

The findings indicate that ECD teachers in Bungoma county perceive that integration of ICT influences selection of teaching method to be used in the classroom. Furthermore, the teachers perceived that Integrating ICT in learning leads to innovative methods of teaching and earner centered methods. However, according to the teachers, the use of technological tools does not increase the quality of early childhood education but it is seen to motivate the young learners. This emphasised as indicated that technological devices promote a friendly co-operative environment in the classroom although the teachers seemed to agree that in some instances, they distract the learners' attention Lastly, the ECD teachers asserted that it is essential to integrate ICT into teaching methods used in ECD in Bungoma county.

4.9.4 Objective Four: To Establish Integration of ICT in Teaching and Learning Materials

Table 4.4 sought to establish the integration of ICT T/L materials in early learning by ECD teachers in Bungoma county. The findings show that Schools use diverse set of ICT tools to communicate, create, disseminate, store, and manage information (Mean = 3.904, SD = 1.048). Further, the respondent instructors said that teachers have access to ICT devises in schools (Mean = 4.000, SD = 0.881), which indicates that most teachers don't have access to utilize ICT devices in schools. In addition, the findings show that teachers don't have the knowledge and confidence of using the ICT devises in schools (Mean = 3.971, SD = 0.939).

Teachers also agreed that technological tool requires visual and manipulative skills to effectively illustrate concepts. The technological tools also improve learning in that visual aids are effective in illustrating learning concepts (Mean = 3.759, SD = 0.990). Through the application of the ICT platform, the instructors felt that using technological tools take a lot of time hence making instruction cumbersome (Mean = 3.875, SD = 1.094). According to the instructors, the technological tools are also helpful in improving the delivery of content during class time (Mean = 3.817, SD = 1.103).

Figure 4.6 indicate teachers responses on the form of ICT devices used. Majority of the respondent 38% use Smartphone in instruction followed by 26% using computers. Other devices such as interactive whiteboard, tablets, video cameras and data projectors are not utilized at all. The variety of technology devices and techniques that can be used in education can be overwhelming. The multiplicity of choices does not always help teachers to adequate use the teaching aids. The choice of teaching aids

should be carefully thought through and the choice should be appropriate to the planned learning tasks (Lapadat, 2015). The use of technology may not always be helpful. In many cases, it can cause quite the opposite result. Inappropriate use of technology can lead to distraction and overuse both from learners, as well as from the teacher side.

4.9.5 Objective Five: To Establish Integration of ICT in the Assessment of Early Learning

The study sought to identify how integrating information communication and technological resources can aid in the assessment of learning in early years. Table 4.5 sought to establish the integration of ICT in assessment of learning in early learners. The results show that using ICT in actual instruction has a positive influence on children performance (Mean = 4.231, SD = 0.895). The respondent instructors further asserted that by utilizing computers and smart phones, teachers develop innovative tests for learners (Mean = 3.836, SD = 1.215) and also integrating ICT in assessing learners helps to deliver traditional assessment formats more effectively (Mean = 3.663, SD = 1.048). ECD teachers in Bungoma also affirmed that the workload assessment has decreased with the introduction of the ICT (Mean = 3.860, SD = 0.897). The findings show that ECE teachers in Bungoma county understands the importance of integrating ICT in assessment of early learners. The Assessment and Teaching of 21st Century Skills (ATC21S, 2013) acknowledge the possibility to collaborate with others and the ability to connect through technology as essential skills in the 21st century.

However, ECD teachers in Bungoma county indicated that teachers don't use ICT to store learners assessment records through applications such as word and excel (Mean

= 4.615, SD = 1.017) and very few of the teachers send learners performance to parents via emails and text messages (Mean = 4.090, SD = 1.035).

ECD teachers in Bungoma county perceive that ICT can be used to deliver traditional assessment formats more effectively and efficiently and also to change the way competences are assessed and develop formats that facilitate the assessment of competences that have been difficult to capture with traditional assessment formats. ICT can be used to develop tests. Although majority indicated that theydon't use ICT to store learners' assessment records through applications such as word and excel and very few of the teachers send learners performance to parents via emails and text messages.

A well-designed assessment strategy can motivate learners, and help teachers and institutions to support deep learning. In contrast, inappropriate forms of assessment may promote surface learning, and will therefore fail to support the true goals of education. Information and communication technologies (ICTs) can facilitate the best aspects of assessment (DePasquale, McNamara, & Murphy, 2003).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents a summary of the findings, conclusion of the study findings followed by recommendations and implications of the study. The chapter finalizes with the limitations and recommendations for further studies.

5.2 Summary of the Findings

The findings are summarized logically depending on the objectives of the study.

5.2.1 Demographic characteristics

Bungoma County has more female teachers / instructors than male counterparts Gender differences and use of ICT has been reported in several studies. However, research on the role of teachers and the usage of ICT have reported low rates of computer use by female teachers due to their restricted exposure, expertise and involvement in technology. This study shows that ECD centers in Bungoma County have more female teachers than male teachers, and therefore, according to the literature, female teachers have a low level of computer use due to their limited access, skill and interest in technology.

Majority of ECD teachers in Bungoma 50.3 per cent (89) have a certificate in ECD. This is the basic qualification requirement for teacher in ECD centers in the county. This knowledge is valuable because it demonstrates that the majority of ECD teachers in Bungoma County do not have specific ICT training as they do not provide any instruction in computer and ICT related skills.

On the basis of these findings, the majority of ECD teachers in Bungoma county 48.0% (85) have taught between 1 and 5 years, and therefore, according to literature, they are likely to integrate ICT into their teaching.

5.2.2 Objective One: Teachers competency in integrating ICT in early learning

The central issue in the integration of ICT into early learning is pegged on the instructors having the requisite ICT training. The results showed that most of the ECD teachers in Bungoma county respondents 69.0% (122) of the have not undergone training in ICT training in the past two years. Their basic computer literacy levels showed that majority 53.1% (94) had basic skills for operating computers with the remaining 12.4% (22) having little or no skills in computer usage. Majority of ECD teachers in Bungoma county 94.4% (167) did not own computer devices and also very few schools have computers 26.0% (46) and majority of 74.0% (131) of schools don't have computers for ECD instructors. This justifies the reason why most ECD teachers in Bungoma county had limited access to the devices hence having basic or little skills for operating computers and other ICT devises.

On the issue touching on proficiency in computer application, a small number of them were able to fully utilize the computing and technological devices. The respondent instructors could not access computer devices regularly both at home and school. In addition, most teachers preferred to use the ICT devices for the management of the classroom as opposed to instruction planning or content generation and management.

Concerning the role of ICT in teachers' roles, the majority of the teachers indicated that ICT does not change the role of the teacher in the classroom. However, for those respondents who use ICT admitted that ICT makes their work easier. The findings also indicated that ICT is very relevant and has a number of benefits when integrated

in early learning. The benefits highlighted include; computers enriches the early childhood learning environment, technology adds to the set of tools available for children to use and help express themselves and new technologies offer teachers additional resources to use as they plan to meet a range of learning styles and individual needs of learners.

Respondents pointed out the following challenges concerning integration of ICT into early learning: teachers' limited training opportunities in the use of ICT; insufficient equipment or funds to buy equipment; absence of on-site technical support; lack of time to develop ICT-integrated teaching or learning activities.

5.2.3 Objective Two: Integration of ICT in Planning For Instruction in Early Learning

Findings in table 4.2 show that ECD instructors require the integration of ICT components in order to pre-plan and post-plan for instruction (Mean = 3.614, SD = 0.952). However, the ECD teachers in Bungoma county affirmed that the use of ICT makes preparation of learning records such as lesson plan and scheme of work more easy (Mean = 3.535, SD = 0.953). Further, the study the teachers perceived that the use of technological tools tends to improve the effectiveness of the teachers in delivering instructions (Mean = 3.737, SD = 0.984).

Regarding the issue touching on how ICT can improve learning activities, the respondent instructors affirmed that the integration of ICT can help in new knowledge retention (Mean = 3.694, SD = 1.03). Further, the use of technological tools to support instructional activities can help in enhancing a child's developmental needs (Mean = 3.514, SD = 1.00). Thus, the respondent instructors affirmed that the integration of ICT into early learning centres can positively contribute to the development of the

young child (Mean = 3.500, SD = 1.00). Lastly, the respondents affirmed that the integration of ICT in learning can aid in making abstract concepts concrete (Mean = 3.736, SD = 0.99)

From the findings, ECD teachers in Bungoma County affirm that the use of ICT is helpful in pre-planning and post-planning of instruction and the use of ICT helps to make learning concepts more concrete. In addition, the teachers indicated that utilization of ICT helps in preparation of teaching records such as lesson plan and scheme of work. However, the teachers perceived that use of ICT in planning for instruction reduced teacher-learner interaction the classroom.

Figure 4.5 show that the majority of respondents do not use ICT in instruction. This is expressed in 25% of learners using ICT in actual classroom engagement (instructional period), 30% using ICT in the pre-instruction process (instruction planning), 15% using ICT during the post-instruction phase. Providing opportunities for a seamless integration of technology into education requires teachers, school administrators, technology coordinators, and parents to play an active role in determining the importance of technology integration in the classroom. Ertmer (2005) suggests that, in order to influence teachers ' beliefs, work needs to be carried out where teachers have first-hand experience in technologies, where teachers witness successful implementation, and where change occurs across professional learning communities.

Based on interviews, Head Teachers and ECD Education Officers in the county of Bungoma thought that technology was very important in the planning of early year’s education. However, the interview revealed that most teachers were concerned about competing educational responsibilities and their efforts to integrate technology. Teachers require time to plan classes, time to teach and time to assess and provide

feedback to learners. When an instructor develops a creatively stimulating technology experience using any piece of software or material, it facilitates children's learning and development (DePasquale, McNamara, & Murphy, 2003).

The results indicated that the integration of ICT into instruction planning can be achieved as the devices can be used to deliver instructions in the classroom. ICT devices also help to visualize learning activities and thus improve the effectiveness of instructions in the delivery of content. As a consequence, technology, if used under regulation, has a much more positive impact on the future of children. Providing opportunities for a smooth integration of technology into education requires teachers, school managers, curriculum coordinators, and parents to play an active role in determining the importance of technology integration in the classroom.

5.2.4 Objective Three: Integration of ICT in Teaching and Learning Methods

Table 4.3 sought to establish the integration of ICT as a platform for instructing early learners. The data show that the respondent instructors affirmed Integration of ICT influence selection of teaching method to be used in the classroom. (Mean = 3.759, SD = 0.919). Furthermore, the respondent instructors perceived that Integrating ICT in learning leads to innovative methods of teaching (Mean = 4.183, SD = 0.785). Learner centered methods are used when using technological devices (Mean = 3.634, SD = 1.012). However, according to the respondent instructors, the use of technological tools does not increase the quality of early childhood education (Mean = 2.808, SD = 1.373) but it is seen to motivate the young learners (Mean = 4.231, SD = 0.895).

As indicated by the respondent instructors, the technological tools promote a friendly co-operative environment in the classroom (Mean = 3.890, SD = 0.913), however, in

some instances, they distract the learners' attention (Mean = 3.409, SD = 1.033). Lastly, the respondent instructions asserted it is essential to integrate ICT into learning and teaching (Mean = 3.664, SD = 1.064).

From the interviews, ECD education officers and headteachers in Bungoma county perceived that use of ICT devices in class motivate learners to perform learning tasks independently by making learning more enjoyable but they do distract the learners' attention. Effective and adequate methods for utilizing ICT in early education in the first three years of educating has indicated that when proper guidelines are followed, there is an richness of technology based activities and improvement in nearly every curriculum learning area that is accessible to classroom instructors. However, it is a teacher's role to introduce proper methods and tools that can enrich the learning activities that encourage communication and social abilities, and at the same time follow the curriculum learning objectives.

The findings indicate that ECD teachers in Bungoma county perceive that integration of ICT influences selection of teaching method to be used in the classroom. Furthermore, the teachers perceived that Integrating ICT in learning leads to innovative methods of teaching and earner centered methods. However, according to the teachers, the use of technological tools does not increase the quality of early childhood education but it is seen to motivate the young learners. This emphasised as indicated that technological devices promote a friendly co-operative environment in the classroom although the teachers seemed to agree that in some instances, they distract the learners' attention Lastly, the ECD teachers asserted that it is essential to integrate ICT into teaching methods used in ECD in Bungoma county.

5.2.5 Objective Four: Integration of ICT in Teaching and Learning Materials

Regarding the integration of ICT into T/L materials, technological tools can aid in the determination of the pertinent learning outcomes and objectives. The technology also helps in the illustrating learning constructs and therefore it can improve learning in several ways such as delivery learning content, instrumentation of learning, and acts as a medium for instructions. Figure 4.6 indicate teachers responses on the form of ICT devices used. Majority of ECD teachers in Bungoma county 38% use Smartphone in instruction followed by 26% using computers. Other devices such as interactive whiteboard, tablets, video cameras and data projectors are not utilized at all. The variety of technology devices and techniques that can be used in education can be overwhelming. The multiplicity of choices does not always help teachers to adequate use the teaching aids. The choice of teaching aids should be carefully thought through and the choice should be appropriate to the planned learning tasks Access to an adequate and satisfactory ICT infrastructure is one of the most significant factors that contribute to the successful and effective utilization of IT however, most school don't have these devices.

Findings from this study shows that Schools in Bungoma county do not use diverse set of ICT tools to communicate, create, disseminate, store, and manage information (Mean = 3.904, SD = 1.048). Further, the respondent instructors indicates that most teachers don't have access to utilize ICT devices in schools. In addition, the findings show that teachers don't have the knowledge and confidence of using the ICT devises in schools (Mean = 3.971, SD = 0.939).

Teachers also agreed that technological tool requires visual and manipulative skills to effectively illustrate concepts. The technological tools also improve learning in that

visual aids are effective in illustrating learning concepts (Mean = 3.759, SD = 0.990). Through the application of the ICT platform, the instructors felt that using technological tools take a lot of time hence making instruction cumbersome (Mean = 3.875, SD = 1.094). According to the instructors, the technological tools are also helpful in improving the delivery of content during class time (Mean = 3.817, SD = 1.103). From the interviews, Headteachers and ECD education officers in Bungoma county agreed to the fact that utilization of ICT devices would make teachers work easy and meaningful but also they pointed out that most schools are not provided with these ICT devices most especially the ECD centres.

5.2.6 Objective Five: Integration of ICT in the Assessment of Early Learning

Table 4.5 sought to establish the integration of ICT in assessment of learning in early learners. The results show that using ICT in actual instruction has a positive influence on children performance (Mean = 4.231, SD = 0.895). The respondent instructors further asserted that by utilizing computers and smart phones, teachers develop innovative tests for learners (Mean = 3.836, SD = 1.215) and also integrating ICT in assessing learners helps to deliver traditional assessment formats more effectively (Mean = 3.663, SD = 1.048). ECD teachers in Bungoma also affirmed that the workload assessment has decreased with the introduction of the ICT (Mean = 3.860, SD = 0.897). The findings show that ECE teachers in Bungoma county understands the importance of integrating ICT in assessment of early learners. The Assessment and Teaching of 21st Century Skills (ATC21S, 2013) acknowledge the possibility to collaborate with others and the ability to connect through technology as essential skills in the 21st century.

However, ECD teachers in Bungoma county indicated that teachers don't use ICT to store learners assessment records through applications such as word and excel (Mean = 4.615, SD = 1.017) and very few of the teachers send learners performance to parents via emails and text messages (Mean = 4.090, SD = 1.035).

ECD teachers in the county of Bungoma feel that ICT can also be used in delivering traditional assessment formats more effectively and efficiently, as well as in changing the way skills are assessed and develop the formats that facilitates the assessment of competencies that have been difficult to capture in the traditional assessment formats. ICT can be used to carry out tests. Although the majority indicated that they did not use ICT to store student assessment records through applications such as Word and Excel, and very few teachers sent student performance to parents through emails and text messages.

Interviews revealed that ICT devices offer a wide range of options for evaluating learning outcomes in a number of ways, including the generation and provision of quality assessment tools that instructors can access. The use of ICT devices in early learning helps to improve the developmental needs of learners and many other aspects of learning. The findings showed that the results of the assessment helped in identifying the adaptations required to help plan for further curriculum integration, and that computers are inherently compelling for young children. The majority of respondents confirmed that technology is a powerful contributor to learning if it is used to deepen the commitment of learners to a meaningful and intellectually authentic curriculum. The study has shown that a well-designed strategy of assessment can motivate learners and help the teachers and institutions foster deep

learning. On the other side, incorrect types of appraisal that encourage surface learning and may thus not help the real goals of education.

5.3 Conclusion

This main purpose of this study was to assess the integration of ICT in early years teaching and learning in the county of Bungoma. The results of the study have shown that the integration of ICT by ECD teachers in schools is minimal. Demographic characteristics such as educational level, age, gender and experience have an impact on the adoption of technology in early years teaching, and therefore an understanding of the personal characteristics that influence the adoption of ICT by teachers and the integration of ICT into teaching is relevant. The researcher concludes that Bungoma County has more female teachers / instructors than male counterparts,

The research concludes that teachers are not competent since majority of ECD teachers in Bungoma County do not have basic ICT training and this is because ECD certification training does not offer any course in computer and ICT related skills. Also, majority of ECD teachers in the county of Bungoma do not own computer devices, and very few schools have computers for ECD instructors

With regard to ICT integration in instruction planning, ECD teachers in Bungoma County say that ICT use is helpful in the pre-planning and post-planning of instruction and the use of ICT helps to make learning concepts more concrete. In addition, the teachers indicated that the use of ICT helps in the preparation of teaching records, such as a teaching plan and a work plan. Teachers, however, perceived that the use of ICT in instruction planning reduced the teacher-learner interaction of the classroom. Providing incentives for a smooth incorporation of technology into

education involves learners, school managers, curriculum coordinators, and parents to take an active role in assessing the value of curriculum inclusion in the classroom.

The integration of ICT in training planning can be achieved as the devices can be used to deliver instructions in the classroom. ICT apps often help to envision learning experiences and therefore enhance the usefulness of guidance in the delivery of information. As a consequence, technology, once applied under regulation, has a far more optimistic effect on the future of children. Providing incentives for a smooth incorporation of technology into education involves learners, school managers, curriculum coordinators, and parents to take an active role in assessing the value of curriculum inclusion in the classroom.

The integration of ICT in teaching and learning influences the selection of teaching methods to be used in the classroom since integration of ICT in learning leads to innovative methods of teaching and student-centred methods as indicated by the findings. ECD teachers argued that it is essential to integrate ICT into the teaching methods used by ECD in the county of Bungoma.

Concerning integration of ICT in teachingand learning materials, technological tools can help in the determination of relevant learning outcomes and objectives. Technology also helps in explaining learning habits and can therefore improve learning in a number of ways, such as providing learning content, learning tools, and serving as an instructional medium. The bulk of ECD teachers in the county of Bungoma use smartphones and computers for teaching. Many technologies such as interactive whiteboards, smartphones, video cameras and data projectors are not used at all.

In regards to use of ICT in assessment for learning, ECD teachers do not use ICT to store student assessment documents via software such as Word and Excel and very few teachers submit student performance to parents via emails and text messages.

Respondents pointed out the following challenges regarding the ICT integration into early learning: training opportunities that were inadequate for teachers in the use of ICT; infrastructure insufficiency or funds for purchase equipment; lack of on-site technical support; lack of the time to develop ICT-integrated teaching or learning programs.

5.4 Recommendations

Based on the findings, the study recommends the following:

i. Teachers should be provided with in-service training on how to use different technology applications, devices and approaches to managing technology in the classroom.
ii. The ministry of education together with the county government to recognizing the critical role of technology in teaching and learning. Provision and facilitation of ICT training and induction of educational software training for instructors in order to improve their ICT capabilities and usage. This can be achieved through regular seminars and workshop training on the type of educational software and the appropriate devices.
iii. Teachers to identifying specific barriers to technology integration and different approaches to overcoming the barriers in their own classrooms.

5.5 Further Research

This study was limited to ECD teachers, headteachers and ECD education officers in Bungoma county, further study could be carried out in other counties to determine the extent to which ICT is integrated in early learning.

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APPENDICES

Appendix I: Letter of Introduction

Date ……

Dear Sir/Madam,

RE: REQUEST TO COLLECT DATA FOR ACADEMIC THESIS RESEARCH PROJECT

I am a PhD learner at Moi University. I am doing a thesis research titled "**Integration of Information Communication and Technology into teaching and learning in early learning: a case of Bungoma County Kenya***".* I have chosen your corporation to be part of my sample population. I am writing to request you to allow me administer research questionnaire to staff in your centre.

Your consideration will be highly appreciated

Yours faithfully

DOUGLAS PATRICK BARASA

EDU/D.PHIL.CM/1009/14

Appendix II: Questionnaire for Teachers

I kindly request you to fill the questionnaires to the best of your knowledge. All the information you provide will be used for the purpose of this research only. Tick the correct alternative and fill in the spaces where applicable.

SECTION A - BACKGROUND INFORMATION OF THE TEACHER

1. Give your gender. Male () Female ()
2. What is your age?
   18-29 yrs () 30-39 yrs () 40-49 yrs ()
   50-59 yrs () Above 61yrs ()
3. What is your highest level of education?
   Certificate () Diploma () Bachelor's Degree
   ()Other_____
4. Years of experience in instructing primary schools
   1- 5 yrs () 6-10 yrs () 11 -15 yrs ()
   16-20 yrs () Above 20 yrs ()

SECTION B: INTEGRATION OF INFORMATION COMMUNICATION TECHNOLOGY IN EARLY LEARNING COMPETENCY

5. Have you had ICT training in the last two years? Yes () No ()
6. What is your level of proficiency in the use of ICT devices
   None ()Basic () Intermediate ()Advanced ()
7. Do you have a computer access at home? Yes () No ()
8. Do you have computers at the learning centre? Yes () No ()
9. If yes, how often do you have access and use computers in school?

   Frequently () Occasionally () Rarely () Never ()

10. Has the role of the teacher changed with the introduction of technology in school?
    Very much () Partially () Not at all ()
11. Does ICT make your work easier?
    Yes () No ()

12. What is the usefulness of computers in teaching?

Content generation:	Useful ()	Not useful()
Classroom administration:	Useful ()	Not useful()
Instruction Planning:	Useful ()	Not useful()
Content management:	Useful ()	Not Useful()

13. General advantages/disadvantages of ICT?

_____
_____
_____
_____
_____
_____
_____
_____

SECTION C: INTEGRATION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN PLANNING FOR INSTRUCTION IN EARLY LEARNING

14. Please indicate your level of agreement on the statements on integration of Information Communication and Technology in planning for instruction in early learning. **TICK** (√**)** as appropriate using the key.**Key: 1**-Not at all; **2**-To a less extent; **3**- Neutral; **4**-To a large extent;**5**-To a very large extent

Statements	**1**	**2**	**3**	**4**	**5**
ICT helps the teacher pre-plan for instruction before going to class and post-plan for instruction					
Use of ICT makes preparation of learning records such as lesson plan and scheme of work more easy					
Technological tools make the early childhood teachers more effective.					
Technological tools decrease teacher-learner interaction.					
Technological tools help the learner retain new knowledge longer.					
The instructional activities supported by technological tools help improve young children's developmental levels.					
The use of technology positively contributes to young children's development.					
Technological tools are influential in making abstract concepts concrete.					

15. How do you use ICT as a teacher?

Tick where applicable.

Usage of ICT	**YES**	**NO**
Actual instruction In the classroom (instructional phase)		
Planning for instruction (pre-instructional phase)		
Post-instructional phase		

SECTION D: INTEGRATION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN TEACHING AND LEARNING METHODS

16. Please indicate your level of agreement on the statements on integration of Information Communication and Technology in teaching and learning methods. **TICK** (√**)** as appropriate using the key below. **Key: 1**-Not at all; **2**-To a less extent; **3**- Neutral; **4**-To a large extent;**5**-To a very large extent

Statements	**1**	**2**	**3**	**4**	**5**
Integration of ICT influence selection of teaching method to be used in the classroom.					
Integrating ICT in learning leads to innovative methods of teaching					
Learner centered methods are used when using technological devices					
Use of technological makes it easy to utilize variety of teaching methods					
Technological tools highly motivate young children					

Teaching methods that adopt ICT promote a friendly co-operative environment in the classroom.					
Technological tools distract young children's attention					
Technological tools are suitable for instructional methods used in early childhood education					
Technological tools are essential for teaching and learning					

SECTION E: INTEGRATION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN TEACHING AND LEARNING MATERIALS

17. Please indicate your level of agreement on the statements on integration of Information Communication and Technology in T/L material in early learning. **TICK (√)** as appropriate using the key .**Key: 1**-Not at all; **2**-To a less extent; **3**- Neutral; **4**-To a large extent;**5**-To a very large extent

Application of ICT inT/L materials

Statements	**1**	**2**	**3**	**4**	**5**
Schools use diverse set of ICT tools to communicate, create, disseminate, store, and manage information					
Teachers have access to ICT devises in schools					
Teachers have the knowledge and confidence of using the ICT devises in schools					
Teachers utilize ICT devices in and out of class activities					
The technological tool requires visual and manipulative skills to effectively illustrate concepts					
Using Technological tools take a lot of time hence making instruction cumbersome					
Technological tools improve the delivery of content during class time					

18. What forms of ICT do you use?

Forms of ICT	**Yes**	**No**
Computer		
Data projector		
Tablet		
Interactive whiteboard		
Videocamera,		
Smartphone		

19. Others specify

_____

_____

SECTION F: INTEGRATION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN ASSESSMENT OF TEACHING AND LEARNING

20. Please indicate your level of agreement on the statements on integration of Information Communication and Technology in assessment of teaching and learning. **TICK** (√**)** as appropriate using the key below.

Key: 1-Not at all; **2**-To a less extent; **3**- Neutral; **4**-To a large extent;**5**-To a very large extent

Statements	**1**	**2**	**3**	**4**	**5**
Using ICT in actual instruction has a positive influence on children performance					
Teachers use ICT to store learners assessment records through applications such as word and excel.					
Teachers send learners performance to parents via emails and text messages.					
By utilizing computers and smart phones, teachers develop innovative tests for learners					
Integrating ICT in assessing learners helps to deliver traditional assessment formats more effectively					
The workload in assessment is decreased with the introduction of ICT					
Using ICT in actual instruction has a positive influence on children performance					

Appendix III: Interview Schedule for Headteachers& Education Officers

1. What are the benefits of ICT in early learning? {Explain}
2. Are ECD teachers trained in utilizing ICT?
3. How often do you conduct ICT training for the teachers?
4. If yes, briefly describe the training?
5. Do you think the ICT program is relevant for the early learning? If yes, how?
6. Do you think the ICT program is adequate for the early learning? If yes how?
7. In your opinion, what is the impact of ICT in early years learning?
8. How confident are teachers in utilizing ICT devices during instruction?
9. Do teachers possess the required technical skills for integrating ICT in early learning?
10. Do you have computer access in schools? If yes, do teachers have access to the computers?
11. . Do you have access to the Internet in school?
12. Which ICT device do teacher use?
13. What challenges hinder integration of ICT in early learning?

Appendix IV: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **133556**

Date of Issue: **09/September/2019**

RESEARCH LICENSE

This is to Certify that Mr.. Douglas Barasa of Moi University, has been licensed to conduct research in Bungoma on the topic: Integration of Information Communication and Technology on Teaching and Learning in Early Learning for the period ending : 09/September/2020.

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National Commission for Science, Technology and Innovation
off Waiyaki Way, Upper Kabete,
P. O. Box 30623, 00100 Nairobi, KENYA
Land line: 020 4007000, 020 2241349, 020 3310571, 020 8001077
Mobile: 0713 788 787 / 0735 404 245
E-mail: dg@nacosti.go.ke / registry@nacosti.go.ke
Website: www.nacosti.go.ke