EARLY CHILDHOOD TEACHERS' PROFESSIONAL BELIEFS AND THE STATUS OF ICT PRACTICES IN THE KENYAN CONTEXT

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DEDICATION

In loving memory of all the children who perished as a result of the Islamist militia attack on Westgate Shopping Mall in Nairobi, Kenya on 21st September 2013. These children will never live, grow and learn through technologies. They will never experience the changing digital society.

God rest their Souls in Eternal Peace, Amen!

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STATEMENT OF CANDIDATE

I hereby certify that this work has not been submitted for a higher degree to any other University or Institution.

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ABSTRACT

Early Childhood Development and Education (ECDE) are currently receiving overwhelming attention in respect to innovation through technology. However, most research on the use of technology in ECDE is, to date, reported in developed countries. Much less research has explored the use of technology in the African context, including Kenya. This research aims to extend the parameters of this research through an investigation of how technology is integrated in Kenya’s ECDE.

The study raises three key questions: What are the professional beliefs of Kenyan early childhood educators about the use of technology in ECDE? What is the status of ICT practices in Kenyan preschools? In what ways are the professional beliefs of ECDE teachers in Kenya linked to their everyday practices and pedagogies in their educational settings?

The study is significant because it acknowledges the voice of preschool teachers, teachers’ trainers and ECDE policy-makers regarding integration of technology in ECDE. This was a three-phase, exploratory sequential mixed methods study with several data collection sources. Phase One included a case study involving 11 preschool teachers in two preschools, one public and one private. A survey was conducted in Phase Three with 508 preschool teachers. The participants for Phase Three included key ECDE stakeholders and other interested parties. The sets of data generated from the three groups of participants were analysed through use of qualitative and quantitative approaches.

The results of this study revealed that preschool teachers, ECDE stakeholders and other interested parties held positive beliefs about the use of technology in ECDE. The study also found that Kenya lacked policy frameworks aimed at teachers’ professional training on use of technology in ECDE. Additional findings of this study pointed to teachers’ limited access, use and confidence in integration of technology in practice.

Implications drawn from this study are focused on future research, policy, and professional training; learning and the role of the Kenyan Government in research and professional practice.

CHAPTER 1

INTRODUCTION

This research study explores Early Childhood Development and Education (ECDE) teachers' professional beliefs and practices involving the use of technology in Kenya. The chapter provides an introduction through a presentation of the background informing this study, an explanation of the research problem and a description of the study's purpose and aims. The chapter also introduces the research questions that guided this study.

Background to the Study

This context of the study is organised in three sections: the historical development of ECDE in Kenya, the current status of ECDE and the place of technology in Kenya's ECDE. Each section is briefly discussed from a global perspective, followed by the African region, and finally narrowed to the specific context of Kenya.

Concept of Early Childhood Development and Education

In view of the diverse nature of early childhood education, organisations use a range of names when referring to this level of education. These include 'Early Childhood Education and Care' (ECEC), used by the Organisation for Economic Co-operation and Development (OECD, 2006); 'Early Childhood Care and Education' (ECCE), used by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2006) and Early Childhood Development (ECD), used by the United Nations Children's Fund (UNICEF, 2011) and the World Bank (World Bank, 2015). This multiplicity of names suggests the kinds of services provided to young children in regards to care, development and education.

The current study adopts the term Early Childhood Development and Education (ECDE), which is defined as care and education services provided to all children, including the vulnerable and marginalised, from conception to eight years of age (Republic of Kenya, 2006a, p. 7).

Early childhood programs worldwide are founded on a solid historical base and the current use of technologies in these programs adds to this historical perspective. For example, kindergartens and nurseries were first established in much of Europe and North America in the 19th century (Kamerman, 2006). The purposes of these earlier childhood programmes included protective services for neglected children and those of poor working mothers (Nutbrown & Clough, 2014), holistic development of children (Lascarides & Hinitz, 2011) and affordable quality care for children whose mothers were in the labour force (Gordon & Browne, 2014).

In addition to Europe and North America, kindergartens and nurseries were established in the same period of the 19th century in some developing countries such as Korea and China. In Korea, its early childhood education cornerstone was laid by Japanese educators and American missionaries during the Japanese colonial period in Korea (Kwon, 2002). At the same time, Kwon reports that the first kindergarten in Japan was introduced in 1897 and over 30 years afterwards, American missionaries introduced Dewey's progressive approach in Japan while Montessori's method was introduced in the 1970s. This means the education provided to young children in these two contexts, namely Korea and Japan was grounded in the philosophies of John Dewey and Maria Montessori (Gutek, 2004). Dewey's philosophy articulates progressive, child-centred education and thematic teaching and learning (Khasawneh, Miqdadi, & Abdulhakeem, 2014) while children's learning through well prepared environments enriched with assorted, colourful materials was the brain child of Montessori (Gordon & Browne, 2014).

More importantly, childhood programs in the 19th century were based heavily on similar models of care for and teaching of young children. Among these models were those founded by Froebel, who argued for children's learning through play (Santer, Griffiths & Goodall, 2007); Pestalozzi's advocacy of mothers as carers and teachers of their own children, child-centred teaching and children as participants in knowledge construction (Huber & Mompoint-Gaillard, 2011); Montessori's emphasis on well-prepared material environments for children's learning (Gutek, 2004), and the activities of missionaries, who reinforced the need to raise and nurture children according to sound moral, social and spiritual values (Gordon &Browne, 2014).

Looking at the historical developments of early childhood education in Africa, the most remarkable development in this sector can be traced to the 1960s, when colonialism in most countries on the continent officially ceased (Kamerman, 2006). The concept of early childhood education was not entirely new, however; it was introduced in Uganda in the 1930s by British colonialists and Indians from Goa, whose main objective was to prepare children for formal education (Ejuu, 2012). Although Uganda achieved its independence in 1962, the government's direct involvement in early childhood education commenced in 1973 but was short lived due to a civil war that lasted until 1979 (Ejuu, 2012). However, according to Ejuu, the new government did recognise and support early childhood education as a critical element for children from birth to eight years of age. More importantly, earlier forms of preschool and child care initiated in the African contexts enabled women to engage in paid labour. Further, these programs were utilized as coordinating centres for addressing children's cognitive, nutritional and health needs.

Development of Early Childhood Education in Kenya

Kenya, which is situated on the eastern coast of Africa, gained its independence from British colonial rule in 1963 (Republic of Kenya, 2013b; 2014a). Kenya borders Somalia to the north-east, Ethiopia to the north, South Sudan to the north-west, Uganda to the west, Tanzania to the south-west and the Indian Ocean to the south-east. It has an area of 581,309 sq. km (Republic of Kenya, 2013b; 2014a). It is divided into 47 administrative units (counties) and an executive president heads the government (Guantai, 2012; Republic of Kenya, 2013b; 2014a). The population of Kenya in 2017 stands at 48,468,222 (World Population Review, 2017) In 2012, Kenya had an infant mortality rate of 48.7 per 1000 live births and average life expectancy of 60.37 (based on the 2009 census) (Republic of Kenya, 2014a).

Kenya is a multilingual and multicultural nation with a diverse population comprising 42 ethnic communities, including three of Africa's major socio-linguistic groups, Bantu (67%), Nilotic (30%), and Cushitic (3%) (Guantai, 2012). Additionally, English is the official language and the medium of instruction and learning from primary to tertiary levels of education. It is also used as a medium of instruction and learning in some preschools, especially in urban areas and those that are privately owned. Vernacular languages are however used as a medium of instruction in some preschools located in rural areas. Nonetheless, the Kenyan National ECDE policy framework (Republic of Kenya, 2006b) specifies that "the language of catchment area (mother tongue) shall be used in all ECD centres for communication and instruction, with gradual introduction of

English and Kiswahili” (p. 16). Despite this policy, many families prefer early English instruction, especially in urban and more middle class areas such as Nairobi.

In addition to English, Kenya has a national language, Kiswahili which enables all the 42 ethnic communities to communicate with and understand one another. Just like other elements of the Kenyan educational curriculum, Kiswahili is taught and examined, mostly from primary to the tertiary levels. It is important to note also that Kiswahili is used and spoken in some African countries other than Kenya. These include Tanzania, Zanzibar, Uganda, Congo, Zambia, Mozambique, Malawi, Rwanda, Burundi, Somalia and Comoro Islands.

The historical development of ECDE in Kenya can be traced back to a period prior to the colonial era in the 19^{th} century. During this period, the type of education prevalent in Kenyan communities before the arrival of western civilisation was generally known as traditional or indigenous education (Adeyemi & Adeyinka, 2003; Higgs, 2008; Omolewa, 2007). The curriculum for this indigenous education was identified in communities’ cultural and everyday practices (Kenyatta, 2011; Pence & Nsamenang, 2008) throughout the year. The main themes in this type of curriculum included community culture, values, traditions and practices, together with the history of the family, the clan and the entire community (Swadener, Kabiru & Njenga, 2000).

In addition, the children’s carers and those who implemented the above-mentioned traditional curriculum comprised older siblings, parents, grandparents, extended family members, community members and ‘significant’ others in the community (Adeyemi & Adeyinka, 2003; Higgs, 2008). The places of learning for children in the indigenous curriculum included homes, market places, grazing fields, plantations, water streams, firewood search places and ceremonies (Kenyatta, 2011; Ng’asike, 2014). According to Ng’asike, the pedagogy that informed the early childhood indigenous curriculum included children’s responses to direct instruction, observation, imitation and apprenticeship. Through this pedagogy, as well as receiving adequate care, children experienced adequate all-round stimulation in terms of the physical, social, intellectual, emotional and spiritual (Githinji & Kanga, 2011). Githinji and Kanga maintain that the intellectual needs of children learning under the indigenous curriculum were enhanced mostly through activities involving stories, riddles and games.

Overall, the learning outcomes informed by the traditional or indigenous curriculum included important aspects of culture and values, such as sharing, social responsibility, belonging, mutual dependence, mutual respect, continuity, obedience, respect for elders, cooperation, fear of God, and ability to relate with other people (Kenyatta, 2011; Ng'asike, 2014; Pence & Nsamenang, 2008).

The snapshot provided in relation to the traditional education for young children prior to colonialism clearly illustrates that the early childhood education is an old practice in Kenya. The institutionalisation of preschool education in Kenya evolved immediately after independence was attained in 1963 (Mbugua, 2004) and, by 1973, an enrolment of nearly 300,000 children, with 6,326 teachers (Swadener, Kabiru & Njenga, 2000) was recorded. By 1979, enrolments had risen to 400,000 children attending some 8,000 preschools, and the number of teachers grew to over 10,000 (Swadener, Kabiru & Njenga, 2000).

Building on the information of Swadener and colleagues, more recent statistics reveal that between 2000 to 2013, the number of preschools in Kenya has continued to increase, from 26,294 in 2000 to 40,100 in 2013 (Republic of Kenya, 2014b). The number of pupils in ECDE doubled from 1,255,194 in 2000 to 2,465,605 in 2013 (Republic of Kenya, 2014b). The number of trained ECDE teachers increased from 38,227 in 2003 to 101,062 in 2013, while the number of untrained teachers declined from 21,903 in 2003 to 13,800 in 2013 (Republic of Kenya, 2014b). This increase was associated with the expansion of teacher training institutions in the country (Republic of Kenya, 2014a).

In addition to improved enrolments, the successive governments of the Republic of Kenya in power since the death of the first president, Mzee Jomo Kenyatta, have demonstrated their commitment to the general well-being of children. This is reflected through the governmental endorsement of numerous global and local policy instruments. These include the 1989 United Nations Convention on the Rights of the Child (CRC), the 1990 Jomtien World Conference on Education for All (EFA), the 2000 World Education Forum (Dakar, Senegal) and Millennium Development Goals (MDGs) (Republic of Kenya, 2006a).

At local level, the Government of Kenya has designed key policy instruments that guide services focused on children's health and education. These include, among others, the National Early Childhood Development Policy Framework (NECDPF) that came into practice in 2006 (Republic of Kenya, 2006a; 2014a). This policy framework provides comprehensive, detailed guidelines on management of the entire ECDE sector. It also advocates the need to nurture children in safe and caring environments that enhance their health and capability to learn and the need to provide good quality care at both family and community levels (Republic of Kenya, 2006a; 2014a). Alongside the NECDPF are the Early Childhood Development Service Standard Guidelines for Kenya (ECDSSGK), whose role is to provide specific service standard guidelines for the provision of ECDE in Kenya (Republic of Kenya, 2006b).

Additional national policy instruments include Sessional Paper No. 1 of 2005 (Republic of Kenya, 2005) which placed the management of ECDE settings under the care of parents and other stakeholders and mainstreamed the sub-sector as part of primary education. The Constitution of Kenya of 2010 (Republic of Kenya, 2010) devolved the management of ECDE to the counties (or districts) for the purpose of involving communities at the grassroots level and enhancing ownership. The recent Sessional Paper No 14 of 2012 (Republic of Kenya, 2012a) provides guidelines and strategies aimed at supporting the ECDE sector, including the use of ICT in pedagogy at this level, while the Basic Education Act,2013 (Republic of Kenya, 2013a) provides guidelines on ECDE management in each and every county. These guidelines, eight (8) in numbers, are implemented by a County management committee and include:

1. promoting the best interests of the institution and ensuring the institution's development
2. developing a strategic plan for the institution
3. promoting quality care, nutrition and health of the children
4. ensuring the development of the children's knowledge, self-confidence, free expression, spiritual and social values and appreciation of other people's needs and views
5. providing a secure physical and psycho-social setting for the children

6. facilitating the development of the children’s affective, cognitive, psycho-motor and physical attributes in an integrated manner, including the development of talented and gifted pupils
7. performing any other function to facilitate the implementation of its functions under this Act or any other written law, and
8. protecting human rights and promoting the best interests of the child.

(The Basic Education Act, No. 14 of 2013, Article 58, p. 253)

Current Status of Early Childhood Education in Kenya

Like other countries, the definition and terms used for Early Childhood Care and Education in Kenya are still inconsistent. Early Childhood Care and Education is known and referred to by several terms and abbreviations, including ‘Early Childhood Education’ (ECE), ‘Early Childhood Care and Education’ (ECCE), ‘Early Childhood Development’ (ECD) and ‘Early Childhood Development and Education’ (ECDE). Kenya’s early childhood development service standard guidelines use the term ‘Early Childhood Development’ (ECD) and defines a child as ‘a human being from conception to eight years’ (Republic of Kenya, 2006b, p. 1). Similarly, the Basic Education Act No. 14 of 2013 refers to this level of education as pre-primary and defines it as ‘the education offered to a child of four or five years before joining level one in a primary school’ (Republic of Kenya, 2013a, p. 9).

For the purposes of the current study, the term ‘Early Childhood Development and Education’ (ECDE) is used interchangeably with the term ‘Preschool’ to refer to institutionalised and formalised educational services provided to children aged from 2 to 6 years. The main purpose of these services is to enhance children’s development holistically (physical, social, cognitive, creative, emotional and spiritual).

The Kenya Government’s initiatives targeting early childhood education are supported by several educational structures. These include the Ministry of Education (MoE), the Kenya Institute of Curriculum Development (KICD), and the Kenya Institute of Special Education (KISE) plus the National Centre for Early Childhood Education (NACECE).

The MoE is responsible for the coordination of ECDE at national level (Republic of Kenya, 2006a); the KICD designs and documents curricula for all non-university educational institutions, including teachers' training, ECDE and special needs programs (Republic of Kenya, 2012b). The KISE coordinates national programs for teachers' training and learners with specials needs (pre-primary to secondary levels of education) (Republic of Kenya, 2009).

NACECE, founded in 1971 (UNESCO, 2005), serves numerous functions, including training of personnel for early childhood education, development and dissemination, in collaboration with KICD, of early childhood education programs; identifying, designing, undertaking, and coordinating research in ECE; coordinating and liaising with external and internal partners, and informing the public of the needs and development of the ECE program. It also offers services to and facilitates interaction between agencies and sponsors (Koskei, 2013). All these functions aim at enhancing the quality of services provided to children by ensuring these services are informed by research, implemented by trained educators and embrace the spirit of partnership through coordination and liaising with stakeholders and other interested parties.

At the district or county level, ECDE is managed by devolved government agencies (Republic of Kenya, 2013b). Previously, this role was undertaken by District Centres for Early Childhood Education, commonly known as DICECEs. These centres, headed by DICECE officers, were charged with the following main functions:

- overall administration of early childhood education in the districts
- training of preschool teachers and other personnel at the district level
- supervision and inspection of preschool programs at the district level
- mobilisation of the local community in the preschool program in order to improve the care, nutrition and education of young children
- participation in the evaluation of preschool programs, and
- carrying out basic research on the status of preschool children,

(Awino, 2014; Sitati, Bota & Ndirangu, 2014)

Apart from NACECE and DICECE, a variety of institutions, including those managed privately; do offer training for early childhood educators, certificate and diploma levels. Further, there are universities, both public and private, that offer training programs for ECDE professional at certificate, diploma, first degree, masters and PhD levels. Notably, a pioneer institution in Sub-Saharan Africa, Kenyatta University, was the first to open its doors in 1995 to the first group of 32 ECDE professionals who pursued a degree program dedicated solely to early childhood education. Among the lecturers for this pioneer program was Dr. Barabra Garner Koech while Professor Beth Swadener, from the United States of America (USA), was one of the external examiners in Childhood Studies.

Currently, Kenyatta University offers ECDE degree programs to Kenyans as well as Ugandans, Tanzanians, Somalis, Sudanese, Rwandans and Nigerians. Kenyatta University has served as an example to more than 20 universities in Kenya, while some universities in Uganda and Tanzania (both public and private) currently offer degree courses in early childhood education. All students pursuing degree courses at Kenyan universities are taught basic computer skills.

Early Childhood Development and Education Curriculum in Kenya

Working in collaboration with the Kenya Institute of Curriculum and Development (KICD) and the National Centre for Early Childhood Education (NACECE), the Kenya Ministry of Education developed a curriculum for preschool children (< 3 years – 6 years) in 2006 (Republic of Kenya, 2008). This curriculum was in use at the time the study being reported in this thesis was being conducted. Documented in this curriculum are 11 learning objectives for children in preschools, as indicated below:

1. provide education geared towards development of the child's mental capabilities and physical growth
2. enable the child to enjoy living and learning through play
3. develop the child's self-awareness, self-esteem and self-confidence
4. enable the child to develop understanding and appreciation of his/her culture and environment
5. foster the child's exploration skills, creativity, self-exploration and discovery
6. identify children with special needs and align them with existing services
7. enable the child to build good habits and acquire acceptable values and behaviours for effective living as an individual and as a member of a group
8. foster the spiritual and moral growth of the child

9. improve the status of the child's health, care and nutritional, and link him/her with health services such as immunisation, health check-ups, growth and monitoring
10. enrich the child's experiences to enable him/her to cope better with primary school life, and
11. develop the child's aesthetic and artistic skills.

(Republic of Kenya, 2008, p. 1)

An examination of the above learning outcomes for preschool children reveals that the use of technology is excluded. Currently, the Government of Kenya is working on strategies and initiatives to introduce the use of technology into primary schools, especially into Class (Grade) One. It is questionable how preschool children transiting to primary Class One will cope better with primary school life (see learning outcome number 10 above) and the technology involved when they are not introduced to this experience at preschool level.

Other than the curriculum framework for children aged from 3 to 6 years old, the MoE, in conjunction with KICD and the NACECE, has developed a training syllabus for ECDE pre-service teachers at certificate level. The 15 learning outcomes for these student teachers are:

1. knowledge, skills and attitudes to develop
    i. relevant ECD programs
    ii. child's communication skills
    iii. child's exploration skills, creativity, self-expression and discovery
    iv. individual child's potential abilities
    v. child's sense of citizenship and positive national attitude
2. create activities that foster positive social interaction
3. acquire, adapt and apply technology in teaching and learning activities
4. identify and develop materials using locally available resource;
5. acquire knowledge, skills and attitudes for further education and training
6. develop positive attitude towards moral and religious values
7. develop acceptable social values which underline good human relationship and use them in dealing with children and the community
8. identify and assist children with special needs and provide services required

9. appreciate the rich and varied cultural heritage of the people of Kenya and instil the same to the children
10. develop national and international consciousness for educational excellence
11. develop positive attitudes towards the provision of proper child health, nutrition and care
12. acquire information on proper environmental conservation practices
13. enrich the child's experience to enable him/her to cope better with primary school life
14. enable the child to enjoy learning through play, and
15. adapt to change or new situations.

(Republic of Kenya, 2006c p. 1)

It is important to note that training of preschool teachers at certificate level takes two years and certification is done by the MoE irrespective of the training organisation, that is, public or private institutions (Republic of Kenya, 2006a). The majority of the teachers who practice in ECDE settings are trained at certificate and diploma levels.

In addition to the national ECDE curriculum, Kenya has three independent private curricula for training preschool teachers, namely, the Kindergarten Headmistresses Association (KHA), Montessori and the Islamic Integrated Programme (IIP). Due to these multiple training curricula, individuals aspiring to become preschool professionals can choose their preferred program. All four teacher-training curricula train teachers in play and child-centred approaches to teaching, with hands-on experiences aimed at developing a child holistically (physically, socially, mentally, emotionally, morally and spiritually). The IIP incorporates Islamic values and principles that are taught to children. Potential teacher trainees for all four programs must have completed secondary education as a minimum academic qualification. In addition, those aspiring to train with the IIP must be practicing Muslims.

The Place of Technology in Kenyan Early Childhood Development and Education

Technology is a ubiquitous element of modern global society and embraces all aspects of our daily lives, interactions, various systems, including education. This is reflected in swift changes taking place in the educational sector as well as in the 'economic, political and cultural society in general, known as the Information Society, indeed it has made the world a global village' (Kaindio Wagithunu, 2014, p. 89). Further, new forms of digital technology penetrating our lives are having a profound impact on human activities (Koc & Bakir 2010; Olatoye, 2011) in ways never witnessed before. For instance, they contribute to human activities focused on 'economic production, work and life just as much as with education and training' (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2005, p. 5).

> *The importance of information technology for work demands that people are prepared for it early in life. Therefore, the study of the information technology should be a subject of our education. Moreover, when people get into contact with it early they get used to its properties. For people that have grown up within a digital environment the information technology is no longer a subject of discussion, but a simple fact of life. The society becomes digital, respectively the digital society does no more notice that it is actually digital.*
>
> (Gutmann, 2001, p. 5)

Despite being over a decade old, Gutmann's seminal quote highlights the need to engage with technology at an early age, grow with it and embrace it as part and parcel of life (Gutmann, 2001). In support of this quote, Prestridge (2009) suggests that new forms of technology enable a 'multiplicity of communication channels, where icons, sounds and words together create dynamic texts that are not place or time dependent, and where ICT is considered a pervasive part of our working, cultural, and private lives, change in what and how we do things is accepted as continual and rapid' (Prestridge, 2009, p. 43).

A variety of terminologies are used in the literature when referring to technological resources. These include 'technology' (Kelly, 2014), 'computer technology' (Odera, 2011), 'computers' (Hinostraza, Labbe & Matamala, 2013; Kiarie, Kerich & Ondigi, 2015), 'technological resources' (Ogott & Odera, 2014), 'educational technology' (Manyara, Amunga & Ondigi, 2015) and 'information and communication technology' (ICT) (Andiema, 2015; Amuko, Miheso-O'Connor & Ndeuthi, 2015), among others**.** For the purposes of this study, the term 'technology' is adopted and is used to refer to computers, digital cameras, digital video recorders, mobile telephones, document scanners, printers, photocopiers and projectors.

The accelerated advancement in ICT has brought outstanding transformations in the twenty-first century to various spheres of life, including the education sector. A sector of the education system, especially in the western world, currently receiving overwhelming attention on the use of technology is early childhood education. For example, the 2012 joint position statement revising earlier statements by the NAEYC and the Fred Rogers Centre (FRC) for early learning and children's media offers a series of 'principles to guide the effective use of ICT and interactive media in early childhood programs' (NAEYC, 2012, p. 5). Similarly, policy frameworks (see for example Learning and Teaching Scotland, 2003; New Zealand Ministry of Education, 2005) articulate the need to use this innovation in ways that can enhance the quality of teaching and children's learning.

In Kenya, the government recognises the potential role of technology in ECDE. This recognition was first documented in the NECDPF of 2006 (Republic of Kenya, 2006a). In this document, the government provides policy statements on the use of ICT for enhancing communication and interaction among children's service providers, for enhancing the quality and efficiency of children's services in health and education and for supporting, developing and implementing ICT training programs for the above purposes (Republic of Kenya, 2006a).

Additionally, the government's recognition of the potential role of ICT in ECDE is documented in the 2012 expanded policy framework for education and training formulated through the combined efforts of the MoE and the Ministry of Higher Education, Science and Technology (see Sessional Paper No.14 of 2012) (Republic of Kenya, 2012a). This document outlines suggested strategies for implementing ICT in education, including, among others, mobilisation of funding to introduce appropriate technology skills that support children's play and psycho-motor development across all ECDE centres (Republic of Kenya, 2012a). This is further emphasised by the following statement in this Sessional Paper:

> *ICT is a major vehicle for teaching and learning from the earliest years. It is at a very young age that learners begin to acquire digital skills which they increasingly use to explore and exploit the world of information and to craft that into knowledge.*
>
> (Republic of Kenya, 2012a, p. 51)

Even though the Government of Kenya appreciates the role of technology in ECDE through its policy frameworks (Republic of Kenya, 2006a; 2012a), its recent and current innovative activities on use of technology in education are focused more on the primary level. This move was initiated in the inaugural speech to the public by the newlyelected president, His Excellency, Uhuru Kenyatta Muigai. In this speech, the president promised to introduce free laptops in primary education within the first six months of his presidency (Buhere, Oduor & Tanui, 2013).

Once the president had taken office, certain initiatives were put in place towards the 'Uhuru Free Laptop Project' (UFLP) for primary children (Oduor, 2013 p. 2). This included the government's identification of 6,000 primary schools that would pioneer the 'ambitious laptop-for-schools project just six months away' (Oduor, 2013 p. 2) and allocation of 50 billion Kenyan shillings (approximately AU$623,850,000) for standard one laptops (Oduor, 2013, p. 2). This initiative was not extended to preschools as no single preschool in the country was considered for being among the pioneers in the ambitious laptop-for-schools project. Additional strategies aimed at achieving the UFLP include the establishment of a computer supply program targeting 20,229 public primary schools and 4,000 public secondary schools (Republic of Kenya, 2014b).

It is important to note that schools (pre-primary, primary and secondary) in Kenya have been grouped into two main categories, public and private. Public schools are educational learning institutions that are founded and supported by the Kenyan government in a number of ways. These include provision of facilities such as classrooms, offices, kitchens, stores, toilets and play space. In addition, teaching and non-teaching staff in this category of schools are employed and paid either by the government or schools' boards of directors in collaboration with parents. Student tuition fees in these schools are subsidized by the government. Teaching, learning and examination are implemented according the Kenyan official educational curriculum and guidelines.

On the other hand, private schools in Kenya are funded and managed by individuals, groups of individuals, companies, church based organizations and international affiliated organizations. Despite being registered by the Ministry of Education, private schools charge varying student tuition fees. The majority of these schools implement the official national educational curriculum and register students to sit for the national examinations just like their counterparts in public schools. In contrast, few of the private schools implement their own curriculum and examinations.

A range of institutions, including 20 primary teacher training colleges, two diploma colleges, 10 model e-learning centres for adult and continuing education (ACE) and the seven public universities (Republic of Kenya, 2014b), were selected to receive the first sets of computers once they were available. Further, 10 model e-learning centres would serve as examples for adults' use of ICT as they continued learning (Republic of Kenya, 2014b). All these initiatives took place in readiness for the rollout of the Government Digital Learning Program (GDLP).

Again, the focus of these strategies was on primary and secondary schools, primary teacher training colleges, diploma colleges, adult learning centres and universities. Preschool centres and teacher training colleges for preschool educators were locked out of the initiatives outlined above. This suggested that preschool children, their teachers and preschool teacher trainers would not participate in the GDLP rollout. In essence, there is already a divide between Kenya's educational institutions and ECDE regarding initiatives aimed at digital literacy.

In the process of laying down strategies aimed at equipping Kenyan educational institutions, including primary schools with computers, the government realised that most rural public primary schools lacked electricity. It therefore embarked on an electrification process, starting in primary schools in 2013. The government officially launched the National Primary Schools Electrification Program (NPSEP) in 2015 (Rural Electrification Authority, 2015).The electrification activities implemented by the Rural Electrification Authority (REA) involved both grid extensions and solar installations for schools within grid network coverage and in off-grid areas.

Further, REA installed solar photovoltaic systems (PVs) in schools more than five kilometres in areas within grid network coverage (Economic Consulting Associates Ltd. United Kingdom, Trama Tecno Ambiental, Spin, Access Energy, Kenya, 2014; Republic of Kenya, 2013b; Rural Electrification Authority, 2015).

Out of a total of 24,795 public primary schools across Kenya without electricity, 13,733 (55.39%) were electrified by REA in 2013 and a total of 20,975 schools, representing 84.59% of all public primary schools, were to be electrified in 2015 (Republic of Kenya, 2013b; Rural Electrification Authority, 2015).

In summary, while the Kenyan Government is to be applauded for this initiative aimed at digitalising public primary schools, the question at hand is why the ECDE sector was excluded from the National Electrification Program (NEP). While it can be assumed that the preschools attached to primary schools will benefit from this initiative, the question arises as to what will become of the 'stand-alone' preschools that have no electricity. Stand-alone preschools are privately managed children's learning institutions that are not attached to primary schools.

The Research Problem

Early childhood education teachers' beliefs about the use of technology are acknowledged as critical in policy decision-making (Sivropoulou, Tsapakidou & Kiridis, 2009) and in how to utilise technology in professional practice (Ihmeideh, 2010). Although the literature documents various examples of the beliefs held by ECDE teachers about the use of technology in this field, this literature is identified in an international context. There is very little research into ECDE teachers' beliefs about the use of technology in ECDE in the African region, including Kenya. The little research there is includes studies by Abdulai (2013) and Asante (2014) in Ghana, Bose (2009; 2010) in Botswana, Andiema (2015), Kaindio and Wagithunu (2014) in Kenya. This suggests there is inadequate empirical evidence about ECDE teachers' beliefs about the use of technology in ECDE. With minimal empirical evidence on preschool teachers' beliefs about the use of technology in ECDE in African contexts including Kenya, it becomes difficult for policy makers to make decisions about the use of technology in ECDE and the support needed by teachers in this regard.

As mentioned earlier, Kenya's MoE, in conjunction with KICD and the NACECE, has developed a training syllabus for ECDE pre-service teachers at certificate level. Of the 15 learning outcomes listed above, outcomes numbers 3, 13 and 15 respectively expect student teachers to acquire, adapt and apply technology in teaching and learning activities; to enrich the child's experience to enable him/her to cope better with primary school life; and to adapt to change or new situations.

In reference to these three stated outcomes, it is not clear how student teachers could acquire, adapt and apply technology in teaching and learning activities without policy frameworks and training in the same. In addition, upon completion of their training, preschool teachers are expected to enrich the child's experience to enable him/her to cope better with primary school life. In view of this outcome, preschool children are expected to be prepared to cope better with computer technology currently being introduced into primary Grade One in Kenya. Preschool teachers therefore need pedagogical skills and knowledge in technology and its applications. This is often overlooked by the Kenyan Government with its current initiatives on the use of ICT in education more focused on the primary sector.

Nonetheless, although the Government of Kenya does recognise the affordances of technology in ECDE (Republic of Kenya, 2006a; 2012a), it is not clear how this recognition is to be actualised into policy, curriculum and practice. The little research work (e.g. Andiema, 2015; Kaindio & Wagithunu, 2014) on the use of technology in Kenyan preschools was more focused on teachers' perceptions and the forms of digital technology they accessed and used. These studies did not examine policy frameworks informing teachers' access to technologies and ways in which they used the technologies in practice. This demonstrates an empirical gap in policy development, curriculum and teaching practice in how technology is implemented in the Kenyan ECDE system. Hence, there was need for a study of this nature.

There is limited understanding of the professional beliefs held by ECDE teachers about the use of technology in their field. In addition, there are gaps in research literature on the requirements of professional training in technology for teachers in ECDE. Empirical evidence on the availability of policy frameworks/curriculum guidelines informing integration of technology in ECDE is largely absent. Further, in regard to ECDE in Kenya, there are substantial gaps in the research literature in a number of different areas, including how technology is used in everyday teacher practices in preschools, levels of teachers' confidence in using ICT, and the provision of support by stakeholders on the use of the innovation. This study therefore, represents an attempt to extend the research in these areas.

Purpose and Aims

This study investigates and contributes to an understanding of the professional beliefs held by Kenyan early childhood educators about the use of technology in ECDE. It also aims to explore the status of ICT practices in Kenyan preschools. Lastly, the study aims to identify ways in which the professional beliefs of Kenyan ECDE teachers are linked to their everyday practices and pedagogies in their educational settings of practice.

Overall, the multifaceted purposes of this study were guided by three major research questions which emerged from a review of literature. The next chapter, which reviews the literature, further elaborates on the background and rationale for the research questions. The three research questions are:

Research Questions

- Research Question 1: What are the professional beliefs of Kenyan early childhood educators about the use of technology in ECDE?
- Research Question 2: What is the status of ICT practices in Kenyan preschools?
- Research Question 3: In what ways are the professional beliefs of ECDE teachers in Kenya linked to their everyday practices and pedagogies in their educational settings?

As well as providing direction for the selection and creation of suitable data gathering and analysis methods throughout the study, these three research questions have been adopted as overall organisational tools to structure the report of the study's major findings.

Overview of the Project

This study was a three-phase descriptive study employing mixed methods to obtain rich sets of data on preschool teachers' use of technology in ECDE settings in Kenya. An approach premised on elements of a case study was adopted in Phase One, involving 11 preschool teachers in two preschools, one public and one private. These teachers participated in classroom observations and one-on-one interviews with the researcher. Phase One data were collected in 2011. Results from this phase informed the design of data collection instruments for Phases Two and Three, comprising a survey questionnaire and one-on-one interviews with key ECDE stakeholders and other interested parties in Kenya, conducted in 2012.

Rationale and Significance

The rationale behind this study can be described in terms of two important areas: scope and significance. Firstly, this study is significant as it aims to identify professional beliefs held by preschool teachers, stakeholders and other interested parties, comprising ECDE policy makers, ECDE teachers' trainers, at both mid-level colleges and universities.

Early childhood teachers' beliefs about the use of technology have been researched previously (see e.g. Abdulai, 2013; Andiema, 2015; Asante, 2014; Kaindio & Wagithunu, 2014). Nonetheless, this study has so far not identified any research works focusing on ECDE teachers, stakeholders and other interested parties' professional beliefs about the use of technology in ECDE. Early childhood teachers, stakeholders and other interested parties' professional beliefs about the use of technology in ECDE were investigated by this study in order to acknowledge the voice of the three groups regarding the use of technology in ECDE. This would contribute to the existing literature, which lacks research involving all three, namely, preschool teachers, stakeholders and other interested parties.

Secondly, this study is significant in its aim to identify the status of ICT practices in Kenyan preschools. The status needs to be identified in terms of availability of policy/curriculum guidelines on the integration of technology in ECDE; professional training in technology; availability and access to technology; locations for technology resources in ECDE centres; teachers' use of technology in everyday practice. The resulting diversified findings will contribute significantly to the limited empirical evidence currently available (see e.g. Abdulai, 2013; Andiema, 2015) in the African region, including Kenya. In addition, these findings could play an informing role in the design of policy frameworks and curricula, preparation of professional training and the implementation of technology in ECDE teaching and learning environments.

Lastly, this study's significance is related to the research processes adopted to gather, analyse and interpret the study's qualitative and quantitative data. Some of these processes were markedly different from previously conducted belief studies and offer some further options to guide prospective researchers in this field. One of these processes was the use of a digital voice recorder during interviews. The method of collecting quantitative data has also contributed to the internal validity of this study. This study adopted data analysis processes to compare the ECDE teachers' professional beliefs and their everyday practices and pedagogies and hence identify any links between the two variables. These processes represent another significant area of this study and may be utilised in future research studies seeking to identify similar links.

Structure of the Thesis

This study is presented as a traditional thesis, a single manuscript that is organised into eight chapters. This first chapter provides an introduction to this study through a presentation of the background information, the research problem, and the study's purpose and aims expressed as three key research questions. It also gives an overview, rationale and significance of the study. The next chapter (Chapter 2) presents a review of the literature in four major areas: (1) innovation and ICT change in ECDE (2) the Kenyan context (3) research on technology in ECDE in Africa and (4) theoretical framework informing this study. This review is followed by an outline of the research design and methods utilised in this study (Chapter 3). Chapters 4, 5 and 6 present the results of the data gathered for this study. The thesis concludes with a discussion (Chapter 7) of this study's findings, linking the outcomes to the research questions and previous research.

The final chapter (Chapter 8) presents the conclusions arising from this study, as well as documenting some of its limitations.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews literature on information and communication technology (ICT) innovation in Early Childhood Development and Education (ECDE) internationally and the Kenyan context. It also examines research on technology in ECDE in Africa and the theoretical framework informing this study,

ICT Innovation in ECDE Internationally

Integrating new technologies in ECDE processes continue to encounter several challenges. As a result, several, models on technology integration have been designed to guide the innovation. These include diffusion of innovations (DOI) and Apple Classrooms of Tomorrow (ACOT).

Diffusion of Innovations Theory

DOI theory was developed by Mitchell Everett Rogers in 1962 (Rogers, 2003). This theory describes the patterns of adoption and predicts the success or failure of this process. Rogers defined an innovation as 'an idea, practice, or project that is perceived as new by an individual or other unit of adoption' (Rogers, 2003, p. 12). Reflecting on this definition, new forms of technologies could have been in use for several decades, but if individuals perceive them as new, then they may still be innovations for them.

Rogers (2003) described diffusion as the process by which an innovation is communicated through certain channels over time among members of a social system (Rogers, 2003, p. 19). In his theory on the diffusion of innovations, Rogers (2003) outlines five stages that inform technology innovation in educational institutions. These stages are knowledge, persuasion, decision, implementation and confirmation.

According to Rogers (2003), an individual or organisation encounters an innovation for the first time, lacks information about it and is motivated to find information about the new innovation. In the persuasion stage, the would-be user's interest intensifies and the individual or organisation researches further information about the innovation. In the decision stage, an organisation or an individual makes a decision on whether or not to adopt the innovation based on the advantages and disadvantages envisaged. During the implementation stage, an organisation or individual puts the innovation into practice, evaluates its use and may be stimulated into searching additional information about it. In the last, confirmation, stage, the individual or organisation decides whether to proceed with the innovation, to reject its use or to use it to a certain extent.

Further, Rogers (2003) explains the characteristics of innovation that enhance or impede its adoption. These include the relative advantages, compatibility with the existing culture, societal values and norms, experiences and the needs of potential users. Additional characteristics, according to Rogers, include the complexity of the innovation, trainability and how observable the outcomes are to the public.

Rogers (2003) describes five categories of innovation adopters in a social system. These include the innovators themselves – individuals who immerse themselves in the innovation and stand out in the crowd. Rogers describes the second category as ‘early adopters’ with great interest in an innovation; the third group as ‘early majority’ – they take a long time to adopt an innovation; the fourth group as ‘late majority’ – they approach an innovation with lots of question marks; and lastly, the fifth group, referred to as ‘laggards’, influenced and persuaded by family members, friends or colleagues to adopt an innovation but are usually sensitive on how to go about it.

Nonetheless, DOI theory has been criticised as ‘a descriptive tool which is less strong in its explanatory power and less useful still in predicting outcomes and providing guidance as to how to speed up the adoption rate of innovation’ (Opati, 2013).

Apple Classrooms of Tomorrow (ACOT)

The Apple Classrooms of Tomorrow project was developed in the 1980s in five public schools in the United States through a partnership between universities, public schools and Apple Computer, Inc. (Ringstaff, Yocam & Marsh, 1997; Dwyer, Ringstaff & Sandholtz, 1991). The project aimed to help high school students succeed in academic endeavours and later in life. ACOT was informed by six design principles for the 21st century high school. These included understanding of 21st century skills outcomes, relevant and applied curriculum, informative assessment, a culture of innovation and creativity, social and emotional connections with students and ubiquitous access to technology (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997).

The first principle documents the need for educators, students, and parents to be conversant with the 21st century skills that students need to acquire to be successful. This principle also emphasises the need for teachers to rethink what to teach before rethinking how to teach and, at the same time, how to evaluate students' learning progress (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997).

The second principle specifies the need for a curriculum with an innovative vision of what the learning environment should look like and application of appropriate methodologies that cater to students' needs (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997). The role of informative assessment of students' learning skills in the 21st century and students' role in evaluating their own learning is documented in the third principle (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997). In the fourth principle, schools are expected to create a culture that supports and articulates innovation for student learning (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997).

Personal, professional and familial relationships that enhance the holistic development of children within the family, school and community are identified in the fifth principle (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997). Lastly, the sixth principle documents students' and educators' ubiquitous access to technology that enables them to research, communicate and collaborate (Ringstaff, Yocam & Marsh, 1997; Sandholtz, Ringstaff & Dwyer, 1997).

International Society for Technology in Education (ISTE) for Students

Building on the ACOT is the International Society for Technology in Education. The ISTE standards for students (ISTE, 2016) were initiated for the purpose of promoting learning for American students in the future. It involved stages whereby, in 1998, ISTE'sfocus was on students' learning to use technology. In 2007 the emphasis was on students using technology to learn and transformative learning with technology was reinforced in 2016 (ISTE, 2016).

The 2016 ISTE standards for students aim to incorporate students' voice in their design and ensure that learning is student-centred (for instance involving knowledge mining processes, creativity, and discovery). Acquisition of foundational technology skills by both students and teachers is critical in application of the standards. These standards are focused on 7 areas which students are expected to master for effective learning in the future. They are:

- empowered learner: students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences;
- digital citizen: students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical;
- knowledge constructor: students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others;
- innovative designer: students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions;
- computational thinker: students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions;
- creative communicator: students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals; and
- global collaborator: students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally

(ISTE, 2016)

International Society for Technology in Education (ISTE) for Teachers

In an earlier model, ISTE designed five standards and performance indicators for teachers in the USA (ISTE, 2008). These standards include:

- facilitate and inspire student learning and creativity: teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments;

- design and develop digital age learning experiences and assessments: teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the Standards;
- model digital age work and learning: teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society;
- promote and model digital citizenship and responsibility: teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices; and
- engage in professional growth and leadership: teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

(ISTE, 2008)

Apart from the four models described above, Plumb and Kautz (2015) suggest a tri-perspective analysis model. This model focuses on information technology (IT) appropriation within an early childhood education and care organisation. It comprises three dimensions, including individualistic, structuralist and interactive processes. The authors explain the individualistic dimension in terms of decision-making and goal setting at individual level. At this level, characteristics such as age, gender, educational level and personality are of paramount importance (Plumb & Kautz, 2015).

Plumb and Kautz relate the structuralist dimension to organisational characteristics such as size, task structure and centralisation of power, which they view as influencing innovation. The dimension recognises an organisation’s goals, including survival, and identifies stakeholders, competitors and government policy as structural elements that influence the innovation (Plumb & Kautz, 2015).

The interactive process considers ‘innovation as a dynamic, continuous phenomenon of change, produced by the continuous interaction of individuals and the structural influences over time' (Plumb and Kautz, 2015, p. 2). Three elements included in the interactive process are:

1. *The content of an innovation (the 'what'), be it a product or a process, is perceived subjectively and is subject to ongoing reinvention and reconfiguration.*
2. *The context of an innovation (the 'why') is subdivided into inner context: the structure, corporate culture, and political context within the organization; and outer context: the social, economic, political, and competitive environment.*
3. *The process of innovation (the 'how') refers to the actions, reactions and interactions from the various interested parties as they seek to move the organization from its present to its future state.*

(Plumb and Kautz, 2015, p. 4)

In addition to models, the National Association for the Education of Young Children (NAEYC), the oldest professional organisation for early childhood educators in the world, was one of the first to recognise the importance of having a policy framework on the integration of technology in early childhood settings to guide practitioners. The 2012 joint position statement revising earlier statements by the NAEYC and the Fred Rogers Centre (FRC) for early learning and children's media responded to concerns about young children's access to technology and screen media in early childhood programs. The statement provides guidance to American educators in ECDE programs who work with children from birth through to age 8.

The statement stated above also offers a series of 'principles to guide the effective use of technology and interactive media in early childhood programs' (NAEYC, 2012, p. 5). The position statement also presents six recommendations for the active and passive use of technology in ECDE teaching and learning. The statement recognises that teachers can take a leadership role in supporting both children and families in the adoption and use of technologies in the early years. The document goes on to conclude the importance of providing support and professional development for educators to embrace technology in ECDE settings and emphasises the value of ongoing research to better understand effective and appropriate uses of technology during early childhood (NAEYC, 2012, p.12).

Countries such as Australia and New Zealand have attempted to provide policy directions through their national curriculum frameworks. For instance, in the case of Australia, the national Early Years Learning Framework (EYLF) (Australian Government

Department of Education, Employment and Workplace Relations for the Council of Australian Governments, 2009) makes reference to the use of technology in early childhood settings, particularly in Outcomes 4 ('Children are confident and involved learners', (p. 37) and 5 ('Children are effective communicators', (p. 39). Within these outcomes, technology integration is mentioned in the specific examples: 'Children resource their own learning through connecting with people, place, technologies and natural and processed materials' (p. 37), and 'Children use information and communication technologies to access information, investigate ideas and represent their thinking' (p. 39).

An important point emphasised in the above frameworks is the need to use technology in ways that enhance the quality of teaching and learning. This also means enabling teachers to manage their work in more effective and efficient ways through using technology (Australian Education Union, 2007; New Zealand Ministry of Education, 2005).

For instance, the New Zealand Government emphasises the importance of using varied technologies that are not only developmentally appropriate in addressing the needs of children in goal-oriented ways. These technologies are also informed by New Zealand's early childhood education (ECE) technology framework and its early learning principles (New Zealand Ministry of Education, 2005). One special feature about this policy is the emphasis on involving children, educators and parents in technology-related activities, 'including communication about and reflection on that learning' (New Zealand Ministry of Education, 2005, p. 2).

Similarly, the Scottish ICT policy framework for early years provides guidelines on the use of technology in enhancing and supporting the development and learning of children aged three to five years (Learning and Teaching Scotland, 2003). The principles underpinning the Scottish technology policy framework were informed by the principles set out in their national curriculum framework for children in this age group that include (a) the best interests of the child, (b) the central importance of relationships, (c) the need for all children to feel included and (d) an understanding of the ways in which children learn (Learning and Teaching Scotland, 2003).

The Scottish policy also suggests the need to move beyond desktop computers by incorporating a broad range of needs-based technologies (for instance, video cameras, mobile telephones and audio cassettes) in children's everyday experiences (Learning and Teaching Scotland, 2003). These suggestions are similar to those documented in the New Zealand policy, reinforcing the need to provide children with various technologies and not only computers (New Zealand Ministry of Education, 2005).

Within this study, this examination of policy internationally is relevant as it explores key concepts in relation to technology use and presents an overview of international issues. The following section focuses more directly on the Kenyan context.

The Kenyan Context

Kenyan Early Childhood Development and Education Policy Frameworks

The Kenyan Sessional Paper No. 1 of 2005 on a policy framework for education, training and research resulted in the development of a comprehensive national ECDE policy framework (Republic of Kenya, 2006a) and service standard guidelines (Republic of Kenya, 2006b). The policy framework provides coordination mechanisms and defines the roles of all service providers, including educators, various ministries (health, education, office of the President, etc.), parents, stakeholders and other interested parties (Republic of Kenya, 2006a). Working with the policy framework are the service standard guidelines that provide specific guidelines on coordinated service provision for children in terms of quality, accessibility, relevance and equity (Republic of Kenya, 2006b).

In previous years, children in Kenya could enrol in Grade One at age 6 and above without first going through preschool education. Currently, according to the Constitution of Kenya (Republic of Kenya, 2010), each and every child is required to obtain preschool education before enrolling in Grade One. This development suggests the government's recognition of early childhood education in terms of its foundational role. Premised on this recognition, a number of policy instruments and strategies have been initiated aimed at improving the quality of services provided to children in Kenya. According to Kang'ethe, Wakahiu and Karanja (2015), the Kenyan 'developers of the ECD policy framework recognised the critical role of investing in young children as a strategy for poverty reduction, universal school enrolment, reduction of child mortality and morbidity, maternal mortality and creation of gender equality' (p. 80).

In recent years, the Kenyan government has been making attempts to align its education sector with the requirements of the Constitution of Kenya (2010) and the Kenya Vision 2030. The Constitution (Republic of Kenya, 2010) is a legal policy framework, a Bill of Rights for every child aged 4 to 17 years to attend school and receive a quality education, and according to which, this responsibility is to be undertaken by the government (Republic of Kenya, 2015). The right of access to quality and relevant education that will enable all Kenyan children to fulfil their potential and realise opportunities for employment is also articulated in Kenya's Constitution of 2010. The Constitution recommends a child-centred, broad and relevant curriculum with adequate resources, the implementation of which should be monitored by responsible professionals (Republic of Kenya, 2010).

A new development policy blueprint, the 'Kenya Vision 2030', aims to develop the nation as an industrialized, middle income country that provides a high quality life for all its citizens by the year 2030. The vision is nested within three pillars that include economic, social and political aspects in Kenya (Ang'ondi, 2013; Republic of Kenya, 2007; Kinuthia, 2009). In order to achieve this vision, the government of Kenya acknowledges that a technology "literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy by the year 2030" (Republic of Kenya, 2012a, p. 51). Given this kind of understanding, the government of Kenya has identified the education system as a springboard for furnishing Kenyans with technology skills for the purpose of creating "dynamic and sustainable economic growth" (Republic of Kenya, 2012a, p. 51).

At the same time, Kenya's Vision 2030 advocates a connection between education and the labour market through the creation of:

> *... entrepreneurial skills and competences; and strong public and private sector partnerships, and development of a middle-income country in which all citizens will: have embraced entrepreneurship, be able to engage in lifelong learning, perform more non-routine tasks, be capable of more complex problem-solving, be able to take more decisions, understand more about what they are working on, require less supervision, assume more responsibility, and as vital tools towards these ends, have better reading, quantitative reasoning and expository skills.*
>
> (Republic of Kenya, 2012a, p. 1)

In order to align the education sector with the 2010 Constitution and Vision 2030 (Republic of Kenya, 2012a; 2014a; 2015), the Government of Kenya has produced several legal and policy frameworks. These include Sessional Paper No. 14 of 2012, focusing on reforming education and training from ECDE to university, using a sector-wide approach (Republic of Kenya, 2012a); the Basic Education Act of 2013, which actualises the provision of free and compulsory basic education (preschool, primary and secondary) (Republic of Kenya, 2013a); the Kenya Institute of Curriculum Development (KICD) Act of 2012, which ensures that curricula and support materials conform to Kenyan standards and values (Republic of Kenya, 2012b); the Kenya National Examination Council (KNEC) Act of 2012 (the Council is responsible for setting and maintaining examination standards and certification values) (Republic of Kenya, 2012c), and the Teachers' Service Commission (TSC) Act of 2012 (the TSC is responsible for recruiting and employing primary and secondary teachers) (Republic of Kenya, 2012d).

As the structure responsible for national early childhood education, Kenya's Ministry of Education (MoE) policy focuses on providing a child-centred educational curriculum. This curriculum is geared towards developing a child in a holistic manner (physically, socially, cognitively, creatively, emotionally and spiritually) (Republic of Kenya, 2008a). It also advocates children living and learning through play and preparation for primary education. The ministry's focus on developing a child holistically through integrated programs is further reinforced in the Basic Education Act, No. 14 of 2013 Article 58. This article emphasises the need to 'facilitate the development of children's affective, cognitive, psychomotor and physical attributes in an integrated manner including the development of talented and gifted pupils' (Republic of Kenya, 2013a, p. 243).

Through the policy framework guidelines for ECDE (Republic of Kenya, 2006b), the Ministry of Education categorises ECDE children as follows: play group (6 months to 2 years); baby class (3 years), pre-primary one (4 years), and pre-primary two (5 years); grade one (6 years), grade two (7 years) and grade three (8 years) (p. 2).

The guidelines also indicate government requirements for serving as a teacher in preschool. These include being above 18 years of age; possessing at least a certificate as a preschool teacher offered by the government or other government-authorised institution;

having a genuine concern for the well-being of young children; using development progress assessment tools; using primary school readiness assessment tools to monitor the progress of individual children and for transition to grade one; and having good communication skills with children, parents and other members of society (Republic of Kenya, 2006b, p. 10).

The Government of Kenya acknowledges the importance of having professionally qualified teachers working as care-givers and teachers of young children (Republic of Kenya, 2006b). In view of this, the Ministry of education offers training aimed at developing teachers who are professionally competent in stimulating and sustaining healthy growth and development of young children (Republic of Kenya, 2006c). Also, teachers are trained in planning appropriate learning environments and working closely with parents and the community (Republic of Kenya, 2006c). In order to achieve these aims, the Ministry of education, in collaboration with the KICD, has developed curriculum guidelines for training preschool teachers both at certificate (Republic of Kenya, 2006c) and diploma levels (Republic of Kenya, 2006d).

A two-year certificate course aims to equip preschool teacher trainees with the basic approaches, knowledge, skills and attitude required in promoting the physical, emotional, social, intellectual, spiritual, moral and cultural development of children (Republic of Kenya, 2006c). Upon completion of the course, the teachers are expected to cater effectively to the needs of all children (Republic of Kenya, 2006c). They are also required to relate well to other personnel and provide parents with appropriate advice in matters related to their children's growth, development and learning (Republic of Kenya, 2006c). Further, trained teachers are expected to be skilled in identification of children with special needs and make informed decisions on interventions (Republic of Kenya, 2006c).

The certificate course has 24 units. These focus on administration and management of ECDE; child growth, development and psychology; health nutrition and care; ECDE curriculum; instructional and learning approaches; children with special needs; guidance and counselling; English and Kiswahili; language, mathematics, science, social environmental, music and movement activities; creative, physical, general knowledge, religious education, material development, research, community development; child rights and child protection; and teaching practice (Republic of Kenya, 2006c, p. 2). However, none of these units focuses on the use of technology resources in professional practice.

The diploma course also takes two years to complete and is open to teachers practicing in both preschools and primary schools. There are 22 units in the syllabus guidelines for training teachers at diploma level, including philosophical, sociological and historical foundations of ECDE; general psychology; curriculum development; children's growth, rights, development and protection; general methods of teaching young children and material development; language, mathematics, music and movement, science, physical and psychomotor activities; research, monitoring and evaluation; pre-adolescent and adolescent development; social studies and creative activities; health, nutrition and care; children in need of special protection; guidance and counselling; community development; personality development; training and management of ECDE programs, and teaching practice (Republic of Kenya, 2006d, p. 4). Again, none of these units focuses on the use of technology in professional practice.

Through the pedagogical content in both curricula, trainee teachers are introduced to various approaches to teaching young children, including teacher-centred, child-centred, child/instructor interaction (eclectic), thematic and integrated (holistic), play exploration and discovery. There is also peer teaching, individual and group teaching, and video programs (Republic of Kenya, 2006c). The content in the two curricula suggests that teachers be trained in how to develop relevant, cost-effective and durable instructional materials for use in teaching and children's learning (both indoor and outdoor), such as concrete materials (real objects), pictures, models, crayons, charts, flash cards, plasticines, audio-visual and play equipment (Republic of Kenya, 2006c). The need to prepare and use professional documents, including syllabi, schemes of work (programs of activities for a whole term), lesson plans (daily programs of activities) and timetables are reinforced equally in the two trainings (Republic of Kenya, 2006d).

At the implementation stage in ECDE classes, teachers are guided through syllabi on how to use instructional assorted materials, including crayons, charcoal, chalk, stones, sticks, pencils, papers, slates, brushes, containers, magazines, newspaper, glue, plasticine, clay and pictures (Republic of Kenya, 2008b). Other than the curriculum and syllabi, teachers' use of instructional materials is also supported by the Constitution of Kenya, 2010 (article 11 (2) (b) and (c)), emphasising the need to use science and indigenous technologies in the development of the nation.

In terms of ECDE administration in Kenya, the country has been divided in recent years into 47 counties, transiting from a centralised to a devolved system of government (Murungu, 2015), such that, at the time of researching and writing this thesis, the ECDE is administered and managed by the 47 devolved county governments. According to Murungu, policy challenges experienced in devolving ECDE to county level include teacher management, access to ECDE in neighbourhoods, including shops, under trees and even in people's homes; quality and standards, teacher education, the ICT component, children with special needs, centre management boards, enforcement of policy frameworks, and the appointment of professionals (Murungu, 2015).

Kenya's ICT in Early Childhood Education Policy Frameworks

Prior to 2006, ICT issues in Kenya were addressed by a number of legislative frameworks, including the Science and Technology Act, cap. 250 of 1977, the Kenya Broadcasting Corporation Act of 1988 and the Kenya Communications Act of 1998 (Republic of Kenya, 2006e). All these frameworks were criticised for being 'inadequate in dealing with issues of convergence, electronic commerce and e-Government' (Republic of Kenya, 2006e, p. 4).

Consequently, the Kenyan national ICT policy was formulated by the Ministry of Information and Communications in 2006 (Republic of Kenya, 2006e), with a mission to improve 'the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services' (p. 1). The four guiding principles of this policy include infrastructure development, human resource development, stakeholder participation and appropriate policy and regulatory framework (Republic of Kenya, 2006e, p. 2). In regard to infrastructure development, the government planned to provide energy, roads, develop software and promote local manufacture of ICT equipment (Republic of Kenya, 2006e, p. 2). Similarly, human resource development to be achieved through ICT included quality teaching and learning in educational institutions, including primary, secondary, tertiary and community levels (Republic of Kenya, 2006e, p. 2).

Prior to the adoption of a national ICT policy, the government identified, through Sessional Paper No. 1 of 2005 (Republic of Kenya, 2005), benefits that would result through integrating ICT into teaching and learning, particularly in primary and secondary schools. According to the government, these benefits included student-centred teaching, student-to-student communication, collaboration and greater opportunities for multiple technologies delivered by teachers. Additional benefits included greater enthusiasm for learning among students and access to a wider range of courses (Republic of Kenya, 2005, p.32).

A newly-developed policy blueprint, the 'Kenya Vision 2030', aims to develop the nation as an industrialised, middle-income country that provides a high quality life for all its citizens by the year 2030. The vision rests on three pillars that include economic, social and political aspects (Ang'ondi, 2013; Government of the Republic of Kenya, 2007; Kinuthia, 2009). In order to achieve this vision, the government acknowledges that a 'technology-literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy by the year 2030' (Republic of Kenya, 2012a, p.51). Given this kind of understanding, the government of Kenya has identified the education system as a springboard for furnishing Kenyans with technology skills for the purpose of creating 'dynamic and sustainable economic growth' (Republic of Kenya, 2012a, p. 51).

An expanded policy framework, Sessional Paper No. 14 of 2012 for education and training, was formulated through the combined efforts of the Ministry of Education focused on reforming education and training for every level in Kenya. Through this framework, the government acknowledged that 'an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy by the year 2030' (Republic of Kenya, 2012a, p. 51). In the same framework, the government planned to 'make education the natural platform for equipping the nation with ICT skills in order to create dynamic and sustainable economic growth' (Republic of Kenya, 2012a, p. 51). In order to address this policy statement, the government has documented several guidelines in the Sessional Paper:

> *Requirements that all teachers and education managers are ICT literate by 2015 and e-curriculum is in place by the same period; ensure the acquisition of ICT competencies to pre-service teacher trainees; integrate ICT into every aspect of education and training across the sector, including the management thereof; establish partnerships for the development of ICT platforms and digital content in all subjects across the education and*

training; develop a national capacity for curricula design in all education and training to facilitate the use of ICT in service delivery; collaborate with relevant ministries to ensure that all learning institutions, schools (primary and secondary) have access to electricity, are connected to the worldwide web and provided with ICT equipment by 2020; and integrate ICT into its own financial and information management systems across the education sector

(Republic of Kenya, 2012a, p.51)

An explicit recognition of the use of ICT in ECDE is documented in the previously-mentioned Sessional Paper No. 14 of 2012. In this policy paper, the government suggests that the use of ICT in preschools could enhance teaching and learning, enable children to master ICT literacy skills for the acquisition of knowledge, to access learning resources and to communicate and collaborate during learning. It states:

ICT is a major vehicle for teaching and learning from the earliest years. It is at a very young age that learners begin to acquire digital skills which they increasingly use to explore and exploit the world of information and to craft that into knowledge. ICT facilitates the opportunity for more student-centred teaching, more self-learning and more peer teaching. It also provides greater opportunity for teacher-to-teacher, and student-to-student communication and collaboration and access to the worldwide web and the learning resources contained thereon.

(Republic of Kenya, 2012a, p.51)

In the same paper, the government suggests the need to mobilise funding for the introduction of appropriate technology skills that support children's play and psychomotor development across all ECDE centres in Kenya. At the same time, the government identified the lack of an ICT curriculum at ECDE and primary levels as one of the challenges to including innovation in education (Republic of Kenya, 2012a).

Similarly, through a national ECDE policy framework (Republic of Kenya, 2006a), the government identified several challenges resulting from lack of appropriate communication mechanisms among ECDE service providers. These challenges included hindrances to service (health and education) delivery systems for all children (including those with special needs) and families, including vulnerable and marginalised communities (Republic of Kenya, 2006a). In order to address these challenges, the government created policy statements outlining the use of ICT for effective communication to enhance interaction among organisations, programs and children's service providers; the use of ICT to enhance the efficiency and quality of children's services in health, education and special needs education, and the use of ICT to support training programs in ICT to enhance efficiency in providing quality health and education services for young children in vulnerable and marginalised communities (Republic of Kenya 2006a, p. 34).

Further, a number of course objectives on technology were documented in the syllabus for training preschool teachers at certificate level. These included trainees' acquisition of information relevant to ECDE programs; identification and development of materials using locally-available resources; identification and utilisation of local resources that would promote social-economic development; being aware of and appreciating the role of technology and industry in national development, and acquiring, adapting and applying technology in teaching and learning activities (Republic of Kenya, 2006c p. 9). Notably, one of the course objectives in the syllabus for training preschool teachers at diploma level aims to equip trainees 'with knowledge and skills in developing and utilising ECDE instructional materials and strategies for ECDE programmes' (Republic of Kenya, 2006c, p. 10).

During teaching and learning in preschools, in-service teachers are provided with government guidelines, handbooks and syllabi in which specific instructional materials for children aged 3 to 6 years old are outlined. These materials include seeds, flowers, leaves, pieces of wood, sticks, clay, chalk, chalkboard, easel board, crayons, glue, cut-out shapes, brushes, paint and cut-out numbers; papers, flash cards, charts, feathers, pencils, scissors, sand, containers, beads, picture books, photographs, models, magazines and newspapers (Republic of Kenya, 2008a, p.16). They also include scales, coconut shells, the alphabet, brushes, dolls, zip fasteners, buttons, strings, harmless insects, bean bags, balls, ropes, beams, boxes and plasticine (Republic of Kenya, 2008b, p. 22).

Research on Technology in ECDE in Africa

Teachers' Attitudes

Chen and Chang (2006) are of the view that early childhood teachers' perceptions about the use of technology resources are important both in informing policy and for planning support. In support of this view are Sivropoulou, Tsapakidou and Kiridis (2009), who reinforce the need to examine early childhood teachers' perceptions about ICT, since these perceptions serve as a critical factor during decision-making on policies aimed at introducing ICT to ECDE settings.

A review of studies across the African region, including Ghana (Asante, 2014), Botswana (Bose, 2009; 2010) and Kenya (Andiema, 2015; Kaindio & Wagithunu, 2014; Mwololo, 2009; Mwololo, Koech & Begi, 2011; Waigera & Begi, 2015) reveals that limited research has been conducted on early childhood teachers' attitudes to the use of digital technologies in ECDE settings.

The limited research evidence indicates that preschool teachers in both Ghana and Botswana were positive about the use of ICT in ECDE. Exploring these research studies in detail, the Asante (2014) study, involving 250 preschool teachers, investigated the status of ICT use in early childhood education in Ghana. Participating teachers were positive about the role of ICT in ECDE. More specifically, Asante reports that 97% of the teachers indicated that it was good for children in Ghana to be introduced early to ICT to enable them to fit in to the technological world.

Furthermore, some teachers in the Asante study were of the view that ICT had a role to play in the early childhood teaching and learning environment. These teachers raised the following arguments: children needed to know about the computer because that was the order of the day; integrating ICT in education stimulated the learning process; ICT was used because pupils understood concepts best when they were given the right opportunity to understand them better, something that ICT tools could offer; ICT provided a pathway to enhance and add value to children's learning; the camera helped children see and understand concepts better, since photos of concepts could be taken and make ideas clearer (Asante, 2014, p. 1755).

However, even though most of the ECDE teachers (97%) in Asante's study were positive about the use of ICT in ECDE, a few participants (3%) felt it was not right for the children to be introduced to ICT at that age. These participants expressed concerns about risks, dangers and safety issues associated with introducing ICT to young children at an early age. Asante reports that this group of teachers also expressed the fear that children could be exposed to inappropriate behaviours in some programs on the Internet.

In the Botswana study, Bose (2009; 2010) assessed early childhood teachers' perceptions about the use of ICT in ECDE settings. Teachers participating in this study were positive about the use of ICT in ECDE, believing that the innovation was necessary in the teaching and learning process and also for children's cognitive, social, communication, creative, physical and emotional development and in terms of their respect for others.

The few studies conducted in Kenya found that teachers in ECDE settings possessed a positive attitude towards the use of instructional media devices in teaching and children's learning (Mwololo, 2009), the use of visual media in instruction delivery (Mwololo, Koech & Begi, 2011), the use of culturally-relevant instructional materials (Waigera & Begi, 2015) and the use of ICT in teaching and learning (Andiema, 2015). However, the teachers participating in the Kaindio and Wagithunu (2014) study expressed negative attitudes towards the use of ICT in ECDE. Each of these studies is examined in detail in the following section.

Mwololo (2009) revealed that preschool teachers had a positive attitude towards the use of instructional media devices in teaching and children's learning. Building on that earlier study, Mwololo, Koech and Begi (2011) also found that preschool teachers had an overall positive attitude towards the use of visual media in instruction delivery. Further, these researchers noted that both trained and untrained teachers had very favourable attitudes towards instructional visual media. Although they found that the trained teachers were more 'homogenous' (p. 101) in their attitude compared to their untrained counterparts, they found no significant differences between the trained and untrained teachers in their positive attitudes towards instructional visual media.

A similar but more recent study by Waigera and Begi (2015) sought empirical evidence on the determinants of Kenyan preschool teachers' use of culturally relevant materials in instruction. The authors found that both private and public preschool teachers had a positive attitude towards culturally relevant instructional materials. Further, using Pearson's correlation coefficient, this study found that preschool teachers' attitude towards culturally relevant instructional materials was related to their use of such materials. The authors concluded that 'attitude towards culturally relevant instructional materials was a very important factor in the use of culturally relevant materials in teaching' (p. 513).

A study by Andiema (2015) found that all the participating teachers (100%) (n=363) held positive attitudes, perceiving ICT as a tool that supported and enhanced their knowledge and skills in teaching, made learning more effective, made it easier to prepare course materials, enhanced communication, made effective use of class time and increased teachers' opportunities.

In contrast, 71% of the preschool teachers (n=52) taking part in the Kaindio and Wagithunu (2014) study had unfavourable attitudes towards the use of ICT in the ECDE curriculum, especially in teaching and learning; this group of teachers disagreed that ICT increased children's interest in learning and prepared them for the primary 'one lap top program'. In their conclusion, Kaindio and Wagithunu suggest that 'the attitudes of the stakeholders need to change before the introduction of ICT in preschool, for the government expects their support' (p. 99).

These studies reveal that very little has been done in the African region, including Kenya, on early childhood teachers' attitudes about the use of technology resources in ECDE settings. This being the situation, this study also considered research conducted in non-ECDE educational levels, focusing on educators' perceptions about the use of technology resources.

Despite this lack of research in the African region, including Kenya, on preschool teachers' attitudes towards the use of technology, the majority of the participants in these studies were positive about it. It is also important to note that a similar trend was identified in the literature review among educators in non-ECDE education institutions. For instance, Mudasiru and Modupe (2011) report on Nigerian secondary teachers' positive attitudes towards the use of ICT for their affordance in enhancing the learning experience. Additionally, secondary school teachers in Tanzania were found to possess positive attitudes about ICT, perceiving it as a tool for the teaching and learning processes (Kafyulilo, 2014) and general pedagogical processes (Ndibalema, 2014). Likewise, secondary teachers in Rwanda felt ICT was an effective teaching tool (Akinyemi, 2015).

At the primary school level, Lufungulo (2015) identified positive attitudes held by primary school teachers towards the use of ICT in teaching and learning. In contrast, a finding by Ngololo, Howie and Plomp (2012) (n=137) indicated that the majority of secondary teachers (70.8%) in Namibia had a negative attitude towards the general use of ICT.

In the case of Kenya, researchers targeting the use of technology in non-ECDE educational levels have found that teachers in secondary schools have positive attitudes towards the use of ICT in teaching and learning (Ayot, Ogembo & Twoli, 2015; Muthomi, Mbugua & Githua, 2012; Sulungai, Toili & Amadalo, 2011; Kiarie, Kerich & Ondigi, 2015; Omollo, Indoshi & Ayere, 2013; Murithi & Indoshi, 2011; Osodo, Indoshi & Ongati, 2010) and in instructional training by tutors in training colleges for primary teachers (Omariba, Ondigi & Ayot, 2015).

While some secondary teachers in Namibia were found to hold a negative attitude towards the general use of ICT (Ngololo, Howie and Plomp, 2012), a review of research literature focusing on the Kenyan context did not reveal a similar trend. However, it is important to note that a review of research literature found no research into Kenyan primary teachers' attitudes towards the use of technology at their level of practice. This is surprising, given the recent policy documents crafted on the use of ICT in the Kenyan education system (see e.g. Republic of Kenya, 2012a) and the ongoing budgeting and expenditure initiatives (for instance, rural electrification) aimed at digitalising the primary schools.

Survey of Technology Resources

The paucity of research in the African context, including Kenya, has focused on the types of ICT resources accessed and used by ECDE teachers. Abdulai's study (2013) was conducted in Ghana, while two studies took place in Kenya.

Abdulai's study found that ECDE teachers in Ghana accessed and used computers, digital/video cameras, telephone/fax machines, programmable toys and projectors. On the other hand, the two studies conducted in Kenya reported that ECDE teachers accessed computers (Kaindio & Wagithunu, 2014) and assorted software resources, including word processors, spread sheets, computer aided instruction software, presentation software, web browsers (Netscape, Explorer) as well as hardware comprising instructional films (videos, CD, VCD, flash disks), keyboards, mouse, LCD projectors with external speakers (Andiema, 2015). Although Andiema's study claims preschool teachers accessed and used the listed assorted software, it is not clear how they accessed and used these resources without computers. A review of this study revealed no mention of the computers. Additionally, the study did not clarify any specific ways in which teachers used the assorted software in practice.

Considering one of these studies in more detail, Abdulai' s (2013) research, involving 44 preschool teachers in ECDE settings, utilised a mixed-method research approach consisting of questionnaire, field visits and observations. The main purpose of this study was to determine the place of ICT in early childhood education in Ghana. As part of the analysis process in this study, the ICT resources used in Ghanaian preschools were grouped into the following five categories: computers (desktop, laptops), digital/video cameras, telephone/fax machines**,** programmable toys and projectors. These technologies were also grouped into two additional categories, namely, functioning and non-functioning.

In terms of functionality, the Abdulai study reported that 19 out of 26 computers identified in the study preschools, one out of three digital/video cameras, five out of eight telephone/fax machines; none of the three programmable toys identified and four out of seven projectors were functional. Based on these findings, Abdulai concluded that the preschools in Ghana under study were under-resourced in regards to availability of ICT resources**.** Table 2.1 presents a summary of the ICT resources availed in Ghanaian preschools.

Examining frequency of use (Table 2.1), Abdulai reported that 18.2% of the participating ECDE teachers indicated they used computers every day, while 27.3% said they used computers once a week; 13.6% stated they used computers once a month and 40.9% responded they never used computers in their teaching. Additional findings in the Abdulai study reveal that all 25 teachers indicated they never used programmable toys and 2.3% never used projectors in their teaching practice. The study did not document why this group of teachers did not use projectors in their teaching.

In his overall conclusion, Abdulai remarked, 'lesson notes, research, and evaluation as well as other classroom activities are still done in the traditional ways of paper and pencil practice' (p. 12) in Ghanaian preschools.

Due to scanty empirical evidence on the types of ICT resources accessed and used by ECDE teachers in the African region, including Kenya, studies into the types of ICT resources accessed and used by teachers in non-ECDE educational institutions and mostly secondary schools have been incorporated in this literature review, due to their contextual relevance. Contextual relevance will continue to be applied to additional areas reviewed and presented in this chapter**.** Notably, this study has not been able to identify any systematic research into the use of ICT in the primary level of education in the African region.

Table 2.1

A Summary of ICT Resources in Ghanaian Preschools

ICT Resources in Ghanaian preschools	Functional	Non-Functional
	Frequency	Frequency
Computers (desktop, laptop)	19	7
Digital/video cameras	1	3
Telephones/fax machines	5	3
Programmable toys	-	3
Projectors	4	3

Furthermore, a review of empirical literature has highlighted the paucity of research into the types of ICT resources accessed and used by teachers in primary schools in Africa. Several studies found teachers (n=231) in Ghanaian secondary schools accessed and used computers, printers, overhead projectors and the Internet, ICT software including word processing, spread sheets, presentation software, database and instructional software (Buabeng-Andoh, 2012). In Tanzania, secondary teachers (n=29) were found to be accessing iPods, mobile telephones, digital cameras, computers (PC or laptop), radios and audio equipment such as MP3, and television sets (Kafyulilo, 2014).

In relation to Ghanaian secondary teachers' levels (based on five-level Likert scale) of technology use, Buabeng-Andoh identified these levels as follows: computers (mean = 1.84), Internet (mean = 1.80), printers (mean = 1.50) and overhead projector (mean = 1.38). The overall mean score, as reported by the Buabeng-Andoh study, was 1.63 and the overall standard deviation was 0.82. Based on this statistical evidence, the Buabeng-Andoh study concluded that participating teachers had a low use of the ICT resources in their teaching practice. This study also associated teachers' low use of technology resources to lack of equipment in classrooms and lack of teachers' skills in using the equipment.

Pertaining to software application, Buabeng-Andoh (2012) use of five-level Likert scale found that word processing was most frequently integrated into teaching by teachers (mean = 1.78), followed by spread sheets (mean = 1.58), and presentation (mean = 1.54), instructional software (mean = 1.46), and database application, which was least integrated into teaching (mean = 1.36).

In reference to the secondary teachers in Tanzania and their frequency of use, the Kafyulilo (2014) study found that computers, followed by radios and televisions, were the tools mostly used by participating teachers. Conversely, iPods, followed by mobile telephones, audio equipment and digital cameras, were the least-used ICT resources by participants.

In the Kenyan context, a small group of researchers have found that secondary school teachers used technology resources in various curriculum areas, including Business Studies (Kiarie, Kerich & Ondigi, 2015), Biology (Ong'amo, Ondigi & Maundu, 2015), English Language (Wamalwa, Rukangu and Bwire, 2015) and in primary teachers' colleges (Omariba, Ayot & Ondigi, 2015).

The types of technologies utilised by participating teachers/trainers in the above-mentioned curriculum areas included computers (Kiarie, Kerich & Ondigi, 2015; Omariba, Ayot Ondigi, 2015; Ong'amo, Ondigi & Maundu, 2015), radios (Omariba, Ayot & Ondigi, 2015; Ong'amo, Ondigi & Maundu, 2015; Wamalwa, Rukangu & Bwire, 2015), mobile telephones (Omariba, Ayot & Ondigi, 2015; Ong'amo, Ondigi & Maundu, 2015), televisions (Omariba, Ayot & Ondigi, 2015; Wamalwa, Rukangu & Bwire, 2015), digital cameras, Internet, interactive white boards (IWB) (Ong'amo, Ondigi & Maundu, 2015), overhead projectors (Omariba, Ayot & Ondigi, 2015; Wamalwa, Rukangu & Bwire, 2015), charts (Omariba, Ayot & Ondigi, 2015; Wamalwa, Rukangu & Bwire, 2015), boards (Omariba, Ayot & Ondigi, 2015; Wamalwa, Rukangu & Bwire, 2015), tablets and liquid crystal display (LCD) devices (Omariba, Ayot & Ondigi, 2015), models, opaque materials, slide and film projectors; record players, cassette recorders, video tape, pictures, tapes, slides, cameras, text books, handouts and photocopy machine (Wamalwa, Rukangu & Bwire, 2015).

Exploring the frequency of technology use, Kiarie, Kerich and Ondigi (2015) found that 87.5% of the participating secondary teachers (n=32) had access to computers in their schools and 62.5% of these teachers had daily access to these resources in schools. The rest, 37.5%, accessed computers in their schools two to three times in a week. In reference to the location of these computers, the teachers with access two to three times a week accessed these resources in the staffrooms, where a single computer was available for the entire school staff.

Omariba, Ondigi and Ayot (2015) noted the frequency of resource use, including ICT, by tutors (n=43) in public primary teachers' training colleges as follows: text books (90.7%), overhead projectors (7.0%), blackboards (90.7%), white boards (44.2%), televisions (7.0%), LCD's (7.0%), computers (20.9%), tablets (2.3%), mobile telephones (23.3%), and charts (37.2%); 90.7% of the participants had never used radios. A review of these statistics suggests that tutors participating in this study used mostly text books and blackboards in their instructional practices.

These studies help create the context for the current research, with limited research in relation to ECDE settings highlighting the need for the current research.

Teachers' Use of Technology in Practice

The limited research conducted in the African context (Ghana and Kenya), mentioned above, reports ECDE teachers' use of technology in numerous ways in their professional practice, including motivating and sustaining children's interest (Abdulai, 2013; Andiema, 2015), sourcing ECDE instructional information (Abdulai, 2013), for children's mathematical thinking through mathematical software, creative communication, knowledge application, inculcation of reading culture and comprehension skills (Andiema, 2015).

However, a study conducted by Asante (2014) revealed 49% of the participating preschool teachers did not integrate technology into their lessons.

Both studies utilised mixed methods for data collection, comprising survey, field visits, observations and interviews. The Abdulai study involved 44 ECDE preschool teachers and focused on examining the status of ICT in Ghanaian preschools. The

Andiema study in Kenya involved 363 ECDE teachers and explored the adoption of ICT in teaching and children's learning in public preschools in Kenya.

Due to the limited research work (Abdulai, 2013; Andiema, 2015) targeting ECDE teachers' use of technology resources in teaching practice in the African context, including Kenya, this study incorporated a review of empirical studies conducted in secondary education. It is important to note that this study has not yet identified research into primary teachers' use of technologies in teaching practice in the African context.

Studies into secondary education found that teachers used technology in a number of ways. These included (in Ghana) giving class instructions, communicating with students, organising class discussions, demonstrations and presentations, assessing students' learning through tests/quizzes, sending feedback to students and supporting collaboration among students (Buabeng-Andoh, 2012), pedagogical purposes in Namibia (Ngololo, Howie & Plomp, 2012) and teaching, learning, and communication with colleagues and parents in Tanzania (Kafyulilo, 2014).

While the Ghanaian teachers in the Buabeng-Andoh study stated that they used technology resources for communicating with students, the Tanzanian teachers in the Kafyulilo study said they used technology resources for communicating with colleagues and parents (the school policy did not allow them to communicate with students via IT). It is not clear how technology impacted on teachers' practices or students' learning outcomes, for these studies did not document such information.

Based on the findings in the Ghanaian study, Buabeng-Andoh suggested that 'these observations are clear evidence that the introduction of ICT in teaching and learning has not transformed educational delivery in secondary schools in Ghana, implying that teachers have not shifted from teacher-centred teaching to student-centred learning despite government effort to support teachers with training in ICT integration into teaching' (Buabeng-Andoh, 2012, p. 44).

In the Kenyan context, a small group of researchers found that secondary teachers' practices involving technology resources included integrating instruction and students' learning of Business Studies (Kiarie, Kerich & Ondigi, 2015) and English Language (Wamalwa, Rukangu & Bwire, 2015); stimulating students' interest in learning, arousing their curiosity, enhancing syllabus coverage, enhancing students' understanding of concepts, accessing quality educational information, communicating with remote groups, providing feedback to students when out of classroom, students' and teachers' research through the Internet (Ong'amo, Ondigi & Maundu, 2015) and tutors' use in the instructional process at primary teacher training colleges (Omariba, Ondigi & Ayot, 2015).

These studies help to set the scene for the current study, with limited research in reference to the use of technology in ECDE practice.

Teachers' Professional Learning on Use of Technology in Practice

Professional capability in use of technology is recognised as an important factor in use of the innovation in early childhood education (Gialamas & Nikolopoulou, 2010; Parette, Quesenberry, & Blum, 2010). Similarly, Elliot (2003) argues in favour of professional learning for ECDE teachers in the area of ICT; without it, the technology becomes a burden to teachers and a waste of children's learning time:

> *Without professional development, digital technologies are millstones around teachers' necks rather than tools to empower children's learning. They can make huge demands on precious time. They cause stress because educators worry that they are not being used or used properly. To maximize learning opportunities for children there must be a budget for professional development and ongoing technical and other support.*
>
> (Elliot 2003, p. 7)

In support of Elliot's argument are Gialamas and Nikolopoulou (2010), who are of the view that both in-service and pre-service ECDE teachers are bound to experience limitations if they do not participate in continuing pedagogical development/training in the use of ICT. These authors believe that both pre- and in-service ECDE teachers should be supported throughout their practices in the use of ICT. This agrees with the position statement by NAEYC and Fred Rogers (2012) advocating the need for early childhood educators to have training and professional development opportunities, and be provided with examples of successful practice to enable them to develop the technology and media knowledge, skills and experience needed to meet the expectations documented in policy frameworks.

Professional learning mechanisms for ECDE teachers suggest various models, including the blended delivery model (Arthur, Beecher, Elliot & Newman, 2006), socioculturally oriented (Newman & Ashton, 2009) and collaborative inquiries (Newman & Mowbray, 2012), mentoring, peer support, professional learning communities, networking, targeted professional development, classroom visits and observations, time for collaborative planning and a buddy teacher system (Mayer & Nolan, 2008). Mayer and Nolan suggest that effective support is based on experienced and novice teachers learning together in a supportive environment, collaborating and reflecting. The authors believe that engagement by experienced and novice teachers in these processes could enhance 'acculturation' (p.22), that is, instilling the professional culture of experienced teachers in the novice teachers.

Empirical evidence in this area in international contexts demonstrates positive impacts, including enhanced instructional practices on the part of preschool teachers (Keengwe & Onchwari, 2009) and improved collaboration (Marklund, 2015 p. 236) as a result of participating in ICT-infused professional learning.

A review of literature in the African context, including Kenya, has so far identified limited research (Ndiritu, Mburu & Kimani, 2013) that has focussed on preschool teachers' professional learning on the use of technology in practice. Ndiritu and colleagues surveyed the ICT skills possessed by 395 pre-service ECDE teachers in the Kenyan context. Their report indicated that a majority (60.83%) of the participating teachers had no knowledge in ICT. The findings also indicated that only 13.01% of the teachers had attended seminars related to ICT; the remaining majority (86.99%) had not attended. According to these researchers, all the teachers felt that their teaching could be highly enhanced by integrating ICT into teaching and learning. Relating to these findings, these authors recommended the need for the government of Kenya to invest more in ICT training for preschool teachers.

Notwithstanding, there is a suite of intervention studies by a cluster of researchers (Jere-Folotiya, Chansa-Kabali, Munachaka, et. al., 2014; Jere-Folotiya, 2014; Ojanen, Kujala, Richardson & Lyytinen, 2013; Ojanen, Jere-Folotiya, Yalukanda et. al., 2015; Puhakka, 2015) with immense interest in primary teachers' professional learning. This learning involves a specific form of technology known as GraphoGame (GG) aimed at enhancing literacy among Grade One pupils in Africa. This initiative is yet to spread to the ECDE sector in the African context including Kenya.

GraphoGame has its origin at the University of Jyvaskyla in Finland. It has so far extended to four African countries, Zambia, Kenya, Namibia, and Tanzania (Serpell, 2014). Richardson and Lyytinen (2014) refer to GraphoGame as ‘a technology-enhanced learning environment for learning to read’ (p. 39). The aim of GraphoGame ‘is to provide an appropriate reading support tool for all learners–from struggling learners to typical learners–in any language environment’ (Richardson & Lyytinen, 2014 p. 39).

According to Serpell, the University of Jyvaskyla collaborated with the University of Zambia and established the Centre for the Promotion of Literacy in Sub-Saharan Africa (CAPOLSA) to promote ‘initial literacy learning in indigenous languages’ (Serpell, 2014, p. 22). This collaboration resulted in a number of instructional ICT intervention research studies in Zambia aimed at enhancing Grade One children’s literacy through the use of GraphoGame (Jere-Folotiya, Chansa-Kabali, Munachaka, Sampa, Yalukanda, Westerholm, Richardson, Serpell & Lyytinen 2014; Ojanen, Jere-Folotiya, Yalukanda, Sampa, Nshimbi, Katongo, Choopa & Lyytinen, 2015).

The Jere-Folotiya et al. study aimed to identify the conditions under which GraphoGame could enhance the literacy skills of first grade students in an African city. GraphoGame was administered on cell phones to students, each of whom was assessed using a battery of locally-developed cognitive tests. These measured emergent literacy skills (orthography), decoding competence (spelling), vocabulary (picture vocabulary test (PVT)) and arithmetic (Zambia Achievement Test (ZAT)). Jere-Folotiya and colleagues reported a positive effect of the game for the spelling test, which closely targeted the skill GraphoGame was designed to promote. According to the researchers, the most effective intervention combined exposure of both teachers and students to the game.

On the other hand, Ojanen and colleagues investigated primary Grade Two teachers, Grade Two children and their parents in acquiring literacy through GraphoGame. The results showed that the children and their parents improved their word reading skills and the children who played GraphoGame performed better than their non-playing classmates in the EGRA letter-sound knowledge test at the end of the intervention. Additionally, Ojanen and colleagues report that teachers, parents and children were all motivated to use ICT-based literacy learning tools.

A similar instructional ICT intervention study (Puhakka, 2015) conducted in Kenya reports on Grade One children's improvement in letter-sound knowledge, word recognition, and spelling after participating in GraphoGame learning in a multilingual environment, comprising Kikuyu and Kiswahili. In its conclusion, the Puhakka study recommends the use of GraphoGame as a tool to enhance early reading acquisition in multilingual learning environments.

A related ICT instructional intervention study by Piper, Jepkemei, Kwayumba & Kibukho (2015) involved Grade One teachers using Kindle e-readers and Google Nexus 7-inch tablets to teach their students English and Kiswahili languages, using the same devices. According to these researchers:

> *The tablet contained multimedia lesson plans, supplementary pedagogical aids, virtual letter flashcards, and the Papaya™ software application, which had audio capabilities to practice letter sounds. The tablet also included the TangarineClass™ application, which contained a sophisticated continuous assessment program that allowed teachers to systematically investigate the quality of pupil learning and compare it with their instruction to determine which lessons they should reemphasize, based on pupil mastery of the content.*
>
> (Piper, Jepkemei, Kwayumba & Kibukho, 2015, p. 9)

Piper and colleagues reported improved performance, and that Grade One pupils were reading at the appropriate benchmarks after they and their teachers participated in the ICT instructional and learning interventions.

Theoretical Framework Underpinning this Study

'Our theoretical perspectives direct our research processes' (Postholm, 2008, p. 37) and these perspectives are commonly referred to as theoretical lenses (Kok, 2008). Two theoretical lenses that directed this research include socio-constructivism (S-C) and cultural-historical activity theory (CHAT). Contemporary researchers focusing on ICT in educational institutions (see e.g. Andiema, 2015; Opati, 2013) are increasingly being directed by Rogers' (2003) diffusion of innovations (DOI) theory. This theory tends to focus on patterns of ICT adoption for individuals or individual institutions. Further, through its five stages, comprising knowledge, persuasion, decision-making, implementation and confirmation, this theory focuses on a linear process, rather than inter-relatedness (Rogers, 2003).

The two theoretical underpinnings of this study, socio-constructivism and cultural-historical activity theory are embedded in the social groups, cultural practices and historical perspectives informing the activity (use of technology resources). These two theories were chosen because they focus on the relationships and interconnectedness among participants' ideas, historical perspectives and activities. The DOI theory lacks these elements and hence was not selected to direct the research processes for this study.

Socio-Constructivism

Socio-constructivism is regarded as an approach that brings together ideas from all members of a learning community (Wilson, Tete-Mensah & Boatenge, 2014). It stresses the idea of collective learning. In this kind of learning, the role of community members, including teachers, parents, peers and significant others in enhancing students' learning are critical (Kundi & Nawaz, 2010). In considering socio-constructivism for this study, the researcher acknowledges the fact that ECDE practitioners' profession is an active process that involves practice and reflection. These professionals are not mere passive recipients of information since they are expected to participate in the contribution of ideas (theories) and construction of knowledge. Using social constructivism as a theoretical lens enabled this study to recognise teachers as key players in events and activities surrounding the use of technology resources in professional practice and in everyday practices.

The choice of socio-constructivism as the theoretical paradigm underpinning this study is based on a consideration of knowledge in terms of peoples' perceptions and interpretations of events taking place in the world (Patel, Gali, Patel, D. V., & Parmar, 2011). This can result in meaning making by an individual who in turn can impose 'meaning on the world, rather than the meaning being imposed on the individual' (Karagiorgi & Symeou, 2005, p. 18). Socio-constructivism stresses 'the social context, culture and collaborative side of learning' (Bay, Bagceci, & Cetin, 2012, p. 343) in which meaningful construction of knowledge assumes a pivotal role.

Through the socio-constructivism lens, participants' perceptions and practices constitute meanings and knowledge in regard to the phenomenon under investigation. For this research, these meanings and knowledge were derived from three social groups of participants practicing in social contexts comprising ECDE centres and educational institutions. The participants participated in this study voluntarily and this was a form of collaboration. Additionally, the 'culture' component of the study involved teachers' practices involving the use of technology resources.

Cultural-Historical Activity Theory

This study acknowledges that the socio-constructivist paradigm does not address the history behind peoples' beliefs, perceptions and practices. Hence, CHAT Engeström, 1987) is the theoretical lens selected to address the unique cultural and historical components of Kenyan ECDE contexts pertaining to the phenomenon (use of technology in ECDE profession) under investigation. The decision was based on CHAT's ability to theorise historical, culture and actions (activity) as interrelated processes, including the structure of the social element in the analysis process.

Cultural-historical activity theory, commonly referred to as activity theory is rooted in the socio-cultural dimensions of Vygotsky (1878, 1986) and was further developed by Leont'ev (1981) and also by Engeström (Engeström 1999; 2001; 2007). Engeström (1987) suggested a model (Figure 2.2) that frames human activity as a by-product of interaction among components comprising tools (instruments or artefacts), subject, object, community, rules, and division of labour as indicated below.

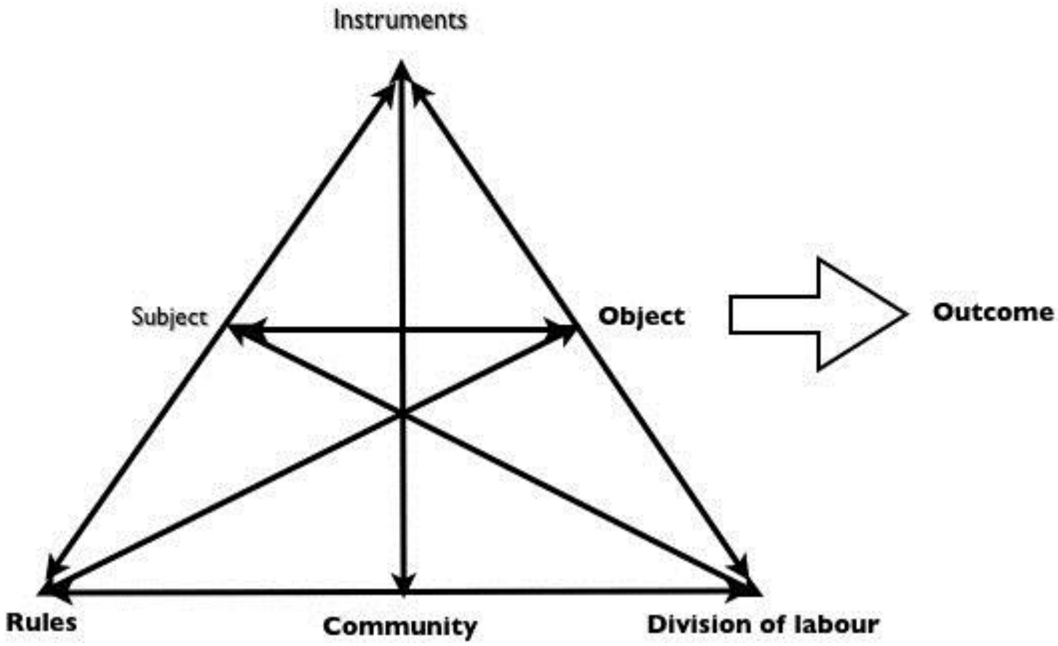

Figure 2.2 Components of the activity system according to Engeström (1987)

- The *subject* of an activity system is the individual or group of individuals (Uden, 2007) taking part in an activity;
- *Object* refers to the raw material at which the activity is directed for development;
- *Tools or instruments* are material such as textbooks or symbolic (e.g., language). Tools participate in transformation of the object into an outcome;
- *Community* refers to the participants of an activity system, who share the same object (Uden, 2007);
- The *division of labor* involves the division of tasks and roles among members of the community and the divisions of power and status; and
- *Rules* are norms that regulate actions and interactions within the system.

Murphy & Rodriguez-Manzanares, 2008, p. 443

Using this model to analyse integration of technology in ECDE system, this study mapped the elements as follows:

- Preschool teachers, teacher trainers and policy makers are *subjects* critical in participating in integration of technology in ECDE ;
- The *object* under development is use of digital technologies in teachers' everyday professional practice for transformation of teaching and learning (*outcome*);
- Tools are digital resources used in teachers' everyday practice for the purpose of transforming teaching and learning in ECDE system;
- Rules are government policies, curriculum documents, syllabi, schemes of work and instructional teaching lessons on integration of technology in ECDE;
- Community comprise ECDE children, teachers, administrators, parents, policy makers, curriculum designers and significant ECDE stakeholders; and
- Division of labour involves the roles and responsibilities of ECDE policy makers, curriculum designers; children as learners, teachers as implementers of ECDE curriculum, the support of administration, parents and the significant others.

Activity theory has been used as a methodological framework by researchers targeting practices and issues surrounding use of ICT in education. In unveiling the contradictions that take place within this kind of activity system, researchers attempt to sensitize participants on operations at hand in their community and actions to be taken for bringing about change or further improvement. For instance, researchers have utilized activity theory to study issues and contradictions in ICT integration processes in Turkish schools (Demiraslan & Usluel, 2008) and as an interpretive lens in the distribution of leadership in an ICT project in a Singapore school (Ho, Chen & Ng, 2016).

In the former study by Demiraslan and Usluel (2008), these researchers utilized an activity theory framework for understanding and describing experiences of students and teachers when using ICT and the contradictions that occurred in the ICT integration process. This study was conducted in two case schools. Based on the evidence gathered, Demiraslan and Usluel found that lack of technological equipment and computer access was emphasized by the teacher and students in the first school. On the other hand, simple technical problems were mentioned by the teacher in the second school, yet students in this school found the computer opportunities to be inadequate. Additionally, the teacher in the first school raised concerns about lack of support by the school administration and also lack of professional training opportunities in ICT.

In the second school, the teacher was concerned about lack of adequate time to implement extra-class activities, including ICT related activities. The two researchers found that there were more contradictions in the activity system of the first school compared to the second school. In their conclusion, Demiraslan and Usluel felt the findings in their study would hold across other studies focused on use of ICT in education:

> *The findings indicate that the use of ICT as a teaching-learning tool does indeed force a shift in the activity system, transforming traditional behaviours, leading to contradictions in and between systems and, consequently, forcing changes in and between systems. Based on the results, we conclude that, along with lack of technology and access, the organizational culture, the changing roles of teacher and students with regard to ICT, inflexible timetable curriculum, the support of the school administration, the mediator role of an ICT coordinator and the collaboration among the teachers were also imperatives that need to be taken into consideration in ICT integration processes.*
>
> (Demiraslan & Usluel, 2008, p. 472)

In the case of the Ho, Chen and Ng (2016) study, observations of 49 meetings and 34 interviews of leaders and the teachers' involved in the ICT project were conducted. Using Activity theory, Ho, Chen and Ng found that there were two interrelated activity systems promoting the use of ICT, and the division of labour between senior and middle management. According to the report in this study, the two main activity systems identified were the Lead ICT project activity system at the Primary 4 teachers' level and the overall ICT implementation activity system at the school level (Ho, Chen & Ng, 2016).

According to Ho, Chen and Ng (2016), distributed leadership was concerned about how various people performed different leadership actions. These researchers aligned these leadership actions to the division of labour in the field of Activity Theory. This theory also assisted these researchers to analyse the leadership actions performed through analysis of the main tools used by Senior Management (SM) and Middle Management (MM). Based on the report in Ho, Chen and Ng (2016) study, SM provided the direction for ICT use in the school and embraced the organisation structures which they had influence over. These included the temporal arrangements of the work day and manpower deployment as tools for empowering leadership activity focused on coaching the Primary 4 teachers (Ho, Chen & Ng, 2016).

Similarly, Ho, Chen and Ng report that the middle managers "provided leadership mainly through coaching the teachers to develop ICT lessons, making suggestions and giving feedback on the ICT lessons developed, and by modelling ICT lesson plans and lessons" (Ho, Chen & Ng, 2016, p. 827). These researchers recommend the need to understand how social norms can influence leadership activity to a point where leaders can come up with innovative solutions. According to these authors, this can be done through exploitation of the social norms or organization structures for the purpose of empowering more levels of people to take on leadership roles. (Ho, Chen & Ng, 2016).

Activity Theory was employed in this study as a conceptual framework for studying human behaviour in educational settings (Engeström, 1999; Leont'ev, 1978; 1981). It also provided a lens for examining how ECDE policy and practice systems can interact to mediate teachers' work in the use of technology in ECDE centres. Building on the third generation of activity theory, the use of technology in an ECDE system could be achieved through an exploration of stakeholders and other interested parties' involvement, including teachers, in at least two activity systems: (a) the system of decision-making, policy formulation and curriculum design on use of technology resources in ECDE institutions and (b) the system of technology use in professional practice that ECDE teachers enact in their classrooms on a day-to-day basis. These two systems connect in ways that could mediate teachers' ability to use technology in their daily practices and pedagogies.

The current study was concerned with what was in place in a larger system of stakeholders and other interested parties. How the elements in this larger system related with one another to shape the teachers' technology use in professional practice was focal point in this study.

This study chose to use CHAT in the hope that this multi-dimensional, practice-based approach (Somekh, 2007) would lead to insightful understandings of what educators in Kenya perceive to be the best way to integrate technology into ECDE programs to enhance teachers' practices. These could in turn impact positively on children's learning outcomes. In this study, CHAT concepts are expounded to highlight the notion of activity system as a unit of analysis in Phase One of this research.

Vygotsky believed that the mechanism for individual development was rooted in society and culture (Cole, John-Steiner, Scribner & Souberman, 1978). Further, according to Vygotsky, an individual's behaviour (mental processes) can be understood only from the historical perspective of the behaviour in question (Cole, John-Steiner, Scribner & Souberman, 1978). The notion of individualism, as emphasised in Vygotsky's first generation of CHAT, is reflected in the entire study; the data collected from each participant played a crucial role in this study and in the overall interpretation of the findings.

Early CHAT theorists (Engeström, 2001; Ivic, 2000) suggest the concept of human labour and tools used were regarded as ways in which humans can change and transform. In the current study, ECDE teachers' practice (human labour), access to and use of technology resources (tools) would change their daily practices and pedagogies and consequently, enhance children's learning outcomes (transformation).

Wells (2002) considers professional learning discourse as one of the artefacts or practices that can mediate the subject's object-directed actions, as posited in the second generation of CHAT. As the founder of the second generation of CHAT, Leont'ev believed that people's work was influenced by social and cultural practices, tools and values, irrespective of whether they worked alone or with others (Kaptelinin, 2005). This study was designed with the understanding that socio-cultural practices, ECDE policies, and curriculum materials; guidelines and the availability of technology resources had a role to play in teachers' professional practices. These complex interrelations between the individual subject (ECDE teacher) and his or her community (ECDE children, parents, and fellow teachers; ECDE policy makers, curriculum designers, practitioners, stakeholders and other interested parties) echo the second generation of CHAT (Engeström, 2001).

In the third generation of CHAT (Engeström 1991; 1999; 2001), Engeström described his belief in a joint activity or practice as the unit of analysis, rather than the individualism proposed by Vygotsky. In the current study, the findings in the Phase One case study informed the design and implementation of Phase Two; in which ECDE teachers were surveyed on a wider scale and stakeholders and other interested parties participated. All sets of data gathered from the three groups of participants formed a joint activity and became the unit of analysis in which common themes in various sets of data from all the participants were sought. These participants formed social systems at various levels of their operation and this is labelled 'the structure of the social world in analysis' (Engeström, 1999, p. 22). However, Vygotsky's notion of individualism played a significant role in Phase Two of the study, since each of the participants provided his/her views about integration of technology in ECDE programs.

The teachers and other stakeholders' opinions and conflicting views on the integration of technology in ECDE programs are the driving forces of change, development, transition and reorganisation (Engeström, 1999) in regard to the appropriate integration of technology in ECDE programs of Kenya. Meyers (2007) acknowledges the idea of a socially distributed activity system by stating:

> *Cultural-historical activity theory addresses human activities as they relate to artifacts, shared practices and institutions, thus it goes beyond individual knowledge and decision-making to take a developmental view of minds in context. As people work, play, think, and solve problems together they demonstrate an accumulated set of habits and values. Learning is not an isolated act; rather it is situated in time and space and influenced by the surrounding actors, resources and behavioural constraints. One should also recognize that agents in the learning process through their activities influence the context in which such learning takes place.*
>
> (Meyers, 2007, p. 4)

Connection between Socio-Constructivism and CHAT

There are common principles that connect social constructivism and activity theories. These include the importance of social context and social interactions, past experiences, collaborations and engagement in active construction (activity, task or process) resulting in meaning-making. Both socio-constructivism and CHAT also emphasise the importance of cultural context in a learning situation or educational research and the use of all forms of tools, including language for voicing ideas, thoughts and inner speech that impact on peoples' actions or activities.

The interacting principles of the two theories are clearly reflected in the current study. For instance, the idea of social context was considered through data collection from three groups of participants, including preschool teachers, stakeholders and other interested parties. These participants practiced in ECDE settings and educational organisations, which, according to both social constructivism and CHAT, can be termed as cultural contexts. Further, this study gathered data on teachers' practices involving the use of technology resources (cultural practices) and data on policy frameworks and professional learning experiences (historical perspectives).

Teachers' practices involving the use of technology resources was the main activity, according to CHAT, or task, process or concept, based on principles in social constructivism. Both social constructivism and CHAT reinforce the use of language. Through their responses in the interviews and the survey, the participants used a language to voice their practices, inner speech, thoughts, views, beliefs and feelings about the use of technology in ECDE programs. These voices represented their behaviour towards the use of technology resources in ECDE from social, historical, psychological, cultural and institutional perspectives.

Chapter Summary and Gaps Identified

This chapter has presented information about policy frameworks on ECDE and ICT in Kenya, a review of research literature on teachers' practices in terms of their use of technology, teachers' perceptions about the use of ICT in ECDE, teachers' professional learning on the use of ICT in practice and the theoretical framework underpinning this study.

A review of literature indicates early childhood education in Kenya is guided by a number of legal policy frameworks, including Sessional Paper No. 1 of 2005 (Republic of Kenya, 2005), the national ECDE policy framework formulated in 2006 (Republic of Kenya, 2006a), service standard guidelines (Republic of Kenya, 2006b), Kenya's Constitution of 2010 (Republic of Kenya, 2010) and Sessional Paper No. 14 0f 2012 (Republic of Kenya, 2012a). All these policy frameworks document specific guidelines on the coordination of service provision for children in terms of quality, accessibility, relevance and equity. Nonetheless, the frameworks are unclear in regards to how the notion of quality, accessibility, relevance and equity are measured.

An exploration of literature focusing on policy frameworks for ICT in ECDE in Kenya reveals a history of frameworks for the use of ICT, mostly in secondary schools and institutions of higher learning. There are policy statements on ICT in the national ECDE policy framework in which the government outlines the use of ICT for effective communication among service providers, for the efficiency and quality of children's services in health, education and special-needs education and for the support of training programs in ICT for service providers (Republic of Kenya, 2006a). It is not clear how the government planned to actualise the statements, especially the training component, since no strategies are included in this policy document.

A clear recognition by the Government of Kenya on the role of ICT in ECDE is documented in Sessional Paper No. 14 of 2012 (Republic of Kenya, 2012a). In the same policy framework, the government identifies the lack of an ICT curriculum at ECDE level, and it does not specify strategies for designing such a curriculum.

Based on the review of literature in the African region, including Kenya, ECDE teachers' practices in the use of technology resources, perceptions about these resources and professional learning in its use are three areas where there is limited research. Previous studies conducted in Kenya (for example, Andiema, 2015; Kaindio & Wagithunu, 2014; Mwololo, 2009; Mwololo, Koech & Begi, 2011; Waigera & Begi, 2015) are inadequate for making policy decisions informing the use of technology in ECDE programs. This study is guided by the following research questions:

- Research Question 1: What are the professional beliefs of Kenyan ECDE educators about the use of technology in early childhood development and education?
- Research Question 2: What is the status of ICT practices in Kenyan preschools?
- Research Question 3: In what ways are the professional beliefs of ECDE teachers in Kenya linked to their everyday practices and pedagogies in their educational settings?

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Overview of the Study

This was a three-phase, mixed methods study with several data collection sources. It involved three groups of participants drawn from preschools and Early Childhood Development and Education (ECDE) key organizations.

Phase One

The first phase of this study was conducted in two preschools and involved 11 teachers as participants. The two preschools, one public and one private, and the 11 teachers were selected through a combination of stratified and random sampling techniques. Data gathering approaches in this phase included observations and semi-structured interviews. Observations were utilized to identify types of instructional materials and technologies accessed and used by teachers. They also served the purpose of identifying ways in which teachers used these resources in their everyday practices and pedagogies. On the other hand, semi-structured interviews were used as a follow-up on evidence elicited through observations. Using these interviews, this study collected data on teachers' views about the use of technology in ECDE, their experiences involving the use of technology in everyday practices and pedagogies and concerns about the use of technology in professional practice. The outcomes resulting from analyses of these sets of data informed development of research instruments utilized in the follow-up phases, two and three.

Phase Two

Phase Two of this study involved provision of survey questionnaires to all teachers (n=563) in both public and private preschools (except the teachers participating in Phase One) in one district selected for this study. A total of 508 teachers returned their questionnaires and were selected for this study. Through these surveys, numerous sets of data were gathered focused on teachers' characteristics, professional training in technology, experiences with technology, both at home and preschools; views about the use of technology in ECDE and concerns about the use of this innovation in professional practice.

Phase Three

The third phase of this study involved 10 stakeholders and other interested parties drawn from key Early Childhood Development and Education (ECDE) organizations across the country. Selection of these participants involved web browsing and a follow-up through telephone conversations. These participants responded to individualised interviews with the researcher through which evidence on their views about integration of technology in ECDE policy, curriculum and practice was collected.

All data gathered for this study were analysed through the use of both qualitative and quantitative approaches. This study's use of systematic protocols and procedures, multiple sources in data collection, thematic analysis approaches and several reviews of the research reports drafts by experts contributed to the rigour of this study. Lastly, ethical considerations were observed in each and every context involved in data generation and on all individuals participating in this study.

Research Design

Heppner, Kivlighan and Wampold (2008, p. 66) refer to a research design as the tool that 'involves developing a plan or structure for an investigation, a way of conducting or executing the study that reduce bias, distortion, and random error'. Bryman (2016) describes a research design as a framework for collecting and analysing data. While Denzin and Lincoln (2011) call them strategies of inquiry, Creswell (2014, p. 41) defines research designs, as 'types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research design'. Given this understanding, the research design selected for this study was informed not only by its intent and research questions, but also, by the researcher's philosophical worldview rooted in social constructivism combined with interpretivism (Lincoln & colleagues, 2011; Mertens, 2010).The constructivist philosophical worldview advocates for a study's theory generation based on understanding of participants' mean-making from construction of social and cultural perspectives(Kelly, 2014; Lincoln & colleagues, 2011; Mertens, 2010).

This study is heavily premised on participants' views about the phenomenon under study. These views were gathered from three sources including surveys and interviews with preschool teachers and stakeholders and other interested parties for the purpose of understanding the socio-cultural perspectives surrounding the phenomenon under study. Through interpretation of these views, this study attempted to make sense of the meanings held by participants about the phenomenon under study. This resulted in an inductive process through which this study aimed to develop theories out of what was found in the field through multiple sources. To achieve this aim, a mixed methods design was selected as the most viable type of inquiry for this study.

Researchers advancing mixed methodology have documented numerous types of mixed methods designs including triangulation, convergent, transformative, embedded, explanatory sequential, and explanatory sequential (Creswell, 2014; Creswell & Plano, 2007; 2011). The selection and use of these designs in various studies is based on philosophical perspective, outcomes expected, and integration of data, timing of data collection, emphasis placed on each database, field of study and single or team of researchers (Creswell, 2014). This study has selected and used the exploratory, sequential mixed methods design.

The intention of this study to generate multiple sets of data through a three-phase process, drawing on mixed methods provided the means through which these data sets were intermingled and used together. A sequential mixed methods design involves a two-phase project in which the researcher first collects and analyses qualitative data and then enriches this database through a second quantitative data collection and analysis (Creswell, 2014, p. 291). According to Creswell, the intent of this strategy is to develop better measurements for the second quantitative phase based on the outcomes of the first qualitative phase.

The current study was conducted through three phases. The first phase involved observations and individualized interviews with teachers. The outcomes resulting from this phase informed the development of instruments utilized in the second follow-up phases, two and three. The Phase One outcome results specified also the variables that needed to be measured in Phases two and three. Figure 3.1 presents a summary of the exploratory sequential mixed methods design used in this study.

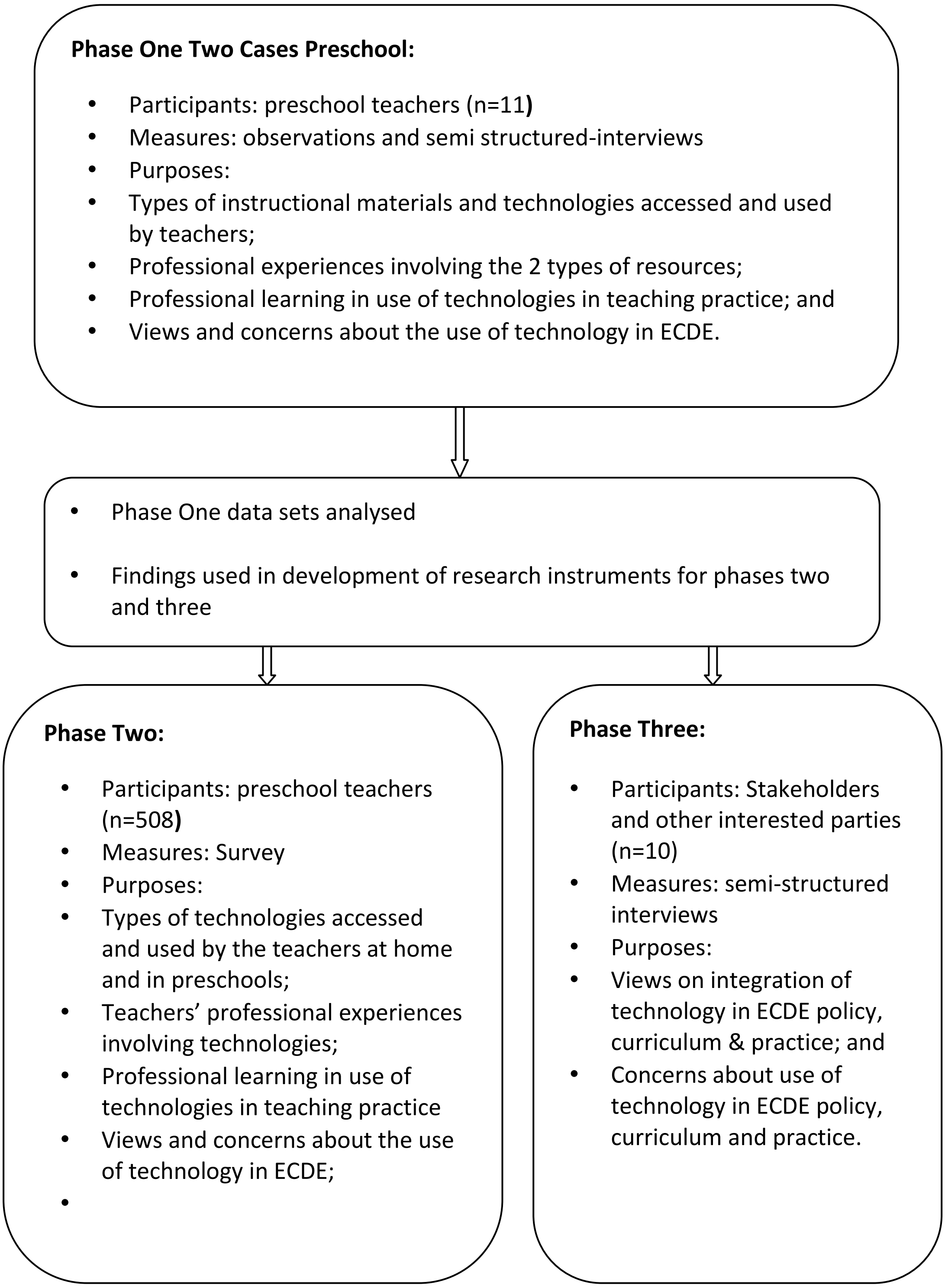

Figure 3.1 Exploratory Sequential Mixed Methods Design Used in this Study: Adopted from Figures Models by Creswell and Plano (2007)

This section has identified and presented the research design selected as a road map for this study. The following section outlines and explains the research methods utilized by this study during the process of data gathering.

Phase One Case Selection

Phase One was designed to collect in-depth, information (Patton, 1990) using a case study methodology. A combination of stratified and random sampling techniques (Teddlie & Yu, 2007) was employed to select the two ECDE settings representing public and private settings.

Using the mentioned sampling techniques, two preschools located in one zone were identified. The two preschools were selected with the assistance of the Ministry of Education on the basis of one being a public preschool facility and the second a private preschool. Using simple random sampling technique, the researcher selected one setting from each of the two lists representing the two types (public and private) of ECE settings. This technique ensured that researcher bias was limited (Teddlie & Yu, 2007) in selecting the two settings for Phase One.

Setting Characteristics

The public setting had six teachers, although one teacher dropped out of the study due to maternity leave soon after the observations and semi-structured interviews. There were seven teachers at the private ECE setting and six participated in the study. One teacher did not complete the data collection tasks because she transferred to a different ECDE setting after participation in the preliminary research activities of Phase One that included observations and semi-structured interviews. The public ECE setting teachers were coded as case public (CPUB's) 01, 02, 03, 04, 05, and 06 and those at the private ECE setting were coded as case private (CPRV's) 01, 02, 03, 04, 05, 06 and 07. The coding ensured anonymity.

The researcher visited the two settings to introduce and familiarize herself with the teachers. With the permission of the managers at both settings, the teachers were invited by letter (see Appendix D, p. 256) to participate in the study. Teachers completed and signed the consent forms as a confirmation of their willingness to participate. Consent forms were returned to the researcher in sealed self-addressed envelopes to avoid any pressure from Directors for teachers to participate.

Phase Two Participant Selection

Phase Two of this research project involved a survey. All teachers practising in ECDE settings located in the district of study (except the teachers participating in Phase One) were invited to participate in Phase Two. While teachers participating in the Phase One practised in preschools located in a middle class area with electricity and internet connection, the survey teachers practiced in both middle class and slum areas where the majority of the community members had limited access to power, ICT resources and internet connections as outlined in Chapter One.

As a way of invitation and participation in this study, through the education officers and staff, teachers in the district of study were provided with survey questionnaires to complete (see Appendix G). Out of 563 questionnaires given out, 508 were completed and returned to the researcher (return rate of 90.23%), with 167 teachers (32.87%) indicating that they practised in public preschools, and 341 teachers (67.13%) indicating that they practised in private preschools. Table 3.1 shows the number of preschool teachers participating in this study based on the type of preschool settings (public or private).

Table 3.1

Number of Preschool Teachers Participating in the Survey

Types of preschools	No. of teachers	%
Public	167	32.87
Private	341	67.13
Total number of teachers	508	100

Throughout this study, the teachers practising in public preschools were coded and identified by the use of ‘survey public’ numbers 001 to 167 (SPUB 001 – 167). Similarly, the teachers practising in private preschools were coded and identified by the use of ‘survey private’ numbers 001 to 341 (SPRV 001 – 341). Notably, teachers in each group were coded as they returned their survey questionnaires. For example, the first teacher in a public preschool to bring back his/her questionnaire was coded as SPUB 001. Likewise, the first teacher in a private preschool to bring back his/her questionnaire was coded as SPRV 001, etc.

Phase Three Participant Selection

Participants taking part in Phase Three were stakeholders and other interested parties in key organizations in Kenya involved with ECDE policy, curriculum development and implementation; ECDE special needs education, institutions of higher learning (public and private universities) and training colleges for ECDE teachers, both public and private. These key stakeholders were identified through websites on the internet. A list of 22 potential stakeholders was reduced to a short list of 12 for contact by telephone to gauge their interest in participating in this study. A critical case sampling strategy (Patton, 1990) was used to select the 12 ECDE stakeholders for participation in Phase Three of this study. Patton (1990) supports this kind of consideration in a sampling process by stating "critical cases are those that can make a point quite dramatically or are, for some reason, particularly important in the scheme of things" (p. 174).

The revised list of 12 stakeholders ensured that only one member from each key organization was included. The short listing was made on the basis of stakeholders' seniority in targeted organizations. At the time of data collection, one of these two stakeholders was overseas and none of her colleagues in the same organization was prepared to participate in this research. The second stakeholder withdrew consent before the interview due to protocol issues in management and the sensitive nature of the organization in which she worked. Consequently, there were 10 stakeholders who participated in this study by responding to individualised interviews with the researcher.

The 10 stakeholders interviewed were drawn from key organizations in Kenya involved with ECE policy, curriculum design and development, as well as those involved with implementation of the curriculum. The organizations involved were:

1. The Ministry of Basic Education (MBE), responsible for basic education, including ECDE policies
2. The Kenya Institute of Curriculum Development (KICD) (formerly Kenya Institute of Education (KIE), in-charge of educational curriculum in Kenya
3. The National Centre for Early Childhood Education (NACECE), responsible for the coordination of ECDE activities across Kenya
4. The Kenya Institute of Special Education (KISE) mandated with the responsibility of coordinating special education across Kenya

5. The Kenya National Examination Council (KNEC) charged with the responsibility of preparing and marking examinations for students in primary, secondary and colleges in Kenya for the purpose of certification
6. Public and private universities with departments that offer ECDE programs at certificate, diploma and degree levels
7. Public ECDE teachers' training colleges, commonly known as District Centres for Early Childhood Education (DICECE's)
8. Private ECDE teachers' training colleges
9. Kenya based international private ECDE teachers' training colleges

Table 3.2 presents three categories of these key organizations

Key ECDE Organizations in Kenya

Organizations	Responsibilities/Focus
National Policy (NP)	Design of the National ECE policy
Curriculum Development (CD)	Development of curriculum, teaching and learning resources for ECE at both classroom and training levels
Teacher Preparation (TP)	Training of ECE teachers in colleges and universities at certificate, diploma and degree levels; also, training of teachers in special needs education (SNE)

Based on the three categories of the key organizations in Table 3.2, the participating stakeholders were initialled and coded with numbers for the purpose of anonymity and observation of ethics protocols. The initials and numbers, presented below, will be used throughout in this study when referring to the 10 stakeholders participating:

National Policy (NP)	NP01
Curriculum Development (CD)	CD01, CD02
Teachers' Preparation (TP)	TP01, TP02, TP03, TP04, TP05, TP06 & P07

This previous section has provided a description and explanation on the process involved in selecting participants for the three phases, one, two and three. The next section identifies and presents the research methods used by this study.

Research Methods

The decision to use a socio-constructivist research methodology was based on an intention to gain an insightful understanding into the area of early childhood teachers' professional beliefs and practices surrounding the use of technology in ECDE from multiple perspectives. These perspectives were, more specifically, those represented by ECDE teachers, policy designers and teachers' trainers both at middle college and university levels. The methods chosen also needed to acknowledge the manner in which believes, policies, practice and professional learning issues intersect in use of technology in early childhood education. This being the case, mixed methods of data collection and analysis were selected. Johnson and Onwuegbuzie (2004) support the use of research founded on mixed methods and maintain that this kind of research has been "respected and treated as a separate design in its own right as a research paradigm whose time has come" (p. 14).

There are numerous definitions of mixed methodologies. For instance, Johnson, Onwuegbuzie and Turner (2007) have synthesized a number of definitions documented by nineteen writers (including one definition by these three writers) focusing on mixed methods research. Despite variation in wording and aspects underscored by the writers, an overwhelming majority of the definitions (99%) highlight the notion of mixing or combining aspects of qualitative and quantitative approaches within a single or set of related studies.

The current study adopted a definition of mixed methods research suggested by Creswell and Plano (2007):

> *Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.*
>
> (Cited in Cameron, 2009, p.5)

The use of a mixed methods approach was important for this study for the purpose of identifying any potential “paradox and contradiction” (Bryman, 2006, p. 105). Additionally, the study sought complementarities (Bryman, 2006; Rocco, Bliss, Gallagher & Perez-Prado, 2003; Teye, 2012) through the findings that emerged. This process was facilitated through the use of survey questionnaire, a quantitative tool that made it possible to access a larger sample of ECDE teachers in Kenya. The data generated by this survey served the role of building on Phase One, a situation commonly referred to as expansion by Cameron, (2009); Creswell (2003); Hall and Ryan (2011); Johnson and Onwuegbuzie (2004); and Terrell (2012). Over and above, the use of semi-structured interviews with ECDE stakeholders and other interested parties also enhanced this study. This was done through capturing a range of voices focusing on the use of technology in Kenyan early childhood education, and at the same time, gaining a more comprehensive understanding of the use of the innovation in preschool teachers’ everyday practices and pedagogies.

Combining data obtained from the three groups of participants occurred at several stages in the process of this study. This included the data collection, analysis and interpretation. In data collection, the mixing involved designing both closed and open-ended research items for generation of both qualitative and quantitative data in phases one, two and three. Data emanating through the use of the three types of research strategies were analysed by employing both qualitative and quantitative analysis techniques.

Qualitative and quantitative research approaches differ on a number of dimensions that include general framework, analytical objectives, question format, data format and flexibility in study design (Mack et al, 2005). Both approaches have their own strengths and weaknesses in terms of time, processes undertaken in research, interpretation and validity of the findings (Johnson & Onwuegbuzie, 2004). For instance, the use of qualitative research is to "understand a given research problem or topic from the perspectives of the local population it involves" (Mack et al, 2005 p. 8).

The strength of qualitative research is attributed to its ability to provide complex textual descriptions of how people experience a given research issue (Johnson & Onwuegbuzie, 2004). However, the use of qualitative approaches in research is known to have both advantages and disadvantages. The disadvantages include: a great deal of time and, sometimes money; the need to access, and make contact with, potential participants whom the researcher has never met and this can make the process of getting started difficult (Seidman, 2013).

On the other hand, quantitative approaches are useful in generating generalizations and predictions of outcomes from data (Johnson & Onwuegbuzie, 2004; Teye, 2012). They can also provide precise, quantitative, numerical data; useful for studying large numbers of people; and the research results are relatively independent of the researcher (Johnson & Onwuegbuzie, 2004). The main weaknesses of quantitative approaches include the lack of direct access to experiencing the phenomena being explored due to concentration on theory or hypothesis testing rather than on theory or hypothesis generation (referred to as confirmation bias) (Johnson & Onwuegbuzie, 2004).

The current study drew on the strengths of both qualitative and quantitative approaches of data collection and analysis. Through the use of both approaches, the study attempted to compensate for the weaknesses inherent in each (Bryman, 2006; Cameron, 2009; Johnson & Onwuegbuzie, 2004). The detailed, inductive and in-depth aspects of the study were managed by the qualitative approach and the quantitative approach ensured that broad and deductive dimensions of the study were attained. The following section identifies the specific data collection methods used by this study.

Data Collection Methods and Procedures

Phase One Instrumentation

The case study of teachers' experiences in the use of technology in their everyday work and pedagogies were identified through two main approaches:

1. Unstructured observations, with researcher as observer:
    a. Observation of technology in learning contexts (including instructional materials and digital technologies). The researcher observed teaching and learning environments in six classrooms in the two participating preschools. These observations were tracked through note-taking, digital voice-recording and photography. The main objective was to identify types of instructional materials and technologies used by teachers in their everyday practices and pedagogies.
    b. Observation of technology use in lessons. Here, the researcher observed teachers' (n=11) use of technology in lessons for the purpose of identifying ways in which they used technologies in their daily practices and pedagogies.

2. Semi-structured interviews (see Appendix A, p. 251)

The use of varied data collection strategies in real-life contexts is a notable characteristic of a case observation as "this ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood" (Yin, 2009, p. 544).

Lesson Observations:

At the initial stage of data collection, teachers were observed in their classes for a four-hour morning session. During these sessions, observations were used to collect data on teachers' use of technology resources in their everyday practices and pedagogies. This is in line with Seidman (2013) who acknowledges that, "to observe a teacher, student, principal, or counsellor provides access to their behaviour" (p. 10). Similarly, Leedy and Ormrod (2005) support the use of observations in qualitative research:

> *Unlike observations conducted in quantitative studies, observations in qualitative study are intentionally unstructured and free-flowing: The researcher shifts focus*

> *from one thing to another as new and potentially significant objects and events present themselves. The primary advantage of conducting observations in this manner is flexibility: The researcher can take advantage of unforeseen data sources as they surface* (Ormrod, 2005, p. 145).

Interviews

In the afternoon, teachers participated in one-to-one, in-depth interviews with the researcher and each interview lasted for duration of 30-45 minutes. The interviews were guided by seven questions designed with reference to review of literature. According to Seidman (2013), the purpose of in-depth interviewing is to understand the "lived experience of other people and the meaning they make of that experience" (p. 9). Interviews are "purposeful interaction in which one person tries to obtain information from another" (Oldridge, 2010, p. 90). Semi-structured interviews are designed to be flexible and to yield in-depth and extended data not anticipated to be obtained by the researcher (Leedy & Ormrod, 2005; Oldridge, 2010).

The teachers at the two settings were invited to participate on a one-to-one basis with the researcher to discuss their current practices in regard to the use of ECDE in their daily work. The interviews were conducted at the teachers' settings of work and were recorded using a digital voice recorder. These interviews provided flexibility and much scope for discussion with the participants about their beliefs and current practices involving use of technology. The interviews also enabled the researcher to seek further insights into data obtained through the unstructured observations of preschool teachers at work at the two selected settings. The interview guide questions are presented in Appendix A.

Phase Two Survey Instrumentation

Phase Two involved preschool teachers (n=508) who responded to a survey comprising 26 multiple choice questions and 9 extended responses (see Appendix G, p. 268). This strategy was selected for the purpose of gathering data from a larger sample of ECDE teachers in one district. Leedy and Ormrod (2005) define survey research as a process that involves acquiring information about one or more groups of people about their characteristics, opinions, attitudes, or previous experience by asking questions and tabulating their answers (Leedy & Ormrod, 2005, p. 54). The main objective of using a survey as a data collection tool is to learn about a large population by surveying a sample representing a population (Leedy & Ormrod 2005). In this study, the main objective of the survey was to obtain data on teachers' views and practices involving the use of technology at their preschools of practice. The survey was triangulated (Rowley, 2002) with the findings from Phase One and Phase Two in order to identify points of convergence.

All teachers in the district of study were provided with a paper version of the survey questionnaire (see Appendix G) to complete. The questions in this appendix were focused on teachers' background information, professional training in use of technology, access and use of technology at home and at their preschools of practice; experiences with the use of technology in teaching practices, views and concerns about the use of technology in ECDE. The survey questionnaires were distributed by an ECDE program officer for this district assisted by her staff. The researcher was uncertain about participants' access and competence in using computers hence, an electronic survey was not offered. The completion and returning of the questionnaire was a confirmation of the teachers' consent to participate in the study. The teachers returned the survey to the researcher via the program officer in the sealed envelope supplied. The survey took approximately thirty minutes to complete.

Phase Three Instrumentation

Stakeholders and other interested parties (n=10) participated in Phase Three of the current study. These participants were identified as critical players in the Kenyan early childhood sector, with the capacity to influence national policy on ECE programs. Seidman (2013, p.10) believes that 'the primary way a researcher can investigate an educational organization, institution, or process is through the experience of the individual people, the "others" who make up the organization or carry out the process'.

Hence, a semi-structured interview (see Appendix I) with 10 key ECE policy stakeholders and interested parties enabled this study to explore in depth participants' views regarding the use of technology in ECDE settings. The questions were focused on stakeholders' and interested parties' views about the use of technology in ECDE policy, curriculum and practice. A semi-structured interview allows for "standard questions with one or more individually tailored questions to get clarification or probe a person's reasoning" (Leedy & Ormrod, 2005, p. 184). The dates, time and location of where the interviews could be conducted was negotiated with each participant. Each interview was recorded using a digital voice recorder, and was 30-45 minutes' duration.

This section has elaborated on data collection methods and procedures employed by this study with an aim of gathering evidence from the three identified sources. The following section presents the methods used to analyse sets of data collected by this study.

Data Analysis Methods and Procedures

This study was conducted through three phases and yielded both textual and numerical data. This necessitated the use of both qualitative and quantitative methods in analysing the data collected. The analysis process in the current study involved aligning the data with the three research questions identified in Chapter One. In this section, procedures and specific analytic methods and techniques are discussed.

Sets of data were generated through observations, interviews and survey in the three phases of the study. This strategy was aimed at seeking corroboration (Bryman, 2006; Cameron, 2009; Johnson & Onwuegbuzie, 2004) among the sets of evidence collected. Observational and interviews data, along with data collected through teachers' responses to open-ended questions in some parts of the survey questionnaire were analysed through theme identification and searching for patterns (Al Qur'an, 2010; Theiler, 2012; Yin, 2009) within each participant's evidence as an individual and also across the different groups of participants involved in each phase of the research. Fereday and Muir-Cochrane (2006) describe thematic analysis as "a form of pattern recognition within the data, where emerging themes become categories for analysis" (p. 4). This approach enabled the analysis of both individual perspectives as well as the perspectives of groups of participants on the use of technology in ECDE contexts in Kenya.

Through the use of 'within' case analysis techniques, the sets of data were first analysed independently through the exploration of participants' views from a single pers pective. This was followed by 'across' case analysis where data were analysed on a collective basis. This aimed at identifying the perspectives of groups of participants. Stakeholders and other interested parties who participated in one-to-one interviews during Phase Three were also categorized in terms of their roles within the organization each participant represented. For example, ECE policy designers and teacher educators (coded as NP 01, CD 01, CD 02, TP 01, TP 02, TP 03, TP 04, TP 05, TP 06 and TP 07) comprised three groups of stakeholders and other interested parties who participated in this research. Through across case analyses, unfolding themes highlighting similarities and variations amongst individual participants and across entire groups of participants could be ascertained.

Overall, all the data obtained through observations, interviews and the open-ended items in the survey were coded. The development of the coding scheme was an on-going process carried out throughout the data collection period and beyond. The coding served a crucial role in reducing large amounts of data into a smaller number of analytic units. This enabled the understanding of the phenomenon under investigation as the research progressed. Rowlands (2005, p. 88) refers to this understanding as ‘a cognitive map, an evolving schema for understanding what was happening in each case’.

The bulk of data was generated through the survey questionnaire conducted during Phase Two. These data were subjected to both simple descriptive and inferential statistics. Simple descriptive statistics were used to compute data involving summations and percentages. While inferential statistics were used in determining correlations and differences between and among variables.

As a preliminary step, a coding book with value labels for all the variables in the three sections of the questionnaire: A, B and C (see Appendix G) was prepared to capture and collate the data from the surveys. Preparing the coding book involved: a) defining and labelling in each of the variables; and b) assigning numbers to each of the responses. A Census and Survey Processing System (CSPro) 4.1 was used as a guide in entering all the data provided by respondents in data files. CSPro is a free software package designed by the United States Census Bureau, Macro International, and Serpro for entering, tabulating, and disseminating data from censuses and other surveys (Iris Center University of Maryland, 2010).

The data in the files were screened and cleaned. This process involved checking and correcting errors and especially values that fell outside the range of possible values for a variable. Cleaning of data involves detecting, diagnosing and editing data abnormalities (Osborne, 2010). As part of the process of screening and cleaning, cross-tabulation was carried out for the purpose of checking for possible correlations between the data files created and the raw data taken directly from the surveys. This was done through random sampling of surveys and subjecting them to cross-tabulation. The cleaned data was then transferred to the Social Package for Statistical Sciences (SPSS) and subjected to both simple descriptive and inferential analyses (Gerber & Finn, 2005). Thus data were organized into summary tables, figures and referenced during the discussion of the findings.

For open-ended questions, with text-based comments, coding involved analysing the questionnaires to identify major categories or common themes. These major themes were listed in the codebook under variable names and each variable assigned a number. Further, a numerical code was assigned to responses that did not fall into the listed categories. When entering the data for each participant, comparison was made on participants' responses with those listed in the codebook and an appropriate number entered into the data set under the corresponding variable. The quantitative data were also subjected to checking and cleaning to ensure there were no errors when conducting an analysis. All these tasks were achieved through the support of prior trained data entry assistants.

Validity

This study's use of mixed methods with variation in data collection resulted in greater validity. Validity was also produced through linking data collection questions and measures to research questions and propositions (Al Qur'an, 2010; Rowley, 2002). More importantly, the findings in Phase One informed the design of the survey and interview protocols for the stakeholders and other interested parties. The threats to internal validity of the survey were addressed by having supervisors review the survey to ensure that the questions were clear and unambiguous. The survey participants were also not required to provide their personal details on the surveys so that individuals could select responses freely without fear or favour. Further, systematic protocols and procedures were adhered to throughout data collection and research experts reviewed drafts of the study reports that emerged from the data being analysed (Theiler, 2012).

Internal Validity

Internal validity seeks to establish a causal relationship, whereby certain conditions are believed to lead to other conditions (Yin, 2009). Theiler (2012) refers to internal validity as the "confidence in the relationships between variables" (p.45). Internal validity or credibility in the relationships between variables in the current study was achieved through pattern matching, explanation-building, the use of multiple sources in data collection, and triangulation of evidence. The pattern matching was done by comparing and contrasting emerging themes in the data collected during the three phases of the research. This was followed by explanation building by seeking to identify similarities and differences in emerging themes.

External Validity and Reliability

External validity and reliability of this study in relation to external measures was challenging to address due to the nature of this study. The intention of the study was however, not to generalize findings to other populations. Rather, the main aim was to provide an in-depth and broad exploration of ICT uptake in ECDE programmes in Kenya by combining both qualitative and quantitative evidence. Accordingly, the measures of construct validity and internal credibility were prioritized in all aspects of project design, implementation and evaluation.

Ethical Considerations

> *Entering any environment to conduct research can be a potential minefield and it is the responsibility of the researcher to give due consideration to possible ethical issues that may arise* (Oldridge, 2010, p. 99).

Seeking ethics approval from relevant authorities was one way through which the current study demonstrated respect for those who consented to participate. Similarly, regard for ethics by this study served an important role of respecting the rights of people who did not wish to participate due to one reason or another. This section outlines accepted procedures in research involving human beings that were considered in the current research project.

Authority to Conduct Research

An application for ethical consideration of this research commenced by obtaining approval for Phase One of the study (Reference number 5201001521 - see Appendix B, p. 252) through the Macquarie University Human Ethics Review Committee before proceeding to Kenya to collect data. Upon arrival in Kenya, the Ministry of Higher Education Science and Technology provided authority for the Phase One study to be conducted by providing a research permit (see Appendix C). Since the current study was conducted in Nairobi, the Nairobi City Education Office issued a letter of authority (see Appendix F) for the study to be implemented in the designated ECDE settings.

A similar procedure was followed during Phase Two and Three of the study (Reference number 5201200599 - see Appendix K), initially through Macquarie University and subsequently, the Ministry of Higher Education Science and Technology also issued a second research permit (see Appendix L). Likewise, the Nairobi City Education Office issued a letter of authority for the study (see Appendix M) to continue in the same district that was used in Phase One, with the inclusion of teachers from ECDE centres in an entire district.

Informed Consent

Each participant who contributed to this study did it on a strictly voluntary basis. They were informed that they could withdraw from the study at any time, without having to give a reason and without consequence. Upon invitation to take part in the study, the purpose, research activities and timelines set for each activity were explained to each participant during each phase of data collection. The expectations of the study and roles to be played during their involvement in the study were also clearly defined in the documentation supplied to each participant. As a confirmation to participate in the study, participants signed two consent forms and returned one to the researcher, and kept the other for their own records.

During Phase One, a range of data was collected including observational notes and other field notes. These aspects were clearly explained in the project information supplied to the ECDE centres at the beginning of Phase One and clarified during a meeting of centre staff before commencing data collection.

Although the researcher did not work directly with the children at the ECDE settings nor collect data from them, permission was sought from parents to access information about their children included in planning documents and as observation notes during Phase One of the study. After signing the consent forms, teachers were provided with introduction letters and consent forms (see Appendix E) to relay to parents. It was also made clear in the letter that the study focused on teachers and would involve their children indirectly when collecting data at the two centres included in Phase One.

Further, parents were informed that their children's consent would be obtained before proceeding with any video footage and every effort would be made to ensure that the children's routines at the centres were not disrupted during data collection. For permission to publish digital recordings (photographs and video recordings) of children taken during the research, parents were instructed to initial one of the three options provided in the letter of consent (see Appendix E).

Phase Two of the study involved teachers in the selected study district while participants for Phase Three were key ECDE stakeholders and other interested parties. Both groups of participants were sent letters of invitation (see Appendices H and I). In these letters, the purpose of the study, research activities to be undertaken, duration and their roles as they participated in these activities were explained. The stakeholders were provided with two options out of which they selected one, that is, whether they preferred their comments to be linked to their names. In the case of survey participants, they were informed that completion and returning of the questionnaire was a confirmation of their willingness to participate freely in the project.

The procedural steps outlined above conform to the Australian National Statement on Ethical Conduct in Human Research (Australian Government, 2007, p. 19) specifying thus:

> *Respect for human beings involves giving due scope to people's capacity to make their own decisions in the research context, this normally requires that participation be the result of a choice made by participants – commonly known as 'the requirement for consent'. This requirement has the following conditions: consent should be a voluntary choice, and should be based on sufficient information and adequate understanding of both the proposed research and the implications for participation in it.*

Confidentiality

In the information letter, all participants were reassured that in agreeing to participate in this research there was no anticipated risk to them as participants, their ECDE settings and the children in the centres. In the confidentiality statement included in the invitation, participants were reassured that any information or personal evidence collected in the course of the study was confidential to the research team identified in the project information. Further, participants were informed that no information concerning their identity would be released without their explicit consent and that the names of individual participants – children, teachers or other stakeholders, would not be used in the publications and presentations emerging from this research.

A statement in the consent form provided to participants included the possibility of contacting Macquarie University Human Research Ethics Committee in case they had complaints or reservations about any ethical aspect of their participation in the research. Participants were informed that the complaints they made would be treated in confidence and investigated and they would be informed of the outcome. Alternatively, they could contact the early childhood education programme officer for the selected study district to confirm the identity of the researcher or express any concerns. The contact details for both the ethics committee and the programme officer were provided in the consent form.

Those who participated in interviews were also assured that the digital recordings and raw data transcripts of their interviews will be accessed by the researcher and supervisors. During research activities, all the materials and equipment containing data were locked in safe filing cabinets in the researcher's home and delivered safely from Kenya to Australia. They are currently kept safely in locked filing cabinets at the Institute of Early Childhood Department office, Macquarie University where they will be stored for a period of five years.

Chapter Summary

This chapter has presented the research design and the methodology employed in this study. The chapter has described the research design, research methods used in data collection and analysis. It has also provided an explanation on validity and ethical considerations for this study. The next Chapter, 4, presents findings from Phase One involving the two preschools with 11 teachers as participants.

CHAPTER 4

PHASE ONE: FINDINGS FROM THE TWO CASE STUDIES

The findings in this chapter can assist readers to understand the context of technology used by Early Childhood Development and Education (ECDE) teachers in Kenya through the analysis of data collected in two preschools located in Nairobi. The collation and analysis of data collected in Phase One of this research study was a necessary first step in informing the design of phases two and three. The contents of this Chapter have been organized under six subsections including case and participants' characteristics, availability and access to technology, teachers' use of technology in teaching practice, teachers' perceptions about the use of technology in ECDE, professional training in technology and concerns about integrating technology in practice.

Case Study and Participants' Characteristics

Case Study Characteristics

As outlined in Chapter 3, two preschools from the study district in Nairobi, Kenya were selected on the basis of being either public or private. This approach to selecting the two preschools was important for the purpose of ensuring representation of preschools in the study area in terms of public and private.

The preschool categorized as public was a Nairobi City Council public facility. It was located in the Eastland suburb of Nairobi, next to a slum area. The occupants in this slum were a mixture of jobless community members (30%), self-employed (50%) as well as those employed (20%) in the varied sectors in the city of Nairobi. The sectors included education, medical, hospitality, beauty industry and banking. On average, the occupants in this area earned between US$0 and 25 (Ksh. 0–2,500) in a single day. The members in this area had access to facilities such as clean water, electricity, public transport and public library. The preschool under study in this area was attached to a primary school and was managed by a head teacher. It had three classes that included a nursery (4.0-7.4 years) and two pre-primary units (5.0-8.11 years). The total enrolment was 180 children comprising 107 boys and 73 girls. On the other hand, the preschool categorized as private was a private fee-paying institution owned and managed by a church organization. It was located in the Eastland area of Nairobi city. The community members in this area were classified as middle-class. They worked mostly in high-paying corporate private companies. This group of members earned between US$50 and 100 (Ksh. 5,000 –10000) in a single day. They had access to electricity, internet connections, cyber Cafes, supermarkets, banking system and restaurants. Most of the residents in this area drove their personal vehicles. The preschool had three classes comprising a baby class (2.0-3.11 years); a nursery class (3.0-6.11 years) and a pre-primary unit (5.0-6.11 years). The total enrolment was 96 children comprising 47 boys and 49 girls.

Participant Characteristics

Eleven female teachers participated in Phase One. Five teachers were drawn from the public preschool and six teachers practising in the private centre. The teachers' ages in both settings ranged between 25-50 years. Each centre had two teachers undergoing training in ECDE either at certificate or diploma level. They both practised as assistant trainee teachers. Additionally, all the eleven teachers had achieved the Kenya Certificate of Secondary Education (KCSE). Based on the education system in Kenya, Secondary Education involves class attendance combined with internal assessments in various subjects for a period of four years. At the end of the fourth year, students are required to sit for the national examinations prepared by the Kenya National Examination Council (KNEC). The students who pass with either an aggregate Grade of A or B are eligible to enter universities for further studies. Those who do not attain the above grades can go to a community college to pursue training for various professions.

The teachers practising in the public preschool had teaching experiences that ranged between one and 17 years. Three teachers (CPUB's 01, 03 & 05) in this setting were qualified ECDE teachers, and each had achieved a certificate and diploma in ECDE studies at a District Centre for Early Childhood Education (DICECE). To add on, CPUB 01 had an additional certificate in Special Needs Education (SNE) and CPUB 03 had certificates also in both Microsoft Word and Power Point from a private college that offered training in ICT. One teacher, CPUB 01 was a leader in this setting as well as a class teacher for the nursery section that took care of children aged 3-4 years. She had worked as a preschool teacher for 17 years. Both CPUB's 03 and 05 were class teachers in two pre-unit classes that catered for children aged 5-6 years. These two teachers had each worked for twelve 12 years as ECDE teachers. The other two teachers (CPUB 02 and 04) were undergoing training in ECDE studies to qualify as preschool teachers at diploma (CPUB 02) and certificate (PUB 04) levels respectively. Prior to enrolling for training as ECDE teacher, the CPUB 2 attended the Kenya Institute of Advanced Technology (KIAT) and qualified with a Diploma in Information Technology (IT). Both CPUB 02 and 04 worked as teacher assistants in the public ECE setting. Teacher CPUB 02 assisted teacher CPUB 01 in the nursery class while CPUB 04 assisted one of the pre-unit teachers, CPUB 03. Table 4.1 provides a summary of public preschools teachers' characteristics.

Table 4.1

A Summary of Public Preschools Teachers' Characteristics

Participants	Professional Qualifications	ICT Qualifications	Professional Experience	Roles	Class
CPUB 01	Certificate & Diploma (ECDE)	None	17 years	Lead teacher; Class teacher	Nursery (3-4 years)
CPUB 02	Teacher trainee (ECDE Diploma)	Diploma in ICT	1 year	Teacher assistant	Nursery (3-4 years)
CPUB 03	Certificate & Diploma (ECDE)	Microsoft & PowerPoint (Certificates)	12 years	Class teacher	Pre-unit (5-6 years)
CPUB 04	Teacher trainee (ECDE Certificate)	None	1 year	Teacher assistant	Pre-unit (5-6 years)
CPUB 05	Certificate & Diploma (ECDE)	None	12 years	Class teacher	Pre-unit (5-6 years)

On the other hand, teachers practicing in the private preschools had teaching experiences ranging between one to over 20 years. There were three teachers in this setting (CPRV 01, 03 and 07) qualified as preschool teachers, certificated at both certificate and diploma levels. Only one teacher (CPRV 05) was a qualified ECDE teacher with a relevant certificate in ECDE. Teacher CPRV 03 was the lead teacher at the private preschool and she assisted teacher CPRV 07 working in one of the two pre-unit classes. Teacher CPRV 03 had worked as a preschool teacher for over 20 years. Additionally, teacher CPRV 01 served as a class teacher in the nursery section in which children aged 3-4 years were taken care of. She had worked as a preschool teacher for 19 years. Both CPRV 05 and 07 were class teachers in two pre-unit classes that catered for children aged 5-6 years. CPRV 05 had worked for 12 years as a preschool teacher, while CPRV 07 had 6 years' teaching experience in the preschool sector. The other two teachers (CPRV 02 and 06) were undergoing training in order to qualify as preschool teachers at certificate level. They worked as teacher assistants in this setting, CPRV 02 assisted teacher CPRV 01 in the nursery class while teacher CPRV 06 assisted one of the pre-unit teachers, CPRV 05. Table 4.2 provides a summary of private preschools teachers' characteristics.

Table 4.2

A Summary of Private Preschools Teachers' Characteristics

Participants	Professional Qualifications	ICT Qualifications	Professional Experience	Roles	Class
CPRV 01	Certificate & Diploma (ECDE)	None	19 years	Class teacher	Nursery (3-4 years)
CPRV 02	Teacher trainee (ECDE Certificate)	None	1 year	Teacher assistant	Nursery (3-4 years)
CPRV 03	Certificate & Diploma (ECDE)	None	20 years	Lead teacher; Teacher Assistant	Pre-unit (5-6 years)
CPRV 05	Certificate (ECDE)	None	12 years	Class teacher	Pre-unit (5-6 years)
CPRV 06	Teacher trainee (ECDE Certificate)	None	01 years	Teacher assistant	Pre-unit (5-6 years)
CPRV 07	Certificate & Diploma (ECDE)	None	06 years	Class teacher	Pre-unit (5-6) years

Availability and Access to Technology

Data on teachers' access to technology was collected through the use of observations and semi-structured interviews with the teachers.

Observation Data

Evidence gathered through field notes taken during the observational visits revealed availability of technological resourcesin form of instructional materials in the six classrooms across the two preschools. All teachers (n=11) accessed and used these materials in their daily teaching practice.This evidenceis presented in Table 4.3.

Table 4.3: *Availability and Teachers' Access to Technology*

Teachers' Access

	Public					Private					
Instructional Materials	01	02	03	04	05	01	02	03	05	06	07
Wall blackboards	√	√	√	√	√	√	√	√	√	√	√
Charts	√	√	√	√	√	√	√	√	√	√	√
Government curriculum guidelines	√	√	√	√	√	√	√	√	√	√	√
Text books	√	√	√	√	√	√	√	√	√	√	√
Teachers' documented schemes of work in exercise books	√	√	√	√	√	√	√	√	√	√	√
Teachers' documented lesson plans in exercise books	√	√	√	√	√	√	√	√	√	√	√
Picture books	√	√	√	√	√	√	√	√	√	√	√
Children's work exercise books	√	√	√	√	√	√	√	√	√	√	√
Teachers' pens and children's pencils	√	√	√	√	√	√	√	√	√	√	√
Crayons	√	√	√	√	√	√	√	√	√	√	√
Plasticine	√	√	√	√	√	√	√	√	√	√	√
Numeracy counters	√	√	√	√	√	√	√	√	√	√	√
Wooden blocks	√	√	√	√	√	√	√	√	√	√	√
Big and small rulers	√	√	√	√	√	√	√	√	√	√	√
Outdoor play materials including balls skipping balls and rings	√	√	√	√	√	√	√	√	√	√	√
Utensils including plastic cups and plates	√	√	√	√	√	√	√	√	√	√	√

Key: √ indicates availability and teachers' access

The evidence in Table 4.3 shows availability of an array of 16 instructional materials accessed by all 11 teachers in the six classrooms across the two preschools. The 16 instructional materials could be categorised into print and non-print tangible materials.

Moreover, observational field notes revealed availability of three types of digital technologies identified at the primary school attached to the public preschool. This data is presented in Table 4.4.

Here, the data in Table 4.4 showed teachers (n=5) at the case public preschool accessed 3 types of digital technologies. These included 53 computers located in a laboratory and school office, a typewriter and duplicating machine also located in the school office. Notably, 35 of the 53 available computers were functional.

Table 4.4

Types of Digital Technologies Accessed by Teachers at the Case Public Preschool

				Teachers' access to Digital Technologies				
Digital resources	Number	Number Functional	Location	01	02	03	04	05
Computers	50	35	Laboratory	o√	√	√	√	√
Computers	3	3	School office	√	√	√	√	√
Type writer	1	1	School office	√	√	√	√	√
Duplicating machine	1	1	School office	√	√	√	√	√

Key: o√ indicates observed access & use; √ observed access

Interview Data

Through the use of unstructured interviews (see item nos. 5 and 6 Appendix A p. 251) with the case preschool teachers (n=11), this study collected information on types of digital resources accessed and used by these educators. This data are presented in Table 4.5.

Here, the data in Table 4.5 indicated that all the participating teachers (n=11) accessed and used some form of digital technologies. These included: personal mobile telephones, computers and children's software; digital cameras, printers, photocopiers, televisions and radios. The evidence disclosed personal mobile telephones were the most ubiquitous form of digital technologies accessed and used by the teachers across the two case preschools.

Table 4.5

Types of Digital Resources Accessed and Used by Teachers

Digital Resources	Public (n=5)	Place of access	Private (n=6)	Place of access
Personal mobile telephones	5	Both at home and school	6	Both at home and school
Computers	4	Both at home and school	2	Home and friend's house
Children's Software	1	Home	0	-
Digital cameras	0	-	1	Home
Printers	1	Elsewhere	0	-
Photocopiers	1	Elsewhere	0	-
Televisions	1	Home	2	Home
Radios	0	-	1	Home

Teachers' Use of Technology in Teaching Practice

Evidence on teachers' use of technology in teaching practice was obtained from two sources including the researcher's observation of teachers' practices in classroom and one-to-one interviews with these teachers.

Observation Data

Data collected through field notes taken during the researcher's observations indicated that all the teachers (n=11) across the two centres used instructional materials (see Table 4.3) in teaching practice. This comprised documentation of teaching and children's learning activities for an entire school term, documentation of daily teaching and children's learning activities, implementation of teaching and children's learning; documentation of children's learning progress and communication with parents. This evidence is documented in Table 4.6.

Table 4.6

Teachers' Use of Instructional Materials in Teaching Practice

Teaching practice elements	Instructional materials used
Documentation of teaching and children's learning programme for an entire school term (schemes of work)	Government curriculum guidelines and text books for reference; Writing materials including exercise books, pens and rulers
Documentation of daily teaching and children's learning activities (lesson plans)	Documented schemes of work for reference Writing materials including exercise books, pens and small rulers
Implementation of teaching and children's learning	Lesson plans, wall blackboards, charts, picture books, children's work exercise books, pencils, crayons, plasticine, numeracy counters, wooden blocks, big rulers, play materials (balls, skipping ropes and rings), assorted plastic cups and plates
Documentation of children's learning progress communication with parents	Writing materials including exercise books, pens and small rulers Children's exercise books used for home work and communication with parents

Interview Data

Apart from observational data, evidence on teachers' use of technology in teaching practice was also gathered through semi-structured interviews (see item nos. 1 and 7, Appendix A). These interview items required teachers to state (item 1) how they planned and documented their teaching and children's learning and (item 7) how they integrated digital resources in their daily practice.

Planning and Documenting Teaching and Children's Learning

Evidence generated through interviews showed all the teachers (100%) used writing materials including exercise books, pens, pencils and makers in planning and documenting their teaching and children's learning. This evidence is supported by teachers' responses documented in Table 4.7.

The data in Table 4.7 show teachers used instructional materials (print and non-print) mostly in planning processes. The data in the table unveiled the different approaches undertaken by participating teachers in planning processes. These included making reference to curricula materials and consideration of child-related factors.

Table 4.7

Planning and Documenting Children's Learning

Teachers	Responses
CPUB 01	*I make daily lesson plans by using Kenya Institute of Education (KIE) materials with no technology*
CPUB 02	*I make lesson plans and schemes of work by using timetable, exercise books and a pen*
CPUB 03	*I first consider children's ability, interests and resources in class. I prepare lesson plans and schemes of work by using a pen and exercise books. In technology we are behind*
CPUB 04	*I use books and pens. No computers*
CPUB 05	*I use a timetable, touchable materials, exercise books and pencils*
CPRV 01	*I mostly do handwritten work for planning*
CPRV 02	*I plan according to age, groups and ability of children. I use a pen and exercise book*
CPRV 03	*I prepare lesson plans by using materials, pencils and markers. I prepare resources needed, for example plasticine. I am still molding children. I prepare learning resources earlier before presenting to children*
CPRV 05	*I make according to children's ages and ability. I use manila papers, sacks, pencils, felt pens and plasticines. No computers*
CPRV 06	*I use locally available materials for example sacks. I only use my hand, needle and thread; pen, paints, crayon to color them, pencils and rubber*
CPRV 07	*I have undergone training to make teaching and learning materials. As a teacher, you must come up with materials. We are creative and use "kunai", bottle tops and drawing. A teacher must be creative*

Integration of Digital Resources in Daily Practice

Data collected through interviews on integration of digital resources in daily practice indicated five teachers across the two centres (CPUB 01, CPUB 05, CPRV 03, CPRV 05 and CPRV 07) used their personal mobile telephones mostly for communication with parents, colleagues and employer. Additional roles by two of the lead teachers included calculation of enrolment and register issues (CPUB 01) and keeping the teacher alert on various activities in school, for teaching language and emotional stability in children and transactions of parents' fee payment (CPRV 03). This data is supported by the teachers' responses indicated in Table 4.8.

In reference to the data in Table 4.8, two teachers (n=5) in the public case preschool used their personal mobile telephones for administrative purposes. Two teachers in the same setting stated that they did not integrate technology in their practice. Interestingly, one teacher said she had never thought about it but asked children questions regarding the innovation.

Table 4.8

Integration of Digital Resources in Daily Practice

Teachers	Responses
CPUB 01	*I use mobiles for calculation: I calculate enrolment and register issues. I also use mobiles to communicate with parents for example when a child is sick.*
CPUB 02	*There is no integration; I carry books and lesson plan in books daily. I refer to my schemes for reference*
CPUB 03	*I ask questions from children. I have never thought of it*
CPUB 04	*I do not integrate*
CPUB 05	*A mobile for communicating to parents if a child is sick or absent. I also use it to communicate to fellow teachers*
CPRV 01	*I do not*
CPRV 02	*No integration*
CPRV 03	*I use a mobile to alert me on various activities in school; For communication with teachers and employer; It serves as a reminder on meetings; I use it as an item for teaching, that is, language development in children and emotional stability in children; I also use it to receive parents' payment of fees through "Mpesa" technology.*
CPRV 05	*I use my mobile to communicate with parents when children are sick and for sending messages when they are needed in school. It is the easiest method of communicating to parents.*
CPRV 06	*I do not do any integration*
CPRV 07	*A mobile phone is very necessary because I use it for communication with all parents when passing very important information and reminding them about trips; Parents also communicate back; A mobile is very reliable, writing on a paper, a paper can easily get lost; All parents have mobile phones; I have almost all the numbers for parents; Right now I don't have my mobile phone because it was stolen a week ago in a parents' graduation ceremony in divinity.*

In like manner, three teachers at the private case preschool (n=6) used their personal mobile telephones in administration roles. Three teachers in the same setting said they did not integrate technology in their practice.

The two sets of data suggest teachers in the two case preschools did not use technology in their everyday practice and pedagogy.

Teachers' Perceptions about the Use of Technology in ECDE

Evidence on teachers' perceptions about the use of technology in ECDE was gathered through the use of semi-structured interviews (see item nos. 2 and 4 Appendix A p.) with the teachers. The two interview items were focused on the teachers' understanding of the term, 'digital technology' and their views on using technology in ECDE curriculum.

Teachers' Understanding of the Term Digital Technology

Through interviews, teachers (n=11) were asked to state their understanding of the term, 'digital technology'. Responses provided by all the participating teachers (100%) demonstrate these teachers perceived 'digital technology' in terms of computers, cameras, mobile telephones, tape recorders, radios, televisions, information technology (IT), face books and videos. This data are presented in Table 4.9.

Looking at the evidence in Table 4.9, teachers (n=11) understood the term digital technology in terms of a range of technology resources. However, 9 teachers (81.1%) across the two settings mentioned 'computers' in addition to other resources. This evidence suggested that teachers associated the term digital technology mostly with computers.

Table 4.9

Teachers' Understanding of the Term Digital Technology

Teachers	Responses
CPUB 01	*Digital technology is where the hard copy of some work is put in software. For example, schemes of work put in computer. One can see computer used in teaching, counseling and preaching.*
CPUB 02	*Digital technology is electronic media for example a computer*
CPUB 03	*Digital technology refers to devices, something like a television, cameras and tape recorders. Digital technology helps in teaching and giving information about something*
CPUB 04	*Digital technology is computers, laptops and mobile phones*
CPUB 05	*Digital technology is something to do with computer. It is the use of new technology for example radios, televisions and computers*
CPRV 01	*Digital technology is seeing the pictures through computer or television. It also refers to camera, mobile and phones.*
CPRV 02	*Digital technology is something to do with computer.*
CPRV 03	*Somebody is trapping my voice through digital for example computer, IT, digital cameras, face books, songs and poems.*
CPRV 05	*Hard for me. I don't know. TV black and white will not work. You have to buy the digital ones because black and white are not digital. I heard that all teachers should learn computers. I admire because children are seen playing games. A friend of mine from Uganda sends me messages yet I don't know how to operate a computer. No privacy when somebody operates your emails. I would like my mum to pay for me so that I learn. My salary is not enough because I have a form one daughter. I know learning computer will reduce my poverty. I have tried all sorts of things including selling and cutting vegetables but nothing has worked for me.*
CPRV 06	*Digital technology is data technology. It is information in computers, TVs, radios and mobile phones*
CPRV 07	*Digital technology is like these cameras. It is information or something being taken, not being manual. Examples are TVs, videos, cameras and play tapes*

Teachers' Views on Using Technology in ECDE Curriculum

Teachers (n=11) views on use of technology in ECDE curriculum were focused on teaching practice and children's learning.

Views on Use of Technology in Teaching Practice

Six participants across the two case preschools were of the view that the use of technology in ECDE curriculum would enable teachers to source and access information on ECDE. One of these participants felt the use of computers would enable teachers to acquire knowledge about ECDE worldwide. Also, the computers would facilitate their search for information on ECDE curriculum in Kenya. This participant's articulation is identified in the following excerpt.

> *Integration of technology in ECE curriculum in Kenya allows us to know more about ECDE worldwide especially through computers. On the other hand, allows us to search all the content in ECDE curriculum in Kenya.* (CPUB 02)

The participants also felt the use of technology in ECDE would enable teachers to communicate with stakeholders comprising parents, managers, ECDE officers and fellow teachers. One participant articulated the need for computers and internet connection in preschools for the purpose of facilitating communication with stakeholders through emails. This response is presented in the following excerpt.

> *I wish we could have computers and internet connection in our ECDE centres. These two resources can make it possible for us to communicate with parents, managers, ECDE officers and fellow teachers in other centres through emails.* (CPUB 03)

Additionally, responses provided by 10 participants indicated the role of technology in enhancing teaching practice. This role was articulated by four of the participants in varied ways. These included role of technology in making teaching and learning processes easier, efficient and effective. This group of teachers were also of the view that the use of technology in preschool education would make learning interesting and this would enable children to acquire knowledge easily. This data is supported by the following quotes from the teachers' responses.

> *Technology would be very effective and increase teachers' knowledge, make work easier for teachers, and save time. It is best because it will bring real picture when you scroll and children see real animals. It is also fun for children. When you draw on board, children do not understand. It is good for making patterns. Technology is better than writing in books all the time.* (CPUB 05)

> *It is a good idea, as it will make it easier to teach, and also share education material. Integration of technology is very important because it will make teaching easier. Teachers should have more training that will help them use technology in ECDE curriculum.* (CPRV 01)

> *Technology is more efficient and thus helps in the storage of data and reduces the work load. It is a program that will make teaching and learning more efficient. It will make teaching efficient and effective.* (CPRV 07)

> *Technology will make teaching and learning effective and more interesting. It will help in planning and come out with appropriate teaching methods. It promotes children's learning and development. It gives teachers easier time to cover all the activities within a very short period of time.* (CPRV 03)

Views on Use of Technology in Children's Learning

All the teachers (100%) across the two preschools were of the view that the use of technology in ECDE curriculum would enable children acquire technology literacy skills at an early age. Three of these participants felt that children's acquisition of ICT skills at an early age had potential benefits. These included learning faster, exploring their careers early and being part and parcel of the world of technology. These responses are identified in the following excerpts.

> *The children will become ICT literate at an early age, and that will make them learn faster.* (CPUB 04)

> *Children should be provided with integration of technology so that they can learn and at the same time, be exposed and be able to explore and identify their career early enough.* (CPRV 02)

> *It is good for our children to learn and grow up knowing what technology is because we are in the world of technology.* (CPRV 06)

The participants (100%) were also of the view that the use of technology in preschools would make learning easy, effective and interesting to all children, including those with special needs. These views were reiterated by four of the participants in the following ways:

> *Need to move with the world by making children have interest in technology. Children will enjoy, learn and for mental development. Children become well informed since they remember what they see. Technology makes children also to understand and retain what they have been taught especially by using computers. At that early age, children improve in their skills on the use of technology.* (CPUB 03)

> *The mind of a child is critical and updated with technology that develops enthusiasm in children. I have two types of software at home. There is need for software in ECDE centres. There is also need for children to use word pad and they can as well learn letters by using the keyboard.* (CPUB 02)

> *It's beneficial to both parents; children and teachers because it saves time and enable the children to acquire more knowledge than when they are taught by a teacher only.*(CPRV 05)

> *There is need for digital resources for learning to become easy. Learning becomes interesting to children and even to special needs children, for example those with hearing and listening problems. There is need for machines to be availed to ECE centres and special needs centres.* (CPRV 07)

The data presented above showed majority of the teachers across the two preschools were positive about the use of technology in teaching practice and children's learning. However, three teachers were concerned that the use of technology in preschool would impact negatively on teachers' practice in a number of ways. These included creating additional work load, expenses involved, required cooperation among stakeholders and lack of space in overenrolled classrooms to accommodate them.

Further, two teachers across the two preschools feared that the use of technology in ECDE curriculum was likely to impact on children's development negatively, in terms of psychomotor and social and skills, eyes problems, attention and sourcing for wrong information beyond their age. These sets of data are supported by the following quotes from the teachers' responses:

> *It gives teachers hard time hence they have too much work* (CPUB 01)

> *It is a time consuming and expensive venture which needs concerted approach for better implementation with all the relevant stakeholders.* (CPUB 05)

> *Madam you are aware that teaching in ECD is not an easy job. The curriculum is wide with emphasis of thematic approach of teaching. This approach requires use of materials and wastes a lot of time. Children are many with no space in classrooms for computers. Parents expect us to teach their children mainly how to speak and read and also number work. Adding computers to all these problems will be too much work for us.*(CPRV 03)

> *Psychomotor tend to bring problems. For example, watching Television (TV), clued to TV affects social development. (*CPUB 03)

> *It is necessary for children, for example how to put cartoons on. However, eyes and attention span may be affected. Also, children look for other things beyond their age.* (CPRV 03)

Professional Training in Technology

Interview item no. 3 (Appendix A,) revealed that six teachers across the two preschools had qualifications in computers operations (see Table 4.10). The term qualification is used in this thesis to refer to the completion of national or internationally recognised courses and other required conditions that confer individuals the status of recognized professionals. In addition, two of these teachers practising in the public centre had furthered their studies and obtained a diploma in information and technology (IT), (CPUB O2), certificate in PowerPoint and Microsoft packages (CPUB 03). The interview evidence indicated also that none of the 11 teachers had attended professional training focusing on use of technology in ECDE practice.

Table 4.10

Teachers' Professional Training in Technology

Teachers	Computer Basics	Advanced Packages	Qualifications	Professional Training in Technology
CPUB 01	×	×	×	×
CPUB 02	√	Data base management Software Development Report generation skills Computer Management Communication skills Internet technology Hardware management and system support.	Diploma in ICT	×
CPUB 03	√	PowerPoint and Microsoft Word	PowerPoint & Microsoft Word	×
CPUB 04	×	×	×	×
CPUB 05	×	×	×	×
CPRV 01	×	×	×	×
CPRV 02	√	×	×	×
CPRV 03	√	×	Typing	×
CPRV 05	×	×	×	×
CPRV 06	√	×	×	×
CPRV 07	√	×	×	×

Key: √ teacher has qualification in computer operations; × denote no qualifications in computers and also lack of professional learning in technology

Teachers' Concerns about Integrating Technology in Practice

Through interviews (see interview item no. 8 Appendix A, p. 251) teachers were asked to share their concerns about integrating technology in their work as ECDE teachers. All the teachers (n=11) provided responses that were focused on non-availability of digital resources, teachers and children's lack of access to technology; teachers' lack of knowledge and skills in technology, non-availability of professional training for teachers and trainers, inadequate finances for technology integration, lack of syllabus, lack of teachers' motivation and lack of support from stakeholders and other interested parties. These sets of data are expressed in the following excerpts (Table 4.11) and summarized also infrequency Table 4.12

Table 4.11

Teachers' Concerns about Integrating Technology in Practice

CPUB 01	*Digital resources are not available; I could be happy if they were available. Children could be more exposed and grow with technology. Some parents have children accessing technology but history to some children.*
CPUB 02	*We being left behind compared to primary. Currently primary section is updated with computer trends. ECDE children interact with others who access technology at home or in other schools. Our children feel sidelined because they are not at par with other children.*
CPUB 03	*Lack of knowledge and government to do something. For example, there is need for workshops and seminars. The challenge limited time. Colleges to be registered for accessing ECDE technology. We lack knowledge and skills. There is also lack of skilled trainers since the computer teacher teaches children only; Inadequate computers and other digital resources due to lack of finances as a result of free primary education (FPE); Not all children in ECDE pay finances.*
CPUB 04	*Lack of money to buy even a mobile. Lack of digital resources influences communication and interaction with others.*
CPUB 05	*Finances: most parents are not able to provide children with technology; Most parents are not aware of the importance of technology, are ignorant and lack information; Facilities: computers are not enough; lack of syllabus and motivation from employers.*
CPRV 01	*Finances are inadequate; The centre is willing to introduce technology but there is lack of money; Each ECDE child pays Kshs.5, 700.00 per term for tuition, feeding and payment of teachers; They carry snacks but are provided with 10 o'clock tea, lunch and cocoa before leaving for home; I have interest in technology if only I can access digital resources.*
CPRV 02	*Expenses: It is expensive to buy a computer and lack of training*
CPRV 03	*Inadequate rooms; Lack of funds and proper management; Lack of proper partnership with mother sponsor, that is, management by the church Some children are already exposed to technology; There is no computer in the office.*
CPRV 05	*The use of technology in my work depends on the sponsor of ECDE. The owner (church) has not realized the value Parents have not requested for the resources although I am not sure; The teachers have not emphasized and I lack of knowledge and skills.*
CPRV 6	*Lack of money to purchase digital resources; Parents have not come up with the idea and as teachers we have not proposed; Lack of cooperation among the teaching staff in support of the idea; Lack of support from other institutions for example Non-Governmental Organizations (NGO's), community members and parents.*
CPRV 07	*I tried to raise this issue as staff but we lack finances and training even though parents are supportive*

The data in Table 4.12 show two major concerns with the highest number of responses (7). These include lack of access to technology resources and lack of support from stakeholders. The data in the table reveal concerns with the non-availability of digital resources in ECDE centres (6 responses), inadequate finances for technology integration (6 responses) and non-availability of professional training for teachers and teachers' trainers. The concerns with minimal responses included lack of skilled trainers (2 responses), lack of teachers' motivation (2 responses) and inadequate space in ECDE.

Table 4.12

Frequency Summary on Teachers' Concerns about Integrating Technology in Practice

Concerns	Frequency
Non-availability of digital resources in ECDE centres	6
Teachers and children's lack of access to technology resources	7
Teachers' lack of knowledge and skills in technology	4
Non-availability professional training for teachers and trainers	5
Lack of skilled trainers	2
Inadequate finances for technology integration	6
Lack of syllabus on use of technology in ECDE	1
Lack teachers' motivation	2
Lack of awareness for parents on use of technology in ECDE	3
Lack of support from management, stakeholders and other interested parties	7
Inadequate space in ECDE	1

Teachers' Additional Information

Finally, teachers were asked (see interview item no. 9 Appendix A) if they had anything else they wished to share. Based on participants' responses, seven teachers had diversified issues focusing on ECDE in general as well as use of technology in ECDE. These included admission, the need for research on children who graduate from school and the need for children to use software and keyboard in learning letters; enrolment issues, the need for government and stakeholders and other interested parties' support; the need for on-site training in technology; parents' expectations and teachers' employment and motivation. These sets of data are identified in the following excerpts:

> *Admission issues, research on children who leave this school; the mind of a child is critical and updated with technology that develops enthusiasm in children. I have two (2) types of software at home. There is need for software in ECDE centres. There is also need for children to use word pad and they can as well learn letters by using the keyboard.* (CPUB 02)

I wish the government and all concerned to look at ECDE from a better perspective on how children ought to grow in the world of technology; there is need to motivate ECDE teachers first for technology is not a priority.(CPUB 05)

I wish we could have technology training in our centres so that we are shown how to teach children. (CPRV 01)

Get computers and more qualified teachers in ECDE; there is need for onsite training in technology. (CPRV 02)

I need further advice on best integration materials. Thematic approach delays children and ECDE is currently competitive; If pre-units leave ECDE without having developed reading is an issue; Current parents focus on children passing exams; There is need for ECDE educationists and technologists to put their minds together and see what they can come up with; Parents' understanding is a challenge – they lack the understanding; There is need for holistic development of children. (CPRV 03)

There is need for a similar research in rural areas, not just confined to Nairobi alone; I did not finish my diploma course due to lack of money; Even primary teachers are limited in technology; Whatever I learnt in Nairobi is what I took there (rural); Rural ECDE teachers are still using out-dated methods, will they be able to use technology? (CPRV 05)

Currently, the ECDE department is overlooked in Kenya; the ECDE department is sidelined by the government; Parents appreciate the good work especially the good foundation and appropriate transition; there is need for the government to appreciate ECDE teachers' work and employ them. (CPRV 07)

Chapter Summary

This chapter has presented findings from the two case study preschools in Phase One. These findings were focused on case and participants' characteristics and qualifications, availability and access to technology, teachers' use of technology in teaching practice and teachers' perceptions about the use of technology in ECDE. The chapter has also presented findings on teachers' professional training in technology and concerns about integrating technology in their work.

Two preschools, public and private participated in Phase One in this study. Each of the two preschools had three classes. These classes comprised baby, nursery and pre-units. Eleven female teachers implementing ECDE curriculum in these classes took part in this study. Five teachers were drawn from the public preschool and six teachers from the private centre. The teachers' ages in both settings ranged between 25-50 years. Over 50% of these teachers (n=11) were professionally qualified as ECDE teachers. Their teaching experience ranged between one and twenty years.

Based on observational data, this study found that participating teachers (n=11) at the two case preschools accessed and used varied instructional materials in their teaching practice. These materials comprised print and non-print tangible materials. Observational data revealed also that teachers (n=5) at the public preschool accessed three types of digital technologies though use of these technologies in teachers' practice was not seen. The technologies observed included 53 computers, a typewriter and duplicating machine.

Nonetheless, evidence gathered through interviews indicated that teachers (n=11) across the two case studies accessed and used personal mobile telephones, computers, and children's software. Additional digital technologies accessed and used by these teachers comprised digital cameras, printers, photocopiers, televisions and radios. Although these teachers accessed and used these forms of digital technologies in their personal lives, their use in teaching practice was limited. Despite this limitation, these teachers (over 50%) believed digital technologies could play a critical role in their teaching practice while 100% of the participants were of the view that digital technologies had the potential of enhancing children's learning opportunities.

Further, this study found that 6 teachers across the two preschools were qualified in ICT yet none of the teachers (n=11) was professionally trained in ICT. Finally, through interviews, teachers (n=11) across the two ECDE centres raised numerous concerns about integration of technology in teaching practice. These concerns included non-availability of digital resources in ECDE for teachers' access; lack of support from stakeholders; inadequate finances for technology integration; non-availability of professional training for teachers and teachers' trainers; lack of skilled trainers; lack of teachers' motivation and inadequate space in ECDE.

The next Chapter, 5 presents findings from Phase Two involving a survey of preschool teachers.

CHAPTER 5

RESULTS FROM PHASE TWO: SURVEY

This chapter presents findings from the Phase Two survey of this study. To obtain a broader scope of teachers' perceptions and practices on the integration of technology in ECDE settings in Kenya, a survey was distributed to all ECDE teachers (n=508), except the ECDE teachers participating in Phase One, in the study district in Nairobi, Kenya. The results obtained from these surveys are presented in this chapter, and are organised under the following main sub-headings: teachers' demographic information, availability and access to technology, teachers' use of technology in teaching practice, teachers' perceptions about the use of technology in ECDE, professional training in technology and concerns about integrating technology in practice.

This chapter presents findings from the Phase Two survey of this study. To obtain a broader scope of teachers' perceptions and practices on the integration of technology in ECDE settings in Kenya, a survey was distributed to all ECDE teachers (n=508), except the ECDE teachers participating in Phase One, in the study district in Nairobi, Kenya. The results obtained from these surveys are presented in this chapter, and are organised under the following main sub-headings: teachers' demographic information, availability and access to technology, teachers' use of technology in teaching practice, teachers' perceptions about the use of technology in ECDE, professional training in technology and concerns about integrating technology in practice.

Teachers' Demographic Information

In section 'A' of the questionnaire (see Appendix G), teachers responded to nine (9) question items focusing on demographics including: gender, age, education and professional backgrounds; institution attended for ECDE training; work experience, types of ECDE centres they worked in; age group they taught and responsibilities held. The majority of survey questions had multiple choice responses and teachers were required to select and tick one answer they felt was most appropriate. Sections B and C had both multiple and open-ended questions. Section B contained 11 items on teachers' professional training in technology (see Appendix G) and section C included 17 items on teachers' access; use and integration of technology in planning and documentation (see Appendix G).

Demographics (Section A)

Teachers' Gender

The number of male and female teachers participating in this study was sought through Part A, item number one of the survey questionnaire (Appendix G). The data collected on this item are presented in Table 5.1.

Table 5.1

Teachers' Gender

N=508

Teachers	M (1)	%	F (0)	%
Public (n=167)	31	18.6	136	81.4
Private (n=341)	33	9.7	308	90.3
Total	64	12.6	444	87.4

The data (Table 5.1) reveal most of the teachers teaching in the district of the study were females (87.4%), while male teachers constituted a small percentage (12.6). Additionally, the data presented in Table 5.1 indicate that both public and private ECDE centres had larger percentages of female teachers (81.4; 90.3) compared to the number of male counterparts (18.6%) and 9.7% respectively. The percentage (12.6) of male preschool teachers in the current study was small compared to the higher number (40.9%) of male preschool teachers (n=44) represented in Abdulai's (2013) study in Ghana.

The data in Table 5.1 suggest that there is gender disparity in ECDE staff establishment in the study district. Notably, all the 11 teachers participating in Phase One of this study were females. The gender disparity in ECDE staff within the study district has reflected the national pattern across Kenya for some time. Farquhar (1997) referred to this scenario as "the dearth of male teachers that requires a challenge of social views on the appropriateness of men as teachers of young children" (p.1). Farquhar's point of view suggested that the gender disparity in ECDE staff was and still is a challenge that has been there for quite a number of decades without much empirical attention.

Kutluca (2011, p. 4) attributed the small number of male pre-service ECDE teachers to 'the fact that male students rarely prefer preschool education departments'. Similarly, a study conducted in Kenya on gender inequalities (Mukuna & Mutsotso, 2011) revealed the feminization of the ECDE teaching profession was linked to culture as the main determinant. As part of cultural practices in Kenya, the care and teaching of young children is associated with females for it is believed that they are more caring, bonding and loving to children than males. According to Kimani and Mwikamba (2010, p. 70) 'an understanding of gender dynamics in science and technology is based on the perspective of how social norms, values and attitudes dictate differentials in the participation of male and female in these fields'.

Teachers' Age Ranges

Teachers' ages were sought through the survey questionnaire item number 2 in Part A (Appendix G). Using this item, teachers (n=508) were provided with a list of ages ranging from 20 to 60+. The participants were required to select and tick one age range in which they belonged. Data on participants' selected age ranges are presented in Table 5.2.

Table 5.2

Teachers' Age Ranges

N=508

		Teachers'	Age	Ranges	
Teachers	20-30	31-40	41-50	51-60	60+
Public (n=167)	93	46	21	05	02
%	55.7	27.5	12.6	3.0	1.2
Private	203	110	27	01	0
(n=341)%	59.5	32.3	7.9	0.3	0
Total	296	156	48	06	02
%	58.3	30.7	9.5	1.2	0.4
Males (n=64)	31	17	16	0	0
%	48.4	26.6	25.0	0	0
Females (n=444)	265	139	32	06	02
%	59.7	31.3	7.2	1.4	0.5

As outlined in Table 5.2, data show teachers participating in the survey across the entire district were aged between 20 and 60+ years. However, according to the evidence in the table, 296 teachers (58.3%) were aged between 20 and 30 years, followed by teachers aged between 31 and 40 years (30.7%). Additionally, the data reveal the number of teachers in each age bracket decreased with age, with only 2 teachers (0.4%) indicating they were aged 60+ years. The majority of ECDE teachers across the study district were in the early stages of their professional practice.

In examining gender as a variable, as seen in Table 5.2, men teaching in preschools in the district of study were aged between 20 and 50 years while women's ages ranged between 20 and 60+ years. While 48.4% were aged between 20-30%, the percentage of females in this age group was 59.7.

Using data presented in Table 5.2, this study utilized a chi-square test of independence to determine if a statistically significant relationship existed between teachers' gender and age. In order to perform this test, two scales were utilized comprising 1 for male teachers and 0 for female teachers. Additionally, age values used in this test resulted from identification of medians for each of the age ranges (see Table 5.2). These age values were: 25, 35.5, 45.5, 55.5 and 65. The outcome of this test revealed lack of significant correlation ($r = 0.111$, $p = 0.012 < 0.05$) between teachers' gender and age.

Teachers' Highest Education Completed

On the survey questionnaire, teachers were provided with four options from which to choose and indicate the highest education they had completed (Appendix G Part (A) Item No. 3). The options included primary, secondary and university education together with 'other' and teachers indicating 'other' were required to specify what they meant by 'other'. During analysis of data collected on teachers' qualifications, it was noted participants indicating the 'other' option had specified by indicating 'post-secondary level of education at diploma/certificate'. This option was therefore included in the analysis process. Table 5.3 presents evidence on teachers' highest education completed.

Table 5.3shows participants' highest education completed. 350 teachers (68.9%) teaching in the district of study had completed post-secondary education at diploma/certificate levels. Both public and private ECDE centres had almost the same percentages (67.7% and 69.5%) of teachers with post-secondary level of education. Noteworthy, a small number of teachers (37; 7.3%) had completed a university degree. In Abdulai's study conducted in Ghana, 4.5% of the participating preschool teachers (n=44) had completed a Master's degree as the highest educational qualification.

However, none of the male preschool teachers had primary level as the highest education completed (Table 5.3). Additionally, the percentage of female teachers with post-secondary education at diploma/certificate levels (71.8%) was exceedingly high compared to male teachers (48.8%). The percentage of male teachers who had completed a university education was 17.2% and 5.9% for female teachers.

Table 5.3

Teachers' Highest Education Completed

N=508

		Educational	Levels	
Teachers	Primary (1)	Secondary (2)	Post-secondary (diploma/ certificate) (3)	University (4)
Public (n=167)	03	41	113	10
%	1.8	24.6	67.7	6.0
Private (n=341)	00	77	237	27
%	0	22.6	69.5	7.9
Total	03	118	350	37
%	0.6	23.2	68.9	7.3
Males (n=64)	0	22	31	11
%	0	34.4	48.4	17.2
Females (n=444)	03	96	319	26
%	0.7	21.6	71.8	5.9

Using data presented in Table 5.3, this study utilized a chi-square test of independence to find out if there was a statistically significant relationship between teachers' gender and highest education completed. For the purpose of performing this test, the two previously utilized scales were adopted for gender, male teachers = 1 and 0 for female teachers. Further, four scales were used for the variables indicate in the measure for the highest education provided (see Table 5.3). These scales were: primary education = 1; secondary education = 2; post-secondary diploma/certificate education = 3; and university level of education = 4. The result of this test indicated lack of a significant correlation (r = -0.000, p = 0.992 > 0.05) between teachers' gender and highest education completed.

Teachers' ages and level of education were subjected to chi-square test of independence. The previously identified values (25, 35.5, 45.5, 55.5 and 65) for age ranges (see Table 5.2) and the above 4 scales for education completed, primary education = 1; secondary education = 2; post-secondary diploma/certificate education = 3; and university level of education = 4 were utilized in this computation.

The test outcome revealed a positive moderate significant correlation (r = 0.635, p = 0.000 < 0.05) between teachers age and highest education completed. This finding suggested teachers' increase in age could have had an influence in their highest education completed.

To add on, through a two independent sample t-test, this study sought to find out if there were any significant difference between teachers' gender and highest education completed and also between teachers' types of preschools and highest education completed. In order to perform this test, 4 scales adopted for this study on teachers' education completed were used. The 4 scales were primary education = 1; secondary education = 2; post-secondary diploma/certificate education = 3; and university level of education = 4 were utilized in this computation. Teachers' mean scores, resulting from these scales pertaining to male and female teachers were computed through use of a two independent sample t-test. The outcome of this test indicated lack of any significant difference (t (73) = -0.01, p (0.994) > 0.05) between male teachers (n=64) ($\bar{x}$ = 2.828, SD = 0.703) and the female teachers (n=444) ($\bar{x}$ = 2.829, SD = 0.523).

Further, through the use of a 4-level scale, teachers' mean scores, resulting from these scales in respect to public and private preschools, were computed through the use of a two- independent sample t-test. The scale comprised primary education = 1; secondary education = 2; post-secondary diploma/certificate education = 3; and university level of education = 4. The outcome of this test indicated lack of any significant difference (t (308) = -1.41, p (0.159) > 0.05) between teachers in public preschools (n=167) ($\bar{x}$ = 2.778, SD = 0.575) and their counterparts in private preschools (n=341) ($\bar{x}$ = 2.853, SD = 0.533).

Teachers' Professional Qualifications

Teachers participating in the survey were provided with several categories of Kenyan professional background in ECDE including untrained ECDE teacher, teacher trainee in ECDE, trained teacher at certificate level, trained teacher at diploma level, trained teacher at degree level and any other option that was to be specified (see

Appendix G, Part (A) Item No. 4). Evidence resulting from participants' indications of their professional qualifications is presented in Table 5.4.

Table 5.4

Teachers' Professional Qualifications

N=508

	Categories	Of	Professional	Background	
Teachers	Untrained (0)	Trainees (1)	Certificate (2)	Diploma (3)	Degree (ECDE) (4)
Public (n=167)	13	26	65	60	03
%	7.8	15.6	46.0	35.9	1.8
Private (n=341)	27	34	149	117	14
%	7.9	10.0	43.7	34.3	4.1
Total	40	60	214	177	17
%	7.9	11.8	42.1	34.8	3.4
Males (n=64)	04	13	22	17	08
%	6.3	20.3	34.4	26.6	12.5
Females (n=444)	36	47	192	160	09
%	8.1	10.6	43.2	36.0	2.0

The data in Table 5.4 reveal that most of the teachers (77.0%) across the district of study were professionally trained at both certificate (42.1%) and diploma (34.8%) levels. This district had the smallest number of ECDE teachers (17) (3.4%) professionally qualified at degree level. Based on gender, male teachers constituted the highest percentage (20.3) of trainees compared to the females (10.6%). Of notable interest also was the percentage of male teachers (12.5%) who were professionally trained as preschool teachers at university level, yet the percentage of female teachers was 2.0%.

The data in Table 5.4 were subjected to statistical tests including chi-square test of independence and a two- independent sample t-test. The chi-square test of independence was used to determine existence of any significant difference between teachers' gender and their professional qualifications. Similarly, the two- independent sample t-test was used to measure existence of any significant differences between male and female teachers in reference to their professional training.

With reference to the first test, a 2-level scale (male teachers = 1 and female teachers = 0) was used in this computation. Additionally, a 5-level scale was used for the categories of teachers' professional background. These included untrained = 0; trainees = 1; trained at certificate level = 2; trained at diploma level = 3; and trained at degree level = 4. The outcome of the chi-square test of independence test on these variables revealed a positive, moderate significant correlation (r =0.67, P-Value = 0< 0.05) between teachers' gender and professional qualifications. This result suggested teachers' gender, being male or female had a moderate influence on the professional qualifications.

The second test involved a two- independent sample t-test to find out if there were any significant differences between male and female teachers; and also between teachers in public and those in private preschools in regards to their professional training. In this test, a 5-level scale was used for the professional qualifications: untrained = 0; trainees = 1; trained at certificate level = 2; trained at diploma level = 3; and trained at degree level = 4. The result of this test demonstrated lack of any significant difference (t (76) = 0.38, p (0.71) > 0.05) between male teachers (n=64) ($\bar{x}$ = 2.19, SD = 1.10) and the female teachers (n=444) ($\bar{x}$ = 2.13, SD = 0.93) in terms of their professional training. Similarly, no significant difference (t (33) = -0.93, p (0.35) > 0.05) was found between teachers in public preschools (n=167) ($\bar{x}$ = 2.08, SD = 0.95) and their counterparts in private preschools (n=341) ($\bar{x}$ = 2.17, SD = 17).

Categories of Training Institutions for ECDE Teachers

Teachers (n=468) who stated they were trainees or trained (see Table 5.4) were asked to indicate where they would or had completed their training as ECDE teachers (see Appendix G, Part (A) Item No. 5). As a guideline, they were provided with five (5) option institutions, including government and private ECDE colleges, public and private universities plus 'the specified other'. Table 5.5 presents data on teachers' (n=468) training institutions.

Overall, as seen in Table 5.5, over half of the number of participating teachers (58.6%) would complete or had completed their training in private colleges and less than half (34.8%) in government colleges. Further, the data in the table indicated few teachers (31) (6.6%) would complete or had completed their training in private universities, with the least number of teachers (2.1%) pursuing their training in private universities. This data suggested most of the preschool teachers in the district of study were not professionally trained in institutions of higher learning.

As seen in the table, similar trend was noted in regards to gender. Over 50% of each of the participating groups, male and female teachers would complete or had completed their training in private colleges and over 30% in government colleges. The least options, as indicated by participants were public universities (male teachers 8.3%; female teachers 3.9%) and private universities (male teachers 5.0%; female teachers 1.7%).

Table 5.5

Categories of Training Institutions for ECDE Teachers

n=508

	Categories	of Training	Institutions	for ECDE
Teachers	Government colleges	Private colleges	Public universities	Private universities
Public (n=154)	66 42.9%	77 50.0%	07 4.6%	04 2.6%
Private (n=314)	97 30.9%	197 62.7%	14 4.5%	06 1.91%
Total %	163 34.8	274 58.6	21 4.5	10 2.1
Males (n=60) %	20 33.3	32 53.3	05 8.3	03 5.0
Fem (n=408) %	143 35.0	242 59.3	16 3.9	07 1.7

Teaching Experience

Item number 6 of the survey questionnaire in Part (A) (Appendix G) required teachers to indicate the number of years they had been teaching in ECDE. Data gathered on teachers' responses on this item are presented in Table 5.6.

Table 5.6 reveals that over half of the surveyed teachers (274) (53.9%) in the district of study had teaching experience of less than 5 years. This happened to be the trend for both teachers teaching in public ECDE centres (57.5%) and likewise in private ECDE centres (52.2%). To add on, as indicated in the table, on overall less than 30% of the teachers in the study district had had teaching experience of 6 – 10 years, 14.0% had worked for a period of 11 – 20 years and 11 teachers (0.2%) had working experience of over 20 years.

Interestingly, participating male teachers had teaching experience of less than 5 years to 10 years while female teachers had experience that cut across from less than 5 years to over 20 years. However, 30% of teachers in each of the two groups had worked in preschool industry for a period of 6-10 years an exceedingly a larger percentage of male teachers (70.3) had teaching experience of less than five years. This data suggested that male teachers had recently joined the ECDE profession.

Table 5.6

Teaching Experience

			N=508		
		Teaching	Experience	(Years)	
Teachers	<5 (3)	6-10 (8)	11-15 (13)	16-20 (18)	>20 (22)
Public (n=167)	96	36	20	10	05
%	57.	21.6	12.0	6.0	3.0
Private (n=341)	178	116	23	18	06
%	52.2	34.0	6.7	5.3	1.2
Total	274	152	43	28	11
%	53.9	29.9	8.5	5.5	2.2
Males (n=64)	45	19	0	0	0
%	70.3	29.7	0	0	0
Females (n=444)	229	133	43	28	11
%	51.6	30.0	9.7	6.3	2.5

The data in Table 5.6 were further examined through statistical tests comprising chi-square test of independence and two- independent sample t-test. The chi-square test of independence was used to find out if there was any relationship between teachers' gender and teaching experience (years in service). On the other hand, the two- independent sample t-test was used to measure existence of any significant differences between male and female teachers as regards to the teaching experience.

This study utilized a 2-level scale for gender: male teachers = 1 and female teachers = 0) and a 5-level scale were used for the categories of teachers' teaching experience in years. This scale resulted from listing and selecting the median of each range of teaching experience in years (< 5; 6-10; 11-15; 16-20; and > 20) (see Table 5.6). The resulting scales from this process included (3) for less than 5 years, (8) for 6-10 years, (13) for 11-15 years, (18) for 16-20 years, and (22) for > 20 years. For < than 5 years, the values included for the purpose of computing a median were 1,2,3,4 and 5 inclusive. Similarly, range > 20 years had 20,21,22,23, and 24 in selecting a median.

The aftermath of the chi-square test of independence test on teachers' gender and teaching experience indicated a negative, weak significant correlation (r = -0.165, p = 0.000 < 0.05) between teachers' gender and teaching experience in years.

The second test involved a two independent- sample t-test to examine existence of any significant differences between male and female teachers, and also between teachers in public and those in private preschools in relation to the teaching experience. In this test, the above 5-level scale (3, 8, 13, 18 and 22) was used for the teachers' teaching experience. The test outcome on gender revealed a significant difference {t (168) = -6.42, p (0.000) < 0.05} between male teachers (n=64) ($\bar{x}$ = 4.48, SD = 2.30) and the female teachers (n=444) ($\bar{x}$ = 6.88, SD = 5.03) in regards to teaching experience. This finding suggested male and female teachers in the study district were not on the same page as far as teaching experience was concerned. Female teachers seem to have had many years of teaching experience ($\bar{x}$ = 6.88) compared to the male teachers ($\bar{x}$ = 4.48).

In respect to types of preschools, no significant difference (t (293) = 0.50, p (0.615) > 0.05) was found between teachers in public preschools (n=167) ($\bar{x}$ = 6.74, SD = 5.27) and the teachers in private preschools (n=341) ($\bar{x}$ = 6.50, SD = 4.61). This test outcome suggested teachers in both types of preschools were at par in terms of teaching experience.

Age Groups Classes

Teachers were asked to indicate age groups classes they taught through item number 8 Part (A) of the survey questionnaire (see Appendix G). Data gathered on this item are presented in Table 5.7.

As seen in Table 5.7, the highest number (229) (45.1%) of participating teachers taught in the nursery age group classes (3-4 years) while 17.3%of the teachers worked in baby group classes for children aged 1-2 years. Each of these trends was noted among each of the two groups of participants, public and private. While none of the male teachers taught in baby class group (1-2 years), 64% of this group of teachers taught in the pre-unit (5-6 years) classes. The female teachers taught in all the three groups of classes though a relatively large number (206) (46.4%) taught in nursery schools.

Table 5.7

Age Groups Classes

			N=508			
			Age Groups	Classes		
Teachers	Baby class (1-2 years)	%	Nursery class (3-4 years)	%	Pre-unit (5-6 years)	%
Public (n=341)	18	10.8	80	47.9	69	41.3
Private (n=167)	70	20.5	149	43.7	122	24.0
Total	88	17.3	229	45.1	191	37.6
Males (n=64) %	0	-	23	36.0	41	64.0
Females (n=444) %	88	19.8	206	46.4	150	33.8

Responsibilities in ECDE Centres

Teachers were asked to indicate their responsibilities at their ECDE centres (Appendix I Part (A) Item No. 9). The options provided for teachers to select from included head of ECDE section, class teacher, assistant class teacher and any other specified responsibility. Data collected on teachers' responses are presented in Table 5.8.

Table 5.8 presents data on teachers' responsibilities in their ECDE centres. According to this data, 7.9% of the participants served as head of ECDE sections. On other hand, the data in the table revealed 70.7% in overall, had the responsibilities of being class teachers. While 63.5% of the teachers teaching in the public centres had similar responsibilities, 74.2% of the teachers in private ECDE centres held similar responsibilities. As seen in the table, all the male teachers (100%) worked as assistant class teachers and none of them was an ECDE section head or a class teacher.

Table 5.8

Responsibilities in ECDE Centres

		N=508	
	Teachers	Responsibilities	
Teachers	ECDE Section head	Class teacher	Assistant class teacher
Public (n=167)	10	106	51
%	6.0	63.5	30.5
Private (n=341)	30	253	58
%	8.8	74.2	17.0
Total	40	359	109
%	7.9	70.7	21.5
Males (n=64)	0	0	64
%	-	-	100
Females (n=444)	40	359	45
%	9.0	80.9	10.1

Professional Training in Technology (Section B)

Through the use of survey questionnaire (see Appendix G, Part B), this study gathered evidence on teachers' professional training in technology. The specific evidence collected included teachers' formal qualifications in ICT, teachers' basic skills and knowledge in integration of technology in ECDE curriculum, ECDE course units on integration of technology in planning and documentation, specific content areas covered on integration of technology in planning and documentation, digital resources accessed and used during training for ECDE profession, impact of technology related ECDE course units, in-service training in integration of technology in teachers' professional activities, impact of in-service training on teachers' skills in technology, teachers' preferred learning models in technology-related professional learning and effectiveness of previous year's in-service training in teachers' integration of technology in planning and documentation.

Teachers' Formal Qualification(s) in ICT

Teachers participating in the survey were asked if they had any formal qualification (s) in ICT (Appendix G, Part B Item No. 1). They were required to provide their responses using either 'yes' or 'no'. Table 5.9 presents data gathered on this item.

Table 5.9

Teachers' Formal Qualification(s) in ICT

			N=508			
Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Yes	69	41.3	105	30.8	174	34.3
No	98	58.7	236	69.2	334	65.8
Total	167	100	341	100	508	100

Table 5.10

Teachers' Formal Qualification(s) in ICT Based on Gender

			N=508			
Responses	Males (n=64)	%	Females (n=444)	%	Total	%
Yes	20	31.3	154	34.7	174	34.3
No	44	68.8	290	65.3	334	65.8
Total	64	100	444	100	508	100

The data in Table 5.9 reveal 41.3% of the teachers in public preschools and 30.8% in private preschools had formal qualifications in ICT. Overall, 34% of the teachers in the study district had formal qualifications in ICT. In terms of gender (Table 5.10), 31.3% of the male teachers and 34.7% of the female teachers had formal qualifications in ICT.

Teachers' Qualifications in ICT

As a follow-up, teachers indicating they held formal qualification (s) (n=174) in ICT in the previous questions were asked also to indicate the qualification(s) they held (Appendix G, Part B Item No.2). The data are presented in Table 5.11.

The data in Table 5.11 show 34.3% of the surveyed teachers had qualifications in Microsoft Word, 23.0% in PowerPoint, 62.0% in Computer Studies and 10.0% in Information Technology (IT). A qualification in IT meant that this group of teachers had trained to use computers in terms of both hardware and software, data processing and distribution. However, as noted in the table, the highest frequency of teachers' qualifications was in Microsoft Word (34.3%) while IT was held by the least number of teachers (10%.0). 41.3% of the participating teachers in public preschools were qualified in Microsoft Word while 30.8% of the participants in private preschools had similar qualifications. In terms of gender (Table 5.11), the percentages of female teachers with qualifications in three of the four areas indicated in the table were below (32.7% in Microsoft Word; 22.3% in PowerPoint; and 1.13% in IT) those of male teachers (45.3% in Microsoft Word; 28.1% in PowerPoint; and 7,8% in IT). However, the data in table 5.11 indicate less than 30% of each group of the participating teachers had qualifications in PowerPoint, Computer Studies and IT.

Table 5.11

Teachers' Qualification(s) in ICT

		N=508		
		Qualification(s)		
Teachers	Microsoft Word	PowerPoint	Computer Studies	Information Technology (IT)
Public (n=167)	69	32	15	01
%	41.3	19.1	9.0	0.6
Private (n=341)	105	85	47	09
%	30.8	24.9	13.8	2.6
Total	174	117	62	10
%	34.3	23.0	12.2	2.0
Males (n=64)	29	18	07	05
%	45.3	28.1	10.9	7.8
Females (n=444)	145	99	55	05
%	32.7	22.3	12.4	1.13

Pre-Service Training in Integration of Technology in ECDE Curriculum

Teachers were asked to indicate the number of course units completed during their college/university years aimed at enhancing their basic skills and knowledge in integration of technology in ECDE curriculum (Appendix G, Part B Item No. 3). In order to respond to this question, participants were provided with five (5) options (none, 1, 2, 3 and more than 3) from which they were to select one option for their answer. The evidence gathered on this item is presented in Table 5.12.

The data in Table 5.12 show 85% of the teachers in public preschools and 74.5% of those in private preschools did not complete any course units during their college/university years aimed at enhancing their basic skills in integration of technology in ECDE curriculum.75% of the participating teachers indicated they did not complete any unit, 6.1% had completed 1 unit, 4.7% 2 units, 1.4% 3 units and 9.8% over 3 units. The data also reveal that 75% of the male teachers and 78.4% of the female teachers had not completed any course units during their college/university years aimed at enhancing their basic skills and knowledge in integration of technology in ECDE curriculum. While 10.8% of the female teachers indicated completion of more than 3 units on this aspect, only 3.1% of the male teachers indicated they had completed over 3 units.

Table 5.12

Pre-Service Training in Integration of Technology in ECDE Curriculum

N=508

Teachers	0	No. %	Of 1	%	Course 2	%	Units 3	%	>3	%
Public (n=167)	142	85.0	11	6.6	05	3.0	02	1.2	07	4.2
Private (n=341)	254	74.5	20	5.9	19	5.6	05	1.5	43	12.6
Total	396	77.5	31	6.1	24	4.7	07	1.4	50	9.8
Males (n=64)	48	75.0	05	7.8	03	4.7	06	9.4	02	3.1
Females (n=444)	348	78.4	26	5.9	21	4.7	01	0.2	48	10.8

Pre-Service Training in Integration of Technology in Planning and Documentation

Teachers were also asked to indicate the number of ECDE course units they took during their college/university years focused on integration of technology in planning and documentation (Appendix G, Part B Item No. 4). For the purpose of responding to this question, participants were provided with five (5) options (none, 1, 2, 3 and more than 3) from which they were to select one option for their answer. The data collected on this item is presented in Table 5.13.

Table 5.13

Pre-Service Training in Integration of Technology in Planning and Documentation

N=508

Teachers	0	%	1	No. %	Of 2	Course %	Units 3	%	>3	%
Public (n=167)	154	92.2	05	3.0	02	1.2	0	-	06	3.6
Private (n=341)	299	87.7	09	2.6	07	2.1	04	1.2	22	6.5
Total	453	89.2	14	2.8	09	1.8	04	0.8	28	5.5
Males (n=64)	52	81.2	05	7.8	03	4.7	02	3.1	02	3.1
Females (n=444)	401	90.3	09	2.0	06	1.4	02	0.7	26	5.9

The data in Table 5.13 indicate that 92.2% of the teachers in public preschools and 87.7% of those in private preschools did not complete any course units during their college/university years on integration of technology in planning and documentation. Overall, 89.2% of the participating teachers indicated they had not completed any course units, 2.8% had completed 1 unit, 1.8% 2 units, 0.8% 3 units and 5.5% over 3 course units. The data also reveal that 81.2% of the male teachers and 90.3% of the female teachers had not completed any course units during their college/university years on integration of technology in planning and documentation. While 5.9% of the female teachers indicated completion of more than 3 units on this aspect, only 3.1% of the male teachers indicated they had completed over 3 units.

Content Areas Covered on Integration of Technology in Planning and Documentation during Pre service Training

Teachers indicating that they took some ECDE course units on use of technology in the previous question (4) were required to indicate three specific content areas covered on integration of technology in planning and documentation during pre-service training (Appendix G, Part B Item No. 5). The data are presented in Table 5.14.

Table 5.14

Content Areas Covered on Integration of Technology in Planning and Documentation during Pre-service Training

N=508

		Content	Areas	Covered
Teachers	Not covered	Use of Microsoft Word in lesson planning	Use of Microsoft Word in schemes of work	Use of Microsoft Word in children’s progress record preparation
Public (n=167)	154 92.2%	13 7.79%	10 6.0%	08 4.8%
Private (n=341)	299 87.7%	40 11.7%	37 10.9%	30 8.8%
Total	453	53	47	38
%	89.2	10.43	9.3	7.5
Males (n=64)	52	11	08	33
%	81.3	17.2	12.5	51.6
Females (n=444)	401	42	39	05
%	90.3	9.45	8.8	1.1

The data in Table 5.14 reveal three specific content areas covered on integration of technology in planning and documentation during teachers' pre-service training. Overall, the use of Microsoft Word in lesson planning was indicated by 10.43% of the participants, in scheming of work (9.3%) and in children's progress record preparation (7.5%).

Digital Technology Resources Accessed, Used and Integrated in Planning and Documentation during Pre-Service Training

Further, teachers were required to list up to five digital technology resources they had accessed, used and integrated in planning and documentation when training as ECDE teachers (Appendix G, Part B Item No. 6). Data gathered on this item are presented in Table 5.15.

Table 5.15

Digital Technology Resources Accessed, Used and Integrated in Planning and Documentation during Pre-service Training

Teachers	Computers	Digital Cameras	Photocopiers	Printers
Public (n=167)	12	3	5	5
%	7.2	1.8	3.0	3.0
Private (341)	39	6	19	17
%	11.4	1.8	5.6	5.0
Total	51	9	24	22
%	10.0	1.8	4.7	4.3

Teachers participating in the survey accessed, used and integrated four forms of digital technology resources in planning and documentation during their pre-service training. These included computers, cameras, photocopiers and printers. Based on the data in Table 5.15, computers were accessed, used and integrated by 10% of the participants, digital cameras (1.8%), photocopiers (4.7%) and printers (4.3%).

Impact of Technology Related Pre-Service Training on Teachers' Practice

Teachers indicating participation in pre-service training on use of technology in teaching were required to rate the impact of technology related ECDE course units on their skills and knowledge in integration of technology in planning and documentation (Appendix G, Part B Item No. 7). In order to respond to this task, teachers were provided with four rating scales from which to select one option: not effective (1), slightly effective (2), effective (3) and very effective (4). The evidence collected on teachers' ratings is presented in Table 5.16.

Table 5.16

Impact of Technology Included Pre-Service Training on Teachers' Practice

		N=508		
		Ratings	Options	
Teachers	Not Effective (0)	Slightly Effective (1)	Effective (2)	Very Effective (3)
Public (n=167)	9	3	1	0
%	5.4	1.8	0.6	0
Private (n=341)	32	06	03	01
%	9.4	1.8	0.9	0.3
Total	41	09	04	01
%	8.1	1.8	0.8	0.2

Table 5.16 shows that 8.1% of the teachers rated the impact of technology related ECDE course units on their skills and knowledge in integration of technology in planning and documentation as not effective, 1.8% rated it as slightly effective, 0.8% as effective and 0.2% as very effective.

In-service Training in Integration of Technology in Daily Professional Activities

Teachers were asked to indicate how much of in-service training in integration of technology in their daily professional activities they had had in the previous school year (2011) (Appendix G, Part B Item No. 8). Six response options were provided for teachers to choose one for their answer. These responses included none, 1 day, 2-3 days, 4-5 days, more than 5 days and 'other' specified response. Data gathered from teachers' responses to this item is presented in Table 5.17.

Table 5.17

In-Service Training in Integration of Technology in Professional Activities

			N=508			
		Response	Options			
Teachers	None	1 Day	2-3 Days	4-5 Days	More than 5 Days	Other
Public (n=167)	167	0	0	0	0	0
Private (n=341)	341	0	0	0	0	0
Total	508	0	0	0	0	0

The evidence in Table 5.17 clearly reveals that none of the participating teachers had participated in professional learning on integration of technology in professional activities.

Access and Integration of Technology in Planning and Documentation (Section C)

This section presents analyses of sets of data gathered on teachers' access and integration of technology in planning and documentation (Appendix G, Part C Item Nos. 1- 14). The specific sets of data collected presented in this section include teachers' understanding of terms, digital technology and documentation, access and use of technology both at home and in school, locations of technology resources in ECDE centres, use of technology in practice, availability of policy/curriculum guidelines on the integration of technology in ECDE, confidence on the integration of technology in planning and documentation, support provided in integrating technology at the ECDE centres by specified stakeholders, teachers' views about the integration of technology in ECDE curriculum in, teachers' concerns on the integration of technology in planning and documentation in ECDE centres and teachers' additional information about the use of technology in ECDE centres.

Teachers' Understanding of Terms

As a preliminary step, teachers (n=508) were required to provide their understandings on two terms including 'digital technology' and 'documentation' These understandings were obtained through survey questionnaire item no. 1 (a) and (b) (see Appendix G, Part C).

Digital Technology

Analysis of data on teachers understanding of the term, 'digital technology' resulted in five groups of responses including lack of understanding of the term digital technology; digital technology as ICT; digital technology as computers and mobile telephones; digital technology as computers, digital cameras and digital video recorders; and digital technology as computers, digital cameras, digital video recorders, televisions and radios. This data are presented in Table 5.18.

The data in Table 5.18 indicate that 4.1% lacked understanding on the term digital technology. On the other hand, majority of the teachers participating in the survey understood this term as ICT (8.5%). They also understood it in relation to forms and number of ICT resources. These included computers and mobile telephones (2 forms) (8.3%); as computers, digital cameras and digital video recorders (3 forms) (51.6%); and as computers, digital cameras, digital video recorders, televisions, and radios (5 forms) (27.6%). This evidence suggests majority of the teachers in the district of study had a full and clear understanding of the term, digital technology.

Table 5.18

Teachers' Understandings on the Term Digital Technology

		N=508				
Teachers' understanding of the term digital technology	Public (n=167)	%	Private (n=341)	%	Total	%
No idea/I don't know	05	3.0	16	4.7	21	4.1
Digital technology is ICT	10	6.0	33	9.7	43	8.5
Digital technology as computers and mobile telephones	23	13.8	19	5.6	42	8.3
Digital technology as computers, digital cameras and digital video recorders	91	54.5	171	50.2	262	51.6
Digital technology as computers, digital cameras, digital video recorders, televisions, and radios	38	22.8	102	29.9	140	27.6
Total	167		341		508	100

Documentation

Analysis of data on teachers (n=508) understanding of the term, 'documentation' resulted in four groups of responses including documentation defined as teaching methods, teaching records preparation, lesson planning and writing schemes of work. This data are presented in Table 5.19.

The evidence in Table 5.19 reveals show teachers understand the term documentation in four ways. These include documentation as teaching methods (9.5%); preparation of teaching records (44.1%); planning of teaching lessons (13.4%); and writing of schemes of work (33.1%). While this term was defined as preparation of teaching records by 56.3% of the teachers teaching in public ECDE centres, a similar understanding was indicated by 38.1% of the teachers teaching in the private ECDE centres.

Table 5.19

Teachers' Understandings on the Term Documentation

N=508

	Teachers	Understandings	of the term	Documentation
Teachers	Teaching methods	Teaching records preparation	Lesson planning	Writing schemes of work
Public	7	94	10	56
(n=167)	4.2%	56.3%	6.0	33.5%
Private	41	130	58	112
(n=341)	12.0%	38.1%	17.0%	32.8%
Total	48	224	68	168
%	9.5	44.1	13.4	33.1

Types of Technology Resources Accessed and Used

In the questionnaire, participating teachers (n=508) were provided with a list of seven (7) different types technology resources including computers, digital cameras, digital video recorders, mobile telephones, document scanners, printers and photocopiers (Appendix G, Part C item no. 2). Using this list, the participating teachers were required to select up to **five** technology resources that they frequently accessed and used at home and at their ECDE centres. Participants' preferences of technology resources are identified as seen Tables 5.20.

In Table 5.20, all seven (7) varied technology resources were considered for selection by the participating teachers. The data in the table indicate mobile telephones were the most frequently accessed and used technology resources by teachers, both at home (90.0%) and at the ECDE centres (94.5%). These were followed by computers, 51.6% for home access and 53.2% for ECDE access. The digital cameras took the 3^{rd} position for home access (40.2%) while the photocopy machines were in a similar position for access at the ECDE centres (40.0%).

On the other hand, digital video recorders (10% home access; 7.1% ECDE access) and document scanners (3.9% home access and 7.1% ECDE access) were accessed and used infrequently by participants.

Table 5.20

Types of Technology Resources Accessed and Used at Home and ECDE Centres Based on Types of ECDE Centres (Public and Private)

Teachers	Public (n=167)	Private (n=341)		Public (n=167	Private (n=341)	
	Place of	Access		Place of	Access	
Digital Resources	Home	Home	Total	ECDE Centre	ECDE Centre	Total
Computers	89	173	262	92	178	270
%	53.3	50.7	51.6	55.1	52.2	53.2
Digital cameras	68	136	204	12	90	102
%	40.7	39.9	40.2	7.2	26.4	20.1
Digital video recorders	11	40	51	08	28	36
%	6.6	11.7	10.0	4.8	8.2	7.1
Mobile telephones	164	334	498	161	319	480
%	98.2	98.0	90.0	96.4	93.5	94.5
Document scanners	06	14	20	02	34	36
%	3.6	4.1	3.9	1.2	10.0	7.1
Printers	21	41	62	22	95	117
%	12.6	12.2	12.2	13.2	27.9	23.0
Photocopy Machines	50	80	130	56	147	203
%	29.4	23.5	25.6	33.5	43.1	40.0

Since teachers were required to select up to 5 technology resources, this requirement was used to design a scale of 0-5 that was used in computation of participants' technology resources accessed and used at home and at their ECDE centres. The 0 in this scale was used where a teacher did not make any selection. Additionally, 1 was used for selection of one resource, 2 for selection of two resources, etc.

As a starting point, this study made an attempt to find the mean scores of teachers pertaining to selection of technology resources accessed and used at home and also at the ECDE centres. The expected mean was 5 since participants were required to select up to 5 resources. To find the means, a one-sample t-test was used on teachers' aggregates for home and ECDE selections. The results for these computations are indicated in Table 5.21.

Table 5.21

Results of One-Sample T-test on Teachers' Aggregates on Technology Resources accessed and used at Home

Variables	N	Mean	StDev	SE Mean	95% CI
Home access and use	508	1.4528	0.7716	0.0342	(1.3855, 1.5200)
ECDE access and use	508	2.4488	0.9787	0.0434	(2.3635, 2.5341)

Results indicated in Table 5.21 reveal the participating teachers (n=508) means and standard deviations on aggregates of technology resources accessed and used at home and at the ECDE centres. As can be seen in the table, participants' mean (out of the expected mean of 5) for selection of technology resources accessed and used at home was 1.45 (SD = 0.77; 95% CI) and 2.45 (SD = 0.98; 95% CI) for selection of technology resource accessed and used at the ECDE centres. These results suggest teachers in the district of study frequently accessed and used 1 type of technology resource at home and two types at the ECDE centres.

This study sought to find if there was a relationship between teachers' selection of technology resources accessed and used at home and at the ECDE centres. Using a scale of 0-5, explained above, this study utilized a chi-square test of independence on teachers' aggregates on selection of technology resources accessed and used at home and at their ECDE centres. The outcome of this test indicated zero correlation (r = 0.059, p = 0.181 > 0.05) between participants' selections of technology resources accessed and used at home and at their ECDE centres.

Further, this study aimed to find out if there was a significant difference between teachers' mean scores on selection of technology resources accessed and used at the their ECDE centres. These differences were evaluated against the types of ECDE centres (public and private). Teachers' mean scores were obtained through computation of aggregates scored on a technology selection scale of 0-5 level scale. These mean scores were subjected to a two-sample t-test for computation. Table 5.22 presents the results of this computation.

Table 5.22

Results of Two-Sample T-test on Teachers' Aggregates on Technology Resources Accessed and at the ECDE Centres Based on Types of Preschools (Public and Private)

Variables	N	Mean	StDev	SE Mean	95% CI	T-Value	P-Value	DF
Public access and use	167	2.11	0.83	0.06		(-4.16		
					(0.735, -0.264)		0.000	502
Private access and use	341	2.61	1.87	0.10				

In Table 5.22, a two-sample t-test on teachers' means revealed a significant difference ($t\ (502) = -4.16$, $p\ (0.000) < 0.05$) between teachers in public centres (n=167) ($\bar{x}$ = 2.11, SD = 0.83) and those in private centres (n=341) ($\bar{x}$ = 2.61, SD = 1.87). This test results suggest teachers in public and private ECDE centres were not at the same level in terms of technology resources accessed and used at the ECDE centres. Basing on the differences on mean scores, it is most likely preschool teachers in public centres were frequently accessing and using two (2) types of technology resources while those in private centres three (3).

Further, teachers' selection of technology resources frequently accessed and used both at home and at their ECDE centres was considered based on gender. Participants' preferences of technology resources based on gender are identified as seen in Table 5.23.

Considering the gender variable, all the male teachers (100%) accessed and used these resources both at home and at their ECDE centres. On the other hand, 90% of the female teachers accessed and used these resources at home and 93.7% at their ECDE centres. Additionally, 71.9% of the male teachers accessed and used computers at home and 64.1% at their ECDE centres. These same resources were accessed and used by 48.7% of the female teachers at home and 51.6% at the ECDE centres. Generally, the data in the table indicated that the percentages of male teachers were greater in regards to access and use of all the 7 technology resources except the digital cameras (9.4%) and female teachers (21.6%).

Table 5.23

Types of Technology Resources Accessed and Used at Home and ECDE Centres Based on Gender

Teachers	Males (n=64)	Females (n=444)		Males (n=64)	Females (n=444)	
	Place of	Access		Place of	Access	
Digital Resources	Home	Home	Total	ECDE Centre	ECDE Centre	Total
Computers	46	216	262	41	229	270
%	71.9	48.7	51.6	64.1	51.6	53.2
Digital cameras	35	169	204	06	96	102
%	54.7	38.1	40.2	9.4	21.6	20.1
Digital video recorders	07	44	51	08	28	36
%	11.0	9.91	10.0	12.5	6.3	7.1
Mobile telephones	64	434	498	64	416	480
%	100	97.7	90.0	100	93.7	94.5
Document scanners	15	05	20	27	09	36
%	23.4	1.1	3.9	42.2	2.0	7.1
Printers	20	42	62	22	95	117
%	31.3	9.5	12.2	34.4	21.4	23.0
Photocopy Machines	58	72	130	56	147	203
%	90.7	16.2	25.6	87.5	33.1	40.0

Using the data in Table 5.22, a chi-square test of independence was performed on teachers' gender and their aggregates on selection of technology resources accessed and used at home and at their ECDE centres. The 0-5 level scale was used in this computation. The aftermath of this test indicated a significant, positive and moderate correlation (r = 0.512, p = 0.000 < 0.05) between participants' gender and selection of technology resources accessed and used at home and also, at their ECDE centres (r =

0.419, $p = 0.000 < 0.05$). The two results suggested that gender, being male or female had a moderate influence on teachers' selection of technology resources accessed and used at home as well as at the ECDE centres.

Moreover, teachers' mean, based on their technology selection scores from the 0-5 level scale were computed through the use of to a two-sample t-test in relation to male and female teachers. Table 5.24 presents the results of this computation.

Table 5.24

Results of Two-Sample T-test on Teachers' Aggregates on Technology Resources accessed and at Home and at the ECDE Centres Based on Gender

Variables (Home access)	N	Mean	StDev	SE Mean	95% CI	T-Value	P-Value	DF
Male teachers	64	3.828	0.680	0.085	(1.4265, 1. 8063)	16.89	0.000	100
Female teachers	444	2.212	0.929	0.085				
(ECDE access)								
Male teachers	64	3.500	0.976	0.12	(0.943, 1. 462)	9.22	0.000	82
Female teachers	444	2.297	0.972	0.046				

In Table 5.24, a two-sample t-test on teachers' means demonstrate a significant difference (t (100) = 16.89, p (0.000) < 0.05) between male (n= 64) ($\bar{x}$ = 3.82, SD = 0.680) and female teachers (n=444) ($\bar{x}$ 2.21, SD = 0.085) in selection of technology resources accessed and used at home. Also, at the ECDE centres (t (82) = 9.22, p (0.000) < 0.05) male (n= 64) ($\bar{x}$ = 3.50, SD = 0.976) and female teachers (n=444) ($\bar{x}$ = 2.297, SD = 0.0972). This test results suggest that male and female teachers were not at the same level in regards to technology resources accessed at home and at the ECDE centres. It appears the male teachers were accessing and using, on average, four (4) types of technology resources both at home ($\bar{x}$ = 3.82) and at the ECDE centres ($\bar{x}$ = 3.50). In comparison, the female teachers were likely to be accessing and using two (2) types of technology resources at home ($\bar{x}$ = 2.21) and at the ECDE centres ($\bar{x}$ = 2.30).

A chi-square test of independence was performed on teachers' demographic variables and selection of technology resources accessed and used at home and at the ECDE centres. The demographic variables comprised teachers' age, highest education completed, professional qualifications and teaching experience.

The age values used in this test resulted from computation of medians for each of the teachers' age ranges (see Table 5.2). The resulting age values were: 25, 35.5, 45.5, 55.5 and 65. A scale of 0-5 on teachers' selection of technology resources was utilized. The two variables, teachers' age values and scores on selection of technology resources were tested using a chi-square test of independence. The outcome of this test indicated a small negative but significant correlation (r = -0.13, p = 0.003 < 0.05) between teachers' age and selection of technology resources accessed and used at home and zero (0) correlation (r = 0.062, p = 0.166 > 0.05) between teachers' age and selection of technology resources accessed and used at the ECDE centres. This result suggest that teachers' increase in age resulted in reduction of the number of technology resources accessed and used at home but not at the ECDE centres. The two findings suggest age could be an influencing factor in preschool teachers' frequency of technology access and use at home.

This study found out that teachers participating in the survey had the highest education completed in four levels comprising primary, secondary, post-secondary diploma/certificate and university (see Table 5.3). For the purpose of scoring and computation, these four (4) levels were assigned scales as follows: primary level of education (1), secondary level of education (2), post-secondary diploma/certificate (3) and university level of education (4). These 4-scales on education will be used in all subsequent computations involving participating teachers' highest education completed. Besides, the 0-5 scale was used in the matter of participants' selection of technology accessed and used.

The two variables, teachers' highest education completed and their scores on selection of technology resources were tested using a chi-square test of independence. The results of this test indicated lack of any correlation between teachers' highest education completed and selection of technology resources accessed and used at home (r = 0.034, p = 0.438 > 0.05) as well as at the ECDE centres (r = 0.004, p = 0.931 > 0.05).

These results suggest that teachers' highest education completed was not an influencing factor in their' selection of technology resources accessed and used both at home and at the ECDE centres.

Through a one-way unstacked Analysis of Variance (ANOVA), this study attempted to find out if there were any significant differences among teachers' grouped means on selection of technology resources accessed and used at home in terms of their educational levels. These levels included primary, secondary, post-secondary (diploma/certificate) and university. The Tukey simultaneous pair wise method was used identifying groups that were similar or had significant differences. According to the Turkey method of grouping, means that do not share a letter are significantly differently. A confidence level of 95% was considered for the ANOVA test. Table 5.25 presents the results of this test.

Table 5.25

ANOVA on Teachers' Selection of Technology Resources Accessed at Home Based on Educational Levels

Education Variables	N	Mean	StDev	Tukey Grouping	95% CI	Pooled StDev	R sq.(pred.)
Primary education	3	2.33	0.58	A	(1.41, 3.25)		
Post-secondary (diploma/ certificate)	350	1.56	0.87	A	(1.47, 1.64)	0.811 > 0.50	0.00%
Secondary education	118	1.50	0.71	A	(1.35, 1.65)		
University education	37	1.41	0.50	A	(1.14, 1.67)		

Examining the ANOVA test results in Table 5.25, no significant difference was found at $\alpha = 0.05$ among the teachers' grouped means in regard to selection of technology resources accessed and used at home based on their educational levels. However, based on the Tukey pair wise grouping method (Table 5.25), teachers with primary education were ranked one ($\bar{x}$ =2.33), those with post-secondary education become second ($\bar{x}$

=156), followed by teachers with secondary education ($\bar{x}$ =1.56) and lastly, teachers with university education ($\bar{x}$ = 1.41). A letter ‘A’ indicated against each group demonstrated lack of differences among or between the means of the four groups. This result suggested that participating teachers’ level of education was not a predictor (R-sq. 0.00%) or influencing factor in their selection of technology resources accessed and used at home.

Similarly, a one-way unstacked Analysis of Variance (ANOVA) was used to find if there were any significant differences among teachers’ grouped means on selection of technology resources accessed and used at their ECDE centres in terms of their educational levels. The analysis outcomes are presented in Table 5.26.

Table 5.26

ANOVA on Teachers’ Selection of Technology Resources Accessed at the ECDE Centres Based on Educational Levels

Education Variables	N	Mean	StDev	Tukey Grouping	95% CI	Pooled StDev	R sq.(pred.)
University education	37	2.70	0.94	A	(2.39, 3.02)		
Secondary education	118	2.58	0.95	A	(2.41, 2.77)	0.977 > 0.50	0.00%
Post-secondary (diploma/ certificate)	350	2.39	0.00	A	(2.28, 2.48)		
Primary education	3	2.00	1.00	A	(0.892, 3.11)		

According to the results in Table 5.26, no significant difference was found at α = 0.05 among the teachers’ grouped means in regard to selection of technology resources accessed and used at their ECDE centres on terms of their educational levels. Nonetheless, Tukey pair wise grouping method (Table 5.26) resulted in teachers with university education being ranked number one ($\bar{x}$ =2.70), followed by teachers with secondary education ($\bar{x}$ = 2.58), post-secondary (diploma/certificate ($\bar{x}$ =2.39) and lastly, teachers with primary education ($\bar{x} = 2.00$). A letter ‘A’ indicated against each group demonstrated lack of differences among or between the means of the four groups. This result suggested that participating teachers’ level of education was not a predictor (R-sq. 0.00%) or influencing factor in their selection of technology resources accessed and used at their ECDE centres.

Interestingly, teachers with primary education were ranked number one (based on Tukey pair wise grouping method) with reference to home access and use and last in selection of technology resources and accessed at the ECDE centres.

This study found that teachers participating in the survey had five (5) categories of professional qualifications in ECDE. These included untrained practicing teachers, practicing teacher trainees, trained certificate holders, trained diploma holders and trained degree holders (see Table 5.4). For the purpose of scoring and computation, these five (5) categories were assigned scales as follows: untrained teachers (0), teacher trainees (1), trained certificate holders (2), trained diploma holders (3), and trained degree holders (4). These 5-scales on professional qualifications will be used in all subsequent computations involving participating teachers’ professional qualifications.

On the other hand, 0-5 scale was used on participants’ selection of technology accessed and used. The two variables, teachers’ scores on professional qualifications and selection of technology resources were tested for independence using a chi-square. The product of this test demonstrated a weak, negative but significant correlation between teachers’ scores on professional qualifications and scores on selection of technology resources accessed and used at home ($r = -0.216$, $p = 0.000 < 0.05$) and lack of any correlation between teachers’ scores on professional qualifications and scores on technology resources accessed and used at the ECDE centres ($r = 0.004$, $p = 0.931 > 0.05$). These results suggest that teachers’ professional qualifications was not an influencing factor in their selection of technology resources accessed and used both at home and at their ECDE centres.

In respect to data gathered by this study, teachers participating in the survey had varied teaching experience comprising less than 5 years, 6-10 years, 11-15 years, 16-20 years and over 20 years (see Table 5.6, p. 108). The median of each of these age ranges were computed and this resulted in a 5-scale for participants’ teaching experience including (3) for less than 5 years, (8) for 6-10 years, (13) for 11-15 years, (18) for 16-20 years, and (22) for > 20 years. These 5-scales on teaching experience will be used in all subsequent computations involving participants' teaching experience.

On the other hand, 0-5 scale was used on participants' selection of technology accessed and used. The two variables, teachers' scores on teaching experience and selection of technology resources were tested for independence using a chi-square. The aftermath of this test indicated lack of any significant correlation between teachers' scores on teaching experience and scores on selection of technology resources accessed and used at home ($r = -0.101$, $p = 0.023 < 0.05$) and at the ECDE centres ($r = 0.079$, $p = 0.077 > 0.05$). These results suggested that teachers' professional qualifications were not an influencing factor in their selection of technology resources accessed and used both at home and at their ECDE centres.

Use of Home Technology Resources

Teachers were asked to describe (Appendix G, item no. 3, p. 268), how they used the technology resources they selected for access at home in question 2 (Table 5.19). An analysis of these descriptions indicated four ways in which participating teachers utilized the selected resources at home including typing, sourcing for information, photography and communication. This evidence is presented in Table 5.27.

Even though all the seven (7) technology resources were considered by teachers (n=508) during selection of resources accessed and used both at home and ECDE centres, only three types of technology resources were used in descriptions on how they were used at home. These comprised computers, digital cameras and mobile telephones. Teachers who had made selections of the three resources (Table 5.20) described four (4) ways in which they used them at home. These included use of computers for typing personal work (36.8%); use of computers for sourcing for information on the World Wide Web (15.4%); use of digital cameras for taking family photographs (21.7%) and use of mobile telephones for communication with family, other relatives and friends (98.0%).

Table 5.27

Use of Selected Home Technology Resources

	N=508					
Use of selected home technology resources	Public Teachers (n=167)	%	Private Teachers (n=341)	%	Total	%
Computers for typing personal work	39	23.4	148	43.4	187	36.8
Computers for sourcing for information on the web	21	12.6	57	33.0	78	15.4
Digital cameras for taking family photographs	39	23.4	71	20.8	110	21.7
Mobile telephone for communication with family members, other relatives and friends	164	98.2	334	97.9	498	98.0

Locations for Technology Resources in ECDE Centres

Teachers participating in the survey were required to describe where the technology resources in their ECDE centres were located (Appendix G, item no. 4). Based on analysis of teachers' descriptions, six locations including classrooms, computer laboratories, libraries, school offices, staffrooms and multipurpose rooms were identified. This evidence is presented in Table 5.28.

Looking at the evidence presented in Table 5.28, six locations including classrooms, computer laboratories, libraries, school offices, staffrooms and multipurpose rooms were identified in teachers' descriptions on locations for technology resources in their ECDE centres. Among these locations, as seen in the table, were school offices identified by 50.0% of the participating teachers and the least identified locations were classrooms, noted by 0.6% of the participants.

Table 5.28

Locations for Technology Resources in ECDE Centres

N=508

Teachers Locations for Technologies	Public (n=167)	Private (n=341)	Total	%
Classrooms	01	02	03	0.6
Computer laboratories	08	54	62	12.2
Libraries	01	06	07	1.4
School offices	61	193	254	50.0
Staffrooms	08	04	12	2.36
Multipurpose rooms	00	04	04	0.8

Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE

Through survey item no. 9 (Appendix G, Part C) teachers were asked if they had policy/curriculum guidelines on the integration of technology in ECDE. They were provided with two options to use in responses, ‘yes’ and ‘no’. Table 5.29 presents data collected on this item

Table 5.29

Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE

N=508

Teachers’ Responses	Public (n=167)	Private (n=341)	Total
Yes	27	113	140
%	16.2	33.1	27.6
No	140	228	368
%	83.8	66.9	72.4
Total	167	341	508

As seen in Table 5.29, 16.2% of the teachers in the public ECDE centres and 33.1% in the private centres responded with a ‘yes’ to a survey question asking if they had policy/curriculum guidelines on the integration of technology in ECDE. Overall, 140 teachers (27.6) responded with a ‘yes’ (Table 5.29) while 72.4% provided a ‘no’ answer.

Teachers' Use of Technology in Everyday Practice

Data on teachers' use of technology in everyday practice was collected in four areas. These included use of technology in planning of teaching and learning activities, use of technology in documentation of teaching and learning activities, involvement of children in planning technology-rich learning experiences and use of technology in sharing experiences on children's learning progress with parents.

The data gathered in the four areas were analysed in terms of teachers' evaluations of the statements based on scales provided: never (1), sometimes (2), nearly always (3) and always (4). Over and above, teachers' scores on the scales in each of the four areas measured on all the four areas combined together were analysed through the use of one-sample and two-sample t-tests. One-sample t-test was utilized to determine whether the mean of teachers (n=508) differed from the expected mean score. On the other hand, a two-sample t-test was used to determine whether mean scores of the two groups of participants, teachers in public and private ECDE centres differed significantly in each of the areas measured and also, in overall scores.

Use of Technology in Planning of Teaching and Learning Activities

Teachers were asked to provide information on the extent to which they used technology in planning of teaching and learning activities at their ECDE centres (Appendix G, Part (C) Item No. 5). On this item, teachers were provided with a scale 1-4 from which they selected one response. The scale included never (1), sometimes (2), nearly always (3) and always (4). Since teachers were being assessed in a practical component, the 4-level scale was considered to be more ideal compared to the 5-level scale that focuses on abstract information. Table 5.30 and 5.31 present data on the extent to which teachers used technology in planning of teaching and learning activities.

In Table 5.30, 5.7% of the participating teachers used technology in planning of teaching and learning activities on always basis; 4.5% nearly always; 28.7% sometimes; and 61.0% never used technology in this component of their teaching practice.

Table 5.30

Extent of Technology Use in Planning of Teaching and Learning Activities

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Never (1)	123	73.7	187	54.9	310	61.0
Sometimes (2)	38	22.8	108	31.7	146	28.7
Nearly always (3)	02	2.0	21	6.2	23	4.5
Always (4)	04	2.4	25	7.3	29	5.7

Table 5.31

Extent of Technology Use in Planning of Teaching and Learning Activities Based on Gender

N=508

Teachers' Responses	Males (n=64)	%	Females (n=444)	%	Total	%
Never (1)	41	64.1	269	60.6	310	61.0
Sometimes (2)	19	29.7	127	28.6	146	28.7
Nearly always (3)	01	1.6	22	5.0	23	4.5
Always (4)	03	4.7	26	5.9	29	5.7

Looking at the data in Table 5.31, 4.7% of the participating male teachers and 5.9% of the female teachers used technology in planning of teaching and learning activities frequently. Conversely, 64.1% of male teachers and 60.6% of female teachers never used technology in this component of their teaching practice.

Using the 4-level scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers were scored on the extent to which they used technology in planning of teaching and learning activities. These scores were tested through the use of one-sample t-test for the purpose of determining the mean (expected mean was 4) for teachers' scores on this aspect of their practice. The results of this computation are presented in Table 5.32.

Table 5.32

One-Sample T-test Results on Teachers' Scores on the Extent of Technology Use in Planning of Teaching and Learning Activities

N=508

Mean	SD	SE Mean	95% CI
1.549	0.826	0.037	(1.477, 1.621)

In Table 5.32, the question relating to teachers' use of technology in planning of teaching and learning activities produced a mean of 1.55 with a standard deviation of 0.83. This result demonstrate that the participating teachers (n=508) extent of technology use in planning of teaching and learning activities was minimal.

In addition to the mean score, this study made comparisons on teachers' scores on use of technology in planning of teaching and learning activities (1-4 scale) and scores on their demographic variables. These variables included gender, highest education completed, professional qualifications and teaching experience. The comparison was also done with teachers' access and use of technology at the ECDE centres (score scale 1-5).

In order to make the comparisons, a chi-square test of independence was used for computation. The previously defined and used scales for demographic variables were utilized in these comparisons. The test results for these comparisons revealed lack of a significant relationship (r = -0.253, $p = 0.000$) between teachers' scores on the extent to which they used technology in planning of teaching and learning activities and their gender. Also, no significant relationship ($r = 0.104$, $p = 0.019$) was found between teachers' scores on the extent to which they used technology in planning of teaching and learning activities and their scores on selection of technology resources accessed and used at the ECDE centres (technology selection scale 1-5). These two test results suggest that teachers' gender, being male or female was not a predictor of teachers' scores on the extent to which they used technology in planning of teaching and learning activities.

However, significant correlations were found between teachers' scores on the extent to which they used technology in planning of teaching and learning activities and their demographic variables. These included age ($r = 0.939$, $p = 0.000 < 0.05$) (strong positive correlation), highest education completed ($r = 0.657$, P-Value = 0.000 <0.05) (moderate positive correlation), professional qualifications (r = 0.724, p = 0.000 < 0.05) (moderate positive correlation), and teaching experience (r = 0.927, p = 0.000 < 0.05) (strong positive correlation). These results suggest that an increase in teachers' age, scores on highest education completed, professional qualifications and increase in number of years in service were predictors in teachers' scores on the extent to which they used technology in planning of teaching and learning activities.

Apart from using a chi-square test of independence for examining relationships, a two-sample t-test was utilized to examine differences in regards to the extent to which groups of teachers used technology in planning of teaching and learning. On this variable, the mean scores for male teachers were compared with those for female teachers and mean scores for teachers in public preschools compared with those in private preschools.

The test results for gender indicates lack of significant difference (t (86) = -0.90, p (0.371) > 0.05} between male teachers (n=64) ($\bar{x}$ =1.469, SD = 0.755) and female teachers (n=444) ($\bar{x}$ =1.561, SD = 0.836). This result suggests that male and female preschools teachers in the district of study were at the same level regarding the extent they used technology in planning of teaching and learning. Table 5.33 presents a summary of a two-sample t-test for male and female teachers on the extent of technology use in planning of teaching and learning activities.

Table 5.33

A Two-Sample T-test for Male and Female Teachers on the Extent of Technology Use in Planning of Teaching and Learning Activities

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Males	64	1.469	0.755	0.094	(-0.296, 0.112)	-0.90	0.371	86
Females	444	1.561	0.836	0.040				

Considering the teachers in public and private preschools, the two-sample t-test reveals a significant difference (t (445) = -4.94, p (0.000) < 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 1.323, SD = 0.624) and those in private centres (n=341) ($\bar{x}$ 1.660, SD = 0.889). This result suggests that the two groups of teachers were not at the same level with reference to the extent of technology use in planning of teaching and learning activities. Table 5.34 presents a summary of the two-sample t-test for teachers in public and private centres on the extent of technology use in planning of teaching and learning activities.

Table 5.34

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Technology Use in Planning of Teaching and Learning Activities

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.323	0.624	0.048	(-0.4704, -0.2025)	-4.94	0.000	445
Private	341	1.660	0.889	0.048				

Use of Technology in Documentation of Teaching and Learning Activities

The teachers participating in the survey were also asked to provide information on the extent to which they used technology in documentation of teaching and learning activities at their ECDE centres (Appendix G, Part (C) Item No. 6). In order to respond to this question, participants were provided with four scales 1-4 from which to select one response. These scales included never (1), sometimes (2), nearly always (3) and always (4). Tables 5.35 and 5.36 present data on the extent to which teachers used technology in documentation of teaching and learning activities in their ECDE centres.

Table 5.35

Extent of Technology Use in Documentation of Teaching and Learning Activities

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Never (1)	126	75.5	187	54.8	313	61.6
Sometimes (2)	35	21.0	92	27.0	127	25.0
Nearly always (3)	02	1.2	33	9.7	35	6.9
Always (4)	04	2.4	29	8.5	33	6.5

In Table 5.35, 6.5% of the teachers used technology in documentation of teaching and learning activities on always basis; 6.9% used nearly always; 25.0% sometimes; and 61.6% never used technology in documentation of teaching and learning activities.

Table 5.36

Extent of Technology Use in Documentation of Teaching and Learning Activities Based on Gender

N=508

Teachers' Responses	Males (n=64)	%	Females (n=444)	%	Total	%
Never (1)	37	57.8	276	62.2	313	61.6
Sometimes (2)	21	32.8	106	23.9	127	25.0
Nearly always (3)	02	3.1	33	7.4	35	6.9
Always (4)	04	6.3	29	6.5	33	6.5

In Table 5.36, 6.3% of the male and 6.5% of the female teachers used technology in documentation of teaching and learning activities always. However, 57.8% of the male and 62.2% of the female teachers never used technology in this particular element of their everyday practice.

Using the 4-level scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers were scored on the extent to which they used technology in documentation of teaching and learning activities. These scores were tested through the use of one-sample t-test for the purpose of determining the mean (expected mean was 4) for teachers' scores. The results of this computation are presented in Table 5.37.

Table 5.37

One-Sample T-test Results on Teachers' Scores on the Extent of Technology Use in Documentation of Teaching and Learning Activities

N=508

Mean	SD	SE Mean	95% CI
1.583	0.879	0.039	(1.506, 1.659)

The test results in Table 5.37 indicate that teachers' mean, out of the expected mean score 4 was 1.58 with a standard deviation of 0.88. This result reveals that the teachers (n=508) extent of technology use in documentation of teaching and learning activities was minimal.

Further, this study made comparisons on teachers' scores on the use of technology in documentation of teaching and learning activities (1-4 scale) and across demographic variables. These variables included gender, highest education completed, professional qualifications and teaching experience. The comparison was also done with teachers' access and use of technology at the ECDE centres (score scale 1-5).

For the purpose of drawing comparisons, a chi-square test of independence was used for computation. The demographic scales used in the previous sections in this chapter were used in these comparisons. The test results for these comparisons revealed lack of a significant relationship (r = -0.252, p = 0.000) between teachers' scores on the extent to which they used technology in documentation of teaching and learning activities and their gender. Also, no significant relationship (r = 0.131, p = 0.003) was found between teachers' scores on the extent to which they used technology in documentation of teaching and learning activities and their scores on selection of technology resources accessed and used at the ECDE centres (technology selection scale 1-5). These two test results suggest that teachers' gender, being male or female was not a predictor of teachers' scores on the extent to which they used technology in documentation of teaching and learning activities.

Nonetheless, significant correlations were found between teachers' extent of technology use in documentation of teaching and learning activities and their demographic variables. These included age (r = 0.930, p = 0.000 < 0.05) (strong positive correlation), highest education completed (r = 0.646, p = 0.000 < 0.05) (moderate positive correlation), professional qualifications (r = 0.722, p = 0.000 < 0.05) (moderate positive correlation), and teaching experience (r = 0.938, p = 0.000 < 0.05) (strong positive correlation). These results suggest that an increase in teachers' age, scores on highest education completed, professional qualifications and increase in number of years in service were predictors in teachers' scores on the extent to which they used technology in documentation of teaching and learning activities.

As well as using a chi-square test of independence in testing correlations, a two-sample t-test was utilized to examine differences in regard to the extent to which groups of teachers used technology in documentation of teaching and learning activities. In this aspect, the mean scores for male teachers were compared with those for female teachers. Additionally, mean scores for teachers in public preschools were compared with those in private preschools.

The test results on gender did not highlight any significant difference (t (84) = -0.05, p (0.963) > 0.05) between male teachers (n=64) ($\bar{x}$ =1.578, SD = 0.832) and female teachers (n=444) ($\bar{x}$ =1.583, SD = 0.886). This result suggests that male and female preschools teachers in the district of study were using similar levels of technology in documenting teaching and learning activities. Table 5.38 presents a summary of a two-sample t-test for male and female teachers on the extent of technology use in documentation of teaching and learning activities.

Table 5.38

A Two-Sample T-test for Male and Female Teachers on the Extent of Technology Use in Planning of Teaching and Learning Activities

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Males	64	1.578	0.832	0.10	(-0.228, 0.218)	-0.05	0.963	84
Females	444	1.583	0.886	0.042				

In respect to the teachers in public and private preschools, the two-sample t-test demonstrated a significant difference (t (467) = -5.87, p (0.000) < 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 1.305, SD = 0.618) and their colleagues in private centres (n=341) ($\bar{x}$ = 1.718, SD = 0.953). This result suggests that the two groups of teachers were at different levels in relation to the use of technology in documentation of teaching and learning activities. Table 5.39 presents a summary of a two-sample t-test for teachers in public and private centres on the extent of technology use in documentation of teaching and learning activities.

Table 5.39

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Technology Use in Documentation of Teaching and Learning Activities

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.305	0.618	0.048	(-0.512, -0.274)	-4.94	0.000	445
Private	341	1.718	0.953	0.052				

Involvement of Children in Planning Technology-Rich Learning Experiences

Teachers were also asked to provide information on the extent to which they involved children in planning technology-rich learning experiences at their ECDE centres (Appendix G, Part (C) Item No. 6). In this connection, participating teachers were provided with four scales 1-4 from which to select one response. These scales comprised never (1), sometimes (2), nearly always (3) and always (4). Table 5.40 presents data on the extent to which teachers involved children in planning technology-rich learning experiences at their ECDE centres.

Table 5.40

Involvement of Children in Planning Technology-rich Learning Experiences

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Never (1)	158	94.6	277	81.2	435	85.6
Sometimes (2)	06	3.6	41	12.0	47	9.3
Nearly always (3)	02	1.2	13	3.8	15	3.0
Always (4)	01	0.6	10	3.0	11	2.1

The data in Table 5.40 reveal that 2.1% of the participating teachers always involved children in planning technology-rich learning experiences; 3.0% nearly always involved children; 9.3% sometimes; but 85.6% never involved children in this particular component of their teaching experience.

Using the 4-level scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers were scored on the extent to which they involved children in planning technology-rich learning experiences. These scores were tested through the use of one-sample t-test for the purpose of determining the mean (expected mean was 4) for teachers' scores. The results of this computation are presented in Table 5.41.

Table 5.41

One-Sample T-test Results on Teachers' Scores on the Extent to which they Involved Children in Planning Technology-rich Learning Experiences

N=508

Mean	SD	SE Mean	95% CI
1.217	0.599	0.027	(1.164, 1.269)

As can be seen in Table 5.41, the mean score, on the extent to which teachers involved children in planning technology-rich learning experiences; out of the expected was 1.217with a standard deviation of 0.599. The expected mean score was 4. This result suggests that teachers (n=508) did not involve children in planning technology-rich learning experiences on any regular basis.

Additionally, a two-sample t-test on means for teachers in public and private centres revealed a significant difference ($t\ (501) = -4.47$, $p\ (0.000) < 0.05$) between teachers in public centres (n=167) ($\bar{x}$ =1.078, SD = 0.364) and those in private centres (n=341) ($\bar{x}$ = 1.284, SD = 0.676). This result suggests that the two groups of participants were at varying levels in terms of the extent to which they involved children in planning technology-rich learning experiences. Table 5.42 presents a summary of the two-sample t-test for teachers in public and private centres based on the extent of children's involvement in planning of technology-rich learning experiences.

Table 5.42

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Involving Children in Planning Technology-rich Learning Experiences

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.078	0.364	0.028	(-0.297, -0.116)	-4.47	0.000	501
Private	341	1.284	0.676	0.037				

Use of Technology in Sharing Experiences on Children's Learning Progress with Parents

Teachers were asked to provide information on how often they used technology in sharing experiences on children's learning progress with parents (Appendix G, Part (C) Item No. 6). On this item, they utilized four scales 1-4 from which to selected one response. These scales included never (1), sometimes (2), nearly always (3) and always (4). Table 5.43 presents data collected on this item.

Table 5.43

Use of Technology in Sharing Experiences on Children's Learning Progress with Parents

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Never (1)	119	71.3	214	62.8	333	65.6
Sometimes (2)	24	14.4	60	17.6	84	16.5
Nearly always (3)	16	9.6	43	12.6	59	11.6
Always (4)	08	4.8	24	7.0	32	6.3

The evidence in Table 5.43 reveals 6.3% of the participating teachers always used technology in sharing experiences on children's learning progress with parents; 11.6% nearly always used technology in sharing experiences on children's learning; 16.5% sometimes; and 65.6% never used technology in sharing experiences on children's learning progress with parents.

Using the 4-level scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers were scored on the extent to which they used technology in sharing experiences on children's learning progress with parents. These scores were tested through the use of one-sample t-test for the purpose of determining the mean (expected mean was 4) for teachers' scores. The results of this computation are presented in Table 5.44.

Table 5.44

One-Sample T-test Results on Teachers' Scores on the Extent of Technology Use in Sharing Experiences on Children's Learning Progress with Parents

N=508

Mean	SD	SE Mean	95% CI
1.587	0.924	0.041	(1.506, 1.667)

As can be seen in Table 5.44, teachers' mean on the extent of technology use in sharing experiences on children's learning progress with parents, out of the expected mean score 4 was 1.587 with a standard deviation of 0.924. This result suggests that teachers (n=508) extent of technology use in sharing experiences on children's learning progress was minimal.

Additionally, a two-sample t-test resulted in lack of any significant difference (t (363) = -1.91, p (0.060) > 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 1.479, SD = 0.856) and teachers in private centres (n=341) ($\bar{x}$ =1.639, SD = 0.953). This result demonstrates that teachers in both public and private centres were on the same level in regards to the extent of using technology in sharing experiences on children's learning progress. Table 5.45 shows a summary of the two-sample t-test for teachers in public and private centres, on the extent of using technology in sharing experiences on children's learning progress.

Overall, teachers' aggregates in the four areas comprising use of technology in planning of teaching and learning activities, use of technology in documentation of teaching and learning activities, involvement of children in planning technology-rich learning experiences and use of technology in sharing experiences on children's learning progress with parents were analysed using both one-sample and two-samples t-tests.

Table 5.45

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Using Technology in Sharing Experiences on Children's Learning Progress

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.479	0.856	0.066	(-0.325, 0.005)	-1.91	0.057	363
Private	341	1.639	0.953	0.052				

The results obtained through use of one-sample t-test are presented in Table 5.46.

Table 5.46

One-Sample T-test Results on Teachers' Overall Scores

		N=508	
Mean	SD	SE Mean	95% CI
5.94	3.08	0.137	(5.666, 6.20)

As evidenced in Table 5.46, teachers' mean, 5.94 was far much below the expected mean score 16. This outcome suggests that overall, teachers in the study district use of technology in everyday practice was small or minimal extent.

A two-sample t-test resulted in a significant difference (t (450) = -4.39, *p* (0.000) < 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 5.19, SD = 2.31) and their colleagues in private centres (n=341) ($\bar{x}$ = 6.30, SD = 3.34). This result suggests that teachers in the two ECDE contexts, public and private were at different levels in regards to extent of technology use in everyday practice. Table 5.47 presents a summary of the two-sample t-test for teachers in public and private centres on the extent of technology use in everyday practice.

Table 5.47

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Technology Use in Everyday Practice

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	5.19	2.31	0.18	(-1.616, -0.617)	-4.39	0.000	450
Private	341	6.30	3.34	0.18				

Teachers' Confidence about Using Technology in Everyday Practice

Data on teachers' confidence about using technology in everyday practice was gathered in four areas including planning and documenting activities for children at the ECDE centres, locating ideal websites that contain information related to ECDE, emailing parents their children's learning projects and cropping and rotating photos on a photo story program (see Appendix G, Part (C) Item Nos. 10-13).Using one option from a five-level Likert scale comprising strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5), each of the participating teachers rated four statements focused on the four mentioned areas based on their confidence on the integration of technology in planning and documentation.

The data gathered in the four areas were analysed in terms of teachers' evaluations of the given statements based on scales provided. Further, teachers' scores on the scales in each of the four areas and also on all the four areas combined together were analysed through the use of one-sample and two-sample t-tests. One-sample t-test was utilized to determine whether the mean of teachers (n=508) differed from the expected mean scores. On the other hand, a two-sample t-test was used to determine whether mean scores of the two groups of participants, teachers in public and private ECDE centres differed significantly in each of the confidence areas measured, as well as in overall scores.

Confidence about Using Technology in Planning and Documenting Activities for Children

The first statement to be rated by teachers (n=508) was **"**I feel confident about using technology in planning and documenting activities for children at my centre". Data collected on teachers' ratings of this statement are presented in Table 5.48.

Table 5.48

Confidence about using Technology in Planning and Documenting Activities for Children

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Strongly Disagree (1)	82	49.1	174	51.0	256	50.4
Disagree (2)	45	27.0	131	38.4	176	34.7
Neutral (3)	17	10.2	10	2.9	27	5.3
Agree (4)	09	5.4	06	1.8	15	3.0
Strongly Agree (5)	14	8.4	20	5.9	34	6.7

As can be seen in the Table 5.48, 8.4% of the teachers in public centres and 5.9% private centres strongly agreed they felt confident about using technology in planning and documenting activities for children. On the hand, over 40% of the teachers, both in public and private centres strongly disagreed with same statement. Overall, 6.7% of the teachers strongly agreed with the statement yet 50.4% of the teachers strongly disagreed (Table 5.40). Teachers' evaluations of the statements showed 85.1% of the teachers responded 'strongly disagree' and 'disagree', believing that they were not confident about using technology in planning and documenting activities for children at their centres. Scores on teacher confidence in using technology in planning and documenting activities for children, based on selected scales comprising strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5) were analysed through the use of a one-sample t-test. The results of this analysis are presented in Table 5.49.

Table 5.49

One-Sample T-test Results on Teachers' Scores on Confidence about Using Technology in Planning and Documenting Activities for Children

N=508

Mean	SD	SE Mean	95% CI
1.809	1.115	0.050	(1.712, 1.906)

In Table 5.49, this question produced a mean, 1.81, far below the mean score 5. This result suggests that teachers (n=508) had little confidence in their own ability to use technology in planning and documenting activities for children at their centres.

A two-sample t-test on means for preschool teachers in public and private centres revealed a significant difference (t (279) = 2.14, p (0.033) < 0.05) between teachers in public centres (n=167) ($\bar{x}$ =1.97, SD = 1.25) and those in private centres (n=341) ($\bar{x}$ =1.73, SD = 1.03). This result suggests significant variance in confidence levels of two groups of teachers' use of technology in planning and documenting activities for children. Table 5.50 presents a summary of the two-sample t-test for teachers in public and private centres.

Table 5.50

A Two-Sample T-test for Teachers in Public and Private Centres on Confidence about using Technology in Planning and Documenting Activities for Children

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.97	1.25	0.097	(0.019, 0.460)	2.14	0.033	279
Private	341	1.73	1.03	0.056				

Confidence about Locating Ideal Websites that Contain Information Related to ECDE

Using a five-level Likert scale, teachers rated the second statement, **"**I feel confident about locating an ideal website that contains information related to ECDE". Evidence gathered on teachers' ratings of this statement are presented in Table 5.51.

Table 5.51 presents data on teachers' ratings on their confidence about locating ideal websites that contain information related to ECDE. The evidence in the table shows 7.8% of teachers in public centres and 3.0% of the teachers in private centres strongly agreed that they felt confident about locating ideal websites that contain information related to ECDE. On the contrary, 53.9% of the teachers, both in public and private centres strongly disagreed that they felt confident about locating ideal websites that contain information related to ECDE. Similarly, the overall score indicated 4.5% of the teachers (n=508) strongly agreed with the statement (Table 5.51). These ratings reveal

85.0% of the participating teachers believed they were not confident about locating an ideal website that contains information related to ECDE.

Table 5.51

Confidence about Locating Ideal Websites that Contain Information Related to ECDE

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Strongly Disagree (1)	96	57.5	178	52.2	274	53.9
Disagree (2)	45	27.0	113	33.1	158	31.1
Neutral (3)	07	4.2	16	4.7	23	4.5
Agree (4)	06	3.6	24	7.0	30	5.9
Strongly Agree (5)	13	7.8	10	3.0	23	4.5

Using the 1.5 confidence rating scale, a one-sample t-test was performed on teachers' scores. Table 5.52 presents the results of one-sample t-test analysis of teachers (n=508) rating scores on their confidence about locating ideal websites that contain information related to ECDE.

Table 5.52

One-Sample T-Test Results on Teachers' Scores on Confidence about Locating Ideal Websites that Contain Information Related to ECDE

N=508

Mean	SD	SE Mean	95% CI
1.760	1.083	0.048	(1.665, 1.85)

In Table 5.52, teachers' mean, 1.76, was far much below the expected mean score 5. This result suggests that teachers' minimal confidence about using technology in planning and documenting activities for children at their centres.

A two-sample t-test on means for teachers in public centres and those in private centres reveals lack of any significant difference {t (290) = 0.17, p (0.0862) > 0.05} between teachers in public centres (n=167) ($\bar{x}$ = 1.77, SD = 1.19) and their colleagues in private centres (n=341) ($\bar{x}$ = 1.75, SD = 1.03). This result suggests the two groups of teachers held similar beliefs in regards to their confidence about locating ideal websites that contain information related to ECDE. Table 5.53 presents a summary of the two-sample t-test for teachers in public and private centres on confidence about locating ideal websites that contain information related to ECDE.

Table 5.53

A Two-Sample T-test for Teachers in Public and Private Centres on Confidence about Locating Ideal Websites that Contain Information Related to ECDE

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.77	1.19	0.092	(-0.019, 0.231)	0.17	0.0862	290
Private	341	1.75	1.03	0.056				

Confidence about Emailing parents their Children's Learning Projects

Using the five-level Likert scale, teachers rated the third statement "I do **not** feel confident about emailing parents their children's learning projects". Table 5.54 presents data on teachers' ratings.

Table 5.54

Confidence about Emailing Parents their Children's Learning Projects

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Strongly Disagree (5)	7	4.2	26	7.6	33	6.5
Disagree (4)	15	9.0	32	9.4	47	9.3
Neutral (3)	10	6.0	41	12.0	51	10.0
Agree (2)	63	37.7	115	33.7	178	35.0
Strongly Agree (1)	72	43.1	127	37.2	199	39.2

Table 5.54 reveals that 43.1% of the teachers in public centres and 37.2% of those in private centres strongly agreed that they did not feel confident about emailing parents their children's learning projects. Additionally, less than 10% of the teachers, both in public and private centres did not agree with the statement, implying they were confident about emailing parents their children's learning projects. Overall, 35.0% of the teachers in the study district agreed with the statement and 39.2% strongly agreed, suggesting that they did not feel confident about emailing parents their children's learning projects.

Using the 5-level scale, teachers mean score was determined though a one-sample t-test. Table 5.55 presents the results of this test.

Table 5.55

One-Sample T-Test Results on Teachers' Scores on Confidence about Emailing Parents their Children's Learning Projects

		N=508	
Mean	SD	SE Mean	95% CI
2.087	1.198	0.0532	(1.982, 2.191)

In Table 5.55, teachers' mean on confidence about emailing parents their children's learning projects, 2.09, was below the expected mean score 5. This result suggests teachers' low level of belief confidence about emailing parents their children's learning projects.

A two-sample t-test on means for teachers in public and private centres revealed a significant difference (t (363) = -2.09, p (0.038) < 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 1.93, SD = 1.11) and their counterparts in private centres (n=341) ($\bar{x}$ = 2.16, SD = 1.23). This result suggests the two groups of teachers were not consistent in their confidence about emailing parents their children's learning projects. Table 5.56 presents a summary of the two-sample t-test for teachers in public and private centres on confidence about emailing parents their children's learning projects.

Table 5.56

A Two-Sample T-test for Teachers in Public and Private Centres on Confidence about Emailing Parents their Children's Learning Projects

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.93	1.11	0.086	(-0.441, -0.013)	-2.09	0.038	363
Private	341	2.16	1.23	0.067				

Confidence about Cropping and Rotating Photos on a Photo Story Program

Using a five-level Likert scale, teachers rated the fourth statement, "I do **not** feel confident about cropping and rotating photos on a photo story program". Evidence gathered on teachers' ratings of this statement is presented in Table 5.57.

Table 5.57

Confidence about Cropping and Rotating Photos on a Photo Story Program

N=508

Teachers' Responses	Public (n=167)	%	Private (n=341)	%	Total	%
Strongly Disagree (5)	04	2.4	18	5.3	22	4.3
Disagree (4)	13	7.8	29	8.5	42	8.3
Neutral (3)	05	3.0	11	3.3	16	3.2
Agree (2)	63	37.7	126	37.0	189	37.2
Strongly Agree (1)	82	49.1	157	46.0	239	47.1

The evidence in Table 5.57 indicates that both teachers in public (49.1%) and private (46.0%) centres strongly agreed that they did not feel confident about cropping and rotating photos on a photo story program. On the other hand, less than 10% of the teachers, both in public and private centres strongly disagreed and also disagreed that they did not feel confident about cropping and rotating photos on a photo story program. Overall, 4.3% of the teachers strongly disagreed with the statement; 8.3% disagreed; 3.2% were neutral; 37.2% agreed with the statement; and 47.1% strongly agreed with the statement (Table 5.57). These varied responses indicate that teachers were heterogeneous in their confidence about cropping and rotating photos on a photo story program.

Using the 5-level scale, a one-sample t-test was performed on teachers' scores in order to identify their mean score on confidence about cropping and rotating photos on a photo story program. Table 5.58 presents the results of this test.

Table 5.58

One-Sample T-Test Results on Teachers' Scores on Confidence about Cropping and Rotating Photos on a Photo Story Program

		N=508	
Mean	SD	SE Mean	95% CI
1.856	1.097	0.049	(1.761, 1.952)

The t-test results in Table 5.58 indicates teachers' mean on confidence about cropping and rotating photos on a Photo Story Program, 1.86. This mean is below the expected mean score 5. This result suggests teachers' low level belief confidence about cropping and rotating photos on a Photo Story Program.

A two-sample t-test on means for the teachers in public and private centres revealed lack of significant difference (t (371) = -1.35, p (0.177) > 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 1.77, SD = 1.00) and their counterparts in private centres (n=341) ($\bar{x}$ = 1.90, SD = 1.14). This result suggests that the two groups of teachers were homogeneous in their confidence belief about cropping and rotating photos on Photo Story Program. Table 5.59 presents a summary of the two-sample t-test for teachers in public and private centres on their confidence about cropping and rotating photos on Photo Story Program.

Table 5.59

A Two-Sample T-test for Teachers in Public and Private Centres on Confidence about Emailing Parents their Children's Learning Projects

N=508

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	1.77	1.00	0.077	(-0.329, 0.061)	-1.35	0.177	371
Private	341	1.90	1.14	0.062				

Overall, teachers' aggregates in the four areas comprising confidence about using technology in planning and documenting activities for children at the ECDE centres, locating ideal websites that contain information related to ECDE, emailing parents their children's learning projects and cropping and rotating photos on a photo story program were analysed using both one-sample and two-samples t-tests.

The results obtained through use of one-sample t-test on teachers' scores on a 5 level scale are presented in Table 5.60.

Table 5.60

One-Sample T-test Results on Teachers' Overall Scores

N=508

Mean	SD	SE Mean	95% CI
7.51	4.35	0.193	(7.13, 7.89)

As evidenced in Table 5.60, teachers' mean on confidence about using technology in everyday practice, 7.51 was below average since the expected mean score was 20. This finding suggests teachers' minimal belief confidence about using technology in everyday practice.

A two-sample t-test resulted in lack of significant difference (t (319) = -2.25, p (0.806) > 0.05) between teachers in public centres (n=167) ($\bar{x}$ = 7.44, SD = 4.46) and their colleagues in private centres (n=341) ($\bar{x}$ = 7.55, SD = 4.30). This result suggests that overall, teachers in the district of study held similar belief confidence in regards to use of technology in everyday practice. Table 5.61 presents a summary of the two-sample t-test for teachers in public and private centres on the extent of technology use in everyday practice.

Table 5.61

A Two-Sample T-test for Teachers in Public and Private Centres on the Extent of Technology Use in Everyday Practice

Sample	N	Mean	SD	SE Mean	95% CI difference	T-Value	P-Value	DF
Public	167	7.44	4.46	0.34	(-0.921, 0.716)	-2.25	0.806	319
Private	341	7.55	4.30	0.23				

Relationships between Teachers' Confidence about Using Technology in Everyday Practice and Extent of Technology Use in Everyday Practice

Through use of Pearson correlation statistical tool, teacher (508) aggregate scores on confidence in using technology in everyday practice were compared with their aggregate scores on use of technology in everyday practice. The outcome of this test (r= 0.924, p = 0.000) indicated a strong positive relationship between teachers' scores on the confidence and use of technology. An increase in scores on the confidence measure was similar to an increase in scores on the use of technology. This suggests that teachers' confidence was likely to be one of the factors influencing preschool teachers' use of technology in everyday practice. Alternatively, this outcome could also suggest that teachers' use of technology in everyday practice was likely to result in their development of confidence in use of the innovation.

When teachers' aggregate scores were compared with their demographic variables through use of Pearson correlation, weak, significant relationships were found between teachers' scores on confidence and access to technology resources at the ECDE centres (-0.319, p = 0.000 < 0.05) and teachers' age (-0.240, p = 0.000 < 0.05). While zero correlation was found between teachers' confidence and professional status (0.014, p = 0.751 > 0.05). Further, strong positive and significant correlations were found between teachers' confidence scores and highest education completed (0.56, p = 0.000 < 0.05) and teaching experience (0.68, p = 0.000 < 0.05). These findings suggest that teachers' demographic characteristics could be an influencing factor in their development of confidence in use of technology in everyday practice.

Stakeholders' Support in Integration of Technology at the ECDE Centres

Teachers were provided with a list of six (6) groups of stakeholders comprising the Ministry of Education, district ECDE officers, managers of ECDE centres, parents/community members, teachers at their centres and teachers in other ECDE centres, plus 'others' in case they had additional (see Appendix G, Part (C) Item No. 14). Participants were asked if they were provided with support in integrating technology at their ECDE centres by these groups of stakeholders. For the participants who responded with a 'yes', they were required to describe the type of support provided. Table 5.62 provides data on the teachers' responses involving 'yes' or 'no' on stakeholders' provision of support on integration of technology.

Table 5.62

Teachers' Responses on Provision of Support by Stakeholders

N=508

	Teachers					
	Public		Private			
Stakeholders	Yes	No	Yes	No	Total (Yes)	Total (No)
Ministry of Education	0	167	0	341	0	508
District ECDE officers	0	167	0	341	0	508
Mangers of ECDE centres	115 68.9%	52 31.1%	285 83.6%	56 16.4%	400 78.7%	108 21.3%
Parents/ community members	90 53.9%	77 46.1%	311 91.2%	30 8.8%	401 78.9%	107 21.1%
Teachers at your centre	18 10.8%	149 89.2%	114 33.4%	227 66.6%	132 26.0%)	376 74.0%
Teachers in other ECDE centres	0	167	0	341	0	508
Others–Churches	-	-	16 4.7%	-	-	-

Teachers participating in the survey (n=508) indicated both ‘yes’ (Table 5.62) and ‘no’ to a question asking if they were provided with support by six groups of stakeholders in integration of technology at their ECDE centres. Out of the 6 groups of stakeholders, as seen in the table, teachers responded with a ‘yes’ to three (3) of the groups including managers of ECDE centres (78.7%), parents/community members (78.9%) and fellow teachers at their centres (26.0%). The data in the table shows that 16 teachers (4.7%) in private ECDE centres were provided with support by a 4th group of stakeholders, namely, the churches. The groups of stakeholders against which all the participating teachers (100%) indicated a ‘no’ included Ministry of Education, District ECDE officers and teachers in other ECDE centres (see Table 5.62).

As for the types of ECDE centres, in reference to Table 5.53, 68.9% of the teachers in the public centres indicated ‘yes’ to managers of their centres, 53.9% to parents/community members and 10.8% to fellow teachers at their centres. Likewise, 83.6% of the teachers in private centres indicated ‘yes’ to managers of their centres, 91.2% to parents/community members and 33.4% to fellow teachers at their centres (Table 5.62).

Teachers responding with a ‘yes’ in the previous question were required to describe the type of support provided by stakeholders in the second part of the question (see Appendix I, Part (C) Item No. 14). The data collected on this item is presented in Table 5.63.

The data in Table 5.63 reveal that teachers participating in the survey were provided with three types of support by the managers in their centres. These included provision of instructional materials to 351 teachers (69.09%); provision of ICT resources including computers, digital cameras, printers and photocopiers to 270 teachers (53.2%) and sponsorship for training in ICT to 43 teachers (8.5%). Additionally, in Table 5.63, teachers in the study district received two (types of support from parents/community members in form of funds to purchase computers (75.4%) as well as donations of computers (62.4%). The data in the table indicates also fellow teacher colleagues at the teachers’ centres of practice provided three types of support including sharing of instructional materials (26.8%), sharing of ideas on ICT (28.2%) and donating computers (5.5%).

Table 5.63

Types of Support Provided on Integration of Technology in ECDE Centres by Stakeholders

Stakeholders	Types of Support	Teachers Public (n=167)	Teachers Private (n=341)	Total (N=508)	%
Managers of ECDE centres	Provides Instructional materials	105 (62.9%)	246 (72.1%)	351	69.1
	Provides computers, digital cameras, printers and photocopiers	92 (55.1%)	178 (52.2%)	270	53.2
	Sponsor training in ICT	13 (7.8%)	30 (8.8%)	43	8.5
Parents/ community members	Funds to purchase computers	84 (50.3%)	299 (88.0%)	383	75.4
	Donations of computers	06 (3.6%)	311 (92.2%)	317	62.4
Teachers at their centres	Sharing instructional materials	15 (9.0%)	121 (35.5%)	136	26.8
	Sharing of ideas on ICT	11 (6.6%)	132 (38.7%)	143	28.2
	Donations of computers	10 (6.0%)	18 (5.3%)	28	5.5
Others - Churches	Provides funds to purchase computers	-	16 (4.7%)	16	3.2
	Donate computers, photocopiers and printers	-	10 (4.31%)	10	3.9

In view of the types of ECDE centres, over 50% of the teachers in the public centres received two types of support from ECDE managers. These comprised instructional materials and provision of ICT resources (Table 5.63). The type of support least received by teachers in public centres (6.0%) was donations of computers provided by fellow teacher colleagues. On the other hand, the two (2) types of support most often provided to teachers in the private centres were received from parents/community members through donations of computers (92.2%) and funds to purchase computers (87.7%). Lastly, the type of support least received was donations from fellow teachers (5.3%) at the centres of practice.

Teachers' Perceptions about the Use of Technology in ECDE

Participating survey teachers were asked about the integration of technology in ECDE curriculum in Kenya (see Appendix G, Item Part C No. 15). Analysis of responses provided by these participants indicated a focus in two areas, namely, use of technology in teaching practice and children's learning.

Use of Technology in Teaching Practice

Teachers participating in the survey believed that the use of technology in ECDE could be used in teaching practice in six ways. These included sourcing for information about ECE; professional networking through social platforms; partnership and communication with families and other stakeholders; reduce, easy teachers' work load and improve efficiency and effectiveness; use in planning, teaching and documentation; and in sustaining children's learning interest. This evidence is presented in Table 5.64.

The data in Table 5.64 shows six ways in which teachers focus on the affordances of technology in teaching practice. These ways include sourcing for information about ECDE. This perception was held by 75.8% of the participants. This perception was articulated by one of the participants in the following way:

> *Also, makes us to be well equipped with a lot of information around the world which we never had idea before or had no chance and resources to reach them. I strongly support it because the world is a global village due to computers.* (SPRV 278)

Additionally, 52.2% of the participants across the district of study believed the use of technology in ECDE would facilitate professional networking through social platforms. Yet 67.9% were of the view that the use of technology in ECDE would enhance partnership and communication with families and other stakeholders. One participant reiterated how technology could play this role:

> *Computers and internet connection play a very important role in ECDE centres. They can make us communicate and form strong partnerships with our managers, parents, families and ECDE teachers who are in places far away from us.* (SPRV 407)

Table 5.64

Use of Technology in Teaching Practice

		N=508				
Use of Technology in Teaching Practice	Public (n=167)	Teachers %	Private (n=341)	%	Total	%
Sourcing for information about ECDE	129	77.3	256	75.1	385	75.8
Professional networking through social platforms	88	52.7	177	51.9	265	52.2
Partnership and communication with families and other stakeholders	111	66.5	234	68.6	345	67.9
Reduce, easy teachers' work load and improve efficiency and effectiveness	161	96.4	337	98.8	498	98.0
Use in planning, teaching and documentation	55	32.9	114	33.4	169	33.3
Use in sustaining children's learning interest	100	59.9	305	89.4	405	79.7

Most teachers (98%) supported the use of technology in ECDE because they believed it had the potential to reduce teacher workloads, and to create efficiency and effectiveness in teaching practice. This potentiality and especially the efficiency aspect were emphasized by five of the participants as indicated in the following excerpts:

> *It makes work easier; it saves a lot of time; it also saves money. If implemented, it can help in making work easier, reduces our work load. It will ease work for the teachers. Not a bad idea, it can make work easier and more efficient.* (SPRV 083)

> *Technology will make planning of teaching efficient. It can make pedagogical documentation easier. Integration of technology is very important because it will make teaching easier.* (SPUB 129)

> *The program [technology] is long overdue, will make teaching and learning effective. Technology should be used in planning and pedagogical documentation as it makes the work easier. It will make it easier for teachers to plan teaching activities throughout the term or year.* (SPUB 050)

That is my dream that technology will soon be integrated in ECE curriculum. I believe it will enhance the teaching and learning of children. Teaching methods will be made efficient. (SPUB 009)

I have no concern but I support that the integration of technology in planning and pedagogical documentation should be widely used in ECE centres. I would prefer the integration of technology in teaching methods. It should be introduced to our education. It will make teaching efficient. Using computers to plan and use it in teaching methods can really assist. (SPRV 227)

Moreover, 33.3% of the teachers taking part in the survey were of the view that the use technology in ECDE could be used in planning, teaching and documentation. While 79.9% of the participants believed the use of technology in ECDE could enable teachers to sustain children's learning interest.

Use of Technology in Children's Learning

Teachers participating in the survey were of the view that the use of technology in ECDE could be used in children's learning in five ways. These included development of eye-hand coordination; development of memory, thinking and logical reasoning; make learning easy, enjoyable and fun; early acquisition of ICT literacy skills; and development of children's talents and life skills. This evidence is presented in Table 5.65.

Table 5.65

Use of Technology in Children's learning

N=508

Use of Technology in Children's Learning	Public (n=167)	Teachers %	Private (n=341)	%	Total	%
Development of eye-hand coordination	118	70.7	158	46.3	276	53.3
Development of memory, thinking and logical reasoning	65	38.9	139	40.8	204	40.2
Make learning easy, enjoyable and fun	93	55.7	174	43.1	267	52.6
Early acquisition of ICT literacy skills	147	88.0	299	87.7	446	87.8
Develop talents and life skills	29	17.4	55	16.1	84	16.5

The data in Table 5.65 shows five ways in which technology could be used in ECDE based on teachers' views. Over 50% of the teachers participating in the survey believed that the use of technology in ECDE could enable children to develop coordination of eye-hand skills. One participant felt development of this skill would take place if children are provided with an opportunity to use computers:

> *The integration of technology in ECE curriculum has brought about the use and knowledge of computers in children's day-to-day life. It makes work easier. Technology helps children to develop eye-hand coordination through the use of computers.* (SPUB 166)

Further, 40.2% of the participants believed the use of technology in ECDE had the potential to develop children's memory, thinking and logical reasoning. Also, 52.6% of the participants believed that technology could make learning easy, enjoyable and fun; and assist in the early acquisition of ICT literacy skills (87.8%) and development of children's talents and life skills (16.5%).

One participant believed technology had the potential to make learning and teaching enjoyable resulting in quick coverage of the content being taught and learnt:

> *It [technology] not only makes learning easy and enjoyable but also fun to both the teacher and the children hence a faster mastery of the topics involved.* (SPUB 024)

Even though the majority of the teachers (see Tables 5.64 and 5.65) were of the view that the use of technology in ECDE could provide affordances in teaching practices and children's learning, few teachers participating in this study felt that the use of technology in ECDE was likely to impact teaching practices (n=67) (13.2 %)and children's development negatively (n=83) (16.3%).

Potential Negative Impacts of Technology on Teaching Practice

Few teachers participating in the survey believed that the use of technology in ECDE was likely to give teachers a difficult time due to too much work; make teachers unproductive; result in unemployment for teachers; and waste of valuable time for teaching and learning due to teachers' lack of ICT skills. These views are presented in Table 5.66.

Table 5.66

Potential Negative Impacts of Technology on Teaching Practice

Potential Negative Impacts of Technology on Teaching Practice	Public (n=21)	n=67 Teachers %	Private (n=46)	%	Total	%
Too much work for teachers	08	38.1	15	32.6	23	34.3
Unproductive teachers	06	28.6	12	26.1	18	26.9
Unemployment for teachers	04	19.1	06	13.0	10	14.9
Waste of valuable time for teaching and learning	03	14.3	13	28.3	16	23.9

Potential Negative Impacts of Technology on Children's Development

Few of the teachers participating in the survey believed that the use of technology in ECDE was likely to cause harm to children; was a risk to children's moral development; and could retard their writing skills, expose them to inappropriate sites and waste their learning time due to the complexity of the innovation. These views are presented in Table 5.67.

Table 5.67

Potential Negative Impacts of Technology on Children's Development

Potential Negative Impacts of Technology on Children's Development	Public (n=28)	n=83 Teachers %	Private (n=55)	%	Total	%
Harmful to children	05	17.9	11	20.0	16	19.3
Risk to children's moral development	10	35.7	13	23.6	23	27.7
Retard writing skills	03	10.7	06	10.9	09	10.8
Expose children to inappropriate sites	06	21.4	15	27.3	21	25.3
Waste of children's learning time due to the complexity of the innovation	04	14.3	10	18.2	14	16.9

Concerns on the Integration of Technology in Planning and Documentation in ECDE Centres in Kenya

Teachers participating in the survey were asked if they had any concerns on the integration of technology in planning and documentation in ECDE centres in Kenya (Appendix G, Part C, and Item No. 16). Data gathered on teachers' responses to this questionnaire item are presented in Table 5.68.

In Table 5.68, most of the teachers (94.5%) were concerned about lack of technology resources for access and use at their centres of practice. Similarly, 76.0% felt training in use of technology in practice was critical. 56.1% were concerned about the adoption and use of technology in Kenya's ECDE context. Participating teachers were also concerned about stakeholders' support in use of technology in ECDE (35.0%); employment for ECDE teachers (27.6%); and security, maintenance and sustainability and sustainability of ICT equipment (18.3%).

Table 5.68

Concerns on the Integration of Technology in Planning and Documentation in ECDE Centres in Kenya

			N=508			
Teachers' raised concerns	Public (n=167)	%	Private (n=341)	%	Total	%
Adoption and use of technology in ECDE	97	58.1	188	55.1	285	56.1
Stakeholders' support in use of technology in ECDE	64	38.3	114	33.4	178	35.0
Technology resources for access and use	147	88.0	333	97.7	480	94.5
Training in use of technology in practice	125	74.9	261	76.5	386	76.0
Employment for ECDE teachers	39	23.4	101	29.6	140	27.6
Security/maintenance &sustainability of ICT euipment	43	25.8	50	14.7	93	18.3

Additional Evidence

Lastly, through survey questionnaire, teachers were asked if they had anything else they wished to share about the use of technology in ECDE centres in Kenya (see Appendix G, Part C, and Item No. 17). The additional evidence collected from teachers through this item is presented in Table 5.69.

According to additional evidence resulting from the survey (Table 5.69), teachers (89.6%) felt infrastructure such as electricity was a challenge as far as integration of technology in ECDE was concerned. There were also teachers (60.2%) who felt there was need for awareness on the importance of technology in ECDE, especially in slum and rural areas. Some teachers (40.6%) were concerned about the negative attitude towards use of technology held by community members, including parents. The need to consider age of ECDE children when integrating technology in ECDE context was an additional point raised by 26.2% of the teachers. While other teachers (16.1%) felt provision of technical support was a crucial factor to be put into consideration during introduction of technology in ECDE. A small percentage (8.3) of participants indicated that technology programmes for ECDE ought to be culturally sensitive in regards to ethnic languages.

Table 5.69

Additional Evidence

	N=508					
Teachers' raised concerns	Public (n=167)	%	Private (n=341)	%	Total	%
Negative attitude on use of technology in ECDE by parents/community members	106	63.5	100	29.3	206	40.6
Awareness on the importance of technology in ECDE especially in slum and rural areas	81	48.5	245	71.9	326	64.2
Age factor to be considered when integrating technology in ECDE	56	33.5	77	22.6	133	26.2
Need for technical support when integrating technology in ECDE	32	19.2	50	14.7	82	16.1
Infrastructure such as electricity is a challenge	139	83.2	316	92.7	455	89.6
Technology programmes for ECDE ought to be culturally sensitive in terms of ethnic languages	23	13.8	19	5.6	42	8.3

Chapter Summary

This Chapter presented findings from the survey part of the Phase Two of this study. The findings were focused on teachers' demographic information, professional training in technology, access and integration of technology in planning and documentation, types of technology resources accessed and used, availability of policy/curriculum guidelines on the integration of technology in ECDE, teachers' use of technology in everyday practice, teachers' confidence about using technology in everyday practice, teachers' perceptions about the use of technology in ECDE and concerns on the integration of technology in planning and documentation in ECDE centres in Kenya.

Findings on demographic information revealed that majority of the teachers (87.4%) were females. A similar trend was noted based on public (81.4%) and private (90.3%) ECDE centres. Additionally, participating teachers were aged between 20 and 60+years and over 50% were in the early stages of their professional practice since they were aged between 20 and 30 years. In terms of education background, over 60% of the teachers had completed post-secondary education at diploma/certificate levels and a small percentage (7.3%) had completed a university degree. A positive but moderate significant relationship was found between teachers' age and highest education completed.

This study also found that most of the teachers (77.0%) were professionally trained at certificate and diploma levels respectively. Additionally, it was noted that a small percentage (3.4) of the participating teachers were professionally trained at degree level. A positive but moderate significant relationship (r = 0.67, p = .02) was found between teachers' gender and professional qualifications. Over 50% of the teachers had trained or were training in private colleges while less than 10% had trained or were undertaking their training in government universities.

Results on teachers' teaching experience revealed over 50% had taught for less than 5 years. This was the case for both teachers in public (57.5%) and private (52.2%) ECDE centres. This constituted a significant difference (t (168) = 6.42, p (0.000) < 0.05) between male teachers (n=64) ($\bar{x}$ = 4.48, SD = 2.30) and female teachers (n = 444) ($\bar{x}$ = 6.88, SD = 5.03) as far as teaching experience was concerned. Even though participating teachers taught in baby, nursery and pre-unit classes (pre-primary), over 60% of the male teachers taught in pre-unit (pre-primary) classes. Over 60% of the teachers played the role of being class teachers and only 7.9% were ECDE section heads.

Apart from demographic information, this study surveyed teachers' professional training in technology. Based on resulting findings, 34.3% of the participating teachers were found to be having formal qualifications in ICT. The specific areas in which these qualifications were held included Microsoft Word (34.3%), PowerPoint (23.0%), Computer Studies and IT (2.0%). Interestingly, this study found that only 22.5% of the teachers had completed pre-service training in integration of technology in ECDE curriculum. Noteworthy, only 0.2 % of this group of teachers rated this training as very effective.

Further, this study sought information on teachers' access and integration of technology in planning and documentation. As a starting point, the participants provided their responses on comprehension of the term 'digital technology' and 'documentation'. Even though a small number of participating teachers (4.1%) did not have an idea or understanding of the term 'digital technology,' over 50% of the teachers defined this term as computers, digital cameras and digital video recorders. Similarly, over 40% understood 'documentation' as process that involved preparation of teaching records and 30% of the teachers associated the term to typing of schemes of work.

The current study found that personal mobile telephones were accessed and used by majority of the teachers both at home (90.0%) and at the ECDE centres (94.5%). To add on, computers were accessed and used both at home and ECDE centres by over 50% of the teachers. However, a significant difference ($t\ (502) = -4.16$, $p\ (0.000) < 0.005$) was found between teachers in public centres and those in private centres. Also, a positive moderation correlation ($r = 0.419$, $p = 0.000 < 0.05$) between participants' gender and selection of technology resources accessed and used at home and at the ECDE centres. Moreover, age was identified as a viable influencing factor in preschool teachers' frequency of technology access and use at home. This study also found that school offices served as locations for technology resources in 50.0% ECDE centres. Despite availability of technology resources in some ECDE centres, few ECDE centres (27.6%) had policy/curriculum guidelines on the integration of technology.

Findings in this study revealed also that teachers in the district of study used technology in planning of teaching and learning activities to a small extent. Further, significant correlations were noted between teachers' extent of technology use in planning of teaching and learning activities and highest education completed, professional qualifications and teaching experience. Interestingly, teachers in both public and private preschools were found to be at the same level as far as far as extent of technology use in planning of teaching and learning activities were concerned. Moreover, significant correlations were found between teachers' extent of technology use in documentation of teaching and learning activities and highest education completed, professional qualifications and teaching experience. Also, a significant difference was found between teachers' in public and those in private centres.

Apart from use of technology in planning and documentation, the current study found that teachers' extent of involving children in planning technology-rich learning experiences was minimal. Notably, teachers in both public and private ECDE centres were at different levels in regard to the extent to which they involved children in planning technology-rich learning experiences. However, this study noted that the two groups of teachers were at the same level on the basis of using technology in sharing experiences on children's learning progress. Generally, the two groups of teachers were at different levels on the extent of technology use in everyday practice. In terms of confidence, this study found that teachers' confidence about using technology in everyday practice was minimal and teachers in both public and private centres held similar beliefs about the use of technology in everyday practice.

Participating teachers received support on integration of technology at their ECDE centres. This support was mostly provided by managers of ECDE centres, parents/community members and least by fellow teachers at the ECDE centres. The support comprised provision of instructional materials, provision of ICT resources and sponsorship for training.

The study found that majority of the participating teachers held perceptions about the use of technology in ECDE. These included use of technology in teaching practice and children's learning. In reference to teaching practice, teachers believed that ICT could be used to source for information about ECDE; networking, partnership and communication; enhancement of effectiveness in teaching practice, planning, teaching and documentation; and sustaining children's learning. Similarly, participants believed that technology could be used in children's learning in a number of ways. These included development of children's eye-hand coordination, memory, thinking, and logical reasoning; make learning easy, enjoyable and fun; acquisition of ICT literacy skills; and development of children's talents and life skills. Nonetheless, few teachers were of the view that the use of technology in ECDE could become a stumbling block in teachers' practice in terms of workload, performance, unemployment and wastage of time. There were also teachers who believed that use of technology in ECDE was likely to affect children's development negatively.

Lastly, teachers raised concerns on the integration of technology in planning and documentation in ECDE centres in Kenya. These concerns were focused on use of technology in ECDE, stakeholders' support, resources, employment for ECDE teachers, security/maintenance and sustainability of ICT equipment. Other concerns included negative attitude about use of technology in communities, need for awareness, consideration for children's age factor, need for technical support, infrastructure and cultural sensitivity.

In-depth and integrative interpretations of the findings revealed in this chapter will be presented in Chapter 7. The next section, Chapter 6, presents findings from Phase Three involving stakeholders and other interested parties (n=10). These respondents provided their views on policy, curriculum and practice involving integration of technology in ECDE programmes in Kenya.

CHAPTER 6 FINDINGS FROM PHASE THREE:

STAKEHOLDERS INTERVIEWS

The previous chapter reported findings drawn from the survey conducted in Phase Two of this study. This chapter presents findings obtained from interviews conducted with stakeholders and other interested parties (n=10) in Phase Three. The main purpose of the study was to identify the views of teachers in ECDE on to the integration of technology in ECDE policy and programmes in Kenya.

Stakeholders and other interested parties (n=10) responded to four interview questions (see Appendix I). Question number one was focused on respondents' views on the inclusion of technology in ECDE policy, curriculum and practice. Question number two elicited data on availability of national and institutionalized policy guidelines on the integration of technology in ECDE programmes. Evidence on time frame for adoption of technology integrated national and institutionalized ECDE policy was gathered through question number three. Lastly, data on issues for consideration in integration of technology in ECDE centres, ECDE teachers' training programs, ECDE courses at universities and ECDE special needs programs were collected through question number four. For the purpose of maintaining a flow, the results in this chapter will be presented based on the order of the questions in the interview protocol.

Views on the Inclusion of Technology in ECDE Policy, Curriculum and Practice

Respondents (n=10) were asked to provide their views on the inclusion of technology in ECDE policy, curriculum and practice. The respondents' views provided on this item were more focused on the requirements and potential benefits of including technology in ECDE policy, curriculum and practice.

Requirements for Inclusion of Technology in ECDE Policy, Curriculum and Practice

Respondents were of the view that inclusion of technology in ECDE required a national policy, curriculum guidelines, resources, professional training for teachers and sensitization and awareness for parents and communities. Table 6 presents these requirements.

Table 6.1

Requirements for Inclusion of Technology in ECDE Policy, Curriculum and Practice

	N=10	
	Respondents	
Requirements for Inclusion of Technology in ECDE Policy, Curriculum and Practice	No.	%
Need for a national policy on inclusion of technology in ECDE	09	90
Need for curriculum guidelines on inclusion of technology in ECDE	08	80
Inclusion of technology in ECDE requires resources	10	100
Inclusion of technology in ECDE requires professional training of teachers	06	60
Sensitization and awareness for parents and communities	04	40

The evidence in Table 6.1 indicates the requirements for inclusion of technology in ECDE policy, curriculum and practice, based on respondents (n=10). Each of the requirements documented in the table is discussed in the following section.

Need for a National Policy on Inclusion of Technology in ECDE

Nine respondents (90%) felt there was need for a national policy to guide inclusion of technology in ECDE programmes both at preschool (including special needs programmes) and teachers' training levels. This view was strongly articulated by one participant involved with teachers' training at university level (TP 05). This participant emphasized the need for a policy at a national level to guide the use of technology in instruction. This participant's view is documented in the following excerpt:

> *Yaah! And there must be a policy at a national level to guide the use of technology. If they say it is compulsory to use IT in your instruction, all of us will go and learn the new technology. But now that it is left for you to choose which mode to use because they are unable to provide the requisite infrastructure for training then you don't.* (TP 05)

Need for Curriculum Guidelines on Inclusion of Technology in ECDE

Eight participants (80%) were of the view that there was need for a national curriculum to guide integration of technology in ECDE programmes both at preschool (including special needs programmes) and teacher training levels. These views were emphasized by four of the participants as outlined below.

One participant (NP 01) involved with formulation of ECDE policies at the Ministry of Education emphasized the need for good plans, including a digitalized curriculum for support of inclusion of technology in ECDE. A similar view was raised by a participant (TP 03) charged with the responsibility of training teachers in special needs education (SNE) at a national level. This participant felt inclusion of ICT in curriculum from preschool to higher education level would address issues in educational system of Kenya. Likewise, one participant (TP 05) in a teachers' training institution at a higher learning level was concerned that education curriculum in Kenya was not in-built with technology at all levels and that made it difficult to integrate technology at teachers training. A participating preschool teachers' trainer (TP 02) at middle level college reiterated this concern by voicing the need for guideline on integration of technology in ECDE teachers' training colleges. These views are supported by the following excerpts from participants' responses:

> *Because we are even moving towards a digitalized curriculum content, the issue of ... ICT is not whether, it is just the question of when ... you know when we have the resources and when we have completely made good plans for the same. Good plans here involve having a budget in place, a curriculum that is digitalized and manpower.* (NP01)

I think ICT is the way to go and.... many people especially in Kenya are still illiterate in IT. So if we include it in our curriculum from preschool to classes of higher learning, we shall be able to articulate issues in education. (TP 03)

... The curriculum itself does not allow this because it is not in-built with technology at all levels. Secondary is not in-built, university is not in-built except a few universities like ..., those ones everything you do is with IT. So the teacher training is not integrating technology, making it very difficult for the teachers even if they have their own laptops and so on to use technology at the instruction level. (TP 05)

Umm eh well truly speaking as in the first place we don't have any guideline as of now as I had said earlier but eh If anything comes up like a guideline for ICT we would like to implement as soon as it is possible. (TP 02)

Inclusion of Technology in ECDE Requires Resources

All the participants (100%) were of the view that inclusion of technology in all ECDE programmes both at preschool (including special needs programmes) and teachers' training levels required infrastructure including electricity, classrooms, technology resources, funds and manpower. Some participants voiced views on more than one area, and thus their comments appear in several areas.

Two participants involved with national curriculum design (CD 02) and special needs training (TP 03) felt there was need for electricity in order to integrate technology in preschools. This evidence is supported by the following response excerpts from these participants.

We are talking about infrastructure; we are not going to integrate the ICT at that level if there is no infrastructure. I am talking about electricity, I am talking about the classrooms; we should be talking about ah laboratories, computer laboratories in schools. We have to make sure that schools are well equipped in order for them to offer those services. If they are not, then we shall be wasting time. (CD 02)

I think the major concern in Kenya is the infrastructure because you go to some places you find still there is no electricity. I have seen a case in Rwanda where we have done it. The primary school kids are not buying books but are going to schools with laptops. And I think we have a lot to be done in Kenya. (TP 03)

The need for classrooms (training space) was mentioned as a critical requirement in integration of technology in ECDE. This requirement was raised by two participants (TP 06 and TP 02) involved with training of ECDE teachers at middle level colleges. This evidence is supported by the following response excerpts from these participants.

> *The second thing is to address the issue of ah infrastructure for training institutions, which are awful inadequate. These training institutions need to have their own training ah infrastructure which they can use. And so long as we don't have that, the trainers will continue to have a big problem. Then the finance to buy eh, eh these, the equipment and what have you. That one is an issue and the government needs to set aside money for the same*. (TP 06)

> *Also one thing we normally have concerned about is we don't have the facilities, both infrastructures for this because even where we are training now we are training on some places which is not ours. So we are only here when the schools are closed. If the school decides to use this facility, you will the kind of problem we are going to face. And also the other facilities to use like the computers there are not even there. Those are the kind of business we would like to be considered.* (TP 02)

Two participants (TP 03 and TP 06) were categorical that Kenya needed to emulate Rwanda where children went to schools, not with pens and books, but with laptops. In other words, these participants articulated the need for technology resources in schools, including preschools. This evidence is supported by the following response excerpts from these participants.

> *I think the major concern in Kenya is the infrastructure because you go to some places you find still there is no electricity. I have seen a case in Rwanda where we have done it. The primary school kids are not buying books but are going to schools with laptops. And I think we have a lot to be done in Kenya.* (TP 03)

> *The government should come in strongly and introduce the issue of computers at that lower level. It should be like Rwanda. Rwanda now computers it's, it's like a pen, in fact Rwanda it's like a pen, all schools' pupils each has a computer, a laptop. I am told there is a laptop and a computer. I am told each pupil has. In Kenya once that is done, we will have made a big step. And children will be very enthusiastic about it, and the teachers, even those who don't want to learn will learn it.* (TP 06)

Apart from laptops, participant CD 02 reinforced the need for computer laboratories in schools, including preschools for facilitation of integration. This participant was concerned that non-availability of computer laboratories in schools would result in services not being offered and this would mean wastage of time. This evidence is supported by the following response from this participant.

> *We are talking about infrastructure; we are not going to integrate the ICT at that level if there is no infrastructure. I am talking about electricity, I am talking about the classrooms; we should be talking about ah laboratories, computer laboratories in schools. We have to make sure that schools are well equipped in order for them to offer those services. If they are not, then we shall be wasting time.* (CD 02)

A requirement focusing on funds and manpower was voiced by participant NP 01 sharing the need for a budget and manpower in order to integrate technology in ECDE. This evidence is supported by the following response:

> *Because we are even moving towards digitalized curriculum content, the issue of ICT is not whether; it is just the question of when ... you know when we have the resources and when we have completely made good plans for the same. Good plans here involve having a budget in place, a curriculum that is digitalized and manpower.* (NP 01)

Inclusion of Technology in ECDE Requires Professional Training of Teachers

Six respondents (60%) felt inclusion of technology in ECDE programmes both at preschool (including special needs programmes) and teacher training levels required training of teachers and trainers in professional ICT practice. Three of these participants suggested forms of professional learning models in technology for preschool teachers. These included in-servicing (CD 01), short courses (CD 01), workshops, seminars and conferences (TP 07). These views are supported by the following excerpts:

> *Of course the first thing is provision of resources. That is an obvious case that they must think about seriously. The second issue is giving more support to teacher training at that level which they need support through in-servicing.* (CD 01)

> *Yeah! We have to build capacity in teachers may be through organising short courses for them on ICT and now ah ... after they are well equipped then that is when they come to plough back whatever they have learnt in schools.*(CD 02)

> *Provide workshops, seminars and conferences to enable teachers learn more about ICT.* (TP 07)

Sensitization and Awareness for Parents and Communities

Lastly, four participants were of the view that inclusion of technology in ECDE would require sensitization and awareness for parents and communities including educators on the importance of the innovation and potential roles of these persons. Two of these participants believed sensitization and awareness on the value of technology would empower parents, other people within the community and teachers to support children’s use of technology at home (CD 01) and in preschools (TP 02). This data is supported by the following quotes from participants:

> *At ECDE level there will be need to sensitize and involve the local community, parents and other people within the community area to recognize the value of technology, even at home to support children in acquiring technology that is*

ECDE level. Most of them are able to use the technology already even at the rural areas but you know in urban is not a problem because most parents are doing it. You buy a laptop in the house everybody is using it. They have what we call mobile phones and these mobile phones nowadays are so, they have these complex ones. (CD 01)

Ah I think the most important thing is to consider the preschool teachers, their background, because most of the teachers who come to train in these institutions are coming from a very poor background. So one thing they have to consider is how are they are going to help these teachers to reach that reality that may be we need this technology not because of financial gains, that we need to develop this so that they can also go and use it preschools. (TP 02)

Potential Benefits of Including Technology in ECDE Policy, Curriculum and Practice

Six respondents (60%) were of the view that the use of technology in ECDE could facilitate communication among ECDE stakeholders; make work easy, improve efficiency and save time; facilitate research projects within the ECDE sector; enhance teaching practice; enable children to acquire ICT literacy skills at an early age; promote children's learning and socialization skills; and contribute to efforts aimed at achieving Kenya's set goals for achievement of Vision 2030. This data presented in Table 6.2 and supported also by excerpts following this table.

Table 6.2

Potential Benefits of Including Technology in ECDE Policy, Curriculum and Practice

N=10

Potential Benefits	No Participants with this View	%
Facilitate communication among ECDE stakeholders and research projects within the ECDE sector	01	10
Make teaching easy, improve efficiency and save time	05	50
Enable children to acquire ICT literacy skills at an early age	03	30
Promote children's learning, socialization and communication skills	05	50
Contribute to efforts aimed at achieving Kenya's set goals for achievement of Vision 2030	03	30

Facilitate Communication among ECDE Stakeholders and Research Projects within the ECDE Sector

One participant (TP 07) felt inclusion of technology in ECDE policy, curriculum and practice would hasten communication among stakeholders, in addition to other roles that included efficiency in work and management and enhancement of research projects within the ECDE sector. This view is indicated in the following response:.

> *Ah...... madam, it is.... It is a positive move to introduce technology in ECDE...... ECDE policy, curriculum and practice in that it leads to improvement of... efficiency of work, one. Secondly, proper time management in terms of saving time, ah...... thirdly, it hastens communication among the stakeholders and also it enhances an easier research projects within the ECDE sector.* (TP 07)

Make Teaching Practice Easy, Improve Efficiency and Save Time

Two participants (TP 05 and CD 02) supported the benefits of including technology in ECDE policy, curriculum and practice. According to these participants, technology had the potential of saving time by making teaching easy and efficient for teachers in terms of preparation of instructional materials, schemes of work, lesson plans and also, in teaching. These views are indicated in the following:

> *Technology makes it easy and efficient for teachers to prepare instructional materials, schemes of work and lesson plans. Also in teaching, for example when teaching about shapes, colours, numbers and letters of the alphabet, etc. Technology is the best as it provides easy work for ECDE teachers. It is faster and saves time. It also enables learners to explore technological devices which make them well equipped about the devices and what revolves around them*. (TP 05)

> *Technology is good and makes work easier for teachers. One does not spend time improvising teaching and children's learning materials. A teacher can download and print these materials from the website by browsing the Internet. Technology makes one explain concepts to children in a better and effective way. Children can as well play games on computers while the teacher prepares for non-computer lessons that are to be taught next.* (CD 02)

Enable Children to Acquire ICT Literacy Skills at an Early Age

Three participants (30%) supported inclusion of technology in ECDE policy, curriculum and practice believing the innovation would enable children to acquire ICT skills at an early age. One participant (CD 01), as seen in the excerpt below, associated children's early acquisition of ICT skills with long term goals such as global competition in business:

> *I think it is an area which the policy should address because as we are moving on, we are in the stage of technology at a greater advancement in technology and*

our children at that very early age should be given an opportunity to access or learn this technology, embrace this technology at the very early age because now we are in a kind of a competitive world. It's like global trend now require that we cannot compete with countries if we are behind and this should be developed right from the ECDE stage so that we don't have a situation where as other countries that we are doing business with have already moved to the high level of technology and we are at a very low, a stage we are not then it will be disadvantaged to the children as they grow up in the education ladder. (CD 01)

Promote Children's Learning, Socialization and Communication Skills

Five stakeholders and interested parties (50%) supported inclusion of technology in ECDE policy, curriculum and practice for the purpose of promoting children's learning, socialization and communication skills. These participants' views on use of technology in promotion of children's learning were emphasized by two participants in the following ways:

> *Integration of technology in ECDE curriculum will improve the performance of learners. It will also make the learning easy.* (TP 03)
>
> *The use of technology helps the children get a lot of communication skills e.g. Internet. So, it should be introduced as a lesson in most ECDE centres. Use of IT is very effective in that, it will improve the learning skills of children at ECDE centres.* (CD 01)

Additionally, one participant (CD 01) reinforced the need to introduce children to social media such as *Facebook* and *Twitter*. This participant believed the positives of introducing young children to mobile telephones, computers and the internet were much more than the negatives that people were emphasizing:

> *People have been having negative thoughts about use of mobile phones at very early age, computers and the internet at very early age but they are now realizing the benefits. There has been an increase now in the use of social media which in other countries starts from the early level. You find children have access to face book, the twitter, it is good to introduce that technology as early as possible. We know the negatives which people have been emphasizing, but the positives are much more.*(CD 01)

Contribute to Efforts aimed at Achieving Kenya's Set Goals for Vision 2030

Lastly, 3 respondents (30%) were of the view that inclusion of technology in ECDE policy, curriculum and practice was one of the strategies that would see Kenya achieve its goals set for Vision 2030.

> *We are heading to, we are talking about globalization, we talking about Vision 2030 in our country; and we are talking about where we want to be in Kenya. Yeah! We are talking about achieving the objectives we have set for our Vision 2030. We are not going to run away from technology. Technology is there for us*

and we have to embrace it right, and we have to embrace it right from the lowest level of education in this country at ECDE for that matter.(CD 02)

So what … what I say is that we will have no choice but bring, that aspect of technology in the early childhood education, ECDE. Because even in the Vision 2030 is emphasized that in the education aspect, educational function ah … as a social aspect of development towards achievement of Vision 2030, technology is emphasized; science, technology and innovation at the education level starting from the lower level planning at ECDE up to University. So we cannot leave it out otherwise we will not be achieving what Kenya is intending to achieve at least by the year 2030 onwards.(CD 01)

A hundred per cent. We are very ready to support that because it will be of benefit to our children and our future generation. In fact to achieve the so called 2030 goals we need a lot of ICT, in particularly from the basics. I mean from early childhood level.(TP 02)

Availability of National and Institutionalized Policy Guidelines on the Integration of Technology in ECDE Programmes

Stakeholders and interested parties (n=10) were asked if policies, curriculum guidelines and curriculum resources were availability in their institutions. Where participants responded with 'none', a follow-up question was asked: were there plans in place for accessing policies, curriculum guidelines and curriculum resources? Data collected on participants' responses to this question are presented in Table 6.3.

As can be seen in Table 6.3, 5 participants (50%) responded with 'none', indicating non-availability of institutionalized policy/curriculum guidelines/resources on integration of technology in ECDE programmes. Out of the 5 participants, only 1 participant said their organization had plans to provide institutionalized policy/curriculum guidelines/resources on integration of ICT in ECDE programmes. One participant, who responded that there were no such plans, stated that their organization did not have an institutionalized policy on ICT due to lack of policy at the national level. He also expressed concern that instruction at their organization was still teacher-centred due to non-use of IT:

At ... university there is no policy! There is no policy! In fact, the teaching is still…. eh…. teacher training approach is still based on …. On teacher centred instructional methodologies. It is not IT based because IT itself is not there because even the teachers don't have the laptops in their own offices. The network that they have access to internet in the offices is very weak, so still use of this may… may not be strong enough. At University level there are no policies because the University draws its policies from national policies of education. So when it has no national one, it doesn't have it here. But we have one of the best established IT centres in public universities but it's only used by those who are doing the science based courses mainly computer engineering, computers *science, IT. But this has not been translated to education, especially ECDE, it not there because the students also are not even able to access computer labs. We have computer labs yes, but they have five or so …. Twenty computers against a student population of a thousand, so it can't work!* (TP05)

Table 6.3

Availability of National and Institutionalized Policy Guidelines on the Integration of Technology in ECDE Programmes

N=10

Participants	Availability of institutionalized policy/curriculum guidelines/ resources on integration of technology in ECDE programmes	If none, plans in place for institutionalized policy/curriculum guidelines/ resources on integration of technology in ECDE programmes
NP 01	Sessional Paper No. 5 on ICT in the entire Kenyan Education system	None
CD 01	Not sure	None
CD 02	ICT or Electronic Materials for preschool children's acquisition of life skills	-
TP 01	None	None
TP 02	None	None
TP 03	Yes but not well articulated	Yes
TP 04	General, all students in the institution are provided with basic skills in computers	None
TP 05	None	None
TP 06	None	None
TP 07	None	Yes

In regards to availability, four participants provided varying responses. For instance, one participant (NP 01) mentioned the Kenyan Sessional Paper number 5 on education as the legal framework that informed the use of technology in education, ECDE inclusive:

> *The Sessional Paper No. 5, ICT policy by the Ministry of Education and ECDE policy; the paper addresses ICT in the entire education system and this means ECDE is included.*

In addition, while participant CD 01 gave a 'not sure' response, participant CD 02 confirmed that their organization had developed ICT materials that would support teachers' efforts in implementation of ECDE curriculum.

> *We have developed curriculum that is supposed to be used both in private and also in public ECDE centres. Now, of late we are trying to……develop materials, ICT materials or electronic materials that can supplement or augment the teachers' efforts as they implement curriculum ah in various centres. We have…. programmes developed on early childhood activities in the several areas, mathematics, oh language, social, creative, music and movement, ah physical outdoor, which can be used by teachers to see how to handle those respective areas of ... with their different age levels. Yes, so we have developed, we have not, we have not done very well or we have not gone very far but at least we have started, we have the DVD''s, we have life skills programmes, which is in form of storytelling where children can learn ooooh life skills, particular life skill ah through video storytelling. For example, last year we developed a puppet, a story telling puppet where children can learn mannerisms, good mannerisms and we went round and piloted the, the programme and it was received very well.* (CD02)

Participant TP 03 said that their organization had a policy but not well articulated but plans were underway to streamline this policy:

> *Mm…mm ……. Yes, we have a policy but not very well articulated because of lack of personnel. That is one hiccup that we are encountering at the moment. But the council has appointed a team to do ICT needs assessment. Thereafter we shall see how we are going to implement this because it is now compulsory that we integrate ICT with education (*TP 03).

Lastly, participant TP 04 said that their organization had a general ICT policy for all the departments and not specifically for the ECDE department:

> *Ok in fact now what I have said is just general, eh what the university has is general for all the departments because as I have just told you, the ICT course is offered to all students. They introduce at least they get the basics of a computer, meaning they can be able to use it and in case if there is…… ah… they are in a school where the computer is, I believe they can. They know basics that they can use even to instruct other children, to instruct children with. But now specifically for the department, we don't have any specific for the department, is general for all the departments.* (TP04)

Timeframe for Adoption of Technology Included ECDE Policy, Curriculum and Guidelines

During interviews, respondents were asked about their views on the time frame for adoption of technology integrated ECDE policy, curriculum, guidelines and resources. These participants provided five types of responses including lack of support for the idea, 'now' response, and 'as soon as it is possible, 'ought to have been yesterday' and 'in the next 5 years'. This evidence is presented in Table 6.4.

Table 6.4

Stakeholders' Views on the Time Frame for Adoption of Technology Integrated ECDE Policy, Curriculum and Guidelines

N=10

Views on Timeframe for Adoption	No. of participants with the views	%
I don't support the idea	1	10
Now	2	20
As soon as it is possible	2	20
Ought to have been yesterday	4	40
In the next 5 years	1	10
Total	10	100

Table 6.4indicates how one participant did not support the idea of integrating technology in ECDE and hence, did not provide a time frame for its adoption. One of the participants felt adoption of technology integrated ECDE policy; curriculum and guidelines could be adopted in the next 5 years. Further, the data in Table 6.4 reveals 8 participants (80%) expressed the urgency of adopting technology integrated ECDE policy, curriculum and guidelines. This urgency was emphasized by two of these participants in the following ways.

> *Um….mm I think it ought to have been yesterday but it should be now; it is only that a lot of things have not been put in place, for instance finances and human resources. So if we delay beyond now we will be caught up by time because the world is a global village and the moment we are ICT compliant is the moment we become part and parcel of that village. If we don't we are going to lag behind. (*NP 01)

> *It is now or never! If I am asked the way you are asking me I would say right now, in fact it was supposed to have been started yesterday. Yaah! We are not going to wait*

anymore because we are not going to be, to allow ourselves to be overtaken by events. We are…. we are talking about eh …… For example, we were being told tweeter and face book and whatever were introduced to all children in the world in less than two years. And now we were challenged, where are our Kenyan children going to be after ten years? Are we going to be behind the Chinese? Are we going to be, going to be behind the British? Because these things were introduced at the same time, Tweeter, Face book, name it! But even face book very few teachers know about it. So we are saying these things we are late, we are late comers. So we cannot afford to wait. If anything government should do something, policies, good policies should be put place. We are very happy that ECDE has been mainstreamed in, in education that it is going to be part and parcel of basic education and let us hope things will move the right way. (CD02)

Key Issues in Informing Policy, Curriculum and Practice Related to the Integration of Technology in ECDE

Respondents were asked if they had any issues about the inclusion of technology in Kenya's ECDE policy, curriculum and practice. Data gathered on these participants' responses are presented in Table 6.5.

Table 6.5 indicates key issues raised by stakeholders (n=10) about integration of technology in ECDE. All respondents felt Kenya lacked resources that could support integration of technology in ECDE programmes. Among the resources mentioned by participants were: finances, electricity, technology equipment, training space and specialized manpower.

Next to resources was lack of national and institutional policy frameworks on integration of technology in ECDE programmes. This issue was raised by 90% of the respondents. This was followed by an issue related to lack of curriculum guidelines, raised by 80% of the respondents and lack of technology included practices in ECDE (70%). Other issues raised included lack of employment and motivation for ECDE teachers (40%) and lack of parents, communities and stakeholders' support.

Table 6.5

Key Issues in Informing Policy, Curriculum and Practice Related to the Integration of Technology in ECDE

N=10

Key issues raised by respondents	No of participants raising the issue	%
Lack of national and institutional policy frameworks on integration of technology in ECDE programmes	9	90
Lack of curricula guidelines on integration of technology in ECDE programmes	8	80
Lack of technology included practices in ECDE programmes	7	70
Lack of knowledge and skills on use of technology in ECDE programmes by educators	6	60
Lack of technology included professional training for ECDE educators	6	60
Lack of government's support in regards to integration of technology in ECDE programmes	9	90
Lack of resources (finances, electricity, technology equipment, training space, specialized manpower) to support integration of technology in ECDE programmes	10	100
Lack of employment and motivation for ECDE teachers	4	40
Lack of parents, communities and stakeholders' support	4	40
Illiteracy in technology and negative perception	5	50

Additional Information

In provision of additional information during interviews, respondents (n=10) re-emphasized the views they had provided earlier on. However, two participants provided additional views focusing on role of Kenyan universities in generation of knowledge (TP 05) and the need for harmonization of all the ECDE curricula in Kenya. The following excerpts attest to this evidence.

> *Lastly, the way forward: the universities should take the central position in generation of knowledge, particularly in early childhood education. There is less*

material for instruction in Kenya. There is need for the universities to take a leading role to generate additional information for instruction and for instruction at early childhood education classroom, teacher training, inspection and management. Two, each institution needs a deliberate policy within its own resources to target technology in teacher training because in the absence of use of technology at this level then there is no way we will in spur the utilization of ICT in teaching yet we are a teacher training institution. That is two, three, governance: Governance is critical for effective implementation of instructional programs. The governance here the way the programs are managed, irregularity of attendance of classes, management of examinations, ah…. capturing the needs ah…… special needs of children. All these issues require attention of the management. So the government structures should put emphasis on the formative years of the child and this must be at institutional level. So this should also emphasize on maintaining the rights of the children, the right of the teacher and how these are integrated for national development. (TP 05)

Goodwill, we should have goodwill from the stakeholders. Curriculum should be in as much as possible be harmonised. We know we are talking about different types of curriculum in early childhood. We are talking about the NACECE/DICECE curriculum, we are taking about KHA (Kindergarten Headmistress Association), and we are talking about Montessori. Now all these, if they are all targeting a child they should be harmonised into one. We are also talking about pedagogies, the methodologies, we are talking about thematic, and we are talking about subject-based, so all these things should be harmonised. Then, we are also talking about motivation, there must be a way to motivate children and also motivate teachers. If teachers are not motivated, like for example right now they are not, nobody is talking about their salaries, and then you don't expect them to deliver. (CD 02)

Chapter Summary

This chapter has presented findings drawn from interviews conducted with stakeholders and other interested parties (n=10) in Phase Three. This group of participants responded to four interview questions. These questions were focused on the inclusion of technology in ECDE policy, curriculum and practice; availability of national and institutionalized policy guidelines on the integration of technology in ECDE programmes, timeframe for adoption of technology integrated national and institutionalized ECDE policy; and issues for consideration in integration of technology in ECDE programmes.

Analysis of respondents' views revealed that 90% of this group of participants felt there was need for national policy on inclusion of technology in ECDE programmes. Similarly, 80% were of the view that there was need for a national curriculum to guide integration of technology in ECDE programmes. An additional requirement was raised by all respondents (100%). These respondents felt inclusion of technology in all ECDE programmes (including special needs) required a range of resources. These included electricity, classrooms, technology resources, funds and manpower.

The need for professional training of teachers was contributed by 60% of the respondents. There were respondents (40%) indicating that educators, parents and communities at large required sensitization and awareness. According to these respondents, sensitization and awareness forums would serve as an eye opener on the importance of technology in ECDE programmes. These kinds of forums would also create awareness on the expected roles to be played by educators, parents and communities in integration of technology in ECDE programmes.

Additionally, respondents were of the view that inclusion of technology in in ECDE policy, curriculum and practice could result in a number of benefits. These included enhanced communication (10%); improved teaching practice (50%); children's acquisition of ICT literacy skills at an early age; improved children's learning, socialization and communication (50%); and achievement of Kenya's set goals for attainment of Vision 2030 (30%). Further, based on respondents' views (n=10), this study found that Kenya lacked national and institutionalized policy guidelines on the integration of technology in ECDE programmes. Also, respondents' views on timeframe for adoption of technology included ECDE policy, curriculum and guidelines yielded varied answers. These included lack of support for the idea (10%); the need for immediate action: 'now' (20%); 'as soon as it is possible (20%); 'ought to have been yesterday' (40%); and 'in the next 5 years' (10%).

Lastly, respondents (=10) raised key issues informing policy, curriculum and practice about the integration of technology in ECDE. These included lack of national and institutional policy frameworks on integration of technology in ECDE programmes (90%); lack of curricula guidelines on integration of technology in ECDE programmes (80%); and lack of technology included practices in ECDE programmes (70%). Additional key issues raised included lack of knowledge and skills on use of technology in ECDE programmes (60%); lack of professional training (60%); lack of government support (90%); issues to do with infrastructure (100%); inadequate employment and motivation for teachers (40%). Respondents were concerned about lack of support from stakeholders (40%); illiteracy in technology and negative perception by community members (50%); the need for Kenyan universities to generate knowledge in ECDE (10%); and the need for harmonization of the Kenyan ECDE curricula (10%). The next section, Chapter 7, presents a discussion of results and links to research questions.

CHAPTER 7

DISCUSSION: LINKING RESULTS TO RESEARCH QUESTIONS

This chapter draws together the results of analyses from the previous three chapters, four, five and six in order to respond to the research questions. The findings are then discussed in the light of the theoretical perspectives, and compared to relevant findings from previous research.

Research Questions

The three research questions of this study focused on identifying the professional beliefs held by early childhood educators about the use of technology in ECDE (Research Question 1), the status of ICT practices in Kenyan preschools (Research Question 2) and ways in which Kenyan ECDE teachers' professional beliefs are linked to their everyday practices and pedagogies in their educational settings (Research Question 3).

Findings from Research Question 1: Belief Identification

The first research question of this study was: what are the professional beliefs of Kenyan early childhood educators about the use of technology in ECDE? In order to respond to this question, this study gathered data in three phases. These phases involved 11 teachers in two case preschools (Phase One), a survey of 508 teachers in preschools across a district (Phase Two) and ECDE stakeholders and other interested parties (n=10). Data collection methods for Phase One included observations and interviews, a survey in Phase Two and interviews in Phase Three. Analyses of the sets of data collected from the three phases were presented in Chapters 4, 5 and 6. The outcomes resulting from these processes were grouped into two major themes derived from participants' perceptions:

- use of technology in teaching practice;
- use of technology in children's learning;

In the context of these two major themes, the participants' beliefs were identified. From this collection of beliefs, some trends were noted revealing similarities and differences among the beliefs. Additionally, there were particular beliefs that were held by one group, two groups or all the three groups of participating educators.

Generally, participating educators believed the use of technology in ECDE could play several roles in teaching practice (Table 7.1) and also in children's learning (Table 7.2).

Table 7.1

Educators' Beliefs about the Potential Roles of Technology in Teaching Practice

Potential Roles of Technology in Teaching Practice	Case Teachers (n=11) %	Survey Teachers (n=508) %	Stakeholders & Other Interested Parties (n=10) %
Make work easy, improve efficiency and save time	-	-	30.0
Enhance efficiency and effectiveness in teaching practice	90.9	98.0	20.0
Use in planning, teaching and documentation	-	33.3	-
Use in sustaining children's learning interest	-	79.7	-
Source and access information on ECDE	55.6	75.8	-
Professional networking through social platforms	-	52.2	-
Partnership and communication with families and other stakeholders	55.6	67.9	10

The summary findings presented in Table 7.1 revealed educators' beliefs on potential roles of technology in ECDE teaching practice. According to Table 7.1, all three groups of educators (case, survey, stakeholders and interested parties) believed the use of technology could enhance efficiency and effectiveness in ECDE teaching practice. They also believed integration of technology in ECDE could promote partnership and communication with families and other stakeholders (Table 7.1).

Other than the use of technology in teaching practice, educators believed technology had the potential to play a role in children's learning. These findings are summarized in Table 7.2.

Table 7.2

Educators' Beliefs about the Potential Roles of Technology in Children's Learning

Potential Benefits of Technology in Children's Learning	Case Teachers (n=11) %	Survey Teachers (n=508) %	Stakeholders & Other Interested Parties (n=10) %
Enable children acquire technology literacy skills at an early age	55	-	30
Making learning easy, effective and interesting to all children	100	52.6	-
Enhance children's learning outcomes	100	-	50
Mental and memory development and acquisition of knowledge	63.6	40.2	-
Development of thinking and logical reasoning	-	40.2	-
Develop children's talents and life skills	-	16.5	-
Promote children's socialization skills	-	-	50

The summary findings in Table 7.2 above indicate educators' beliefs about the potential roles of technology in children's learning. These findings show the three groups of educators had varied beliefs on roles of technology in children's learning.

Discussion of Answers to Research Question 1: Belief Identification

Early childhood educators' perceptions about the use of technology are crucial in informing decision-making, planning and policy-making on use of technology in ECDE (Chen & Chang, 2006; Sivpoulou, Tsapakidou & Kiridis, 2009). Kaindio and Wagithunu (2014) suggest that, "the attitudes of the stakeholders need to change before the introduction of ICT in pre-school for the government expects their support" (p. 99). The answers to Research Question 1 (What are the professional beliefs of Kenyan ECDE educators about the use of technology in ECDE?) are summarized in Tables 7.1 and 7.2. In view of the third generation of CHAT (Engeström 1991; 1999; 2001), educators' held beliefs as a group were a joint activity and became the unit of analysis and interpretation. Educators believed that the use of technology could play several roles in teaching practice as well as children's learning.

Beliefs about Potential Roles of Technology in Teaching Practice

Proponents of CHAT including Engeström (2001), Ivic (2000) and Vygotsky (1978) suggest human labor and tools used are ways in which humans change and transform. Educators participating in this study believed the use of technology (tools) in ECDE could play several roles in teaching practice (labor) (Table 7.1). More specifically, educators taking part in this study believed that introduction of technology in ECDE could make work easy, improve efficiency and save time (Table 7.1).They also believed that the use of technology in ECDE was likely to enhance effectiveness in teaching practice (Table 7.1).These beliefs concur with statements documented in Kenya's policy framework on ECDE (Republic of Kenya, 2006a). In this framework, the government suggests the need to use ICT for the purpose of enhancing efficiency and quality of children's services in health and education (Republic of Kenya, 2006a). Thus, from a CHAT perspective, the participants and government identified the importance of technology as a mediating tool.

Additionally, Table 7.1 reveals that participating educators felt the use of technology in ECDE could play a role in planning, teaching and documentation. Planning is a critical process in a learning/education environment such as ECDE. Educators' belief on use of technology in planning resonates well with the content offered in ECDE training programmes (Republic of Kenya, 2006c). This training empowers teachers with skills on how to plan teaching and learning programmes. Just like planning, teaching is a core activity that takes place in ECDE institutions on daily basis. Educators' beliefs on the role of technology in teaching are accord with this routine. During training, ECDE teachers are introduced to varied approaches on how to teach young children. Educators' belief on use of technology in teaching indicates that technology can be introduced as one of the teaching approaches.

Educators' beliefs on use of technology in ECDE practice are in alignment with findings by Ihmeideh (2010). Ihmeideh's study, based in Jordan found that participating ECDE teachers believed that computers could be used as part of the teaching and learning process. Teachers participating in Ihmeideh's study strongly agreed that computers could be used as part of the 'print-rich' classroom environment. Educators' beliefs in the current study are accord with a small number of studies conducted in the African region. For instance, an earlier study by Bose (2009; 2010) revealed participating ECDE teachers perceived ICT as a necessary tool in the teaching process in Botswana. Similarly, all the participating Kenyan ECDE teachers in Andiema's (2015) study were of the view that ICT was a tool that supported and enhanced ECDE teachers' knowledge and skills in teaching.

As mentioned earlier, teachers participating in this study believed that the use of technology in ECDE could play a role in documentation of teaching practice. Sparrman and Lindgren (2010) are of the view that visual documentation is used by educators for the purpose of improving their understandings of children while strengthening their professionalism. Sheridan, Williams and Sandberg (2013) explain the purpose of documentation from the perspective of discovering how an ECDE centre has contributed to children's learning and children have learnt by being there. In Kenya's ECDE context, teachers' practices involve documentation of teachers' work covered as well as children's learning progress (Republic of Kenya, 2006 c & d).

Nonetheless, a finding of this study focused on educator beliefs about the role of technology in documentation of teachers' practice as well as children's learning progress has not been identified in previous studies in the African context. This evidence adds to the body of research on ECDE educators' perceptions about the role of technology in ECDE. The evidence also extends our understandings on the unique perceptions held by ECDE educators about the role of technology in ECDE teaching practice.

In addition to documentation, educators believed introduction of technology in ECDE could be used in sustaining children's learning interest (Table 7.1). An almost similar belief was identified in educators' views focused on the potential roles of technology in children's learning (Table 7.2). The participants believed that technology had the potential to make learning easy, effective and interesting to all children. The two findings described in this section concur with findings in Asante's (2014) study. Teachers participating in Asante's study felt that ICT had a role to play in Ghanaian ECDE context. This role involved stimulation of children's learning process. Moreover, these teachers felt that ICT provided a pathway to enhancing and adding value to learning process of children (Asante, 2014).

Finally, additional roles that technology was likely to play in ECDE teaching practice are indicated in Table 7.1. These included sourcing and accessing for information on ECDE; professionally networking through social platforms; partnerships and communication with families and other stakeholders. These roles have not been identified in previous research studies targeting ECDE educators' perceptions about the use of technology in teaching practice. This evidence extends our understandings on various ways in which technology could be utilized in ECDE teaching practice.

Beliefs about Potential Benefits of Technology in Children's learning

Two schools of thought have been central to whether children should use technology resources. Amid this debate, educators participating in this study believed the use of technology in ECDE could enable children to acquiretechnology literacy skills at an early age(Table 7.2).They also believed that the innovation could be used in ECDE for the purpose of enhancing children's learning outcomes (Table 7.2).

Educator beliefs about technology literacy skills resonate well with the Kenyan government policy statements on use of ICT in education. For instance, the government aims to develop Kenya into an industrialized, middle-income country with high quality life for all its citizens by the year 2030. In order to achieve this dream, the government suggests the need for workforce skilled in technology (Ang'ondi, 2013; Government of the Republic of Kenya, 2007; Kinuthia, 2009; Republic of Kenya, 2012a). Likewise, in the Kenya's Sessional Paper No. 14 of 2012 (Republic of Kenya, 2012a), the government indicated that the use of technology in ECDE could enable children to master ICT literacy Improvement of children's learning outcomes is a crucial process in every ECDE program. This goal is reflected in participating educators' belief on use of technology for the purpose of enhancing children's learning outcomes. As outlined in Kenya's ECDE policy framework (Republic of Kenya, 2006a), children's learning outcomes include physical, mental and memory development; thinking, logical reasoning and talent exploitation, plus language and emotional development; exploration and exploitation of the world of information (Republic of Kenya, 2012a).

Apart from the Kenyan policy frameworks, educators' belief on technology literacy skills builds on a finding by Asante (2014) in Ghana. The report resulting from this study indicated that 97% of the participating ECDE teachers believed that it was good for children in Ghana to be introduced early to ICT to enable them fit into the technological world. Likewise, ECDE teachers participating in Ihmeideh's (2010) study were of the view that ECDE classrooms could contain computer centres that provided children with developmentally appropriate literacy software and activities.

Participating educators believed the use of technology in ECDE could enhance children's learning outcomes (Table 7.2). This belief was held by 100% of the case study teachers and 50% of the stakeholders and other interested parties. The educators believed also that the use of technology in ECDE had the potential of developing children's mental and memory capabilities plus acquisition of knowledge. This belief was held by 63.6% of the case teachers and 40.2% of the teachers participating in the survey. They were also of the view that the innovation could develop children's thinking and logical reasoning (survey teachers, 40.2%); develop children's talents and life skills (survey teachers, 16.5%); and promote children's socialization skills (stakeholders and other interested parties, 50%).

The beliefs described in this section, whereby teachers and stakeholders identify the power of technology to mediate children's learning outcomes (object), resonate well with the concepts in CHAT. According to Leont'ev's (Wilson, 2014) line of argument, a collective activity system such an ECDE program has a motive or object. In this case, the motive of ECDE programs is to develop children through learning experiences. In reference to participating educators' beliefs, children's (subjects) learning outcomes (object) could be influenced by technology resources as mediating tools or artefacts (Demiraslan & Usluel, 2008). This potentiality is reported in evidence documented in international studies. For instance, an earlier study by O'Hara (2008) reports on children's development of social skills due to interaction with technology resources. A similar study by Roberts-Holmes (2013) indicates that children's experience with technology results in development of language, communication and cognitive dispositions. Similar developments have been empirically recorded in children's developments involving technology. These include motivation, perseverance, numeracy, creativity and independence (Couse & Chen, 2010).

In Kenya's context, the Ministry of Education (Republic of Kenya, 2012a) suggests the need to use ICT as a major vehicle for teaching and learning. According to the Ministry, this could be done through play and psychomotor development (Republic of Kenya, 2012a).

Educator beliefs about the role of technology in children's learning processes in Kenya's ECDE contexts (Table 7.2) accord with previous research. For instance, Asante's (2014) study found that preschool teachers in Ghana felt technology had a role to play in the early childhood teaching and learning environment. According to these teachers, ICT played the role of providing a pathway to enhancing and adding value to children's learning processes (Asante, 2014). According to these teachers, ICT played the role of providing a pathway to enhancing and adding value to children's learning processes (Asante, 2014). Similarly, preschool teachers participating in Bose's (2009; 2010) study believed the innovation was necessary in teaching and learning process. These participants believed also that technology could aid children's development in cognitive, social, and communication; respect for others, creativity, physical and emotional development (2009; 2010).

With reference to Kenya, a study by Andiema (2015) found that preschool teachers had positive attitudes towards the use of technology in ECDE. These educators believed in technology's affordances for the purpose of supporting and enhancing knowledge and skills in teaching, learning, preparation of instructional materials and enhanced communication. Earlier studies in this context had also found that preschool teachers felt the use of instructional media devices could be used to enhance teaching and children's learning (Mwololo, 2009).

However, this study provides evidence on educators' beliefs (Table 7.1) that have not been revealed in previous empirical literature and more so in the African context. These include:

- Use of technology in planning of teaching and documentation.
- Use of technology in sourcing and accessing information on ECDE.
- Use of technology in professional networking through social platforms.

The beliefs indicated above add to the body of research literature focusing on educators' perceptions about the use of technology in ECDE. They also extend our understandings on the diversified perceptions held by ECDE educators, stakeholders and other interested parties about the use of technology in ECDE. Participants' beliefs in general, reflected a broader awareness of the affordances of technology in ECDE teaching practice. This awareness incorporated several aspects including the process (planning and documentation), knowledge base (source and access to information) and socialization and knowledge share (professional networking).

In regard to the affordances of technology in children's learning, this study provides evidence on educators' held beliefs that have not been revealed in previous empirical literature in the African context. These include:

- use of technology in ECDE for development of children's memory
- affordance of technology in development of children's thinking and logical reasoning
- use of technology in ECDE for development of children's talents and life skills
- use of technology in ECDE for promotion of children's socialization skills

The beliefs indicated above add to the body of research literature focusing on educators' perceptions about the use of technology in ECDE. They also extend our understandings on complex perceptions held by ECDE educators including stakeholders and other interested parties about the use of technology in ECDE for the purpose of enhancing children's learning outcomes. Participants' beliefs signified a deeper understanding of the potentialities of technology in children's learning. This understanding included the affordances of technology in developing children's memory, eye-hand coordination and thinking; logical reasoning, talents and life skills early in life.

Educators participating in this study held varied positive beliefs about the affordances of technology in ECDE. Nevertheless, there were some educators who believed the use of technology in ECDE could impact on the teaching practice and children's development negatively. These beliefs are presented in Table 7.3.

Table 7.3

Potential Negative Impacts of Technology on Teaching Practice and Children's learning

Potential negative impacts of technology on teaching practice	Case Study Teachers %	Survey Teachers %	Stakeholders & Other Interested Parties %
The innovation would be an additional work load for teachers	27.3	4.5	-
Unproductive teachers	-	3.5	-
Unemployment for teachers	-	2.0	-
Waste of valuable time for teaching and learning	-	3.2	-
Potential negative impacts of technology on children's development			
Harmful to children	-	3.2	10
Risk to children's moral development	18.2	4.53	10
Retard writing skills	-	1.8	-
Expose children to inappropriate sites	-	4.1	-
Waste of children's learning time due to the complexity of the innovation	-	2.8	-

In Table 7.3, less than 30% of the participating educators believed the use of technology in ECDE would be an additional work load for teachers. This belief was held by 27.3% of the Phase One teachers and 4.5% of the teachers participating in the survey. Moreover, teachers participating in the survey believed that the use of technology in ECDE would make teachers unproductive (3.5 %), result in unemployment for teachers (2.0 %) and waste valuable time for teaching and learning (3.2 %). These beliefs focused on teachers' practices and have not been revealed in previous studies. The beliefs extend our understandings about some educators' beliefs about the negative impacts of technology on teaching practice. The beliefs held by less than 30% of the educators reflected their concerns and fears about the use of technology in ECDE. These concerns and fears included additional work load, poor job performance, and unemployment for preschool teachers and waste of teaching and learning time.

In addition to educators' beliefs about negative impacts of technology on teaching practice; some educators believed the use of technology in ECDE was likely to impact on children's development negatively (Table 7.3). They believed the innovation had the potential to harm children. This belief was held by 3.2% of the survey teachers and 10% of the stakeholders and other interested parties. The educators believed also that technology was a risk to children's moral development (case study teachers, 18.2%; survey teachers, 4.5%; stakeholders and other interested parties, 10%). In addition, some teachers participating in the survey believed the use of technology in ECDE was likely to retard children's writing skills (1.8%), expose children to inappropriate sites (4.1%) and waste children's learning time due to the complexity of the innovation (2.8%).

The findings described above are in accordance with findings by previous researchers. These researchers found that preschool teachers held beliefs about the negative impacts of technologies on children's development. For instance, the teachers participating in these studies were concerned about the idea of children spending a lot of time using computers (Ihmeideh, 2010; Sivropoulou, Tsapakidou & Kiridis, 2009). Through their beliefs, teachers raised concerns about technology's negative effects on children's social, emotional, moral and physical development (Ihmeideh, 2010). Teachers participating in Ihmeideh's study also raised issues about repercussions on children's writing and phonological awareness skills (Ihmeideh, 2010). Additional research evidence demonstrate risks to children, dangers, safety issues and inappropriate behaviors exhibited in some programmes on the internet (Asante, 2014) as some of the concerns raised by participating ECDE teachers. Other issues raised by participating teachers include dangerous values like violence, sex associated with World Wide Web (Ihmeideh, 2010).

Findings from Research Question 2: The Status of ICT Practices in Kenyan Preschools

The second research question was: what is the status of the use of technology in Kenyan preschools (research question 2)? In order to respond to this question, this study utilized several data sources for the purpose of obtaining a holistic picture about the status of the use of technology in Kenyan preschools. These sources included observations and interviews with 11 preschool teachers in two case preschools, a survey of 508 preschool teachers in a district and interviews with 10 ECDE stakeholders and other interested parties. Several sets of data gathered through the above sources were presented and analyzed in chapters 4, 5 and 6. The findings include the following:

1. Availability of policy/curriculum guidelines on the integration of technology in ECDE
2. Teachers' professional training in technology
3. Availability and Access to Technology
4. Locations for technology resources in ECDE centres
5. Teachers' use of technology in everyday practice
6. Teachers' confidence about using technology in everyday practice
7. Stakeholders' support in integration of technology at the ECDE centres

For the purpose of connecting ideas and ensuring easy understanding, findings on each of the above areas are discussed and compared to previous relevant research studies. Where applicable, an explanation is provided on how they contribute to our understandings or literature review.

Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE

Informed by CHAT (Engeström, 1999; Leont'ev, 1978; 1981) as a lens in this study, culture and history of a system play critical roles in a given activity. For instance, the ECDE system in Kenya has its cultures and histories. These comprise decision-making at various levels, policy formulation, and curricula materials; professional support, practices and stakeholders' roles. All these cultures and historical elements contribute to implementation of ECDE (activity) in Kenya. Subsequently, they play an informing role in the use of technology (activity) in ECDE. According to Plumb and Kautz (2015), an organization's innovativeness such as the use of technology in ECDE (activity) is determined by the structuralist perspective, comprising government policy and stakeholders.

Through the survey of preschool teachers (n=508), this study found that 16.2% of the participants in the public ECDE centres and 33.1% in the private centres had policy/curriculum guidelines on the integration of technology. Overall, 27.6% of the ECDE centres had policy/curriculum guidelines on the integration of technology.

Further, participants taking part in Phase Three provided views on availability of national and institutionalized policy frameworks on the integration of technology in ECDE programmes. Based on these views, 50% of the respondents (n =10) indicated lack of institutionalized policy guidelines on the integration of technology in ECDE. These participants attributed this non-availability to lack of technology integrated ECDE policy at a national level. On the other hand, varied responses were provided by five of the participants (50%). These included being ‘not sure’, naming the Kenyan Sessional Paper No. 5 on education as a response, and mentioning availability of electronic materials for children as a response; indicating ‘a not-well articulated policy’ and mentioning a general policy for all students as response.

Discussion of Findings on Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE

In the second generation of activity theory (Engeström, 1999), the social relationship between subject (ECDE teachers’ practices) and object (integration of technology in ECDE) is mediated by rules (policy frameworks). These rules, commonly known as norms, policies, regulations and conventions, can both constrain and enhance (Ho, Chen & Ng, 2016; Demiraslan & Usluel, 2008) actions and interactions within the activity system. This system could be integration of technology in ECDE programmes.

In the current study, only 27.6% of the teachers participating in the survey had access to policy/curriculum guidelines on the integration of technology in ECDE. This resulted in a scenario which Engeström (2008) refers to as two types of activity systems with contradictions. The contradictions here involved one type of ECDE system with policy/curriculum guidelines and the second type of ECDE system without policy frameworks. This argument is based on the third generation concept of activity theory.

In view of the national ECDE policy framework (Republic of Kenya, 2006a), the government of Kenya documented statements on use of ICT in ECDE. These statements were focused on the use of ICT in ECDE for effective communication. This strategy aimed at enhancing interaction among organizations, programs and children's service providers. Additional statements were focused on use of ICT in enhancing the efficiency and quality of children's services in health, education and special needs education. Through the same policy framework, the government of Kenya articulated the need to use ICT in supporting training programs in ICT. The training would in turn enhance efficiency in provision of quality services in health and education for young children in the vulnerable and marginalized communities (Republic of Kenya 2006a, p. 34). Despite these policy statements on use of ICT in ECDE, 72.4% of the teachers participating in the survey part of this study indicated lack of policy/curriculum guidelines on the integration of ICT in ECDE.

Learning objectives for children in Kenyan preschools are documented in the Kenyan ECDE curriculum (Republic of Kenya, 2006a). According to CHAT, these learning objectives are rules and regulations that guide teaching, learning and assessment activities. An examination of the learning objectives (see Chapter One, p. 10) revealed that the use of technology was excluded. Teachers' limited use of technology, in their daily practice, as found by this study, can partly be attributed to this exclusion. Lack of political will, rules and norms to guide actions and interactions with technology within the ECDE system leaves teachers and stakeholders in a situation of helplessness.

In addition to policy statements, the government of Kenya recognizes the potential role of ICT in ECDE. This recognition is reflected in the Sessional Paper No. 14 of 2012 (Republic of Kenya, 2012a). In this document, the government suggests ways in which ICT could be used in ECDE, including enhancing teaching and learning; facilitating children's mastery of ICT literacy skills for acquisition of knowledge; accessing learning resources; and communicating and collaborating during learning. Nonetheless, these are only suggested approaches, and do not constitute policy frameworks on the use of ICT in ECDE.

In the same Paper, Sessional No. 14 of 2012 (Republic of Kenya, 2012a), the government planned to mobilize funding for the introduction of appropriate technology skills. The aim of these skills was to support children's play and psycho-motor development across all ECDE centres in Kenya (Republic of Kenya, 2012a). Through the same document, the government contradicted itself by noting lack of ICT curriculum as a challenge in introducing ICT in ECDE (Republic of Kenya, 2012a). This contradiction confirms further a finding by this study pointing to insufficient policy/curriculum guidelines on integration of technology in ECDE programmes.

Research evidence on availability or lack of policy/curriculum guidelines on the integration of technology in ECDE has not been reported in previous literature in the African context. This evidence has opened a fresh chapter in the field of research targeting use of technology in ECDE. The evidence also creates awareness on the need for policy frameworks on integration of technology in ECDE. Further, this evidence extends our understandings on conditions required for integration of technology in ECDE. Among these requirements are policy and curriculathat can guide use and integration of technology in ECDE programmes.

Teachers' Professional Training in Technology

Vygotsky believed the mechanism of individual development change is rooted in society and culture. Further, individual's behavior (mental processes) can only be understood from the historical perspective of the behavior in question ((Vygotsky, 1978). In this study, teacher practice involving the use of technology (behavior) could partly be understood from both the historical and cultural dimensions. The historical dimension includes teachers' past and on-going professional training in technology. On the other hand, contextual factors in ECDE programmes

(society) constitute cultures. These cultures have a critical role to play in teachers' professional training in technology. This training is what Vygotsky refers to as 'individual development'.

This study utilized two sources to collect data on teachers' professional training in technology. The two sources included interviews with teachers (n=11) in two case preschools and a survey of preschool teachers (n=508) in an entire district. Each of the specific evidence gathered is described as follows.

Teachers' Formal Qualifications in ICT

Relating to the teachers in the two case preschools, this study found that six (n=11) teachers across the two preschools had qualifications in computers. Out of this number, only two participants had furthered their studies and obtained a Diploma in Information and Technology (IT) (CPUB O2) and certificates in PowerPoint and Microsoft packages (CPUB 03). Notably, both teachers belonged to the public preschool. Further, the interview evidence revealed none of the 11 teachers had attended professional training on integration of technology in ECDE practice.

Looking at the findings resulting from the survey (n=508), the percentage of teachers with formal qualifications was 34.3%. The overall qualifications under these qualifications included Microsoft Word (34.3%), PowerPoint (23.3%), computer studies (12.2%) and diploma in IT (2.0%).

In view of the types of preschools, 41.3% of the teachers (n=167) in the public preschools were qualified in Microsoft Word, 47.8% in PowerPoint, 9.0% in computer studies and 0.6% had diploma in IT. As for the teachers (n=341) in private preschools, 30.8% were qualified in Microsoft Word, 24.9% in PowerPoint, 13.8% in computer studies and 2.6% had a diploma in IT. In reference to gender, 31.3% of the male teachers and 34.7 of the female teachers had qualifications in ICT.

Pre-Service Training in Integration of Technology in ECDE Curriculum

Through a survey, this study found that 15% of the teachers (n=167) in public preschools had completed pre-service training in integration of technology in ECDE curriculum. A similar training had been completed by 25.5% of the teachers practicing in private preschools (n=341) Overall, 22.5% of the teachers (n=598) in the study district had completed pre-service training on integration of technology in ECDE curriculum. On a specific note, only 11% of the teachers had completed pre-service training on integration of technology in planning and documentation.

Digital Technology Resources Accessed, Used and Integrated in Planning and Documentation during Pre-Service Training

This study found that that teachers participating in the survey accessed, used and integrated five (5) types of digital technology resources in planning and documentation during pre-service training. These included computers, digital cameras, mobile telephones, photocopiers and printers. Computers were accessed and used by 10.0% of the participants; digital cameras (1.8%); mobile telephones (10.4%); photocopiers (4.7%); and printers (4.3%).

Impact of Technology Related Pre-Service Training on Teachers' Practice

Teachers participating in the survey indicated ratings on the impact of technology related ECDE course units on their skills and knowledge in integration of technology in planning and documentation. The results revealed that the technology related pre-service training was not effective (8.1%), slightly effective (1.8%), effective (0.8%) and very effective (0.2%). It is important to note that 89% of the participants (n=508) did not provide any ratings because this group of participants had not completed any course units during their college/university years focused on integration of technology in planning and documentation.

In-Service Training in Integration of Technology in Daily Professional Activities

Lastly, this study found that none of the teachers (n=508) had attended in-service training on integration of technology in their professional activities in the previous school year. Table 7.4 presents a summary of the findings on teachers' professional training in technology.

Table 7.4 reveals that 45.5% of the case preschool teachers were qualified in computers. Overall, 34.3% (n=519) of the teachers participating both in the case study and survey had qualifications in Microsoft Word; 23.3% in PowerPoint; 12.2% in Computer Studies; and 2.0% had a diploma in IT. Despite some of the participating teachers' possession of formal qualifications in ICT, only 22.5% of the participating teachers in the entire district were qualified in integration of technology in ECDE curriculum. In addition, less than 11% of the participants had accessed and used digital resources in practice during training. Of surprise is the fact that none of the participants in the entire district of study had attended in-service training on use of technology in practice.

Table 7.4

A Summary of the Findings on Teachers' Professional Training in Technology

	Case public preschool teachers (n=5) %	Case private preschool teachers (n=6) %	Overall (n=11)	Survey public preschool teachers (n=167) %	Survey private preschool teachers (n=341) %	Overall (n=508) %
Qualifications in computers	40	50	45.5	-	-	-
Qualification in Microsoft Word	20	-	9.1	41.3	30.8	34.3
Qualification in PowerPoint	20	-	9.1	47.8	24.9	23.3
Qualification in Computer studies	-	-	-	9.0	13.8	12.2
Diploma in IT	20	-	9.1	0.6	2.6	2.0
Qualification in integration of technology in ECDE curriculum	-	-	-	15	25.5	22.5
Accessed and used digital resources in practice during training	-	-	-	< 8	< 13	< 11
Attended in-service training on use of technology in practice	-	-	-	0	0	0

Discussion of the Findings on Teachers' Professional Training in Technology

The National Association for the Education of Young Children (NAECY) supports the importance of providing professional development aimed at empowering ECDE teachers in embracing technology. Similarly, in its ECDE policy framework, the Kenyan government (Republic of Kenya, 2006a) suggested the need to use ICT in ECDE for the purpose of supporting training programmes. Despite this suggestion, less than 11 teachers (n=519) participating in this study indicated that they had had professional training on how to integrate ICT in ECDE.

Researchers focusing on the use of technology in ECDE recommend the need for professional training of teachers in use of technology. According to these researchers, professional development of teachers in technology can empower them with knowledge and skills on how to teach children basic ICT skills and appropriate dispositions about the innovation (Kerckaert, Vanderlinde & Braak, 2015). Professional development is also important in enhancing teachers' positive beliefs about the use of ICT in ECDE (Gialamas & Nikolopoulou, 2010; Ihmeideh, 2010). Further, professional development is critical in instilling teachers with decision-making skills in how to integrate ICT in their classes (Nikolopoulou & Gialamas, 2009). These recommendations coincide with Koehler and Mishra (2009, p. 60).suggesting that 'the development of technological pedagogical content knowledge (TPCK) by teachers is critical to effective teaching with technology'.

In a similar dimension, six educators (n=10) taking part in this study felt inclusion of technology in ECDE programmes, both at preschool (including special needs programmes) and teachers' training programmes, required training of both teachers and their trainers in use of the innovation in professional practice. Additionally, the current study found that nine of the teachers (n=11) across the two cases preschools lacked formal qualifications in ICT. Further, only 22.5% of the teachers participating in the survey (n=508) had completed pre-service training on integration of technology in ECDE curriculum. Moreover, none of the participants (both case and survey) had completed in-service training in integration of technology in daily professional activities.

The findings described above present a scenario of insufficiency in professional training of Kenyan ECDE teachers in ICT. The findings are consistent with several studies conducted in the African context. For example, Asante (2014) found that 60% of the participating Ghanaian preschool teachers lacked knowledge in ICT. Also, Asante (2014) found that 61.4% of the preschool teachers in Ghana were not provided with professional support on use of ICT. Likewise, Ndiritu, Mburu and Kimani (2013) found that over 60% of the Kenyan participating preschool teachers lacked knowledge in ICT and over 80% had not attended any professional learning forums on use of ICT. In contrast, Abdulai (2013) found that 61.3% of the preschool teachers in Ghana were proficient in the use of ICT and 34.1% could manipulate overhead projectors.

Availability and Access to Technology

Evidence on availability and teachers' access to technology was collected through the use of observations and semi-structured interviews with 11 teachers in the two case study preschools, and through a survey of 508 preschool teachers. Findings indicated that all case study teachers (100%) accessed and used an assortment of 16 instructional materials in the six classrooms across the two settings of study. Table 7.5 presents a list of these materials, categorized into two groups, print and real objects.

Table 7.5

Instructional Materials Accessed and Used by Case Study Teachers

Print materials	Real objects
Charts	Wall blackboards
Government curriculum guidelines	Teachers' pens and children's pencils
Text books	Crayons
Teachers' documented schemes of work in exercise books	Plasticine
Teachers' documented lesson plans in exercise books	Numeracy counters
Picture books	Wooden blocks
Children's work exercise books	Big and small rulers
	Outdoor play materials including balls, skipping ropes and rings
	Utensils including plastic cups, cutlery and plates

The evidence in Table 7.5 shows an assortment of 16 instructional materials accessed and used in daily practice by the case study teachers. As can also be seen in Table 7.5, these materials comprised print and real objects.

In addition to evidence on the instructional materials accessed and used by the case study teachers (n=11) at the two centres, observational field notes indicated availability of three forms of digital resources located at the primary school attached to the public case study centre. These resources included 38 functional computers. Out of this number, 35 computers were located in the primary school's laboratory and three in the school office. Additional digital resources included one functional type writer and one functional duplicating machine. Interestingly, only one teacher was seen accessing the computer laboratory during observations.

The observational evidence described above revealed all the case study teachers (100%) accessed and used mostly instructional materials. Further, the evidence indicated that these teachers had limited access to digital technologies. However, the evidence gathered through interviews indicated otherwise, suggesting that teachers across the two case study settings accessed and used some forms of digital technologies as shown in Table 7.6.

The summary findings tabulated in Table 7.6 revealed forms of digital technologies accessed and used by case study teachers. These included personal mobile telephones, and computers; children's software, digital cameras, and printers; photocopiers, televisions and radios. Table 7.6 also shows that teachers accessed and used these technologies in various places, including homes, schools, friend's house and elsewhere.

In addition, this study found that teachers participating in the survey accessed and used seven types of digital technologies. Summary findings on this item are documented in Table 7.7.

As can be witnessed by evidence in Table 7.7, teachers participating in the survey accessed and used seven types of digital technologies. These comprised personal mobile telephones, and computers; digital cameras, photocopy, and machines; printers, digital video recorders, and document scanners. The evidence in the table also indicates that personal mobile telephones were the most ubiquitous digital technologies frequently accessed and used by participating teachers both at home (90.03%) and at their ECDE settings of practice (99.49). In contrast, digital technologies with the least frequency of access and use by teachers participating in the survey included printers (12.20%; 23.03%), digital video recorders (10.04; 7.09) and document scanners (3.94; 7.09%) (Table 7.7).

Table 7.6

Forms of Digital Technologies Accessed and Used by Case Study Teachers

	Teachers (N=11)	
Forms of Digital Technologies Accessed and Used	%	Place(s) of Access and Use
Personal mobile telephones	100	Both at home and school
Computers	54.6	Home, school, friend's house
Children's Software	9.1	Home
Digital cameras	9.1	Home
Printers	9.1	Elsewhere
Photocopiers	9.1	Elsewhere
Televisions	27.3	Elsewhere
Radios	9.1	Home

Table 7.7

Summary on Types of Digital Technologies Accessed and Used at Home and ECDE Centres

		Teachers (N=508)		
Digital Technologies	Home	%	ECDE	%
Personal mobile telephones	498	90.0	480	94.5
Computers	262	51.6	270	53.2
Digital cameras	204	40.2	102	20.1
Photocopy machines	130	25.6	203	40.0
Printers	62	12.2	117	23.0
Digital video recorders	51	10.0	36	7.1
Document scanners	20	3.9	36	7.1

Discussion of the Findings on Availability and Access to Technology

This study provides evidence demonstrating preschool teachers in the district of study accessed and used three forms of instructional materials. These comprised print materials, real objects and digital technologies.

In reference to print materials (Table 7.5), all teachers (100%) in the two case preschools accessed and used seven forms of print material. These comprised wall charts, government curriculum guidelines, and text books; plus schemes of work written in exercise books. Additional forms of print materials included lesson plans written in exercise books, picture books and children’s work exercise books.

Apart from print materials, this study found that all the case study teachers (100%) in the two case preschools accessed and utilized 9 assorted real materials (Table 7.5). These included wall blackboards, pens and pencils; crayons and plasticine. Other materials, (see Table 7.5) included numeracy counters, wooden blocks, and rulers, play materials and utensils.

In terms of digital technologies, over 90% of the case study and survey teachers (Tables 7.6 and 7.7) accessed and used personal mobile telephones both at home and at the ECDE centres. Over 50% of each group of participants accessed and used computers at home, schools and at a friend’s house (Tables 7.6 and 7.7). However, those digital technologies least accessed and used by case study teachers were children’s software, digital cameras and printers; photocopiers, and radios (Table 7.6). Each of these resources was accessed and used by only 9.1% of teachers in the two case studies (Table 7.6).

On the other hand, printers, digital video recorders and document scanners were the least accessed and used digital technologies by teachers participating in the survey (Table 7.7). According to the evidence in this table, less than 15% of the participants in the survey accessed and used the three mentioned digital resources at home. Even though printers were accessed and used at the ECDE centres by 23% of the survey participants, digital video recorders and document scanners were accessed and used at the ECDE centres by less than 10% of this group of participants (Table 7.7).

This study has presented evidence indicating that 100% of the case study teachers taking part in Phase One accessed and used print and real materials in their everyday professional practice (Table 7.5). This evidence resonates well with the Kenyan government policy framework on training of ECDE teachers. In this policy framework (Republic of Kenya, 2006a; 2008a), the government suggests the need to train teachers on how to develop relevant, cost-effective and durable instructional materials for use in teaching and children’s learning. These materials ought to include concrete (real) materials, pictures, models, crayons, charts, flash cards, plasticines, audio-visual and play equipment (Republic of Kenya, 2006a; 2008a). Moreover, the policy framework reinforces the need for ECDE teachers to prepare and utilize professional documents in their practice. These include schemes of work, lesson plans and timetables (Republic of Kenya, 2006a; 2008a). These policy directions are also in tune the Constitution of Kenya, 2010 (article 11 (2) (b) and (c). This article emphasizes the need to use science and indigenous technologies in the development of the nation.

Given that all the case study teachers accessed and used print and real materials, this practice demonstrated the role of history and culture in the Kenyan ECDE system. The policy frameworks and training (histories) informed teachers’ practices involving access and use of print and real materials (culture). Nonetheless, there are limited studies conducted in the African context that have made an attempt to find out the kind of digital technologies accessed and used by ECDE teachers. None of these studies has provided us with evidence in regard to what kind of traditional materials accessed and used by this group of educators in instruction. The evidence provided by the current study provides new knowledge on early childhood education.

In regard to digital technologies, over 90% of the case and survey teachers (Tables 7.6 and 7.7) accessed and used personal mobile telephones both at home and at the ECDE centres. Over 50% of each group of participants accessed and used computers at home, schools and at a friend's house (Tables 7.6 and 7.7). It is also important to note that few teachers in each of the two participating groups accessed and used additional varied forms of digital technologies. These included digital cameras, photocopying machines, printers, digital video recorders, document scanners, televisions and radios.

The findings described above are systematic with findings in previous research studies conducted in the African context, including Kenya. For example, a study (Abdulai, 2013) conducted in Ghana reported that participating preschool teachers accessed and used varied technologies. These included computers (desktop, laptops), digital/video cameras, and telephone/fax machines**;** programmable toys and projectors. A study (Asante, 2014) taking place in the same region found that Ghanaian preschool teachers accessed and used computers, tape recorders, and radios; digital cameras, programmable toys, and closed circuit-television set; computer with internet, simulated environments, and electronic white boards; interactive stories computer games, projectors, and internet; telephone mobiles, communication software and tools.

Similarly, research studies conducted in Kenya revealed that preschool teachers accessed computers (Kaindio & Wagithunu, 2014). They also accessed and used assorted software resources comprising word processors, spread sheets, and computer aided instruction software; presentation software and web browsers (Netscape, Explorer) (Andiema, 2015). Andiema (2015) reported also that preschool teachers in Kenya accessed and used hardware comprising instructional films (videos, CD, VCD, flash disks), keyboards, and mouse; LCD projectors with external speakers. .

Locations for Technology Resources in ECDE Centres

Through observations involving five teachers at the case public preschool centre, this study found that computers were located in a school laboratory and in the office. Additionally, a type writer and duplicating machine were located in school offices. Similarly, findings obtained through survey revealed that technology resources were located in six locations. These included classrooms, computer laboratories, and libraries; school offices, staffrooms, and multipurpose rooms. School offices were the most common locations for technology resources. The least common locations included computers laboratories (indicated by 12.2% of the teachers), and classrooms, (indicated by 0.6% of the participants).

Discussion of the Findings on Locations for Technology Resources in ECDE Centres

The finding outlined above contributes to research literature because nothing similar has been identified in previous research studies focusing on locations of technology in ECDE and especially in African contexts.

However, a study (Oldridge, 2010) conducted in New Zealand found that participating teachers were concerned about the location of digital technologies in preschools. These teachers felt it was better for these resources to be placed in preschool classrooms for easy access and use in practice. These teachers were opposed to the idea of placing ICT resources in selected areas for they felt this step was a stumbling block to meaningful and authentic learning. Based on these concerns, Oldridge's (2010, p, 192) study concluded that:

> *The physical placement of ICT in a designated area does not promote integrated, meaningful and authentic learning opportunities. When teachers have to stop the learning that is taking place to direct children to the ICT area in order to extend this learning it would seem that this would be contradictory to good teaching practice.*

Teachers' Use of Technology in Everyday Practice

Teachers' use of technology in everyday practice was gathered through three sources. These included observations and interviews with 11 teachers at the two cases preschools and a survey of 508 preschool teachers in a district. Analyses and findings obtained were presented in chapters 4 and 5.

Resulting findings revealed teachers (100%) across the two cases preschools used instructional materials comprising print and non-print tangible materials. These materials were used by teachers in everyday practice in the following ways:

1. Documentation of teaching and children's learning programmes (schemes of work) for a whole term.
2. Documentation daily teaching and children's learning activities (lesson plans).
3. Implementation of teaching and children's learning.
4. Documentation of children's learning.
5. Communication with parents.

Additional evidence through one-to-one interviews with teachers at the two case preschools revealed all the participants (100%) used writing materials including exercise books, pens and markers. These materials were used in practice involving planning and documentation of teaching and children's learning. Also, this study found that 45.5% of the teachers across the two case preschools utilized their personal mobile telephones mostly for communication with parents, colleagues and employer. It is also important to note that two lead preschool teachers used their personal mobile telephones mostly for administrative purposes involving calculation of enrolment and register issues (CPUB 01) and keeping the teacher alert on various activities in school and transactions of fee payment (CPRV 03).

Through a survey, evidence on teachers' (n=508) use of technology in everyday practice was collected in four areas. These included use of technology in planning of teaching and learning activities; use of technology in documentation of teaching and learning activities; involvement of children in planning technology-rich learning experiences; and use of technology in sharing experiences on children's learning progress with parents.

Use of Technology in Planning of Teaching and Learning Activities

Using a 4 point Likert scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers (n=508) assessed the extent to which they used technology in planning of teaching and learning activities at their ECDE centres. The results of this assessment indicated a total of 310 teachers (61.0%) never used technology in planning of teaching and learning activities at their ECDE centres. Nonetheless, 28.7% of the participants indicated they used technology sometimes, 4.5% used it nearly always and 5.7% used the innovation always.

A one sample t-test on teachers' scores was performed. This test utilized a 4 point scale described in the previous section. This resulted in a mean of 1.549 (SD = 0.826) out of the expected mean of 4. This result demonstrated that the participating teachers (n=508) extent of technology use in planning of teaching and learning activities was minimal. Further, a two-sample t-test on teachers' means revealed a significant difference ($t(445) = -4.94$, $p (0.000) < 0.05$) between teachers in public centres (n=167) ($\bar{x}$ =1.3, SD = 0.6) and those in private centres (n=341) ($\bar{x}$ =1.7, SD = 0.). This result suggested that the two groups of teachers were not at the same level in relation to the extent of technology use in planning of teaching and learning activities.

Use of Technology in Documentation of Teaching and Learning Activities

A 4 point scale never (1), sometimes (2), nearly always (3) and always (4) was used to assess the teachers' extent to which technology was used in documentation of teaching and learning activities at their ECDE centres. The outcome of this assessment revealed a total of 313 teachers (61.6%) never used technology in planning of teaching and learning activities at their ECDE centres. However, 25.0% of the participating teachers indicated they used technology sometimes, 6.9% used technology nearly always and 6.5% used the innovation always.

Through use of one-sample t-test, participants' mean, out of the expected mean score 4, was 1.6 with a standard deviation of 0.9. This result indicated that the participating teachers (n=508) extent of technology use in documentation of teaching and learning activities was below average.

Involvement of Children in Planning Technology-Rich Learning Experiences

Using a 4 scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers assessed the extent to which they involved children in planning technology-rich learning experiences. A total of 435 out of 508 teachers never involved children in planning technology-rich learning experiences. However, , 9.3% of the participants indicated they involved children in planning technology-rich learning experiences sometimes, 3.0% nearly always and 2.1% always.

Through a 4-pointscale, participants' scores were tested through the use of one-sample t-test. This process aimed to determine the participants' mean (expected mean was 4). Teachers' mean score was found to be 1.2 with a standard deviation of 0.6. This result suggested that participating teachers (n=508) extent of involving children in planning technology-rich learning experiences was below average.

Use of Technology in Sharing Experiences on Children's Learning Progress with Parents

Using a 4 point scale comprising never (1), sometimes (2), nearly always (3) and always (4), teachers assessed the extent to which they used technology in sharing experiences on children's learning progress with parents. Analysis of these assessments demonstrated a total of 333 teachers (65.6%) never used technology in sharing experiences on children's learning progress with parents. 16.5% of the participants indicated they used technology in sharing experiences on children's learning progress with parents sometimes, 11.6% nearly always and 6.3% always.

Through use of a one-sample t-test, participating teachers' mean score was found to be 1.6 with a standard deviation of 0.9. This result suggested that the extent of technology used by teachers (n=508 in sharing experiences on children's learning progress with parents was below average.

Teachers' overall mean score in the four areas discussed above was 5.9. This mean score was far below the expected mean score 16. This result suggested that generally, the extent of teachers' use of technology in everyday practice was small. A two-sample t-test resulted in a significant difference ($t\ (450) = -4.39$, $p\ (0.000) < 0.05$) between teachers in public centres (n=167) ($\bar{x} = 5.19$, SD = 2.3) and their colleagues in private centres (n=341) ($\bar{x} = 6.30$, SD = 3.3). This result indicated that teachers in the two ECDE contexts, public and private were at different levels in relation to the extent of technology use in everyday practice.

Discussion of the Findings on Teachers' Use of Technology in Everyday Practice

This study found that all the case teachers (100%) across the two case preschools used instructional materials comprising print and non-print tangible materials in their daily practice. This study found that 45.5% of the teachers across the two preschools used their personal mobile telephones mostly for communication and not in their professional practice. Additionally, teacher (n=508) use of technology in everyday practice was below average ($\bar{x}$ = 5.9, SD = 3.0, 95% CI = 5, 7, 6.20), where the expected mean score was 16.

In respect to planning of teaching and learning activities, this study found that all the teachers (n=11) participating in Phase One, and 61.0% of the Phase Two participants did not use technology in their practice. This finding supports a similar finding by Asante (2014) in Ghana, revealing 49% of the participating preschool teachers did not integrate technology into their lessons.

Teachers participating in the current study had limited use of technology in their professional practice. This is not surprising in view of the cultures and histories underpinning activities in the Kenyan ECDE system. Based on the Kenyan government policy framework (Republic of Kenya, 2006a; 2008a), ECDE teachers are trained on how to use print and real materials (indigenous technologies) in teaching and children's learning. This means the limited use of technology in ECDE is to a larger extent not out of teachers' design. The social systems comprising politicians, policy-makers, teachers, educators and the significant others have a contribution to make to such a limitation.

Despite the limited use of technology by the participants, the evidence in the current study serves the purpose of creating awareness. This awareness focuses on ways in which ECDE teachers could use digital technologies in their everyday practices. These include planning, documentation, and involvement of children in planning technology-rich learning experiences, plus sharing experiences on children's learning progress with parents. The evidence is also an eye-opener to future researchers targeting ways in which digital technologies are being utilized in ECDE teachers' professional practices.

Teachers' Confidence about Using Technology in Everyday Practice

For the purpose of finding a mean score, a 5-point scale, strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5)was used on teachers' (n=508) self-rating scores on their confidence in using technology in planning and documenting activities for children. Using the above mentioned scale, these scores were subjected to a one-sample t-test. The outcome of this test revealed a mean score of 1.8 out of the expected mean score 5. This result indicated that teacher confidence in using technology in planning and documenting activities for children at their centre was below average.

Further, teachers lack of confidence in using technology was attributed to a range of factors including locating an ideal website that contains information related to ECDE ($\overline{x}$ =1.8), emailing parents regarding their children's learning projects ($\overline{x}$ = 2.1), confidence about cropping and rotating photos on a photo story program ($\overline{x}$ =1.9). This mean is below the expected mean score 5.

Participants' (n=508) overall mean was 7.5, out of the expected mean score 20. This result suggested that teachers' overall confidence about using technology in everyday practice was low.

Teachers' level of confidence about using technology in everyday practice has not been identified in previous studies. Studies reporting on use of technology in the African context were more focused on teachers' attitudes, access and use of technology in ECDE. This evidence adds to the body of research literature on use of technology in ECDE. More specifically, the evidence (low confidence) extends our understandings on preschool teachers' held confidence about using technology in various activities of their everyday practices.

The understanding could play a critical role in designing stimulating training programmes that can enhance teachers' confidence in use of technology in ECDE. The understanding could also serve as an eye opener on the kind of support that could be provided in ECDE programmes focused on integration of technology. This information is critical since teachers' confidence "affect their classroom practices and, consequently, the children's learning" (Nikolopoulou & Gialamas, 2015, p. 410). Similarly, educator confidence impacts on their attitude towards integration of technology in practice Blackwell et al. (2014).

Stakeholders' Support in Integration of Technology at the ECDE Centres

A survey of 508 teachers revealed three (3) groups of stakeholders provided preschool teachers with support in integration of technology at the ECDE centres. The percentage of teachers indicating they received support from managers of ECDE centres was 78.7%, parents/community members (78.9%) and fellow teachers at their centres (26.0%). Additionally, 4.7% of the teachers in private ECDE centres received support from churches. In contrast, all the participating teachers (100%) indicated lack of any support from Ministry of Education, District ECDE officers and teachers in other ECDE centres.

As for the types of ECDE centres, 68.9% of the teachers in the public centres were provided with support by managers of their centres, 53.9% from parents/community members and 10.8% from fellow teachers at their centres. Likewise, 83.6% of the teachers in private centres received support from managers of their centres, 91.2% from parents/community members and 33.4% from fellow teachers at their centres.

Three (3) types of support provided by managers included provision of instructional materials; provision of ICT resources including computers, digital cameras, printers and photocopiers and sponsorship for training in ICT. Additionally, teachers received two (2) types of support from parents/community members in form of funds to purchase computers as well as donations of computers from well-wishers. Also, fellow teacher colleagues at the ECDE centres provided three (3) types of support including sharing of instructional materials, sharing of ideas on ICT and donation of computers.

In view of the types of ECDE centres, over 50% of the teachers in the public centres received two (2) types of support from ECDE managers inform of instructional materials and provision of ICT resources. The least type of support received by teachers in public centres (6.0%) was donations of computers provided by fellow teacher colleagues. On the other hand, the two most common forms of support provided to teachers in the private centres was received from parents/community members through donations of computers (92.2%) and funds to purchase computers (87.7%) while minimal support, in form of donations was provided by fellow teachers (5.3%) at the centres of practice.

Previous researchers targeting use of technology in ECDE have not reported on stakeholders' support to teachers on use of technology in ECDE. The finding on this aspect by the current study adds to the body of research literature on use of technology in ECDE.

Findings for Research Question 3: Links Identification

The third research question for this study was in what ways are Kenyan ECDE teachers' professional beliefs linked to their everyday practices and pedagogies in their educational settings? In order to answer this question, this study utilized data gathered from Phase One. This phase involved 11 teachers in two case preschools. Data collection methods for this phase included observations and interviews. Analyses of the sets of data collected from this phase were presented in Chapter 4. The sets of data and findings focusing on participants' professional beliefs (interviews) and practices (observations and interviews) were used to respond to the research question under discussion (3).

In reference to beliefs, this study found that the case study teachers (n=11) believed the use of technology in ECDE could play several roles in teaching practice and children's learning. These roles are summarized below.

1. Enhance efficiency and effectiveness in teaching practice
2. Source and access information on ECDE
3. Partnership and communication with families and other stakeholders
4. Enable children to acquire technology literacy skills at an early age
5. Making learning easy, effective and interesting to all children
6. Enhance children's learning outcomes
7. Mental and memory development and acquisition of knowledge

In reference to teaching practice, observational and interview evidence indicated all the teachers (n=11) across the two preschools used instructional materials in teaching practice. Even though these teachers did not use digital technologies, the kind of practices and pedagogies they engaged in on a daily basis were noted by this study. A summary of these practices and pedagogies is presented below.

1. Documentation of teaching and children's learning programme for an entire school term (schemes of work),
2. Documentation of daily teaching and children's learning activities (lesson plans),
3. Implementation of teaching and children's learning,
4. Documentation of children's learning progress,
5. Communication with parents and other ECDE stakeholders.

Table 7.8 presents comparisons on teachers' beliefs and their everyday practices and pedagogies. Existence of links is indicated by an asterisk (*).

Table 7.8

Comparisons on Teachers' Professional Beliefs and Practices

Teachers' Professional Beliefs about use of technology in ECDE	Teachers' everyday practices and pedagogies
Enhance efficiency and effectiveness in teaching (B1) *	Documentation of teaching and children's learning programme for an entire school term (schemes of work) (P1) *
Source and access information on ECDE (B2)	Documentation of daily teaching and children's learning activities (lesson plans) (P2) *
Partnership and communication with families and other stakeholders (B3) *	Implementation of teaching and children's learning (P3) *
Enable children to acquire technology literacy skills at an early age (B4)	Documentation of children's learning progress (P4) *
Make learning easy, effective and interesting to all children (B5)	Communication with parents and other ECDE stakeholders (P5) *
Enhance children's learning outcomes (B6)	
Mental and memory development and acquisition of knowledge (B7)	

Discussion of Answers to Research Question 3: Links Identification

Exploration of links between teachers' beliefs and practices is critical. Links are likely to highlight ways in which teachers are likely to use an innovation. According to Kuzborska, (2011, p. 102), 'teachers interpret and respond to innovations only in the ways which relate to the existing beliefs and practices'.

Looking at the comparisons in Table 7.8, teachers' belief item (B1) paired with practice items (P1, 2, 3 and 4) indicate links between teachers' beliefs about the use of technology in enhancing efficiency and effectiveness in teaching and their practices. These practices include documentation of schemes of work, lesson plans, and implementation of teaching and children's learning, plus documentation of children's learning progress. In addition, a link was also identified between teachers' belief item

(B3) on use of technology in partnership and communication with families and other stakeholders and practice (P5) on communication with parents and other ECDE stakeholders.

However, teachers' beliefs did not always match the practice (see Table 7.8). These included use of technology in sourcing and accessing information on ECDE; children's acquisition of technology literacy skills at an early age; and making learning easy, effective and interesting to all children; enhancing children's learning outcomes; and use of technology in mental and memory development plus acquisition of knowledge.

This study provides comparisons on preschool teachers' held beliefs about the use of technology in ECDE and their everyday practices and pedagogies. These comparisons showed some similarities between some of the teachers' beliefs and certain practices, discussed above. It is important to note that the teachers' practices discussed in this section did not involve use of digital technologies. These practices involved mainly traditional instructional materials. These materials comprised print and real artefacts.

In view of digital technologies, there were disconnections between teachers' beliefs and practices with these resources. Majority of the teachers (90.9% case and 98.0% survey participants) believed in these resources'potentiality in enhancing efficiency and effectiveness in teaching practice (see Table 7.1). Yet none of these participants had attended in-service training on use of technology in practice (see Table 7.4). Further, findings from survey revealed only 11% of the respondents (n=508) had completed pre-service training on integration of technology in planning and documentation. (Table 5.13). Moreover, 5.7% of the survey teachers used technology in planning of teaching and learning and 6.5% used used technology in documentation of teaching and learning (see p. 223). These revelations indicate disconnections that existed between teachers' beliefs about use of technology in ECDE and practice, including professional training. These disconnections could have been caused by lack of Kenyan political will and policy frameworks on integration of technology in preschools.

Chapter Summary

This chapter has synthesized findings of analyses from the previous three chapters, four, five and six. It has also responded to the research questions and linked these findings to theory and empirical literature.

The three research questions of this study attempted to identify early childhood educators' professional beliefs about the use of technology in ECDE; the status of the use of technology in Kenyan preschools; and ways in which Kenyan ECDE teachers' professional beliefs are linked to their everyday practices and pedagogies in their educational settings.

This study found that the three groups of participating educators held professional beliefs about the use of technology in ECDE. More specifically, these educators believed that technology had the potential to improve teaching practice as well as children's learning. Similar perceptions were also identified in selected studies undertaken in those countries with similar social and cultural contexts to Kenya. However, there were certain unique elements noted in educators' beliefs. These included the use of technology in planning, documentation, enhancement of children's talents and logical thinking. These elements added to the knowledge base on use of technology in ECDE for the purpose of improving teaching practice.

Looking at the second research question, this study unveiled numerous findings in an attempt to establish the status of the use of technology in Kenyan preschools. These included insufficient policy frameworks on use of technology in ECDE. The study also found that teachers were not professionally trained in technology. They also had limited access to technology. This study further noted that there were technology resources in ECDE centres, but located mostly in offices.

Further, the current study found that teachers' use of technology in everyday practice was limited and their confidence levels on use of the innovation were below average. Lastly, it was noted through a survey that there were few stakeholders in ECDE providing support on use of technology in ECDE.

The findings examined under the second research question provided a holistic picture indicating some of the difficulties faced in regard to the status, implementation and adoption of technology in Kenyan ECDE environments. This status calls into question how best to integrate technology in the Kenyan ECDE system. In the third research question, this study found that teachers' professional beliefs were linked to certain aspects of their practices involving the use of traditional instructional materials.

Theorising from CHAT's (Engeström, 1987) perspective, teachers' use of technology in daily practice was constrained by both historical and cultural components of the Kenyan ECDE contexts. This indicates that historical, culture and integration of technology in ECDE are interrelated processes. On the historical platform, this study found that the Kenyan ECDE policy/curriculum lacked guidelines on the integration of technology in ECDE. Also, findings revealed teachers were not professionally trained on integration of technology in ECDE. Its most likely lack of policy/curriculum guidelines contributed to teachers' lack of professional training on integration of technology in ECDE; limited perceived confidence about using technology in everyday practice and limited stakeholders' support in integration of technology in the ECDE centres.

In regard to culture, this study found that participating teachers used mostly traditional materials in their everyday practice. These materials comprised real and print technologies located in ECDE classrooms. A kind of culture in ECDE centres was also identified in location of digital technologies. These resources were located mainly in school offices. This kind of culture could not promote use of technology in ECDE even if policy guidelines were available.

The last chapter, Chapter, 8, will present conclusions arising from findings of the research. It also presents limitations of the study and suggests implications for future research, professional training and learning, policy and role of government in these implications.

CHAPTER 8

CONCLUSIONS AND IMPLICATIONS

This chapter begins by presenting conclusions arising from this study. Following these , limitations of the study are documented. The chapter closes by suggesting a number of implications for future research, professional training and learning, policy and role of government in these implications.

Conclusions

This study was set out to investigate professional beliefs held by Kenyan early childhood educators about the use of technology in ECDE, the status of the use of technology in Kenyan preschools and ways in which the professional beliefs of Kenyan ECDE teachers are linked to their everyday practices and pedagogies in their educational settings of practice.

The study was guided by the following research questions:

1. What are the professional beliefs of Kenyan early childhood educators about the use of technology in ECDE?
2. What is the status of ICT practices in Kenyan preschools?
3. In what ways are the professional beliefs of ECDE teachers in Kenya linked to their everyday practices and pedagogies in their educational settings?

Professional Beliefs of Kenyan Early Childhood Educators about the Use of Technology in ECDE

Educators in Kenyan early childhood contexts do experience numerous challenges in their profession. These include lack of facilities such as classrooms, electricity, and instructional materials. Poor working conditions, inadequate renumeration and motivation for these educators are additional challenges. Despite these challenges, this research has shed considerable light on the question of Kenyan early childhood educators' professional beliefs about the use of technology in ECDE. In view of the socio-constructivism framework, Kenyan early childhood educators have do have theories about use of technology in ECDE. These theories are more focused on the affordances of technology in innovating teaching practice and children's learning.

In regard to teaching practice, Kenyan ECDE educators do theorerize technology in terms of efficiency, easy work and a time saving tool in teaching practice. According to these educators, use of technology in ECDE technology could result in effective impact on teaching practice. Affordances of technology in planning, teaching and documentation; in sustaining children's learning interest, sourcing and accessing information on ECDE are additional theories identified in participating teachers' beliefs. Additional theories, based on educators' beliefs include communication with ECDE stakeholders and professional networkin

In addition, Kenyan ECDE educators have theorirized about the critical role technology could play in children's learning. This role involves enabling children to acquire technology literacy skills at an early age and enhancing children's learning outcomes. Additional roles include use of technology in developing children's mental and memory capabilities; acquisition of knowledge; social skills; making learning easy; fun and interesting. These theories are critical in contributing to current empirical literature focusing on introduction of technology

However, not all early childhood educators are positive about the affordances of technology in ECDE. A small number of participants (less than 10%) in the current study theorerized the use of technology in ECDE in connection with negative impacts on teaching practice. These include creating additional work for teachers; making teachers unproductive; and wasting valuable time for teaching and learning; being harmful to children; risky to their moral development; and a tool that could retard their writing skills. An additional theory indicates that use of technology in ECDE would expose children to inappropriate sites and waste children's learning time due to the complexity of the innovation. These theories constitute an element of consideration for policy makers, curriculum designers and educators who are keen in implementing use of technology in ECDE programmes in the Kenyan context.

Status of ICT Practices in Kenyan Preschools

The status of the use of technology in early childhood education in Kenya is an area that has not been explored empirically. This scenario leaves a gap in early childhood literature as far as use of technology is concerned. This study has successfully provided new insight into the question of the status of the use of technology in Kenyan preschools. This status was examined from multiple perspectives for the purpose of obtaining a holistic picture of the question at hand. These perspectives comprised the following:

1. Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE
2. Teachers’ Professional Training in Technology
3. Teachers’ Understandings of Selected Terms (digital technology and documentation)
4. Availability and Access to Technology
5. Locations for Technology Resources in ECDE Centres
6. Teachers’ Use of Technology in Everyday Practice
7. Confidence about Using Technology in Everyday Practice
8. Stakeholders’ Support in Integration of Technology at the ECDE Centres

Availability of Policy/Curriculum Guidelines on the Integration of Technology in ECDE

This study identified substantial contradictions in Kenya’s ECDE environments in terms of policy frameworks on use of technology in ECDE. Overall, 27.6% of the ECDE centres had policy/curriculum guidelines on the integration of technology. Views provided by 50% of the respondents in Phase Three indicated the organizations in which they worked did not have national nor institutionalized policy guidelines on the integration of technology in ECDE. On the other hand, the varied responses provided by the other 5 respondents included ‘not sure’, and referred to the Kenyan Sessional Paper No. 5 on education, availability of electronic materials for children, ‘a not-well articulated policy and a general policy for all students.

Teachers’ Professional Training in Technology

Kenya’s early childhood education policy reinforces the importance of training preschool teachers. Nonetheless, this policy seems not to have taken care of preschool teachers’ professional training in technology. Based on the findings in the current study, a majority of teachers lacked pre-service training experiences on integration of technology in ECDE curriculum. Through a survey, this study found that 85% of the teachers (n=167) in public preschools and 74.5% in private preschools (n=341) had not completed any training on integration of technology in ECDE curriculum. Overall, 77.5% of the teachers (n=508) in the study district had not completed this training and 89% had not completed any training on integration of technology in planning and documentation. Further, this study found that none of the teachers participating in Phases One and Two had attended professional training on how to integrate technology in practice.

It is not surprising that teachers participating in this study were not professionally trained. This study found that that there were contradictions or insufficient policy frameworks on use of technology in ECDE. Policy frameworks play a critical role in directing curriculum formulation, training of teachers on innovations and implementation. Without these crucial instruments, it is not possible for training of human resources to take place.

Teachers' Understandings of Selected Terms

Most preschool teachers have some understanding of digital technologies. They associate the term with a range of technology resources. These include computers, televisions, and mobile telephones; cameras, tape recorders, radios and information technology (IT). Teachers' uderstandings about technology suggest meaning-making and knowledge held about the term, technology. These meanings and knowledge can play an important role during provision of support to preschool teachers in form of digital technologies and training.

Similarly, preschool teachers have an understanding of the meaning of documentation. The preschool teachers participating in this study understood the term, 'documentation' in terms of teaching methods, preparation of teaching records, planning of teaching lessons and writing of schemes of work. Nonetheless, teachers' understanding of the term documentation did not reflect any widespread attempt to document their practice.

Availability and Access to Technology

Preschool teachers do access and use three forms of technologies. These include print, real objects and digital resources. Print and real materials are accessed and used mostly in preschools. While digital resources are accessed and used by this group of educators in preschools, at home, friend's houses and 'elsewhere'. This study identified some of the digital resources accessed and used by participating teachers. These included personal mobile telephones, computers, and digital cameras; photocopy machines, printers, digital video recorders and document scanners.

However, personal mobile telephones were the most ubiquitous digital technologies frequently accessed and used by teachers, both at home and at the preschools. Other than personal mobile telephones, computers were also frequently accessed and used by teachers both at home and in the preschools.

On average, preschool teachers accessed and used between one and three types of technology resources both at home and at their preschools. A one-sample t-test on teachers' scores on selection of technology resources accessed and used resulted in a mean of 1.45 for home and 2.45 for ECDE centres. Teachers' access and use of technology resources is not an influencing factor in their access and use of the same at the preschools. A chi-square test of independence on the two variables demonstrated zero correlation ($r = 0.059$, $p = 0.181 > 0.05$).

However, gender is an influencing factor in preschool teachers' selection of technology resources accessed and used at home as well as at the ECDE centres. Through chi-square test of independence, this study found a significant, positive and moderate correlation between participants' gender and selection of technology resources accessed and used at home ($r = 0.512$, $p = 0.000 < 0.05$) as well as at their ECDE centres ($r = 0.419$, $p = 0.000 < 0.05$).

Preschool teachers in public and private ECDE centres might not be at par in reference to frequency of access and use of technology resources at their preschools. Teachers in public centres could be accessing and using two (2) types of technology resources more frequently while those in private centres three (3). This conclusion was reached as a result of a two-sample t-test on teachers' selection of technology resources accessed and used at their ECDE centres. The outcome of this test revealed a significant difference ($t (502) = -4.16$, $p (0.000) < 0.05$) between teachers in public ($n=167$) ($\overline{x} =2.11$, $SD = 0.83$) and those private centres ($n=341$) ($\overline{x} =2.61$, $SD = 1.87$).

Similarly, male and female teachers access and use technology differently in ECDE centres. A two-sample t-test on teachers' scores on selection of technology resources demonstrated a significant difference (t (82) = 9.22, p (0.000) < 0.05) between male (n= 64) ($\overline{x}$ =3.50, SD = 0.976) and female teachers (n=444) ($\overline{x}$ =2.297, SD = 0.0972) about selection of technology resources accessed and used at the at the ECDE centres. It appeared the male teachers were accessing and using, on average, four (4) types of technology resources at the ECDE centres ($\overline{x}$ =3.50). In comparison, the female teachers were likely to be accessing and using two (2) types of technology resources at the ECDE centres ($\overline{x}$ =2.30).

Nonetheless, teacher demographics such as age, highest education completed professional qualifications and teaching experience are not predictors or influencing factors on preschool teachers' selection of technology resources accessed and used at their ECDE centres. Through a chi-square test of independence, this study found zero (0) correlation between teachers' selection of technology resources accessed and used at their ECDE centres and age (r = 0.062, p = 0.166 > 0.05); highest education completed (r = 0.004, r = 0.931 > 0.05); professional qualifications (r = 0.004, P-Value = 0.931 > 0.05) and teaching experience (r = 0.079, p = 0.077 > 0.05).

Locations for Technology Resources in ECDE Centres

Digital technologies identified in preschools are located in specific areas other than preschool teaching and classroom environments. This study found that digital technologies were mostly located in preschool offices, but surprisingly, rarely located in classrooms.

Teachers' Use of Technology in Everyday Practice

The extent of technology use in everyday teacher practice is minimal. Through one-sample t-test, teachers' mean was found to be 5.94, far below the expected mean score 16. This study found that participating teachers' extent of technology use in each of the four areas of everyday practice was below the expected mean score of 4. These areas included teachers' use of technology in planning of teaching and learning activities ($\overline{x}$ =1.549, SD = 0.826); documentation of teaching and learning activities ($\overline{x}$ =1.583, SD = 0.879); involving children in planning technology-rich learning experiences ($\overline{x}$ =1.217, SD = 0.599) and technology use in sharing experiences on children's learning progress ($\overline{x}$ =1.587, SD = 0.924).

Certain demographic characteristics are predictors of teachers' use of technology in everyday practice. These include teachers' age, highest education completed, professional qualifications and teaching experience. Through use of a chi-square test of independence, this study found strong, positive correlations between teachers' use of technology in each of the everyday practice components and teachers' age, highest education completed, professional qualifications and teaching experience.

Confidence about Using Technology in Everyday Practice

Teachers' use of technology in everyday practice was below average (7.51). This is because the expected mean was 20. Conclusively, preschool teachers have inadequate confidence in using technology in everyday practice.

A one-sample t-test was performed on teachers' scores in each of the four areas of the everyday practice. These areas included confidence in using technology in planning and documenting activities for children at the ECDE centres, locating ideal websites that contain information related to ECDE, emailing parents their children's learning projects and cropping and rotating photos on a photo story program. The outcomes of the tests in each of these areas revealed teachers' lack of confidence.

Stakeholders' Support in Integration of Technology at the ECDE Centres

This study found that stakeholders, comprising managers of ECDE centres, parents/community members, fellow teachers and churches do provide support on use of technology in ECDE centres. This support included provision of instructional materials, ICT resources including computers, digital cameras, printers and photocopiers, sponsorship for training in ICT, funds to purchase computers and donations of computers Also, fellow teacher colleagues at the teachers at ECDE centres provided three (3) types of support including sharing of instructional materials, sharing of ideas on ICT and donating computers.

Notably, the Ministry of Education, District ECDE officers and teachers in other ECDE centres did not provide this support.

Limitations of the Study

Collection of survey data could have extended beyond the urban district of Nairobi to a district in a hardship area, for instance Northern and North-Eastern parts of

Kenya where communities have mobile schools due to pastoralist kind of life that keeps them moving in search of water and greener pastures for their livestock.

A selected sample comprising 10 ECDE stakeholders represented key organizations responsible for early childhood education in Kenya. Data collection might have included the views of parents as critical stakeholders in the education of young children.

This study could have extended to ECDE centres in rural areas. These are the areas that normally lag behind whenever there are new innovations in educational systems. The study could also involve teachers in preschools with special needs children to obtain their views about the use of technology in these contexts.

Implications for Future Research

This study will now provide implications for future research, in policy, professional training and learning, as well as outlining a role for Kenyan government.

The educators participating in this study comprised preschool teachers, ECDE policy-makers, educational curriculum designers and teacher trainers. These groups of educators were positive about the use of technology in innovating teaching practice and children's learning.

Researchers planning to conduct research on the use of technology in the Kenyan ECDE system should make an attempt to obtain views of parents. Parents are critical stakeholders in ECDE and their views about the innovation could contribute to technology integrated policy and practice. Future researchers could make an attempt to obtain children's views on the use of technology at home and in ECDE settings. These views could provide ideas on what they think of the innovation for learning. This information is equally important in preparation of technology-integrated ECDE policy, curriculum design and practice.

Educators participating in this study believed that use of technology in ECDE could innovate teaching practice as well as children's learning. Future researchers focused on ECDE should make an attempt and find out ways in which technology is influencing teaching and learning in preschools.

Although ECDE educators are positive about the affordances of technology in ECDE, there are some educators who believe that use of technology in ECDE could cause more harm than good. These educators believe the use the use of technology in ECDE is likely to impact teachers' practice and children's learning negatively. Future researchers should involve this group of ECDE educators in intervention studies. These kinds of studies would determine whether these educators' beliefs change or remain the same.

Overall, 27.6% of the teachers participating in the survey indicated their preschools had policy/curriculum guidelines on the integration of technology. There is a need for research studies to investigate the kind of policy/curriculum guidelines availed in these few preschools on the integration of technology, and how these policy frameworks are informed by a national and institutional policy. Future studies could also examine factors contributing or hindering the formulation ECDE integrated policy frameworks and curricula.

This study found that digital technologies were mostly located in computer laboratories and offices. Future research studies should aim at identifying factors contributing to placement of technology resources in offices and computer laboratories and not in classrooms. From a theoretical perspective, this study confirms and even more strongly emphasizes the importance of technology as a mediating device, when education is viewed from a Cultural Historic Activity Theory perspective. Teacher beliefs about what they can achieve with technology, both on a professional level and in terms of improving student outcomes, depends upon the effective use of technology. Thus, from a theoretical perspective, it is critical that breakdowns (contradictions) in activity systems are identified and remedied in order for desired educational outcomes to be realized.

Implications for Policy

Overall, 72.4 % of the preschool teachers participating in the survey indicated their ECDE centres lacked policy/curriculum guidelines on the integration of technology. This evidence was reiterated by 50% of the participants taking part in Phase Three. These participants expressed concern that there was lack of policy guidelines on integration of technology in ECDE, both at institutional and national levels. In view of these findings, there in need for a policy on integration of technology in ECDE programmes of Kenya.

A majority (77.5%) of the participating preschool teachers lacked pre-service training experiences on integrating technology in the ECDE curriculum. There is a need for better policy frameworks on how to integrate technology in teachers' training programmes for preschool teachers. Additionally, curricula materials and resources ought to be availed in teachers' training programs for the purpose of training teachers on how to effectively use technology in their practice.

This strategy could also enhance teachers' confidence in using technology in the classroom.

Implications for Professional Training and Learning

This study found most of the participating preschool teachers lacked basics in computers. Arguably, basics skills and knowledge in computers is a critical prerequisite in learning how to use technology in profession. In view of this, preschool teachers ought to be supported in the acquisition of basics skills and knowledge in technology. This needs to be done through pre-service training and in-service professional learning. While working towards acquisition of basic skills in technology, teachers should be encouraged to obtain certification. Teachers' acquisition of certification in ICT could serve as a motivating factor to integrate technology in daily practice. Teacher trainers ought to be supported in the training of preschool teachers to integrate technology in the ECDE curriculum.

Preschool teachers need support in form of professional learning on integration of technology in ECDE curriculum. This support could be provided as in-service at their preschools. This study found that none of the teachers participating in both Phase One and Two had attended in-service training in integration of technology in their professional activities.

Role of Kenyan government in the Presented Implications

The government's role is critical to the effective adoption and integration of technology in ECDE. This could be done through provision of funds for research studies. The government needs to implement the findings of research reports on technology in ECDE. Additionally, it is the government's role to liaise with relevant authorities in matters related to design of policies and curricula on integration of technologies in ECDE programs. These policies and curriculum ought to be informed by current research.

Preschool teachers need support in order to adopt technology in their practice. This support comprises access to infrastructure, varied digital technologies, and professional training/learning on the effective use of technology, and the provision of employment and suitable salaries. Collaboration with organizations, international bodies, other stakeholders and interested parties is key in addressing these needs.

REFERENCES

Abdulai, A. (2013). The place of information and communication technology (ICT) in early childhood education in the Winneba municipality of Ghana. *Journal of Educational Research and Reviews 1*(2), 9 – 15.

Adeyemi, B. M. & Adeyinka, A. A. (2003).The principles and content of African traditional education. *Educational Philosophy and Theory, 35*(4).

Akinyemi, F. O. (2015). Technology use in Rwandan secondary schools: an assessment of teachers' attitudes towards geographic information systems (GIS). *International Research in Geographical and Environmental Education* DOI: 10.1080/10382046.2015.1106848 Downloaded on 12/12/2015

Al Qur'an, M. N. (2010). How to use multiple case studies in international business research: Methodological aspects. *International Review ofBusiness Research Papers, 6*(2), 104-119.

Amuko, S., Miheso-O'Connor, M., & Ndeuthi, S. (2015). Opportunities and challenges: Integration of ICT in teaching and learning mathematics in secondary schools, Nairobi, Kenya. *Journal of Education and Practice 6*(24), 1- 6.

Andiema, N. C. (2015). Challenges of adoption of information communication technology on teaching and learning in public preschools in North Rift Region, Kenya. *International Journal of Economics, Commerce and Management 3*(12), 518-528.

Andiema, N. C. (2015). Adoption of information communication technology on teaching and learning in public preschools in North Rift Region, Kenya. *Chemistry and Materials Research 7*(1), 66 – 76.

Ang'ondi, E. K. (2013). Kenyan students' perceptions of new technologies to improve access to education. *Education Information Technology, 18*, 223-231.

Arthur, L., Beecher, B., Elliot, R., & Newman L. (2006). E-learning: Do our students want it and do we care? *Proceedings of the 23rd annual Ascilite Conference: Who's learning? Whose technology?* (pp. 55-59).

Asante, J. N. (2014). The state of ICT integration in the early years in Ghana schools. *Literacy Information and Computer Education Journal (LICEJ), Special Issue 3*(1), 1750-1757.

Australian Education Union (2007).*Early Childhood Education Policy 2007.*Annual Federal Conference, Southbank Victoria 3006.

Australian Government (2007).National statement on ethical conduct in human research. *Developed jointly by National Health and Medical Research Council*. Australian Vice-Chancellors' Committee.

Australian Government Department of Education, Employment and Workplace Relations for the Council of Australian Governments (2009). Belonging, being and becoming: The Early Years Learning Framework for Australia. *Commonwealth of Australia.*

Awino, N. L. (2014). Impact of supervision on the implementation of early childhood education curriculum in selected public preschools in Lang'ata District, Nairobi County, Kenya. *Masters of Education Thesis in Early Childhood*, University of Nairobi, Kenya.

Ayot, H. O., Ogembo, J. O., & Twoli, N. W. (2015). Predictors of extent of integration of computers in classroom teaching and learning among science and mathematics teachers in public secondary schools in Kwale County, Kenya. In Bwire, A. M., Nyagisere, M. S., Masingila, J. O., & Ayot, H. O.*Proceedings of the 4th International Conference on Education*, 133 – 141. Nairobi, Kenya: Kenyatta University.

Bay, E., Bagceci, B., & Cetin, B. (2012). The effects of social constructivist approach on the learners' problem solving and metacognitive levels. Journal of Social Sciences, 8(3), 343-349.

Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014).Factors influencing digital technology use in early childhood education classroom.*Journal of Education Research 7*(4), 231-255.

Bose, K. (2009). Developmentally Appropriate Technology in Early Childhood (DATEC) in Botswana: In-service teachers' perspectives. *International Electronic Journal of Elementary Education, 1*(3), 218-231.

Bose, K. (2010). Information and communication technology empowerment of early childhood teachers in Botswana. *International Journal of Scientific Research in Education (IJSRE) 3*(3), 166-176.

Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative Research, 6*(1), 97–113.

Bryman, A. (2016). *Social research methods*.(5th Ed.). New York: Oxford University Press.

Buabeng-Andoh, C. (2012). An Exploration of teachers' skills, perceptions and practices of ICT in teaching and learning in the Ghanaian second-cycle schools. *Contemporary Educational Technology 3*(1), 36 – 49.

Buhere, K., Oduor, A., & Tanui, K. (2013). Ministry has capacity to implement laptops project. Kenya Nation Newspaper Commentary, Friday, 17th May 2013.

Cameron, R. (2009). A sequential mixed Model research design: design, analytical and display issues. *International Journal of Multiple Research Approaches, 3*(2) 140-151.

Chen, J-Q.& Chang, C. (2006).A Comprehensive approach to technology training for early childhood teachers. *Early Education &Development 17*(3), 443-465.

Cole, M., John-Steiner, V., Scribner, S. & Souberman, E. (Eds.) (1978).*Mind in Society. The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Creswell, J. W. (2003). *Research design: qualitative, quantitative, and mixed methods approaches* (2nd Ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2014). (4th Ed.).*Research design: qualitative, quantitative and mixed methods approaches.* Thousand Oaks, California: SAGE Publications, Inc.

Creswell J. W. & Plano, C. V. L. (2007).*Designing and conducting mixed methods research.*(1st Ed.). Thousand Oaks, CA: Sage Publications.

Creswell J. W. & Plano, C. V. L. (2007).*Designing and conducting mixed methods research.*(1st Ed.). Thousand Oaks, CA: Sage Publications.

Demiraslan, Y. & Usluel, Y. K. (2008).ICT integration processes in Turkish schools: Using activity theory to study issues and contradictions. *Australian Journal of Educational Technology 24*(4), 458 – 474.

Denzin, N. K., & Lincoln, Y. S. (Eds.).(2011). *The SAGE handbook of qualitative research* (4th Ed.). Thousand Oaks, CA: Sage

Dwyer, D., Ringstaff, C., & Sandholtz, J. (1991).Changes in teachers' beliefs and practices in technology-rich classrooms. *Educational Leadership 48*(8), 45-52.

Economic Consulting Associates Ltd. United Kingdom, Trama Tecno Ambiental, Spin, Access Energy, Kenya (2014). Project design study on the renewable energy development for off-grid power supply in rural regions of Kenya. Project no. 30979. Final report submitted to KfW Development Bank by: Economic Consulting Associates (UK), Trama Techno Ambiental (Spain) and Access Energy (Kenya). November 2014.

Ejuu, G. (2012). Early Childhood Development Policy Advances in Uganda. *Contemporary Issues in Early Childhood 13*(3) downloaded on 12/4/16 from www.wwwords.co.uk/CIEC

Elliot, A. (2003). Learning with computers (2nd Ed.)*Research in Practice Series, 10*(4), 1-18.

Engeström, Y. (1999). Innovative learning in work teams: Analyzing cycles of knowledge creation in practice, Helsinki: Orienta-Konsultit.

Engeström, Y. (2001). Making expansive decisions: An activity-theoretical study of practitioners building collaborative medical care for children. In C. M. Allwood, & M. Selart (Eds.), *Decision making: Social and creative dimensions,* Dordirecht: Kluwer.

Farquhar, S. (1997). Are male teachers really necessary? A Paper presented at the NZARE Conference, Auckland, New Zealand December 1997.

Fereday, J. & Muir – Cochrane (2006).Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods 5*(1), 80 – 92.

Fleet, A., Honig, T., Robertson, J., Semann, A., & Shepherd, W. (2011). What's pedagogy anyway? Using pedagogical documentation to engage with the early years learning framework. Children's services central, New South Wales. Downloaded on 28/05/2016 from http://www.cscentral.org.au/Resources/what-is-pedagogy-anyway-.pdf

Gerber, S. B. & Finn, K. V. (2005).Using SPSS for Windows: Data analysis and graphics (2nd Ed.). Springer Business Media, Inc.

Gialamas, V. & Nikolopoulou, K., (2010). In-service and pre-service early childhood teachers' views and intentions about ICT use in early childhood settings: A comparative study. *Computers & Education, 55*, 333-341.

Githinji, F. W. & Kanga, A. (2011). Early childhood development education in Kenya: A Literature Review on Current Issues. *International Journal of Current Research 3*(11), 129-136.

Gordon, A. M. & Browne (2014).*Beginnings and beyond: foundations in early childhood education* (9th Ed.) New York: Wadsworth CENGAGE Publishers.

Guantai, L. N. (2012). Scoping Study of Early Learning in Kenya. Trust Africa.

Gutek, G. L. (2004) (Ed.). The Montessori Method: The origins of an educational innovation: including an Abridged and Annotated Edition of Maria Montessori method.Belmont: Thomson Brooks/Cole.

Gutmann, M. (2001).*Information technology and society*. Retrieved 21/11/2013, from http://www.zurich.ibm.com/pdf/news/Gutmann.pdf

Ho, J. P. Y.; Chen, D-T. V. & Ng, D. (2016). Distributed leadership through the lens of Activity Theory.*Educational Management Administration & Leadership 44*(5), 814 -836.

New York: The Rowman & Littlefield Publishing Group, Inc. Downloaded 23/04/2016 http://www.arvindguptatoys.com/arvindgupta/montessori-new.pdf

Hall, J. N. & Ryan, K. E. (2011). Educational Accountability: A qualitatively driven mixed methods approach. *Qualitative Inquiry,17*(1), 105-115.

Heppner, P. P., Kivlighan, D.M., & Wampold, B. E. (2008).*Research design in counseling* (3rd Ed.). Belmont: Thomson Brooks/Cole.

Higgs, P. H. (2008). Towards an indigenous African educational discourse: A philosophical reflection. *International Review Education 54*, 445-458.

Hinostroza, J. E., Labbe, C. & Matamala, C. (2013). The use of computers in preschools in Chile: Lessons for practitioners and policy designers. *Computers & Education*,(68), 96 – 104.

Howard, J., Miles, G. E., & Rees-Davies, L, (2012). Computer use within a play-based early years curriculum. *International Journal of Early Years Education 20*(2), 175-189.

Huber, J. & Mompoint-Gaillard, P. (2011) (Eds.).Teacher education for change. The theory behind the Council of Europe Pestalozzi Programme: Council of Europe Pestalozzi Series No.1. Council of Europe Publishing.ISBN 978-92-871- 7019-4. Downloaded on 23/4/2016 http://www.coe.int/t/dg4/education/pestalozzi/Source/Documentation/Pestalozzi1_TeacherEducationForChange_EN.pdf

Ihmeideh, F. (2010). The role of computer technology in teaching reading and writing: preschool teachers' beliefs and practices. *Journal of Research in Childhood Education, 24*, 60-79.

IRIS Center at the University of Maryland (2010). User Guide: CSPro Data Entry and Analysis Soft Ware for Implementers of UsaiD Poverty Assessment Tools. United States Agency for International Development.

Ivic, I. (2000). Lev S. Vygotsky (1896-1934). UNESCO: International Bureau of Education, Venice

Jere-Folotiya (2014). Influence of Grade One Teachers and Graphogame on Initial Literacy Acquisition: Lusaka District. *Doctoral Thesis*, University of Jyvaskyla/University of Zambia, Finland/Zambia.

Jere-Folotiya, J., Chansa-Kabali, T., Munachaka, J., Sampa F., Yalukanda, C., Westerholm, J., Richardson, U., Serpell, R., & Lyytinen, H. (2014).The effect of using a mobile literacy game to improve literacy levels of grade one students in Zambian schools.*Education Tech Research and Development, 62*(4), 417-436.

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14–26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007).Toward a definition of mixed methods research.*Journal of Mixed Methods Research 1*(2), 112–133.

Jumba, P. K., Etyang, F., Bwire, A. M., & Ondigi, S. R. (2015). Do Pictures have an Effect on Learner Performance in Composition Writing? *Proceedings of the ICE*

Kafyulilo, A. (2014). Access, use and perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania. *Educ Info Technol 19*, 115 – 127.

Kaindio, M. P. & Wagithunu, M. N. (2014).Integrating information communication technology skills in preschool education in Kenya. *Mediterranean Journal of Social Sciences MCSER Publishing 5*(5), 89-109.

Kamerman, S. B. (2006). A global history of early childhood education and care. *Background paper prepared for the Education for All Global Monitoring Report 2007 Strong Foundations: early childhood care and education*. United Nations Educational, Scientific and Cultural Organization.

Kang'ethe, S. N., Wakahiu, J. J., & Karanja, M. (2015).Assessment of the early childhood development policy implementation in Kenya, a case study of Ruiru district. *Journal of Education & Social Policy, 2*(1), 78-89.

Kaptelinin, V. (2005). The object of activity: Making sense of the sense-maker. *Mind, Culture, and Activity, 12*(1), 4-18.

Karagiorgi, Y. & Symeou, L. (2005).Translating constructivism into instructional design: potential and limitations. *Educational Technology & Society, 8*(1), 17-27.

Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Early Childhood Education Journal, 37*, 209–218.

Kelly, S. A. (2014). Perceptions, beliefs and practices about Technology among teachers in a Jamaican Infant School. *Doctor of Philosophy Thesis*, University of South Florida, USA.

Kenyatta, J. (2011). *Facing Mount Kenya*. Nairobi: East African Educational Publishers Ltd. ISBN 978-9966-46-017-2.

Kerckaert, S., Vanderlinde, R. & Braak, J. V. (2015). The role of ICT in early childhood education: Scale development and research on ICT use and influencing factors. *European Early Childhood Education Research Journal, 23*(2), 183 – 199.

Khasawneh, O. M., Miqdadi, R. M., & Abdulhakeem Y. H. (2014).Implementing pragmatism and John Dewey's educational philosophy in Jordanian public schools. *Journal of International Education Research – First Quarter 10*(1), 230 - 248.

Kiarie, B. K., Kerich, W. & Ondigi, S. R. (2015). Use of computers in teaching and learning Business Studies in secondary schools: Westlands District, Kenya. In Bwire, A. M., Nyagisere, M. S., Masingila, J. O., & Ayot, H. O. (2015) *Proceedings of the 4th International Conference on Education*, 133 – 141. Nairobi, Kenya: Kenyatta University.

Kimani, E. & Mwikamba, K. (2010).Gender dynamics in science and technology. *Journal of Agriculture, Science and Technology (JAGST), 12*(2), 70-81.

Kinuthia, W. (2009).Educational development in Kenya and the role of information and communication technology. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 5*(2), 6-20.

Koc, M. & Bakir, N. (2010).A needs assessment survey to investigate pre-service teachers' knowledge, experiences and perceptions about preparation to using educational technologies. *TOJET: The Turkish Online Journal of Educational Technology 9* (1), 12-22.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Kok, A. (2008). Evaluation of an online social constructivist tool based on a secondary school experience in a Middle East country. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 4*(3), 127-136.

Koskei, J. R. (2013). Teachers' awareness and ability to implement NACECE curriculum in Uasin Gishu County, Kenya.*Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS) 4*(2), 399-406. ISSN: 2141-6990.

Kundi, G. M. &Nawaz, A. (2010).From objectivism to social constructivism: The impacts of information and communication technologies (ICTs) on higher education. *Journal of Science and Technology Education Research 1*(2), 30-36

Kutluca, T. (2011).A study on computer usage and attitudes toward computers of prospective preschool teachers.*International Journal on New Trends in Education and Their Implications 2*(1), 1-13.

Kuzborska, I. (2011). Links between teachers' beliefs and practices and research on reading. *Reading in a Foreign Language*, *23*(1), 102-128.

Kwon, Y. I. (2002). Western influences in Korean preschool education. *International Educational Journal,3(*3) Downloaded on 5/6/2016http: //iej.cjb.net

Lascarides, V. C. & Hinitz, B. F. (2011).*History of early childhood education*. New York: Routledge Taylor & Francis Group.

Learning and Teaching Scotland (2003). Early Learning, Forward Thinking: The Policy Framework for ICT in Early Years. Learning and Teaching Scotland, Dundee.

Leedy, P. D. & Ormrod, J. E. (2005).*Practical research: planning and design* (8th Ed.). New Jersey: Pearson Education, Inc.

Leont'ev, A. N. (1978). *Activity, consciousness and personality*. Englewood Cliffs, NJ: Prentice Hall.

Leont'ev, A. N. (1981). *Problems of the development of the mind*. Moscow, Soviet Union: Progress.

Lincoln, Y. S. & Guba, E. G. (1985).*Naturalistic inquiry.* Beverly Hills, CA: Sage Publications.

Lufungulo, E. S. (2015). Primary school teachers' attitudes towards ICT integration in Social studies: A study of Lusaka and Katete Districts. *A Dissertation submitted in Partial Fulfillment of the Requirements for the Degree of Master of Education in Social Studies,* University of Zambia, Zambia.

Mack, N., Woodsong C., MacQueen, Guest, G., & Namey E. (2005). Qualitative research methods: A data collector's field guide. *Family Health International*, Research Triangle Park, North Carolina 27709 USA

Manyara, J. M., Amunga, H., & Ondigi, S. R. (2015). Effective educational technology integration through capacity building: Inexorable modernization of the Kenyan education system. In Bwire, A. M., Nyagisere, M. S., Masingila, J. O., & Ayot, H. O. (2015) *Proceedings of the 4th International Conference on Education*, 133 – 141. Nairobi, Kenya: Kenyatta University.

Marklund, L. (2015). Preschool teachers' informal online professional development in relation to educational use of tablets in Swedish preschools.*Professional Development in Education, 41*(2), 236-253.

Masoumi, D. (2015). Preschool teachers' use of ICT: Towards a typology of practice. *Contemporary Issues in Early Childhood 16* (1). 5 – 17.

Mayer, D., & Nolan, A. (2008). Literature review & recommendations: effective professional learning models for supporting early career early childhood teachers, Warrawong Advisory Committee of the Foundation of Graduates in Early Childhood Studies, Melbourne, Australia.

Mbugua, T. J. (2004). Early childhood care and education in Kenya.*Childhood Education, 80*(4), 191-197, DOI: 10.1080/00094056.2004.10522230

Mertens, D. M. (2010).*Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods* (3rd ed.). Thousand Oaks, CA: Sage.

Meyers, E. M. (2007). From activity to learning: using cultural historical activity theory to model school library programmes and practices. *Information Research, 12*(3).

Ministry of Education Strategic Plan 2006-2011. Nairobi, Teachers Service Commission.

Mudasiru, O. Y. & Modupe, R. B. (2011).Student-teachers' competence and attitude towards information and communication technology. A case study in a Nigerian university. *Contemporary Educational Technology, 2*(1), 18-36.

Mukuna, T. E. & Mutsotso, S. N. (2011).Gender inequalities in early childhood development education teaching profession in Kenya.*Educational Research, 2*(13), 1876-1885.

Murithi, N. & Indoshi, F. C. (2011). Attitude of teachers and students towards use of computers in teaching of computer studies curriculum in secondary schools. *International Journal of Current Research 3*(11), 191-195.

Murungu, J. W. (2015). Devolving early childhood development Education in Kenya: policy challenges and opportunities. *International Journal Education and Research 3*(2), 611-618.

Muthomi, M. W., Mbugua, Z. K., & Githua, B. N. (2012).Teachers' disposition towards use of scientific calculators in mathematics instruction in Meru County in Kenya. *International Journal of Applied Science and Technology, 2*(2), 89-92.

Mwololo, J. N. (2009). Preschool teachers‟ knowledge and attitude towards use of visual media in instruction in Kibwezi District, Kenya.*Masters of Education Thesis*, Kenyatta University, Kenya.

Mwololo, J. N., Koech, B. G. & Begi, N. (2011).Preschool teachers' knowledge and attitude towards use of visual media in instructional delivery in Kibwezi District, Kenya. *Journal of Research in Education and Society, 2*(1), 97-105.

National Association for the Education of Young Children (NAEYC) &the Fred Rogers Center (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8.* A Joint Position Statement of the National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College.

Ndibalema, P. (2014). Teachers' attitudes towards use of information communication technology (ICT) as a Pedagogical Tool in Secondary schools in Tanzania: The case of Kondoa District. *International Journal of Education and Research, 2*(2), 1-16.

Ndiritu, A. W., Mburu, D., & Kimani, G. (2013). "ICT integration in early childhood development teacher training curriculum: need to start from the beginning". In: 3rd KIE Education symposium. Kenya Institute of Education

Newman, L. & Ashton, J. (2009). Socio-cultural learning approaches: exploring early childhood communities of practice. *Journal of Australian Research in Early Childhood Education, 16*(1), 87-101.

Newman, L. & Mowbray, S. (2012). "We were expected to be equal": teachers and academics sharing professional learning through practitioner inquiry. *Teachers and Teaching: Theory and Practice, 18*(4), 455-468.

New Zealand Ministry of Education (2005). Foundations for Discovery Supporting Learning in Early Childhood Education through Information and Communication Technologies: A Framework for Development. Te Tahuhu o te Matauranga, Wellington.

Nganga, L. W. (2009). Early childhood education programs in Kenya: challenges and solutions. *Early Years 29*(3), 227-236, DOI: 10.1080/09575140902984400

Ng'asike, J. T. (2014). African early childhood development curriculum and pedagogy for Turkana nomadic pastoralist communities of Kenya.In R. Serpell & K. Marfo (Eds.), *child development in Africa: views from inside.New directions for child and adolescent development, 146,* 43-60.

Ngololo, E. N., Howie, S. J., & Plomp, T. (2012). An evaluation of the implementation of the national ICT policy for Education in Namibian rural science classrooms. *African Journal of Research in Mathematics, Science and Technology Education 16*(1), 4-17.

Nikolopoulou, K., & Gialamas, V. (2015). ICT and play in preschool: early childhood teachers' beliefs and confidence. *International Journal of Early Years Education 23*(4), 409-425, DOI: 10.1080/09669760.2015.1078727 Retrieved on 7/5/2016

Nikolopoulou, K., & Gialamas, V. (2009).Investigating pre-service early childhood teachers' views and intentions about integrating and using computers in early childhood settings: compilation of an instrument. *Technology, Pedagogy and Education, 18*(2), 201-219.

Nutbrown, C. & Clough, P. (2014).*Early childhood education: history, philosophy and experience* (2nd Ed.). London: SAGE

Odera, F. Y. (2011). Emerging issues in the implementation of computer technology into Kenyan secondary school classrooms. *International Journal of Science and Technology 1*(6), 260-268.

Oduor, A. (2013). State to use KSh. 50 Billion for Standard One Laptops. Kenya Nation Newspaper Commentary, Wednesday, 22nd May 2013.

Ogott, G. O. & Odera, F. Y. (2014).Use of technological resources in the acquisition of language skills in early childhood development and education programmes in Gem Sub-County, Kenya. *International Journal of Academic Research in Progressive Education and Development, 3*(4), 1-13.

Ojanen, E., Jere-Folotiya, J., Yalukanda, Y., Sampa, F., Nshimbi, Katongo, M., Choopa, M., & Lyytinen, H. (2015). Mobile Solution for Better reading instruction in rural Africa. In Cunningham, P., Cunningham, M. (Eds).*IST-Africa 2015 Conference Proceedings,* 1-13. IIMC International Information Management Corporation 2015

Ojanen, E., Kujala, J., Richardson, U., & Lyytinen, H. (2013). Technology-enhanced literacy learning in Zambia: Observations from a multilingual literacy environment. *Insights on Learning Disabilities: From Prevailing Theories to Validated Practices, 10* (2), 103-127.

Olatoye, R. (2011). Levels of participation in ICT training programmes, computer anxiety and ICT utilization among selected professionals. *International Journal of Education & Development using Information & Communication Technology, 7* (2), 15-26.

Oldridge, L. A. (2010). Digital foundations: A study of perceptions and practices surrounding the use of ICT in ECE centres. *Doctor of Philosophy Thesis*, Massey University, New Zealand.

Omariba, A., Ayot, H. O. & Ondigi, S. R. (2015).Teachers' Preparedness in Integrating Information Communication Technologies in Public Primary Teacher Training Colleges in Kenya. *Proceedings of the ICE*, 333 – 343.

Omariba, A., Ondigi, S. R. & Ayot, H. O. (2015).Teachers' Preparedness in Integrating Information Communication Technologies in Public Primary Teacher Training Colleges in Kenya. *Proceedings of the ICE*, 333 – 343.

Omolewa, M. (2007). Traditional African modes of education: Their relevance in the modern world. International Review of Education 53, 593-612.

Ondigi, S. R. &Ayot, H. O. (2015). Recent Developments in e-Learning Pedagogy: Role of Kenyatta University in Teacher Education. *Proceedings of the ICE*, 377 - 390.

Ong'amo, B., Ondigi, S. & Maundu, J. (2015). Integration of ICT in the Teaching of Biology A Case of Selected Secondary Schools in Mumias Sub County, Kenya. *Proceedings of the 4th International Conference on Education*, 391–413. Nairobi, Kenya: Kenyatta University

Opati, O. D. (2013). The use of ICT in teaching and learning at Makerere University: The case of College of Education and External Studies. *Master of Philosophy Thesis*, Oslo University, Norway.

Organization for Economic Co-operation and Development (OECD) (2006). Starting Strong II: Early Childhood Education and Care (ECEC). OECD Publishing, Paris. ISBN 92-64-03545-1.

Osborne (2010). Data cleaning basics: Best practices in dealing with extreme scores. DOI: 10.1053/j.nainr.2009.12.009 Retrieved on: 02 June 2016 from https://www.researchgate.net/publication/244872484 data cleaning basics best practices in dealing with extreme scores

Osodo, J., Indoshi, F. C., & Ongati O. (2010).Attitudes of students and teachers towards use of computer technology in Geography education. *Educational Research* 1(5), 145-149.

Parette, H. P., Quesenberry, A. C., & Blum, C. (2010).Missing the boat with technology usage in early childhood settings: A 21st Century view of developmentally appropriate practice.*Early Childhood Education Journal, 37*, 335-343.

Patel, C. J., Gali, V. S., Patel, D. V., & Parmar, R. D. (2011). The effects of information and communication technologies (ICTs) on higher education: From objectivism to social constructivism. *International Journal of Vocational and Technical Education, 3*(5), 113-120.

Patton, M. (1990).*Qualitative evaluation and research methods*, 169-186. Beverly Hills, CA: Sage.

Pence, A. & Nsamenang, B. (2008).A case for early childhood development in sub-Saharan Africa.Working Paper No. 51. The Hague, The Netherlands: Bernard van Leer Foundation.

Piper, A. M., D'Angelo, S., & Hollan, J. D. (2013). Going digital: understanding paper and photo documentation practices in early childhood education. *Computer Supported Young People.*

Piper, B., Jepkemei, E., Kwayumba, D., & Kibukho, K. (2015). Kenya's ICT policy in practice: the effectiveness of tablets and E-readers in improving student outcomes. *FIRE: Forum for International Research in Education 2*(1), 3-18.

Plumb, M. & Kautz, K. (2015). Barriers to the integration of information technology within early childhood education and care organizations: A review of the literature. Australasian Conference on Information Systems 30 November – 4 December 2015, Adelaide, Australia

Plumb, M. & Kautz, K. (2015). Innovation determinants and barriers: A tri-perspective analysis of IT appropriation within an early childhood education and care organization. *Australasian Journal of Information Systems, 19,* 1 – 22.

Postholm, M. B. (2008). Cultural historical activity theory and Dewey's idea-based social constructivism: Consequences for Educational Research. *Critical Social Studies,*1, 37-48.

Prestridge, S. (2009).Teachers' talk in professional development activity that supports change in their ICT pedagogical beliefs and practices. *Teacher Development, 13*(1), 43-55.

Puhakka, C. S. A. (2015). Digital Solutions for Multilingual Learning Environments: The Case of GraphoGame[TM] Adaptations in Kenya. *Doctor of Philosophy Dissertation,* University of Jyvaskyla, Finland.

Puhakka, C., Lyytinen, H., & Richardson, U. (2015). Technology enhanced literacy learning in multilingual Sub-Saharan Africa: The case of GraphoGame Kikuyu and Kiswahili adaptations in Kenya. In P. Kommers, P. Isaias, & T. Issa (Eds.), Perspectives on Social Media: A Yearbook (pp. 183-190). New York: Routledge.

Republic of Kenya (1977).Kenya Science and Technology Act.

Republic of Kenya (1988).Kenya Broadcasting Corporation Act.

Republic of Kenya (1998). Kenya Communications Act.

Republic of Kenya (1999). Totally Integrated Quality Education and Training (TIQET): Report of the Commission of Inquiry into the Education System of Kenya, Under the Chairmanship of Dr. Davy K. Koech. Presented to His Excellency, Hon. Daniel T. Arap Moi, *CGH, MP*, President and Commander-in-Chief of the Armed Forces of the Republic of Kenya

Republic of Kenya (2005). Sessional Paper No.1 of 2005: A Policy Framework for Education and Training and Research. Nairobi: The Government Printer, 2005.

Republic of Kenya (2006a). National early childhood development policy framework. Nairobi: The Government Printer, 2006.

Republic of Kenya (2006b). Early childhood development service standard guidelines for Kenya. Nairobi: The Government Printer, 2006.

Republic of Kenya (2006c).Teacher certificate in early childhood development and education syllabus. Nairobi: Kenya Institute of Education, 2006.

Republic of Kenya (2006d).Diploma in early childhood development and education syllabus. Nairobi: Kenya Institute of Education, 2006.

Republic of Kenya (2006e).National information & communications technology (ICT) policy. Ministry of Information and Communications (2006).

Republic of Kenya (2007).*Kenya Vision 20130: The popular version*. Nairobi: Government of the Republic of Kenya, 2007. Retrieved on 26/5/2016 http://www.konzacity.go.ke/wp-content/uploads/2014/12/Popular_Version.pdf

Republic of Kenya (2008a).Early Childhood Development and Education Syllabus. Ministry of Education: Kenya Institute of Education, 2008.

Republic of Kenya (2008b).Handbook for Early Childhood Development Education Syllabus. Ministry of Education: Kenya Institute of Education, 2008.

Republic of Kenya (2009). Final draft: The national special needs education policy framework. Nairobi: Ministry of Education.

Republic of Kenya (2010). The Constitution of Kenya, 2010 (Revised Ed.): Laws of Kenya. Published by the National Council for Law Reporting with the Authority of the Attorney General, 2010.

Republic of Kenya (2012a).Sessional Paper No.14 of 2012. A Policy Framework for Education and Training: Reforming Education and Training in Kenya. Nairobi: The Government Printer, 2012.

Republic of Kenya (2012b).The Kenya Institute of Curriculum Development Act, 2012. Kenya Gazette Supplement No. 145 (Act No. 64). Nairobi: The Government Printer, National Council for Law Reporting Library.

Republic of Kenya (2012c). The Kenya National Examination Council Act, 2012. Kenya Gazette Supplement No. 146 (Acts No. 29). Nairobi: Government Printer, National Council for Law Reporting Library.

Republic of Kenya (2012d). The Teachers' Service Commission Act No. 20 of 2012. Kenya Gazette Supplement No. 101 (Act No. 20). Nairobi: The Government Printer, National Council for Law Reporting Library.

Republic of Kenya (2013a). Laws of Kenya: Basic Education ACT, No. 14 of 2013. Nairobi: Government Printer.

Republic of Kenya (2013b). Millennium development goals: status report for Kenya. Ministry of Devolution and Planning. Nairobi: Government Printer.

Republic of Kenya (2014a). Kenya Education for All: The 2015 National Review. Ministry of Education, Science and Technology. Nairobi: Government Printer.

Republic of Kenya (2014b). Economic survey 2014: Keeping you informed. Nairobi: Kenya National Bureau of Statistics (KNBS) ISBN: 9966-767-47-9.

Republic of Kenya (2015).Reforms in the Education Sector in Kenya.*Public Lecture* Delivered by Prof. Jacob T. Kaimenyi, PhD, FICD, EBS. Cabinet Secretary, Ministry of Education, Science and Technology, Kenya. On 24th February 2015, 9.00 am at Kenyatta University Amphi Theatre.

Richardson, U. & Lyytinen, H. (2014). The GraphoGame Method: The Theoretical and Methodological Background of the Technology-Enhanced Learning Environment for Learning to Read. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments, 10*(1), 39-60.

Ringstaff, C., Yocam, K., & Marsh, J. (1997).Integrating technology into classroom instruction: An assessment of the impact of the ACOT teacher development center project. ACOT report #22. Cupertino, CA: Apple Computer, Inc. Retrieved May 15, 2016 from http://www.apple.com/euro/pdfs/acotlibrary/rpt22.pdf

Rocco, T. S., Bliss, L.A., Gallagher, S., & Perez-Prado, A. (2003). Taking the next step: Mixed methods research in organizational systems. *Information Technology, Learning and Performance Journal, 21(*1), 19-29.

Rogers, E. M. (2003). *Diffusions of Innovations.*(3rd Ed.). New York: The Free Press, *a Division of Macmillan Publishing Co, Inc.*

Rowlands, B. (2005). Grounded in practice: using interpretative research to build theory. *The Electronic Journal of Business Research Methodology, 3*(1) 81-92.

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1) 16-27.

Rural Electrification Authority (2015).The project for establishment of rural electrification model using renewable energy in the Republic of Kenya.*Project Completion Report Volume 1 Main Report*. Japan International Corporation Agency (JICA).

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997).*Teaching with Technology: Creating Student-Centered Classrooms*. New York: Teachers College Press.

Santer, J., Griffiths, C., & Goodall, D. (2007). Free play in early childhood: A literature review. *Play England: Making space for play*. London: National Children's Bureau. ISBN 13: 978-1-905818-10-5.

Seidman, I. (2013). *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences* (3rd Ed.). New York: Teachers College Press.

Serpell, R. (2014). Promotion of Literacy in Sub-Saharan Africa: Goals and Prospects of CAPOLSA at the University of Zambia. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments 10*(1), 22-38.

Sitati, E. M., Bota, K., & Ndirangu, M. (2014).The role of stakeholders in professional development of ECE teachers in Kakamega County, Kenya.*Journal of Education and Practice 14*(30), 6 – 16.

Sivropoulou, I., Tsapakidou, A., & Kiridis, A. (2009). The opinions of the Kindergarten teachers in relation to the introduction of computers to nursery schools: Preliminary approach. *Acta Didactica Napocensia 2*(1), 69-80.

Somekh, B. (2007). *Pedagogy and learning with ICT: Researching the art of innovation.* New York: Routledge Taylor & Francis Group Publishers.

Sulungai, Toili & Amadalo (2011). Teachers related factors influencing the integration of information technology in the teaching of mathematics in secondary schools in Kenya. *Africa Journal of Education and Technology, 2*(1), 1-14.

Swadener, B. B., Kabiru, M., & Njenga, A. (2000).*Does the village still raise the child? A collaborative study of changing child-rearing and early education in* Kenya. Albany: State University of New York Press.

Teddlie, C., & Yu, F. (2007).Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research,* 1, 77-100.

Terrell, S. R. (2012). Mixed-methods research methodologies. *The Qualitative Report 17*(1), 254-280.

Teye, J. K. (2012). Benefits, challenges, and dynamism of positionalities associated with mixed methods research in developing countries: Evidence from Ghana. *Journal of Mixed Methods Research, 6*(4) 379-391.

Theiler, J. M. (2012). A shared story of successful Spanish learning: An embedded multiple case study. *Open Access Theses and Dissertations from the College*

United Nations Children's Fund (UNICEF) (2011). Evaluation Report: Evaluation of UNICEF's Early Childhood Development (ECD) programme with focus on government of Netherlands Funding (2008-2010). *Global Synthesis Report*. United Nations Children's Fund, New York.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2005). Policy review report: Early childhood care and education in Kenya. *Approved by the Ministry of Education, Science and Technology, Government of Kenya*. Paris: UNESCO/OECD Early Childhood Policy Review Project.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2005). Regional guidelines on teacher development for pedagogy-technology integration (working draft).*UNESCO Implemented Project on Training and Professional Development of Teachers/Facilitators in Effective Use of ICTs for Improved Teaching and Learning*. Bangkok: Asia and Pacific Regional Bureau for Education.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2006). Romania Early Childhood Care and Education (ECCE) programmes: *Country profile prepared for the Education for All Global Monitoring Report 2007 Strong Foundations: Early Childhood Care and Education*. Compiled by: UNESCO International Bureau of Education (IBE) Geneva, (Switzerland).

Waigera, J. & Begi, Nyakwara (2015). Determinants of preschool teachers' use of culturally relevant materials in instruction: A case of Kieni West sub-county. Paper presented during 4th International Conference on Education held at Kenyatta University, 14th – 16th July 2015. Nairobi; Kenya

Walters, K. (2006). Capture the moment: using digital photography in early childhood settings. Research in practice series. Australia: Early Childhood Australia Inc.

Wamalwa, E. J., Rukangu, S. & Bwire, A. M. (2015). Instructional Media Use in Enhancing Students' Learning of the English Language in Bungoma District's Secondary Schools in Bungoma County, Kenya. *Proceedings of the ICE,* 96 – 104.

Wells, G. (2002). Dialogue in activity theory. *Mind, Culture, and Activity* *9(*1), 43–66.

Wien, C. A; Guyevskey, V. & Berdoussis (2011).Learning to Document in Reggio-inspired Education. *Early Childhood Research and Practice* (*ECRP), 13*(2), 1-14.

Wilson, V. (2014).Examining teacher education through cultural historical activity theory.*Tean Journal 6*(1), 20-29.

World Bank (2015). World Bank support to Early Childhood Development (ECD): An independent evaluation. *Independent Evaluation Group (IEG), World Bank Group*. International Bank for Reconstruction and Development/the World Bank: Washington DC.

World Population Review (2017). Kenya Population 2017. http://worldpopulationreview.com/countries/kenya-population/

Wilson, K. B., Tete-Mensah, I., & Boatenge, K. A. (2014). Information and communication technology use in higher education: perspectives from students. *European Scientific Journal 10*(19), 161-171.

Yin, R. K. (2009).*Case study research: Design and methods* (4th Ed.). Applied Social Research Methods Series Vol. 5. New Delhi: Sage Publications, Inc.

Yu, G. S. (2012). Professional development through the study of children's interests: The use of collaborative inquiry and documentation protocol among early childhood teachers. *Doctor of Philosophy Dissertation*, University of Illinois, Urban-Champaign, Illinois.

APPENDICES

LIST OF APPENDICES

APPENDIX A Interview Guide Questions for ECDE Teachers in Kenya

Macquarie University Ethics No. 5201001521

1. How do you usually plan and document your teaching and children's learning?
2. What is your understanding of the term digital technology?
3. Can you briefly describe your professional training in technology?
4. What are your views about using technology in ECDE curriculum?
5. Do you access and use digital resources?
6. What are some of the digital resources that you usually access?
7. Can you tell me about how you integrate digital resources in your daily practice?
8. What are your concerns about integrating technology in your work as an ECDE teacher?
9. Is there anything else you would like to share?

APPENDIX B Macquarie University Ethics Committee Approval Phase One Data Collection

MACQUARIE UNIVERSITY

19/05/2011

HS Final Approval - Gladys (Ref: 5201001521)

Ethics Secretariat ethics.secretariat@mq.edu.au

Re: "Enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology: The case of Kenya"

Thank you for your recent correspondence. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and you may now commence your research.

The following personnel are authorised to conduct this research:

Dr Marina Papic: Chief Investigator
Mrs Gladys Milimu: Co-Investigator

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports. Your first progress report is due on 1 May 2012.

If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements

are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

http://www.mq.edu.au/policy

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of Final Approval to an external organisation as evidence that you have Final Approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely,

Dr Katey De Gioia
Acting Chair
Faculty of Human Sciences Ethics Review Sub-Committee
Human Research Ethics Committee

****
Office of the Deputy Vice Chancellor (Research)

Ethics Secretariat
Research Office
Level 3, Research HUB, Building C5C
Macquarie University
NSW 2109

Ph: +61 2 9850 6848
Fax: +61 2 9850 4465

Email:
For Enquiries: ethics.secretariat@mq.edu.au

http://www.research.mq.edu.au/

APPENDIX C Ministry of Higher Education Kenya Research Permit Phase One Data Collection

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
Telephone: 254-020-241349, 2213102
254-020-310571, 2213123.
Fax: 254-020-2213215, 318245, 318249
When replying please quote

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RRI/12/1/SS-011/30/4**

Date: **20th June, 2011**

Gladys Milimu Shaji
Macquarie University
Sydney
AUSTRALIA

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on **"Enhancing the pedagogical beliefs and practices of Early Childhood Teachers for the appropriate integration of technology: The case of Kenya"** I am pleased to inform you that you have been authorized to undertake research **in Makadara District** for a period ending ***31st December, 2011.***

You are advised to report to **the District Commissioner & the District Education Officer, Makadara District** before embarking on the research project.

On completion of the research, you are expected to submit **one hard copy and one soft copy** of the research report/thesis to our office.

P. N. NYAKUNDI
FOR: SECRETARY/CEO

Copy to:

The District Commissioner
Makadara District

The District Education Officer
Makadara District

APPENDIX D Information and Consent Form – Case Study Teachers

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Institute of Early Childhood
Faculty of Human Sciences
MACQUARIE UNIVERSITY NSW 2109
Phone: +61 (02) 9850 9867
Fax: +61 (02) 9850 9890

Email: iec@ mq.edu.au

<u>Name of Project</u>: Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: the Case of Kenya (Macquarie University Ethics No. 5201001521)

Dear Teacher,

My name is Gladys Milimu and I am a PhD student at Macquarie University in Australia. You are invited to participate in a study on enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology. The purpose of the study is to establish professional learning strategies and support for the integration of technology in planning and pedagogical documentation. The study is being conducted under the supervision of Dr Marina Papic, Institute of Early Childhood, Faculty of Human Sciences Macquarie University, Australia. Her contact telephone number is +61-2-98509867 and her email address is marina.papic@mq.edu.au

If you decide to participate, I will observe you in your class for 1 day from 9.00 am to 12.00 noon in the week beginning 11th July 2011. The main purpose of this exercise will be to obtain information on the integration of technology at your centre. During the same week, you will be invited to participate in an individual interview with me to discuss your current practices on the use of technology in planning and pedagogical documentation. The interview will take place in your centre during your afternoon planning time and will be 30-45 minutes in duration.

Based on the observations and interview, I will provide you with a report outlining your current practices in using technology and suggested areas to be addressed in the professional learning activities. In the four weeks of September 2011, I will provide you with professional support to enhance further the integration of technology in your planning and documentation of teaching and learning activities.

The project will conclude with a focus group (approximately 1.5 hours duration) with all teachers at your centre to discuss your experience with the professional development provided. Both the interviews and the focus group will be recorded and transcribed. The recordings will be accessed by the researcher and supervisors only.

To gain a greater insight into your planning, I will also need to collect copies of your documentation to highlight your use of technology. Additionally, I will take some digital recordings of some activities in the course of this study. The recordings will be accessed by the researcher and supervisors only. I will not be working directly with the children or collecting data on them. However, permission is being sort from parents to access information about their children included in planning documents and as observation notes. Overall, there are no anticipated risks to you, your ECDE centre or the children.

It is to be noted that any information or personal evidence collected in the course of this research are confidential. Access to data will be confined to persons involved in the research and no information concerning your identity will be released without your explicit consent. The results of the research, digital recordings and excerpts of transcripts will be published in academic journals and conference proceedings and used for teaching purposes. No children's or staff names will be used in the publications and presentations. At the conclusion of the study, a summary of the findings of the research will be sent to you.

If you decide to participate, you are free to withdraw from further participation in the research at any time without having to give a reason and without consequence. To confirm your permission please sign both forms and return one in supplied reply paid envelope. Following this, permission letters will be supplied to the centre to be distributed to the parents.

Thanking you for your cooperation

Yours sincerely,

Gladys Milimu

Consent Form

Name of Project: Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: The Case of Kenya (Macquarie University Ethics No. 5201001521)

I, ---
---have read (or, where appropriate have had read to me) and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Name: ____

(Block letters)

Participant's Signature: _________________ Date:___________________

Investigator's Name: GLADYS MILIMU

Contact telephone number: +61-2- 98509867

Email address: _gladys.milimu@students.mq.edu.au

Investigator's Signature: ____________________Date:________________

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome. You may also contact the early childhood education programme officer for the district of study, Mrs Rachael C. Ng'eno should you wish to confirm my identity or express any concerns. Her contact address is: P.O Box 30298-00200, Nairobi; Mobile No. +254722240764 and email address: rcngeno@yahoo.com

(INVESTIGATOR'S [OR PARTICIPANT'S] COPY)

APPENDIX E Information and Consent Form – Children

MACQUARIE UNIVERSITY

Institute of Early Childhood
Faculty of Human Sciences
MACQUARIE UNIVERSITY NSW 2109
Phone: +61 (02) 9850 9867
Fax: +61 (02) 9850 9890

Email: iec@ mq.edu.au

Parents/Guardians ____

<u>Name of Project</u>: Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology. The Case of Kenya (Macquarie University Ethics No. 5201001521)

Dear Parent/Caregiver,

I am seeking your permission for your child to participate in a research project that provides professional learning for early childhood teachers in the area of technology. The aim of the project is to enhance the practices of early childhood teachers in integration of technology in their planning and documentation of teaching and learning practices. The research will focus on teachers but will indirectly involve your child during the teacher's teaching practices.

The study is being conducted by Mrs Gladys Milimu, a PhD student at the Institute of Early Childhood Macquarie University, Sydney in Australia under the supervision of Dr Marina Papic. Her contact details are +61-2-98509867, marina.papic@mq.edu.au. The research will involve the observation of your child's teacher in their daily classroom practice. The teacher will also be interviewed- out of school hours and the researcher will collect data on the integration of technology in current practice. The teachers will participate in a technology-based professional learning program over a period of 4 weeks.

The research requires that I photograph, video and audiotape the teacher engaged in technology-based professional experience, and this footage may capture your child along with other children. The whole process will take place from 04-07-2011 to 30-11-2011. However, the digital recordings will take place from 05-09-2011 to 30-09-2011 and mostly during morning hours on alternative days. Your child's consent will be obtained before proceeding with any footage. Your child will not be put under pressure during the study and may withdraw at any time without having to give reason and without consequence. Every effort will be made to ensure that the child's routine is not disrupted unnecessarily.

The information collected will be confidential to the researcher, however, results of the research will be published in academic journals and conference proceedings, presented at conferences and will play an informing role in the design and implementation of technology based training curriculum for ECDE teachers in Kenya. Any reference to your child will remain anonymous. At the conclusion of the study, a summary of the findings of the research and the professional learning program will be sent to the Head teacher of your centre and you will have the opportunity to view this material. If you have any queries about the study, please do not hesitate to contact me on mobile No. +254 -2- 724865284. To confirm your permission please sign both forms and return one to the Head teacher of your centre.

Yours Sincerely

Mrs Gladys Milimu

Consent Form

<u>Name of Project</u>: Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology. The Case of Kenya (Macquarie University Ethics No. 5201001521)

I, -- have read (or, where appropriate have had read to me) and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

<u>I understand that:</u>

1. My child may be photographed and videotaped by the researcher while engaged in technology based learning activities along with his/her teacher and other children.
2. My child's work may be collected and retained by the researcher. Photographs, video footage and my child's work samples may be used in the design of a Professional Learning Program for early childhood teachers.
3. This program will be used initially by a number of Kenya ECDE centres and may be used more widely in the future by international child care centres with similar context as Kenya.
4. Results of the study including photographs, video footage and work samples will be published in academic journals and conference proceedings, presented at conferences and used for teaching purposes.

Participant's Name: ____

(Block letters)

Participant's Signature: ____________________Date ________________

Investigator's Name: GLADYS MILIMU

Investigator's Signature: _____________________ Date ______________

For permission to publish digital recordings (photographs and video recordings) of your child taken during

the research please initial **one** of the following:

☐ I give permission for digital recordings of my child to be published as part of this research and as part of the professional development program.

☐ I give permission for digital recordings of my child to be published as part of this research and as part of the professional development program **ONLY** if personal identifiable features are screened in the editing process

☐ I do not give permission for digital recordings of my child to be published as part of this research and as part of the professional development program.

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome. You may also contact the early childhood education programme officer for The district of study, Mrs Rachael C. Ng'eno should you wish to confirm my identity or express any concerns. Her contact address is: P.O Box 30298-00200, Nairobi; Mobile No. +254722240764 and email address: rcngeno@yahoo.com

(INVESTIGATOR'S [OR PARTICIPANT'S] COPY)

APPENDIX F Nairobi City Council Letter of Authorization Phase One Data Collection

CITY COUNCIL OF NAIROBI

TELEGRAM "SCHOOLING"
TELEPHONE: 221166/224281
EXT: 2426 /2590

CITY HALL ANNEXE
P. O. BOX 30298 GPO
NAIROBI

CITY EDUCATION DEPARTMENT

GL/NC/141 VOL IV/70

14th March, 2011

Headteachers,
Buru Buru Zone –Makadara District,
Nairobi

RE: RESEARCH AUTHORIZATION

This is to certify that ***Gladys Milimu Shaji*** of Macquaire University Sydney, Australia, has been granted authority to collect data in your school for her PhD degree.

The research title is on "***Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: A case of Kenya***".

You are therefore requested to accord her necessary assistance in this exercise and ensure that the school learning programme is not interrupted.

Upon completion of this study, the researcher is requested to submit a copy of the findings report to this office.

JECINTA A. CHARLES
Ag. CHIEF ADVISOR TO SCHOOLS
FOR : DIRECTOR CITY EDUCATION TO SCHOOLS

Cc – **Education officer- Makadara District**

APPENDIX G Survey for Early Childhood Teachers in Kenya Phase Two Data Collection

Project: **Enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology: The case of Kenya**

(Macquarie University Ethics No. 5201001521)

In this survey, **'technology'** refers to computers, digital cameras, digital video recorders, mobile telephones, document scanners, printers and photocopiers.

Please select and tick one answer for each question as appropriate.

Part A: **Background Information**

1. What is your gender?
   - o Male
   - o Female
2. Please indicate your age range.
   - o 20-30 years
   - o 31-40 years
   - o 41-50 years
   - o 51-60 years
   - o 61+ years
3. What is the highest education you have completed?
   - o Primary Education
   - o Secondary Education
   - o University Education
   - o Other (please specify) ________________________________
4. What is your professional background?
   - o Untrained ECDE teacher
   - o Teacher trainee in ECDE
   - o Certificate in ECDE
   - o Diploma in ECDE
   - o Degree in ECDE
   - o Any other (please specify) ______________________________

Please proceed to question 6 if you indicated you are "untrained ECDE teacher".

5. Where will or did you complete your training as an ECDE teacher?
    - Government ECDE College
    - Private ECDE College
    - Public University
    - Private University
    - Any other (please specify)

      ____
6. How many years have you been teaching in ECDE?
    - Less than 5 years
    - 6-10 years
    - 11-15 years
    - 16-20 years
    - Over 20 years

7. What type of ECDE centre do you currently work in?
    - Public
    - Private
8. Indicate your ECDE class.
    - Baby class (1-2 years)
    - Nursery class (3-4 years)
    - Pre-unit class (5-6 years)
9. What is your responsibility at your current ECDE centre?
    - Head of ECDE section
    - Class teacher
    - Assistant class teacher
    - Any other (please specify)

      ____

Part B**: Professional Training in Technology**

1. Do you have any formal qualification(s) in ICT?

   Yes

   No
2. If yes, what qualifications do you hold?

   ____

   ____

   ____
3. How many course units aimed at enhancing your **basic skills and knowledge in integration of technology in ECDE curriculum** did you complete during your college/university years?
    - None
    - 1
    - 2
    - 3
    - More than 3

4. How many ECDE course units focusing on integration of technology **in planning and documentation** did you take during your college/university years?
    - o None
    - o 1
    - o 2
    - o 3
    - o More than 3

Please proceed to <u>Question</u> 8 if you responded with "none" to Question 4.

5. Indicate three specific content areas covered on integration of technology in planning and documentation during your college/university years?

    a) ______________________________
    b) ______________________________
    c) ______________________________

6. Please list up to five digital technology resources you have accessed, used and integrated in planning and documentation when training as an ECDE teacher.
    a) ______________________________
    b) ______________________________
    c) ______________________________
    d) ______________________________
    e) ______________________________
7. How would you rate the impact of technology related ECDE course units on your skills and knowledge in integration of technology in planning and documentation?
    - o 1 Not effective
    - o 2 Slightly effective
    - o 3 Effective
    - o 4 Very effective

8. How much of in-service training in integration of technology in your daily professional activities have you had during last school year (2011)?
    - o None
    - o 1 Day
    - o 2-3 Days
    - o 4-5 Days
    - o More than 5 days
    - o Other (please specify)

    ____

Please proceed to <u>Part</u> C if you responded with "none".

9. On a scale of 1-5, please mark how effective your in-service training was in improving your basic skills in technology.
    - o 1 Not very effective
    - o 2 Not effective
    - o 3 Not sure
    - o 4 Somewhat effective

- 5 Very effective

10. If you were to be given an opportunity to participate in a technology-related professional learning program, what is your preference in regard to the following modes of learning? Rank the 5 strategies listed below from 1-5 where **1** is your least preferred and **5**is your most preferred.

Strategies	**Ranking (1-5)**
Explore on my own	
Work with colleagues and/or friends as needs arise	
Attend a one day workshops off-site	
Attend professional conferences	
Participate in professional learning activities at the ECDE centre	

11. On a scale of 1-5, please mark how effective last year's in-service training was in helping you integrate technology in planning and documentation.
    - 1 Not very effective
    - 2 Not effective
    - 3 Not sure
    - 4 Somewhat effective
    - 5 Very effective

Part C: **Access and Integration of Technology in Planning and Documentation**

1. What is your understanding of the following two terms?
   a) Digital technology

   ____

   ____

   b) Documentation

   ____

   ____

2. Please tick up to five technology resources that you frequently access and use at home and at your ECDE centre.

Home	**ECDE Centre**
Computers	Computers
Digital cameras	Digital cameras
Digital video recorders	Digital video recorders
Mobile telephones	Mobile telephones
Document scanners	Document scanners
Printers	Printers
Photocopiers	Photocopiers

3. Please describe how you use the home technology resources you ticked in question 2.
   a) ____
   b) ____
   c) ____
   d) ____
   e) ____

4. Please describe where the technology resources in your ECDE centre are located.

   ____

   ____

5. To what extent do you use technology **in planning of teaching and learning activities** at your ECDE centre?
   - o 1 Never
   - o 2 Sometimes
   - o 3Nearly always
   - o 4 Always
6. To what extent do you use technology **in documentation** of teaching and learning activities at your ECDE centre?
   - o 1 Never
   - o 2 Sometimes
   - o 3Nearly always
   - o 4 Always
7. To what extent do you involve children in planning technology-rich learning experiences in your centre?
   - o 1 Never
   - o 2 Sometimes
   - o 3 Nearly always
   - o 4 Always
8. How often do you use technology in sharing experiences on children's learning progress with parents?
   - o 1 Never
   - o 2 Sometimes
   - o 3 Nearly always
   - o 4 Always

9. Do you have policy/curriculum guidelines on the integration of technology in ECDE?
    - Yes
    - No

Rate the following statements based on your confidence on the integration of technology in planning and documentation.

10. **“**I feel confident about using technology in planning and documenting activities for children at my centre”.
    - 1 Strongly Disagree
    - 2 Disagree
    - 3 Neutral
    - 4 Agree
    - 5 Strongly Agree
11. **“**I feel confident about locating an ideal website that contains information related to ECDE”.
    - 1 Strongly Disagree
    - 2 Disagree
    - 3 Neutral
    - 4 Agree
    - 5 Strongly Agree
12. “I do **not** feel confident about emailing parents their children’s learning projects”.
    - 1 Strongly Disagree
    - 2 Disagree
    - 3 Neutral
    - 4 Agree
    - 5 Strongly Agree
13. “I do **not** feel confident about cropping and rotating photos on a photo story program”.
    - 1 Strongly Disagree
    - 2 Disagree
    - 3 Neutral
    - 4 Agree
    - 5 Strongly Agree

14. Are you provided with support in integrating technology at your centre by the following ECDE stakeholders?

Stakeholders	**YES**	**NO**	**If 'yes' describe <u>what type of support</u> is provided**
Ministry of Education			
District ECDE Officers			
Managers of ECDE centres			
Parents/community members			
Teachers at your centre			
Teachers in other ECDE centres			
Others:			

15. What are your views about the integration of technology in ECDE curriculum in Kenya?

____
____
____

16. What concerns, if any, do you have on the integration of technology in planning and documentation in ECDE centres in Kenya?

____
____

17. Is there anything else you would like to share about the use of technology in ECDE centres in Kenya?

____
____
____
____
____

THANK YOU for your time in completing this survey.

APPENDIX H Project Information and Consent – Survey Teachers

Institute of Early Childhood
Faculty of Human Sciences
Macquarie University NSW 2109
Australia

Name of Project: **Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: The Case of Kenya**

(Macquarie University Ethics No. 5201001521)

Dear Teacher,

My name is Gladys Milimu and I am a PhD student at Macquarie University in Australia. You are invited to participate in a study on enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology. The purpose of the study is to establish professional learning strategies and support that will enhance the beliefs and practices of teachers for appropriate integration of technology in planning and pedagogical documentation.

The study is being conducted under the supervision of Dr Marina Papic, Institute of Early Childhood, and Faculty of Human Sciences Macquarie University, Australia. Her contact telephone number is +61-2-98509867; Fax No. +61-2-98509890 and her email address is marina.papic@mq.edu.au

The questionnaire will take approximately 30 minutes to complete. The purpose of the survey is to obtain information on your access, use, beliefs and integration of technology in your planning and documentation of teaching and learning activities in your ECDE centre. The survey will also gather information on what Kenyan teachers perceive as the best approaches to professional learning on integrating technology in ECDE centres. The results of the survey will be published in academic journals and conference proceedings, presented at conferences, used for teaching purposes and will play an informing role in the design and implementation of technology based training for ECDE teachers in Kenya. No names of individuals and centres will be used in the publications and presentations arising from this research.

If you decide to participate, please complete the survey and return the survey by sealing it in the self-addressed envelope provided and posting it to me by end of September 2012.

The completion and returning of the questionnaire will be a confirmation of your participation in the project. If you have any queries about the project or the data collection procedures, please do not hesitate to contact Mrs Rachael C. Ng'eno, program officer, the district of study Centre for early childhood education. Her mobile No. is +254722240764.

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone +61- 02- 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

You may contact the early childhood education program officer for The district of study, Mrs Rachael C. Ng'eno should you wish to confirm my identity or express any concerns about your participation in this research. Her contact address is: P.O Box 30298-00200, Nairobi; Mobile No. +254722240764 and email address: rcngeno@yahoo.com.

You may also contact me for further information about this research. My personal contact address in Kenya is: P.O. Box 54192-00200, Nairobi; Mobile No. +254722780844 and email address: gladys.milimu@students.mq.edu.au

Thanking you for your cooperation

Yours sincerely

Gladys Milimu

APPENDIX I ECDE Stakeholders and Other Interested Parties in Kenya Interview Protocol Phase Three Data Collection

MACQUARIE UNIVERSITY

(Macquarie University Ethics No. 5201001521)

A) Interview Questions for the Director, Ministry of Basic Education

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What policy guidelines does the Ministry of Basic Education have on the integration of technology in ECDE programs?
3. Considering the current educational, social-economic and political contexts of Kenya, do you think the technology integrated ECDE policy should be adopted now or in the next 5 years?
4. If the policy is to be adopted, what issues do you think the government of Kenya needs to be concerned about when integrating technology in ECDE centres?

B) Interview Questions for the Director, Kenya Institute of Education (KIE)

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What curriculum policy does KIE have on the integration of technology in ECDE programs?

   If none, are there plans to develop technology integrated ECDE curricula?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the technology integrated ECDE curricula should be developed now or in the next 5 years?
4. If technology integrated ECDE curricula are developed, what issues do you think the government of Kenya needs to be concerned when integrating technology in ECDE centres?

C) Interview Questions for the Senior Assistant Director, National Centre for Early Childhood Education (NACECE)

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What curriculum resources has the NACECE prepared on the integration of technology in ECDE programs?
   If none, are there plans to prepare technology integrated ECDE curriculum resources?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the technology integrated ECDE curriculum resources should be prepared now or in the next 5 years?
4. If the technology integrated ECDE curriculum resources are prepared, what issues do you think the government of Kenya needs to be concerned about when integrating technology in ECDE centres?

D) Interview Questions for the Head of ECDE Department, Nairobi University

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What policy guidelines are there on the integration of technology in ECDE courses at your university?
   If none, are there plans to develop a policy on the integration of technology in ECDE courses?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the policy on the integration of technology in ECDE courses should be adopted now or in the next 5 years?
4. If the policy is adopted, what issues do you need to be concerned about when integrating technology in ECDE courses at your university?

E) Interview Questions for the Head of ECDE Department, Mount Kenya University

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?

2. What policy guidelines are there on the integration of technology in ECDE courses at your university?
   If none, are there plans to develop a policy on the integration of technology in ECDE courses?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the policy on the integration of technology in ECDE courses should be adopted now or in the next 5 years?
4. If the policy is adopted, what issues do you need to be concerned about when integrating technology in ECDE courses at your university?

F) Interview Questions for the Program Officer, Nairobi City Centre for Early Childhood Education (CICECE)

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What guidelines are there on the integration of technology in ECDE teachers' training program at CICECE?
   If none, are there plans to develop guidelines on the integration of technology in teachers' training program at your centre?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the guidelines on the integration of technology in your ECDE teachers' training program should be adopted now or in the next 5 years?
4. If the policy is adopted, what concerns do you need to address when integrating technology in ECDE teachers' training program at your centre?

G) Interview Questions for the Program Officer, Vihiga District Centre for Early Childhood Education (DICECE)

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What guidelines are there on the integration of technology in ECDE teachers' training program at your centre?
   If none, are there plans to develop guidelines on the integration of technology in teachers' training program at your centre?

3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the guidelines on the integration of technology in ECDE teachers' training program should be adopted now or in the next 5 years?
4. If the policy is adopted, what concerns do you need to address when integrating technology in ECDE teachers' training program at your centre?

H) Interview Questions for the Director, St. Michael ECDE Training College

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What guidelines are there on the integration of technology in your ECDE teachers' training college?
   If none, are there plans to develop guidelines on the integration of technology in your ECDE teachers' training college?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the guidelines on the integration of technology in your ECDE teachers' training college should be adopted now or in the next 5 years?
4. If the policy is adopted, what concerns do you need to address when integrating technology in your ECDE teachers' training college?

J) Interview Questions for the Director, Kenya International Montessori Program

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What guidelines are there on the integration of technology in your ECDE teachers' training college?
   If none, are there plans to develop guidelines on the integration of technology in your ECDE teachers' training college?
3. Considering the current educational, socio-economic and political contexts of Kenya, do you think the guidelines on the integration of technology in your ECDE teachers' training college should be adopted now or in the next 5 years?
4. If the policy is adopted, what concerns do you need to address when integrating technology in your ECDE teachers' training college?

L) Interview Questions for the Director, Kenya Institute of Special Education (KISE)

1. What are your views on the inclusion of technology in early childhood development and education (ECDE) policy, curriculum and practice?
2. What policy guidelines does KISE have on the integration of technology in ECDE special needs programs?
   If none, are there plans to develop policy guidelines on the integration of technology in ECDE special needs programs?
3. Considering the current educational, social-economic and political contexts of Kenya, do you think the policy guidelines on the integration of technology in ECDE special needs programs should be adopted now or in the next 5 years?
4. If the policy is to be adopted, what issues do you think the government of Kenya needs to be concerned about when integrating technology in ECDE special needs programs?

APPENDIX J Information and Consent Form – ECDE Stakeholders and Other Interested Parties in Kenya

Institute of Early Childhood

Faculty of Human Sciences

MACQUARIE UNIVERSITY NSW 2109

Phone: +61 (02) 9850 9867

Fax: +61 (02) 9850 9890

Email: iec@ mq.edu.au

Name of Project: **Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: The Case of Kenya** (Macquarie University Ethics No. 5201001521)

Dear Sir/Madam,

My name is Gladys Milimu and I am a PhD student at Macquarie University in Australia. You are invited to participate in a study on enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology. The purpose of the study is to establish professional learning strategies and support that will enhance the beliefs and practices of teachers for appropriate integration of technology in planning and pedagogical documentation.

The study is being conducted under the supervision of Dr Marina Papic, Institute of Early Childhood, and Faculty of Human Sciences Macquarie University, Australia. Her contact telephone number is +61-2-98509867; Fax No. +61-2-98509890 and her email address is marina.papic@mq.edu.au

You are invited to participate in an individual interview with me to discuss the current practices in early childhood education institutions on the use of technology in planning and pedagogical documentation. The interview will take place in August 2012 at your place of work at a time that is convenient for you and will be 30-45 minutes in duration. The purpose of the interview is to obtain information on strategies and best practices for integrating technology in early childhood programs for the purpose of enhancing the quality of teaching and learning in early childhood development and education (ECDE) centres.

It is to be noted all the evidence collected in the course of this research will be confidential to the research team. That is, access to data will be confined to persons involved in the research and no information concerning your identity will be released without your explicit consent. The results of the interview will be published in academic journals and conference proceedings, presented at conferences, used for teaching purposes and will play an informing role in the design and implementation of technology based training for ECDE educators in Kenya. No names of individuals or institutions will be used in the publications and presentations. At the conclusion of the study, a summary of the findings of the research will be sent to you.

To confirm your permission please sign both consent forms attached with this letter and return one to me in the reply paid envelope supplied.

Thanking you for your cooperation.

Yours sincerely

Gladys Milimu

Consent Form

Name of Project**: Enhancing the Pedagogical Beliefs and Practices of Early Childhood Teachers for the Appropriate Integration of Technology: The Case of Kenya** (Macquarie University Ethics No. 5201001521)

I, --- have read (or, where appropriate have had read to me) and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Name: ____

(Block letters)

Participant's Signature: _________________ Date:____________________

Investigator's Name: GLADYS MILIMU

Contact telephone number: +61-2- 98509867

Email address: gladys.milimu@students.mq.edu.au

Investigator's Signature: ____________________Date:_______________

Indicate whether or not you would like your comments linked with your name.

☐ I would like my comments linked with my name

☐ I would **not** like my comments to be linked with my name

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone +61 (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

[PARTICIPANT'S COPY]

APPENDIX K Macquarie University Ethics Committee Approval Phases Two and Three Data Collection

MACQUARIE UNIVERSITY

RE: HS Ethics Final Approval (5201200599) (Condition met)

Fhs Ethics <fhs.ethics@mq.edu.au> 11/09/2012
to Dr, A/Prof, me

Dear Dr Papic,

Re: "Enhancing the pedagogical beliefs and practices of early childhood teachers for the appropriate integration of technology: The case of Kenya"

Thank you for your recent correspondence. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and you may now commence your research.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

A/Prof Manjula Waniganayake
Dr Marina Papic
Mrs Gladys Mammy Shaji Milimu

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 11th September 2013

Progress Report 2 Due: 11th September 2014
Progress Report 3 Due: 11th September 2015
Progress Report 4 Due: 11th September 2016
Final Report Due: 11th September 2017

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_ research_ ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_ research_ ethics/forms

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

http://www.mq.edu.au/policy

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_ research_ ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds

will not be released until the Research Grants Management Assistant has received a copy of this email.
If you need to provide a hard copy letter of Final Approval to an external organisation as evidence that you have Final Approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely,

Dr Peter Roger
Chair
Faculty of Human Sciences Ethics Review Sub-Committee
Human Research Ethics Committee

****
Faculty of Human Sciences - Ethics
Research Office
Level 3, Research HUB, Building C5C
Macquarie University
NSW 2109

Ph: +61 2 9850 4197
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Email: fhs.ethics@mq.edu.au

http://www.research.mq.edu.au/

APPENDIX L Ministry of Higher Education Kenya Research Permit Phases Two and Three Data Collection

REPUBLIC OF KENYA

HARAMBEE

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349
254-020-310571, 2213123, 2219420
Fax: 254-020-318245, 318249
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: NCST/RRI/12/1/SS011/30

Date: 14th August 2012

Gladys Milimu Shaji
Macquarie University
Sydney.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "***Enhancing the pedagogical beliefs and practices of Early childhood teachers for the appropriate integration of technology: The case of Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Makadara District** for a period ending **30th November,** ***2012.***

You are advised to report to **the District Commissioner and the District Education Officer, Makadara District** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, ~~HSC~~.
DEPUTY COUNCIL SECRETARY

Copy to:

The District Commissioner
The District Education Officer
Makadara District.

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development."

APPENDIX M Nairobi City Council Letter of Authorization Phase Two and Three Data Collection

CITY COUNCIL OF NAIROBI

TELEGRAM "SCHOOLING"
TELEPHONE: 221166/224281
EXT: 2426 /2590

CITY HALL ANNEXE
P. O. BOX 30298 GPO
NAIROBI

CITY EDUCATION DEPARTMENT

GL/NC/141 VOL IV/251

10th September, 2012

GLADYS MILIMU SHAJI
INSTITUTE OF EARLY CHILDHOOD,
MACQUARIE UNIVERSITY,
NEW SOUTH WALES,
2709 SYDNEY, AUSTRALIA.

RE: RESEARCH / SURVEY AUTHORIZATION

We are in receipt of your letter dated 6th September 2012 requesting for authority to conduct research in Makadara district ECDE centers on ***" Enhancing The Pedagogical Beliefs and Practices of Early Childhood Teachers for The Appropriate Integration of Technology: The Case of Kenya"***

I wish to inform you that authority has been granted to you to carry out the research in centers of your choice in the district

Please be informed that the survey should not interfere with teaching & learning in schools.

Liaise closely with respective Head teachers for the success of your research. On completion, this office expects a copy of the research findings.

I wish you success.

JACINTA A. CHARLES
Ag. CHIEF ADVISOR TO SCHOOLS
FOR: DIRECTOR CITY EDUCATION

Cc Education Officer – Makadara District