Information and Communication Technology (ICT) in Teacher Education

Towards facilitating conducive learning environments for learners with visual impairment

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Information and Communication Technology (ICT) in Teacher Education: Towards facilitating conducive learning environments for learners with visual impairment

Dedication

This dissertation is dedicated to my youngest daughter, Pretty Adeke Odeke.

Abstract

Information and communication technology (ICT) in education has rapidly evolved across the world. This is due to the reforms that are taking place in education including teacher education, special needs education, industries and legislative provisions. To catch up with these (ICT) reforms and developments that are taking place in different sectors, initiatives are being set up that could be partly informed by research.

In this study, I investigated ICT in teacher education: Towards facilitating conducive learning environments for learners with visual impairment. This study was carried out with the intention of finding out how prospective teachers are taught ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

I used Actor-Network Theory (ANT) to guide this study because ANT guided studies are interested in finding out how humans and nonhumans work together to make something happens but not why it does happen. I used the qualitative research approach with a case study design. Through this approach and design, I collected data using interviews and non-formal observation. Twenty (20) participants took part in the study. These participants were: 16 early career teachers, two teacher educators, one participant from the curriculum-developing institution, and one from the National Association of the Blind. Data were analyzed thematically.

The presentation, interpretation, analysis, and discussion of findings are discussed with the backing of the actor-network theory (ANT) and the literature. I considered the usefulness of ANT in extracting information that would be used in conceptualizing how both human and nonhuman actors are useful in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment.

During and after presentating, interpretating, analysing, and discussing the findings three major issues were revealed. The first issue that came out is that ICT is being taught to prospective teachers during preservice teacher education. It is being taught following the guidelines of the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2002), the World Bank (2006) and the ICT policies in Uganda. This arose from the findings that showed that ICT is being taught to prospective teachers, early career teacehrs use it to perform other activities but not as a pedagogical tool towards facilitating convenient learning environments.

The second issue that emerged from the findings was that teacher educators are engaged in preparing prospective teachers to develop skills in using ICT. Findings further revealed that, although teacher educators are engaged in teaching ICT to prospective teachers, there is a need to take into account that they (prospective teachers) are taught skills of using ICTs as pedagogical tools towards facilitating satisfactory learning environments. Thirdly, findings revealed that Ministry of Education and Sports (MoES), Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind (UNAB), and primary teachers' colleges (PTCs) are involved in teacher education at different capacities with minimal collaboration on teacher education.

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List of Abbreviation

ANT	Actor-network theory
CCTV	Closed-circuit television
ERIC	Education Resources Information Center
ICT	Information and communication technology
ITEK	Institute of Teacher Education, Kyambogo
LWVI	Learners with visual impairment
MoES	Ministry of Education of Sports
MoICT	Ministry of Information and communication technology
NORHED	Norwegian Higher Education and Development
NSD	Science Data Services
OPP	Obligatory passage point
PTC(s)	Primary teachers' college(s)
PWDs	People with disabilities
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
UACE	Uganda Advanced Certificate of Education
UCC	Uganda Communication Commission
UCE	Uganda Certificate of Education
UNAB	Uganda National Association of the Blind
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISE	Uganda National Institute of Special Education
UPE	Universal Primary Education
WHO	World Health Organization

1   Chapter One: Introduction

1.1   Introduction

The theme of this study is Information and Communication (ICT) teaching in teacher education; towards facilitating conducive learning environments for learners with visual impairment[1]. This study intended to find out how prospective teachers[2] are taught ICTs as pedagogical tools during their preservice teacher education towards facilitating conducive learning environments for learners with visual impairments. ICT is an acronym for "Information and communication technology" and any technology that provides access to information through telecommunication can be referred to as ICT (Khan, March 2020). Information Technology (IT) originally referred to computers and associated hardware such as disk drives and printers and the 'C' was added in the late 1990s to account for the influence of the communication aspect of technology whereby the communication element was driven by the development of the Internet, which provided the platform for email and mobile technologies ICT covers a diverse set of technologies in digital form (Caldwell, 2020). Teacher education is one of the areas of special interest because it plays a double role concerning ICT, the first being that it develops both prospective teachers' professional skills and secondly, the expertise in these prospective teachers in facilitating their learners' learning (Thorvaldsen, & Madsen, 2020; Reynolds et al., 2020). In this dissertation, I have used the words "pedagogical tool" instead of a teaching approach or method. These words (pedagogical tools) have been used to refer to any approach that one could be using while teaching or learning. This decision was taken because the current Ugandan preservice teacher education program aims at preparing teachers who would be able to use ICTs as pedagogical tools. This is because when early career teachers take off with their teaching career, they do not unlearn teaching habits that they had learned during their teacher education instead, they may start with innovative teaching techniques they were taught including the use of ICTs (Batane & Ngwako, 2017).

I have begun this chapter by writing the background of the study. This is followed by the purpose of the study, the research problem. The concept of ICT is followed by the clarification of main concepts. In this chapter, I also formulated the aim of the study and the research

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[1] A learner with visual impairment is used to refer to learners/persons who are blind learners/persons who have low vision.
[2] For someone to be a preservice or a prospective teacher, she or he must have enrolled for a two or three-year course in an institution of higher learning, have never done a similar course, or have not yet completed their teacher education course (Netshirando, 2014).

questions which is followed by the significance of the study. The last part of this chapter is the organization of the dissertation.

1.2 Background of the study

Over the years, Information and Communication Technology (ICT) has received increasing attention in many countries as an integral part of education especially in teacher education (Lawrence, & Tar, 2018; Qasem &Viswanathappa, 2016; Karunaratne et al., 2018). There is no doubt that the requirements of the 21st century for effective, functional and quality education cannot be separated from the applications of ICT tools because ICTs have undoubtedly gained an upsurge of interest (Aderonmu & Ejeba, 2020; Häkkinen et al., 2020). In Uganda, the increased importance of ICT in education and its use as teaching and learning tools in most institutions of learning including teacher education has attracted numerous studies (Ndawula et a., 2012; Bakkabulindi, 2011, 2012; Omona et al., 2010; Sebbowa et al., 2014; Bakkabulindi & Ndibuuza, 2015). Though the above studies have been carried out in Uganda, their focus has been on the attitudes of the users towards ICTs and their general challenges during their use (Bakkabulindi & Ndibuuza, 2015; Kintu & Zhu, 2015; Ndawula et al., 2012; Bakkabulindi, 2012) while paying less attention to their teaching as pedagogical tools during teacher education. As a result, ICT teaching in teacher education posits a two-step process; first teaching to acquire knowledge, and secondly practice the acquired knowledge (professional application) because knowledge and practice are intertwined and incarnate (Segal, & Heath, 2020). Hence, ICT integration in teacher education programs should aim at professional growth among prospective teachers (Dey & Roy, 2019). This is because ICT advances are here to stay, and crises such as the current coronavirus pandemic only come to highlight the digital deficit not just in terms of supporting ICT or learners' skills, but also and perhaps most significantly as regards teacher perceptions, attitudes, and actual preparedness (Ferdig et al., 2020). They (Ferdig et al., 2020) add that as a result of these advances, teacher educators need to focus on preparing education specialists to understand that online teaching requires its own set of skills, tools, and teaching practices. In this line, Khan (2020) posits that when teaching ICT in teacher education, the main objective is to give more opportunities to prospective teachers to build and improve quality teachers and thus to improve the education system in our nation.

Consequently, while preparing teachers of this (21st) century, the intention should be that they [incoming teachers] gain the skills that may enable them to teach all learners with different learning and special educational needs using different pedagogical approaches, including ICT

tools (Göksün, & Kurt, 2017; Siddiq et al., 2017; Zyad, 2016; Kouroupetroglou, 2015; Bhattacharjee & Deb, 2016; Hepp et al., 2015; Ghavifekr, & Rosdy, 2015; Albion et al., 2015; Buabeng-Andoh, 2012; Jordan, 2011; Goktas et al., 2009; Jimoyiannis & Komis, 2007; Lawless & Pellegrineo, 2007; Kessy et al., 2006). In this 21st century, the motivation for teaching ICT in teacher education is because of the increase of its teaching in institutions of learning is becoming significant worldwide because it is offering great possibilities in teaching and learning (Kouroupetroglou, 2015).

Secondly, ICT is becoming increasingly important in daily lives and in the field of education which requires teachers to be equipped or to equip themselves with competencies which may enable them (teachers) to design new teaching/learning environments as well as methods of using the most modern ICTs adapted for the field of education (Qasem & Viswanathappa, 2016). Therefore, schools need teachers who can examine the versatile forms of knowledge and skills that are required to effectively integrate emerging technologies in their teaching practice (Schols, 2019). To meet the above, during teacher education, prospective teachers need to be prepared to integrate ICT in education in general because they are regarded as the true pillars if ICT is to be integrated in education as a pedagogical tool (Elatrachi & Oukarfi, 2020).

In the Ugandan context, Ministry of Education and Sports (MoES) is promoting the integration of ICT in education as an academic subject, a teaching/learning tool and a tool for effective school management (Nambi, 2019). Despite significant political will and spending by governments on technical equipment and preparation of personnel, levels of ICT integration in institutions of learning during teaching and learning are often low (Gill & Dalgarno, 2008). Gill and Dalgarno add that one of the challenges facing teacher educators is how to ensure that prospective teachers get the necessary combination of skills and pedagogical knowledge that may enable them to use today's ICTs in the classroom as well as continue to develop and adapt to new ICTs that emerge in the future. This, therefore, necessitated prospective teachers to be taught skills of teaching all categories of learners in a class at any given time. The enabled the Ugandan MoES to advocate for the teaching of ICT in all levels of education including tacehr education. This follows the 2014 ICT policy developed by the Ministry of Information and Communications Technology (MoICT) which entrusted universities and other institutions of learning with the responsibility of developing human resources to teach ICT as well as the establishment of effective innovation centers (Nambi, 2019).

In teacher education, if ICT is to be taught to prospective teachers, the focus should be on the development of skills to enable them to adapt it specifically for teaching/learning purposes (ped-

agogical tool) (Derke, 2018). In this context, in education, the process of ICT can be classified into two broad categories thus ICT as a technical resource and ICT as a teaching and learning tool (Derke, 2018). I have introduced the concepts of teaching and learning here because these two terms "do not exist and cannot be identified as separate from the networks through which they are enacted. These two concepts are not independent entities or processes but assemblages" (Fenwick & Edwards, 2010, p.41). Therefore teaching ICT in teacher education could be significant because teachers act as catalysts while using it as a pedagogical tool that may support the development of classrooms that would be comfortable for both the teacher and the learners (Derke, 2018). Since teachers act as catalysts, there is a need to teach them to use ICT as a pedagogical tool to facilitate conducive learning environments. However, numerous institutions, including primary teachers' colleges, took up the teaching of ICT and they have adopted its teaching for various purposes.

As mentioned in section 1.1 above, this study was carried out in primary teachers' colleges with an attempt of finding out how prospective teachers are taught to use ICTs as pedagogical tools towards facilitating an acceptable learning environment specifically for learners with visual impairment. Though the intention was to carry out this study in primary teachers' colleges, I focused on early career teachers who had completed their teacher education between 2013 and 2016 because I anticipated that they had the experience of being taught ICT and they are using it during their teaching. That is why it was essential to focus on preservice teacher education where these teachers were taught techniques of teaching including using ICTs as pedagogical tools towards facilitating conducive learning environments.

1.2.1   Preservice teacher education in Uganda

Preservice teacher education in Uganda is a two-year full-time course. The aim of this course (preservice teacher education) is to guide prospective teachers to attain attitudes, skills and knowledge considered desirable for a teacher to make them competent in their work following the norms set by the Ministry of Education of a given country (Kárpáti, 2009; Osuji, 2009). Secondly, during preservice teacher education, prospective teachers expected to gain skills of using ICTs as pedagogical tools towards facilitating conducive learning environments for all learners in a given placement setting. The reason for teacher education is to enable prospective teachers to meet gain skills in teaching. Therefore, the successful application of a teaching method like using ICT during teaching depends entirely on the support and attitudes of teacher educators involved in its teaching during teacher education (Rana, 2016). Teacher educators play a fundamental role in augmenting the worth of education whereby they directly influence the quality of

prospective teachers and therefore, though more indirectly, the learning of learners these prospective teachers teach there-after (Ping et al., 2018). Skills mastered during teacher education could be applied thereafter as pedagogical tools towards facilitating an auspicious learning environment.

During preservice teacher education, prospective teachers could be guided on how to teach all learners in situations where they (teachers) encounter learners with diverse needs. The needs that teachers may encounter among learners may range from access to services, improved educational provision, specialist support services from teachers and other personnel, awareness-raising in and out of school communities, orientation and mobility skills, provision of assistive technology and attainment of independent living skills among others (Ravenscroft, 2012). Prospective teachers are also taught different approaches or skills of using available tools/materials in the environment towards facilitating auspicious learning environments for learners in the classroom during teacher education.

However, ICT integration in pre-service teacher education programs continues to be a challenge all around the world (Goktas et al., 2009; Aslan & Zhu, 2015). This is not different from developing countries including Uganda, in that most of them are still in the initial stages of integrating ICT into education including preservice teacher education curriculum (Guma et al., 2013). This is because educational systems around the world, in both developed and developing countries, are under increasing pressure to integrate ICTs into teacher education programs to develop teachers' skills of using them as pedagogical tools when teaching the knowledge and skills needed in the 21st century (programs so that prospective teachers could develop skills of using them as pedagogical tools (Kalu-Uche & Eze, 2020; Aziz & Quraishi, 2018; Bhattacharjee, & Deb, 2016; Zyad, 2016; Hepp et al., 2015; Jamil et al., 2015; Buabeng-Andoh, 2012; Goktas et al., 2009; Jimoyiannis & Komis, 2007; Lawless & Pellegrino, 2007; Kessy et al., 2006). In this struggle, Uganda as a government is willing to teach prospective teachers ICTs as pedagogical tools during teaching, its use is still at the primary stages due to inadequacy of operational policies, basic infrastructure (power like electricity, stand by generators or solar and devices), financial support and teachers' capability to teach it (Ndiwalana & Tusubira, 2012).

Notwithstanding, ICT teaching in teacher education should involve teaching prospective tachers strategies on how to use computers and other ICT implements as pedagogical tools in the general content areas such as mathematics, science, reading and social studies to allow teachers to learn to apply ICT skills in meaningful ways (Simon, 2014). This should not be different in the

Ugandan context whereby, if possible, ICT teaching in teacher education could involve the use of computers and other equipment to facilitate its teaching. Following the above background, in the next section, I am describing the reason why I carried out this study thus the purpose of the study.

1.3 Purpose of the study

Preservice teacher education is a level of education where prospective teachers are taught skills of teaching learners using a variety of pedagogical skills. Felder and Brent (2017) say that if a question is posed to educators on what teaching is, one may get variations of two completely different responses: whereby the first may discuss teaching as showing or explaining something; whereas the second may define teaching as causing someone to know something. Felder and Brent further say that whereas the first definition indicates that if you cover something in a course, whether or not the learners learned it, you have taught, the second definition implies that if the learners did not learn it, you did not teach it. Though both definitions are valid, I intended to find out the teaching of ICT in teacher education towards facilitating conducive learning environments for learners with visual impairment. The intention was to get the experiences from early career teachers who have recently completed their teacher education on how the ICT they were taught is helping them towards facilitating conducive learning environments for learners with visual impairment.

For that reason among the aspects that prospective teachers are expected to do during teacher education is to be taught ICTs and thereafter use them as pedagogical tools while teaching. To teach while using ICT as a pedagogical tool, these prospective teachers are expected to have learned competencies of its use in teaching towards facilitating favorable learning environments. Teacher educators are therefore expected to be role models in teaching and using teaching approaches/methods and strategies from which prospective teachers may develop knowledge and skills of teaching (Okwaput, 2013). Though the study is being carried out in primary teachers' colleges, its emphasis is on early career teachers who completed their teacher education between 2013 and 2016. The colleges were the main concentration and they were essential channel points of getting to early career teachers who had graduated from there. I concentrated on early career teachers rather than the prospective teachers because I assumed that they (early career teachers) had been taught the ICT content that is in the curriculum. Secondly, I assumed that since these are already practicing teachers, they could have put into practice the ICT knowledge they learned during their preservice teacher education and they have the experiences of using it as a pedagogical tool. The purpose of this study was to find out how early career teachers integrate

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experiences they were taught in their two years of preservice teacher program into practice to provide a prevailing view of ICT teaching that includes appropriate pedagogy, experiential practice and appropriateness of the teaching-learning materials as key factors. These factors will help in finding out how early career teachers use them (ICTs) as pedagogical tools towards facilitating conducive learning environments.

1.4 Research problem and clarification of concepts

Uganda was one of the first countries in sub-Saharan Africa to implement full inclusion of learners with disabilities in general, and those with visual impairment in particular, into ordinary classes (Charema, 2010). Although most teachers are showing great interest in and are motivated to learn about computer education which in most cases is ICT during their teacher education, to date, its use is limited to a narrow range of applications, mainly for personal purposes (Jimoyiannis & Komis, 2007). ICT is a discipline that covers a diverse set of technologies in digital form encompassed in modern technological software used in education and training for enhancing the professional competency of teachers and learning capabilities among learners (Ahmed et al., 2019). It (ICT) is a scientific, technological, and engineering discipline and management technique used in handling information in application and association with social, economic and cultural matters (Elatrachi & Oukarfi, 2020; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2002; Guma et al., 2013; United Nations report, 1999).

As I have explained below, ICT is a scientific, technological, and engineering discipline and management technique used in handling information in application and association with social, economic and cultural matters (Elatrachi & Oukarfi, 2020; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2002; Guma et al. 2013). ICT consists of all technical means used to handle and facilitate the capturing, acquisition, storage, retrieval, manipulation, dissemination, receiving, creation, management, processing, transmission, dissemination of information and aid communication in all forms including textual, voice, data, graphics and video (Alabi, 2016; Joshi, 2015; Guma et al. 2013; Mohanty, 2011; Cacavs, Bulent & Punar, Karaoglan Bahar, 2009). However, Guma et al. (2013) define ICT as an electronic means of capturing, processing, storing and communicating information. A broad and specific definition of ICTs includes desktops computers, portable computers, network hardware and software, email, telecommunications equipment and services, the internet, telephones, television, radio, projectors, interactive whiteboards, mobile devices, cellular phones, satellite systems, storage devices, audiovisual equipment used in communication during teaching and learning, information technology equipment and services, media and broadcasting, libraries and documentation centers,

commercial information providers, network-based information services, teleconferencing such as video conferencing, audio conferencing, television lessons, radio broadcasting lessons/counseling, interactive voice response systems, interactive voice response systems, audio cassettes, CD ROM and assortment of other technological tools that have turned out to be valuable teaching and learning resources (Khan, 2020; Avisteva, March, 2020; Singhavi & Basargekar, 2019; Ojok, 2018; Albugami & Ahmed, 2015; Pernia, 2008; Ahmed et al., 2019; Sharnma, 2003; Sanyal, 2001; Bhattacharya & Sharma, 2003; United Nations report, 1999; Pernia, 2008). Other writers say ICT comprises equipment and resources used to communicate, store, retrieve, manipulate, disseminate, receive, create and manage information (Khan, 2020; Avisteva, March 2020; Alabi, 2016; Joshi, 2015; Guma et al., 2013; Mohanty, 2011; United Nations report, 1999). Some of these ICTs have been modified and are now in schools and used during teaching and learning processes hence the need for teachers to be prepared on how to use them while teaching.

In the context of teacher education, in Uganda, ICT is being taught as part of a professional subject. The government of Uganda, through Ministry of Education and Sports (MoES), Ministry of Information and Communication Technology (MoICT) and Kyambogo University have made attempts to build ICT laboratories in primary teachers' colleges and equipped them with the necessary equipment. Apart from regular ICT equipment, some of these primary teachers' colleges have been equipped with ICT equipment for persons with visual impairment. The ICT resources for people with visual impairment are categorized into high-tech and low-tech resources (Erdem, 2017). The high-tech include computers and associated adapted soft wares, PowerPoint projectors and CCTVs, smartphones, mobile telephone soft wares like Google assistant, Google classroom, the loop, optelec clear reader, zoom text, Optical Character Recognition software (OCR) among others whereas low-tech include magnifiers, table lamps, hand-held electronic magnifiers and Perkins Brailler.

Other High-tech resources that Sah (2013) identifies are screen readers which convert electronic text into speech; screen magnifiers (zoom text) for presenting enlarged screen content; screen recognition software which allows input of data using a voice other than mouse/keyboard, OCR software, large monitors for enlarged view screens; large print keyboards with contrast colors (alternative keyboards); scanners for converting images from print material to computer file which can be converted into other accessible formats; and CCTVs; as high-tech ICT resources that are compatible in the learning. There was a need to find out how teachers are prepared on how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The motivation of this study is derived from the assumption

that once preservice teachers are taught how to use ICTs as pedagogical tools, they may facilitate conducive learning environments for learners with visual impairment.

Low tech ICT devices (some) are electronic but do not include highly sophisticated and advanced components such as electronic voice/audio recorders, audio players, talking calculators with large print/keys and electronic magnifiers. High-tech resources use complex, multifunction technology and usually include computers and associated soft wares (Sah, 2013). The motivation of this study is derived from the assumption that once prospective teachers are taught how to use ICTs as pedagogical tools, they may facilitate conducive learning environments for learners with visual impairment.

In this study, the problem is to find out how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. Secondly, I have used the teaching of ICT in teacher education to find out how prospective teachers are taught varied sets of technological equipment to facilitate conducive learning environments for learners with visual impairment and how they are used as pedagogical tools.

1.4.1 Clarification of concepts

In this section, I clarified the key terms that I have used in this study to ensure uniformity and understanding by the readers. These concepts are teacher education, impairment, visual impairment, conducive learning environment and pedagogical tool.

Teacher education

Teacher education[3] refers to preparation, professional education of teachers or professional development of current and future teachers towards the attainment of attitudes, skills and knowledge considered desirable to make them efficient and effective in their work, following the need of a given society at any point in time (Ogunyinka et al., 2015; Imig, & Imig, 2007). It is the program that is offered to people whose intentions are to become teachers. It includes training and or education occurring before the commencement of service (pre-service) and during service (in-service or on-the-job) (Ogunyinka et al., 2015). To be a teacher of any level of education in Uganda, prospective teachers have to undergo preparation to develop pedagogical skills to facilitate their teaching and their learners' learning before they are recruited into the teaching profession. In this study, I use the concept preservice teacher education and teacher education interchangeably to refer to the education prospective teachers receive to develop competencies in

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[3] Preservice teacher education refers to professional education that is undertaken by prospective teachers before teaching service commences.

teaching particularly while using ICTs as pedagogical tools towards facilitating appreciated learning environments for learners with visual impairments. Preservice teacher education is also referred to as initial teacher education (Haydn, 2014; Osuji, 2009).

In Uganda, teacher education appears in three different contexts thus preprimary, primary and secondary education level. Persons who wish to teach preprimary join institutions that prepare them to become preprimary school (nursery school or kindergarten) teachers. Those persons who wish to teach in primary schools undergo a two-year-preparation in primary teachers' colleges. After the two years, they attain Grade III teachers' certificates whereas secondary school teachers join National Teachers colleges (2 years) or universities (3 years) and attain either diplomas or undergraduate degrees. On completion, they teach secondary schools.

Impairment

It is defined as "any loss of or abnormality of psychological, physiological, or emotional structure or function" (World Health Organization [WHO], 1980, p. 27). Impairments generally affect levels of functioning in the person's body, e.g., mental or physical, whereby affected persons may not function as expected by society.

Visual impairment

It is defined as any loss of or abnormality of psychological, physiological, or emotional structure or function to such a degree as to qualify as an additional support need through a significant limitation of a visual capacity; resulting from either disease, trauma, congenital or degenerative conditions among others that cannot be corrected by conventional means such as refractive correction or medication (Ngwoke et al., 2020; World Health Organization [WHO], 1980).

Therefore, the term "visual impairment" covers a wide range of different types of eye disorders and degrees of vision loss (Hennig et al., 2017). Visual impairment is an umbrella term for both blindness and low vision and it encompasses minimal impairments; mild, moderate, severe, profound vision loss, near-blindness, blindness and color vision loss (The International Council of Ophthalmology, 2002). A person with visual impairment is one who is unable to perform a visual task as expected by the society or community. For example, if the majority of people can read a particular print font and one has difficulty in reading it, the person who cannot read it is considered to have a visual impairment. In 2011 the number of people with reduced vision and blindness amounted to approximately 285 million worldwide, with 246 million suffering from low vision and 39 million affected by blindness (World Health Organization 2013).

Conducive learning environment

A conducive learning environment is crucial to the success of learning of the adult learners (Madu, & Obiozor, 2012). Fraser (1983 as cited by Lim et al., 2003) defines conducive learning environments as the provisions and procedures necessary to establish and maintain an environment in which instruction and learning can occur and the preparation of the classroom as an effective learning environment. With the world changing rapidly into digital media and information, ICT is seemingly performing a self-motivated role in classroom practices including making teaching and learning more effective by adapting these technologies to suit the teaching of learners with visual impairment has been on-going and is of great advantage in bridging the gaps from classroom practices to the rest of their lives outside the school. (Rony, 2017). Effective teaching and learning is the repertoire of instructional strategies that embrace all human interactive skills and materials employed by the teacher to promote, facilitate and communicate learning in the classroom situation leading to improved performance on the part of the learner (Natia & Al-hassan, 2015).

Therefore, a conducive learning environment is one that is fundamental for positive teaching and learning to take place satisfies the needs of learners, not only in the acquisition of numeracy and literacy skills but is also able to link the economic and occupational needs of the group to literacy with their learning activities (Nyoni, & Mufanechiya, 2012; Madu & Obiozor, 2012). The creation of conducive learning environments involves teacher arrangements of the physical environment, establishing rules and procedures, maintaining learners' attention to lessons, and engagement activities to create and maintain a learning environment conducive to successful instruction (Deryakulu, & Altun-Akbaba, 2014). Lim et al., (2002, December) and Lim et al., (2003) add that a well-managed classroom is one in which learners are consistently engaged in the learning tasks that create a conducive environment for the effective integration of ICT in schools.

Lastly, a teacher who creates an environment conducive to teaching and learning through positive, goal-directed humor would make the learner gain confidence and be eager to learn more because a truly concerned, committed, the understanding, knowledgeable, high-spirited and supportive teacher is there to aid learners in regaining control of their learning (Chabeli, 2008). As a result, the impact of teaching prospective teachers how to use ICTs as pedagogical tools determines how they would use it thereafter (Kozma, 2003). This should be done to create conducive

learning environments for learners with visual impairment with the use of appropriate pedagogical tools.

Pedagogical tool

The word pedagogical is derived from the word pedagogy which, according to Bernstein (2000 as cited by Westbrook et al., 2014: Alexander, 2013; Florian, & Kershner, 2009) is defined as a sustained process whereby somebody acquires new forms or develops existing forms of knowledge, conduct, practice and criteria from somebody or something deemed to be an appropriate source and assessor. Alexander, (2013) adds that whereas other people look at pedagogy as teaching, it is not just teaching but it involves a bigger picture that involves all that takes place in the classroom during teaching. A tool is an implement used to perform a particular task.

Since the purpose of this study was to find out the teaching of ICT in teacher education, my intension was to find out how prospective teachers are guided to gain knowledge, practice and criteria of using it (ICT) as a pedagogical tool towards facilitating conducive teaching and learning environment for learners with visual impairment. ICT plays a leading role in teacher preparation so that prospective teachers learn how they can enhance their pedagogical skills and content knowledge (Ahmed et al., 2019). The basis for this argument is that pedagogical approaches teachers use while teaching is gained or promoted during their preliminary teacher education, continuing professional development, the learner to be taught, or those specified in the curriculum (Westbrook et al., 2014). On some occasions, pedagogical approaches could be determined by those persistently used by other teachers in the classrooms or the kinds of teaching and learning experiences. This is because "pedagogy comprises teachers' ideas, beliefs, attitudes, knowledge and understanding about the curriculum, the teaching and learning process and their students, and which impact on their teaching practices" (Westbrook et al., 2014, p. 7). Elatrachi and Oukarfi, (2020) note that although computers and other ICTs are increasingly used in higher institutions of learning, the use of ICT for teaching purposes by teachers is still very limited. Therefore, in this study, I intended to find out how ICT is taught during teacher education as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairments.

1.5 The aim of the study and research questions

The advances in ICTs have caused vital changes in individual and social domains as well as the way education at all levels of education because of the availability of media-rich learning environments (Rana, 2016). Nowadays google classroom, e-learning, zoom classroom, etc. are the

very common terms that are used in the field of education (Das, 2020). To realize this study, I had to generate and formulate the aim of this research as well as the research questions that guided it. These (aim and the research questions) are explained in section 1.5.1 and 1.5.2 below.

1.5.1 The aim of the study

The aim of this study was to investigate the teaching of ICT prospective teachers during their teacher education towards facilitating favorable learning environments for learners with visual impairment. the focus of the study was primary teachers' colleges in Uganda. I decided to carry out a study in preservice teacher education because it is at this level of education that pedagogical competencies are taught and acquired by prospective teachers. I decided to pay attention to primary teachers' colleges rather than colleges that prepare preschool or secondary school teachers because the NORHED-Enabled project that is carried out in Kyambogo University in Uganda, Kenya Institute of Special Education (KISE) in Kenya and the University of Dar es Salaam in Tanzania, was aiming at finding out how primary school teachers are prepared during their prospective (initial) teacher education to teach children with sensory impairments in primary schools. After describing the aim of this study, I had to formulate three questions that I anticipated could guide this study as stated in section 1.5.2 below.

1.5.2   Research questions

To respond to the above aim of the study, I formulated three research questions and the first research question is:

1.   What are the stakeholders' perceptions of teaching ICT in teacher education?

This question arose from the experience that ICT is taught in some primary colleges in Uganda. Early career teachers use the ICT they learned during teacher education while preparing schemes of work and lesson plans but they do not use it as a pedagogical tool towards facilitating a favorable learning environment. Most teachers manipulate their computers between themselves and their children, preparing lessons and teaching online and marking assignments (Kalloo et al., 2020: McKenzie 2020). This led me to the second question which is more specific and centers on the study aim. The question is:

2.   How are teacher educators engaged in preparing prospective teachers to develop skills of using ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment?

This question intended to find out how teacher educators are preparing prospective teachers on how to use ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment. By formulating this question, I aimed to get participants' views on how teacher educators are influencing or could influence prospective teachers to use ICTs as pedagogical tools during teaching and learning.

The third research question is:

3. How are institutions working together in teacher education to prepare prospective teachers to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment?

Teacher education in Uganda is a government program with input from different institutions. One main institutional actor that works towards preservice teacher education is the MoES. This ministry is in charge of salary payment, buying scholastic material, building infrastructure and sponsoring prospective teachers admitted into the PTCs. Another role played by MoES is to oversee how teaching is conducted. MoES also partners with other stakeholders to procure teaching materials like ICT equipment, such as computers, which is used for teaching prospective teachers to enable them to develop operational skills. MoES prepares teacher educators through Kyambogo University and the curricula that guide preservice teacher education, and it assesses and certifies newly qualified teachers on its behalf. Other national organizations that collaborate with MoES during teacher preparation are MoICT and the UNAB, UNESCO; World Bank, National Curriculum Development Center, among others. These organizations come together because of their relevance in education and specifically teacher education. This, therefore, leads me to discuss the significance of this study is explicated below.

1.5.3 Occurrences of people with visual impairment

The population of persons with disabilities globally is 15% of the world's population (World Report on Disability, 2015; UN Enable). Of the above population, it is estimated that 253 million persons have a visual impairment, of which 36 million are blind, and 217 have moderate visual impairment globally (WHO, 2015; IAPB, 2015). Visual impairment encompasses minimal impairments; mild, moderate, severe, profound vision loss, near-blindness, blindness and color vision loss (The International Council of Ophthalmology, 2002). These categories of visual impairments refer to low vision as well as blindness (Kinengyere et al., 2017; Arunga et al., 2016). Arunga et al., further define low vision as visual acuity of less than 6/18, but equal or better than 3/60, or a corresponding visual field loss to less than 20 degrees in the better eye with the best

possible correction whereas they define blindness as visual acuity of less than 3/60, or corresponding visual field loss to less than 10 degrees in the better eye with the best possible correction (Arunga et al., 2016).

In Sub-Saharan Africa, the number of children with visual impairment and specifically those who are blind children has increased by 31% and the prevalence ranges from 0.3/1000 children in high-income countries to 1.5/1000 children in low-income countries (Asferaw et al., 2017). Approximately 90% of children with visual impairment in Low and Middle-Income Countries (LMIC) do not attain formal education (Kinengyere et al., 2017). Asferaw et al., (2017) add that in the poorest countries, the main cause of visual impairment is corneal scarring due to vitamin A deficiency, measles, ophthalmia neonatorum and the use of traditional practices, which have declined dramatically in many countries as a result of economic development and more extensive programs of measles immunization and better control of vitamin A deficiency. Although the other causes like measles, traditional practices and vitamin A deficiency have considerably decrease, cataract is now often the most common avoidable cause of blindness in these settings (Asferaw et al., 2017).

In the Ugandan context, people with disabilities constitute 12.4% (approximately 4.5 million) of the total population (Kinengyere et al., 2017; Uganda Population & Housing Census Report, 2014; UBOS, 2014). 6.1% (approximately 2.1 million) of the total population of people with disabilities in Uganda are persons with visual impairment (Uganda Population & Housing Census Report, 2014; UBOS, 2014; Kinengyere et al., 2017). However, UBOS (2019, as cited in Rohwerder, 2020) warns that information from the survey and population censuses has to be used with caution because of the changes in the phrasing of questions and the definition of a person with a disability. Nonetheless, Rohwerder (2020), observes that there was still a lack of reliable information about the actual numbers of persons with disabilities given the fact that it was not always clear what disability definition is being used and if statistics using the Washington Group referred to those with any type of disability or only to those with a lot of difficulties or cannot do at all.

Vision has an essential role in a child's development, and the visual deficit is a risk factor not only for altered vision-sensory development but also for education and overall socioeconomic status throughout someones' life (Ngwoke et al., 2020). Ngwoke et al. add that if there is any group of individuals with disabilities who need quality education, those with visual impairment should be at the forefront.

The first category of people with disabilities to go to school in Uganda was those with visual impairment. This was after the establishment of the first special school for children with visual impairment in early 1955 which was followed by the setting up of several residential units in mainstream schools in different parts of the country (Lynch et al., 2011). According to Forbes, (2007), Farrell et al., (2007) and Lindsay (2007 as cited by Sharma and Nuttal, 2016), empirical evidence suggests that inclusive education produces many benefits for learners with special needs as well as the general student population. Since then, children with visual impairment have been enrolled in primary schools in integrated as well as inclusive settings. Lynch et al., (2011) add that given the particular challenges children with visual impairment face in accessing information, modifications to the teaching and learning techniques commonly used in the mainstream classrooms were essential. This necessitated teachers to be prepared at both in-service and preservice level on how to teach learners with visual impairment. Since ICT is now a common teaching tool and it is taught during teacher education, there was a need to find out how ICT is taught to prospective teachers as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment.

The similarity between findings of the above researchers from Nigeria, Uganda and elsewhere in the world is that they emphasize equal educational opportunities for every child including those with visual impairment. For education of learners with visual impairment to take place, the researchers made some recommendations on the way forward which centered on centering on curriculum content, implementation processes and capacity building programs for personnel and collaborative and interdisciplinary approaches.

Just like the Nigerian system of education, the Uganda education system lacks the essential elements which must be in place to provide an appropriate education in the least restrictive environment for the learners with visual impairment. The essential elements that were identified by Suleiman (as cited by Blaise-Okezie et al., 2015) to meet the learning needs of learners with visual impairment are first, children with visual impairment ought to have specialized services, books, and materials in appropriate media including ICT and other equipment to ensure equal access to the core and specialized curriculum. This may enable these children to compete effectively with their peers in school and ultimately in society. Secondly, there must be a full range of program options and support services so that the individualized education program (IEP) team can select the most appropriate in the least restrictive environment for each child with visual im-

pairment. The last element that Blaise-Okezie et al., (2015), identify is that there must be adequate personnel preparation programs to prepare teachers to provide specialized services which address the unique academic and non-academic curriculum needs of children with visual impairment which should be followed by ongoing specialized personnel development opportunities for staff working with children with visual impairment.

1.6 Significance of the study

Many initiatives coming from the research community and the educational, conferences, policies and authorities have been directed towards preparing teachers to integrate ICT in their teaching and everyday educational practice (Jimoyiannis & Komis, 2007). Since the aim of teacher education is to prepare competent teachers who are in a position of addressing the learning needs of learners in the classroom, this study intended to find out how prospective teachers are prepared to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. This follows the introduction of the teaching of ICT in teacher education in Uganda in 2013. Since all newly graduating teachers are expected to teach all categories of learners in the same class, teachers are supposed to acquire skills in all areas, including how to use ICTs as pedagogical tools to enable them to teach all learners.

This study may bring to light teachers' views towards teaching and learning how to use ICTs as pedagogical tools and how they could be used during teaching towards facilitating a favorable learning environment for learners with visual impairment. Since the study targeted early career teachers, the study brought to light the kind of preparedness these teachers had acquired during their preservice teacher education in how to use ICT during teaching. This is because it is known that the processes of teacher education are very important for teachers to have sufficient knowledge, skills and attitudes about ICT usage and to realize its integration in the teaching processes (Gündüz, 2020).

Ebner and Schiefner (2010 as cited by Chisango et al., 2020), note that there are two categories of teachers. The first categories of teachers they note are digital immigrants. Digital immigrants learned to use computers at some stage during their adult life and have retained stunted behaviors like printing out emails (Wang et al., 2013; Hoffmann et al., 2014). Ebner and Schiefner (2010 as cited by Chisango et al., 2020; Prensky, 2001) add that teachers who belong to the digital immigrants are those who were trained before ICT was introduced as a pedagogical tool hence they prefer the traditional method of teach-

ing like face-to-face teaching, chalk and board, and the "teach-reply-test" settings are coming to an end.

The second category of ICT teachers is digital natives. These are the new generations of young people born into the digital age (1980 and above) and they tend to speak the language of technology fluently (Wang et al., 2013; Hoffmann et al., 2014; Prensky, 2001). Wang et al. add that digital natives are assumed to be inherently technology-savvy, digital immigrants are usually assumed to have some difficulty with information technology. Whereas the native generation learns through experimentation, collaboration and peer-to-peer connection, the digital immigrants are immersed in an unfamiliar culture of ICT use, language and behavior (Thorvaldsen, & Madsen, 2020).

Nevertheless, to date, in Uganda, teaching prospective teachers how to use ICTs as pedagogical tools is relatively new. Teaching ICT to prospective teachers to use as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment is even newer because most of them either have limited or no skills in its use (McNair & Galanouli, 2002). Notwithstanding, since all teachers go through formal teacher education, there is a need to adapt strategies of preparing prospective teachers on how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. This study may also act as a basis for addressing the gaps encountered by teacher educators, institutions and other interested parties in teaching prospective teachers ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Lastly, this study may contribute to the literature on how prospective teachers could be taught ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. The findings can stimulate interest among different stakeholders to find ways in which the teaching of ICT can be improved especially by adding the component of ICT for persons with visual impairment.

1.7   Organization and structure of the dissertation

This dissertation has nine chapters. Chapter one is the introductory chapter that highlights the introduction and Background of the study, the purpose of the study, the research problem, ICT in education, clarification of concepts, the aim of the study and research questions.

In the second chapter, I discuss the introduction of preservice teacher education in Uganda. This is followed by a description of the introduction of a western type of teacher education in Uganda, teacher education in Uganda today, the introduction of ICT teaching in teacher education in

Uganda and **t**eacher preparation in ICT to facilitate a conducive learning environment. I concluded this chapter by describing **a**n Ideal ICT classroom and application of Actor-Network Theory (ANT). The third chapter presents a review of the relevant literature in teacher education and specifically teacher education for learners with visual impairment. The themes covered in this chapter include an overview of the development of competencies in ICT; perceptions of teaching ICT to prospective teachers as pedagogical tools towards facilitating practical learning environment; other themes include teacher educators' engagement to prepare prospective teachers in using ICT and factors for successful teaching of ICT to prospective teachers. Lastly, I write about institutions working together to improve the skills of prospective teachers in using ICT as a pedagogical tool.

In chapter four, I discuss the actor-network theory (ANT), which I used to analyze the teaching of prospective teachers on how to use ICTs as pedagogical tools towards facilitating a conducive learning environment for learners with visual impairment. I also discuss how ANT could be applied to facilitating appropriate learning environments for learners with visual impairment. I also discuss analytical concepts used in this study: ANT, a research method; the methodological application of ANT in the study; ordering and materiality; the inspiration to use ANT in this study; the merits of applying ANT in educational science; translation as an analytical concept in this study; the justification for applying translation in this study and the impact of ANT in this study.

In chapter five, I discuss the methodology I used during the study. I deliberate on the research approach and design, target population, sample, sampling strategy, data collection, processing, and the overall application of ANT theory as well as the research methodology. I also deliberate the ethical issues considered during the study. I conclude this chapter by describing the limitations of this study.

In chapters six, seven and eight, I present, analyze, interpret, and discuss the data. In chapter six, I present, analyze and discuss data on the competency development, the strategies used, and the hindrances encountered during teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating a suitable learning environment for learners with visual impairment. Similarly, both the intrinsic and extrinsic factors that affect the teaching of ICT to prospective teachers as a pedagogical tool are presented and discussed from an ANT perspective. In chapter seven, I present and discuss findings on teacher educators' engagement towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating an appropriate learning environment for learners with visual impairment. I explain the importance of teaching prospective teachers to teach using ICT as well as combining both ordinary ICT and ICT for learn-

ers with visual impairment. In chapter eight, I discuss how the institutions collaborate with the ministries concerned in Uganda to improve the skill of using ICT while teaching. Finally, in chapter nine I have written the conclusion, recommendations and the need for further research.

2 Chapter Two: Teacher Education in Uganda

2.1 Introduction

This study investigated ICT teaching in teacher education to facilitate appropriate learning environments for learners with visual impairment. To understand how the teaching of ICT was introduced in teacher education in Uganda, I have started by describing the introduction of preservice teacher education in Uganda. This is followed by the introduction of a western type of teacher education in Uganda, teacher education in Uganda today, the introduction of ICT teaching in prospective teacher education in Uganda and teacher preparation in ICT to facilitate conducive learning. I conclude this chapter by describing an Ideal ICT classroom.

2.2 Overview of teacher education in Uganda

The profession of teaching is complex in that it requires various kinds of knowledge thus from general to specific where general knowledge could be knowledge of the subject matter or pedagogical principles whereas specific knowledge is more precise and transitory such as knowledge of what to be taught to particular learners as well as what has taken place in a particular class. For one to be employed in the teaching profession, one has to undergo teacher education. To understand teacher education in Uganda, I introduce this chapter by writing the historical perspective of teacher education in Uganda before the introduction of the European type of teacher education. This is followed by a description of the introduction of a western type of teacher education in Uganda. I conclude this chapter by recounting the preparation of teachers of children with visual impairment in Uganda.

2.2.1 Teacher preparation before the coming of European

Although European Christian missionaries claimed that on their arrival to Uganda in the 18th century, there were no teachers, Tiberondwa[4] (1977) disagrees. According to Tiberondwa, by the time European missionaries came to Uganda, teachers who were prepared by the community or clan elders existed and were engaged in teaching young people important traditional values that could be carried on. Tiberondwa (1977) quotes one traditional ruler of the Lango community in northern Uganda who stated that:

> .... we had our teachers in this area for many centuries. We had our education long
> before the Europeans came here and we had teachers who used to conduct traditional

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[4] It was impossible to obtain Tiberondwa's textbook in order to give the original source.

education wherever man lived. Even animals, both domestic and wild, have educa-
tion and have teachers among themselves (pp. 6-7).

The above statement validates the fact that the type of teacher education Christian missionaries introduced and taught to Ugandans was the western-type as opposed to the traditional one that already existed. Therefore, in Uganda, the introduction of western-type teacher education was built on the tradition that existed and was conducted among community members.

Compared to the western-type of teacher education, where instructors are prepared in formal institutions, in the Ugandan traditional perspective, instructors were community elders, parents, older siblings in the homes and communities or friends where children lived. In some societies, it was the whole community's responsibility in educating children rather than being the responsibility of selected people as it is today. Traditional teachers taught and transferred knowledge and community values to young people who lived within that particular community. When Europeans came to Uganda, they devalued the African system of education hence saw the need of introducing a western type of education. To do this, they had to introduce a western type of teacher education also referred to as preservice teacher education.

2.2.2 The commencement of the western type of teacher education in Uganda

The western-type of teacher education was introduced in Uganda after the arrival of the European missionaries, who introduced formal education (Ssekamwa, 1997; Tiberondwa, 1977 in Hadidja, 2014; Scanlon, 1964a). The Europeans devalued traditional teachers, their quality of teaching, and the type of education. The western-type of education emphasized that the role of teachers is to provide high-quality education as compared to traditional education which aimed at teaching specific aspects and life-long development (Madalinska-Michalak, 2017; Kagoda & Ezati, 2013; Darling-Hammond, 2000). Madalinska-Michalak, (2017) says that among the aspects considered in the quality of western-type education are the teacher's preparation and education level whereby if the teacher has low education, it is assumed that this teacher may not be able to teach appropriately hence the need for teacher preparation institutions.

Today, Ugandan teachers are identified by their teacher education level, professional development, achievements, and placement. There are four levels of teacher education: Certificate, Diploma, Undergraduate (for primary and secondary) through to graduate levels, i.e., Postgraduate [Diploma], Masters, and Doctor of Philosophy (for primary, secondary and post-secondary institutions) (SACMEQ – The Southern and Eastern Africa Consortium for Monitoring Educational Quality, 2017).

There are 51 PTCs in Uganda which offer preservice teacher education for primary school teachers. Forty-five are owned and funded by the government, with most students being sponsored by the government and six are private and funded by religious institutions or individuals (Kagoda & Ezati, 2013; O'Sullivan, 2010). Of the 45 government-aided PTCs, 23 are core institutions that run both pre- and in-service programs and 22 are non-core institutions, hence they run preservice teacher education programs only.

In Uganda, one meets a requirement to join a PTC if she/he has completed at least four years of lower secondary education and possesses a Uganda Certificate of Education (UCE) certificate or its equivalent. An additional two years of advanced secondary education, with possession of the Uganda Advanced Certificate of Education (UACE) is an added advantage (Kagoda & Ezati, 2013; Norton & Tembe, 2006; Okwaput, 2013).

A standard curriculum drafted and enacted by the Ministry of Education and Sports in collaboration with Kyambogo University, (the institution mandated to prepare primary school teachers), is used. The entire teacher preparation program takes two years, in which thirteen subjects are taught. These subjects are Professional Education Studies (with a component of special needs education); Mathematics Education; English Language Education; Foundations of Education; Social Studies Education (which has a component of ICT); Religious Education; Music Education; Physical Education; Kiswahili Education; Local Language Education; Early Childhood Education; Agriculture; Art and Crafts; Business Studies; Home Economics; Technological (ICT) Studies; and Science and Health Education. The duration of the course is two years.

On completion and passing all the above subjects, the candidates are awarded a Grade III teachers' certificate, which is the minimum qualification for primary school teachers. This allows the holder to teach primary school children all subjects in a primary school curriculum (Kagoda & Ezati, 2013). Hence, teacher preparation has an impact on primary teachers' performance, and today's teachers who undergo preservice teacher education are introduced to ICT.

2.2.3   Teacher preparation for children with visual impairment in Uganda

Preparation of teachers in Uganda to gain skills in facilitating appropriate learning environments for learners with visual impairment hit its landmark in 1968. This was the year the first teachers were introduced to the skills pedagogical of teaching learners with visual impairment in special and integrated classrooms to gain skills towards facilitating favorable learning environments for this category of learners. Teachers who enrolled for this course were either teaching in schools that were practicing special education or integration or were intending to carry out the integra-

tion. These teachers were enrolled for a one-year in-service certificate course in a center for the blind where this service was being carried out. The course concentrated on classroom management, causes of visual impairment and its implications, and development of competencies in braille and typing as techniques of teaching learners with visual impairment. What is important to note is that before the introduction of this certificate course in Uganda, most teachers that were interested in teaching learners with visual impairment were either taken overseas for in-service programs, or acquired skills at work while teaching these learners in their respective placements.

In 1988, after about twenty years of separate preparation of teachers who taught learners with different disabilities, the need for more teachers in special needs education grew because of the increasing number of children with visual impairment being enrolled in schools. The one-year in-service certificate course was merged with others taught by different programs to teach children with special educational needs. A curriculum was enacted for the teaching of a two-year course leading to the award of a diploma in various disciplines. To manage this, the Department of Special Education was established at the then Institute of Teacher Education, Kyambogo (ITEK), the present-day Kyambogo University, to prepare teachers to teach children with visual impairment, among other disabilities.

During the above period, there was no policy managing the preparation of teachers in the area of special needs (Okwaput, 2006). In 1991, an act which mandated the establishment of the Uganda National Institute of Special Education (UNISE), which is now the Faculty of Special Needs and Rehabilitation, Kyambogo University, was passed by Parliament to prepare teachers in the area of special needs education (Ssenkaaba, 2017). UNISE was established to develop competencies for teachers who were to teach learners with disabilities. Some of these teachers were already teaching in schools that had children with disabilities, whereas others intended teaching in schools where these categories of children were enrolled. Since most learners were enrolled in integrated settings, in 1992 a policy was established by the government, *Education for National Integration and Development*, which pledged to support special needs education by providing funds in the form of bursaries to support the preparation of teachers in the area of special needs education (Okwaput, 2006; Uganda White Paper on Education, 1992).

The establishment of UNISE marked the stabilization of the diploma course in special education and the beginning of a national strategy for developing support services for children with disabilities, including those with visual impairment. After the stabilization of the diploma course, in 1998 a bachelor's degree course was started in the Department of Education, ITEK, and the pre-

sent-day Kyambogo University. For those who had an interest but already held bachelors' degrees, a postgraduate diploma was put in place. This later led to the introduction of a masters' degree in special needs and inclusive education at the Faculty of Special Needs Education, Kyambogo University. One of the course units taught to these students in ICT. This was done to develop pedagogical and research competencies in teachers teaching learners with disabilities including those with visual impairment.

Today, inclusion is viewed as a commitment to educating each child, utilizing avail-able services and supports, to the maximum extent possible, in the classroom he or she would otherwise attend (Ajuwon et al., 2015). The embracing of the philosophy of inclusive education by most countries, including Uganda, has led to the enrollment of learners with visual impairment into schools closer to their homes. According to Ajuwon et al., (2015), supporters of inclusion believe that in an inclusive setting, children who have disabilities, for example, those with visual impairment, are given opportunities to interact with their peers without visual impairments through simple physical proximity and modeling, which leads to effective social and language skills acquisition that may not be possible in a segregated setting. They add that the benefits of inclusion are believed to increase academic motivation and self-esteem for all learners and promote a sense of belonging for those learners with learning needs (Ajuwon et al., 2015).

Since prospective teachers are taught ordinary ICT, there is a need to include ICT content for learners with visual impairment in the preservice teacher education curriculum. Experience from teacher education programs is a factor that could influence new teachers' use of ICT as pedagogical tools (Instefjord & Munthe, 2016). This could enable prospective teachers to be prepared to use it as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment because many teachers have low levels of ICT knowledge and attitudes about its use in classroom environments (Pilten et al., 2017). Another benefit identified by Mohanty (2011) is that if teachers are taught how to use ICTs as pedagogical tools towards facilitating appropriate learning environments, it makes it easier for them to plan and prepare for a lesson in advance as well as designing appropriate equipment for teaching.

Therefore, teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments should aim at necessitating them to be competent in using various categories of ICT in the classroom (Aslan & Zhu, 2017). The first research question of this study sought to find out the participants' perceptions about teaching prospective teachers how to use general ICTs.

2.3 ICT teaching in teacher education, policies and motivation

The idea of teaching ICT to prospective teachers is linked to UNESCO (2002) and other development agencies, such as the World Bank (2007). These organizations urged governments and member states to consider integrating ICT into preservice teacher education (Tezci, 2011; Lee et al., 2007). Uganda being a member state and signatory to UNESCO, drafted a policy to guide how its teaching could be implemented in these institutions and preservice teacher education in particular. In the next section, I am discussing ICT in teacher education.

2.3.1 ICT teaching in teacher education

Teaching prospective teachers to use ICTs as pedagogical tools, just like using it in other professions, such as engineering and health, is a highly complex and skilled practice that demands applied knowledge. If teachers are not well prepared in its use, it may become a challenge. For example, just like an obstetrician who uses an ultrasound machine to get accurate results must learn how to use the scanner, the same would apply to a teacher who wants to use ICTs as pedagogical tools towards facilitating suitable learning environments. The integration of ICT into the very idea of teaching and learning always places pedagogy over technology (Majumdar, 2006). When one learns ICT, the intention should then diverted to how the acquire knowledge in ICT could be used during teaching. To overcome hindrances that could be encountered while using ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment, teacher preparation plays a decisive role. This is because the possibilities of using ICT during teaching to transform education and its impact on all aspects of society over recent years are becoming common (Instefjord & Munthe, 2016). Transformation, according to Caldwell (2020), is a term used to describe the potential effect of ICT integration on teaching and learning. This is in line with Guma et al., (2013) who say that ICTs provides to teachers and learners with opportunities to operate, store, manipulate, and retrieve information, encourages independent and active learning, self-responsibility in learning in programs such as distance learning, it motivates teachers and learners to continue using learning outside school hours, plan and prepare lessons, design materials such as course content delivery, facilitate sharing of resources, expertise and advice.

Uganda being a member state and signatory to UNESCO, had to implement its teaching in teacher education. The argument by UNESCO and World Bank on the inclusion of ICT in the teacher education curricula was that it should aim at preparing teachers who can cater to the needs of learners with disabilities including those with visual impairment (World Bank, 2007:

UNESCO, 2006). Therefore, they (World Bank, 2007; UNESCO, 2006; UNESCO, 2002) recommended that prospective teachers should be taught a wide range of educational ICTs across their professional preparation and use it as a pedagogical tool towards facilitating appropriate learning environments. Guma et al., (2013) add that:

> The use of ICT in the classroom teaching-learning is very important for it provides teachers and learners with opportunities to operate, store, manipulate, and retrieve information, encourages independent and active learning, and self-responsibility for learning such as distance learning, motivate teachers and students to continue using learning outside school hours, plan and prepare lessons and design materials such as course content delivery and facilitate sharing of resources, expertise and advice (p. 4061).

While preparing prospective teachers, teacher educators need to pay attention to three domains: knowledge, personality and performance/pedagogy. This is to impart to prospective teachers diverse and varying ICT skills at multiple grade levels (Bernadowski et al., 2013).

The Uganda Education Act (Government of Uganda, 2008) and Carlson and Gadio (2002) discuss initial or preservice teacher education as a process that deals with the preparation of individuals to acquire professional competencies and growth that brings the desired standard or sufficiency by instruction and practice that enhances the skill of teaching.

UNESCO (2002; 2006) and the World Bank (2007) guiding documents emphasize that teacher preparation should aim to meet the educational needs of all learners in a classroom. They (UNESCO, 2002; 2006; World Bank, 2007) state that one way of achieving the teaching of ICT to prospective teachers is by infusing it into the entire teacher education program whereby throughout their teacher education experience, prospective teachers should learn about and with ICT and thereafter how to incorporate it into their teaching to facilitating appropriate learning environments. In teaching prospective teachers ICT, Haydn (2014) says that:

> "ICT in Initial Teacher [Education] … [is] aimed to develop insights into how courses of initial teacher training [sic] prepare student teachers how to use ICTs as pedagogical tools in their teaching" (p. 455).

What Haydn means by 'preparing student teachers how to use ICTs as pedagogical tools in teaching' is that teacher educators should have the ability to teach prospective teachers to gain the skills of making good use of ICT as a teaching approach (Haydn, 2014). Therefore, as UNESCO recommends, all teachers need to be taught how to use ICTs as a pedagogical tool

during their teacher education and use it thereafter to address the teaching and learning needs of the Education for All movement[5] in inclusive classrooms (UNESCO, 1994, 2000, 2002; Resta, 2002).

Following UNESCO's recommendation, Uganda implemented the teaching of ICT in PTCs in 2013. Funds were extended towards its teaching by UNESCO through the UNESCO-China Funds-in-Trust and by the Republic of Uganda through the Ministry of Education and Sports (MoES) (ICT teaching guiding paper, 2012).

The point to stress is that introduction of ICT into initial teacher education is fundamental because this supports a foundational shift for teachers' capacity to adapt to changing contexts, circumstances, and new working cultures (Guma et al., 2013). This kind of teacher preparation would help to meet the learning needs of all learners to acquire the knowledge and skills (Hepp et al., 2015; Buabeng-Andoh, 2012; Goktas, et al., 2009; Jimoyiannis & Komis, 2007; Lawless & Pellegrino, 2007; Kessy et al., 2006). This is because in developed countries, prominent ICTs in/for education includes television, radio, laptops, cellular phones, e-book readers, computers, printers, internet, interactive whiteboards, digital videos, simulations, multimedia, scanners, and other electronic equipment in different teaching/learning activities (Jamil et al., 2015). Jamil et al., add that integration of these technologies allows teachers, learners and other educational administrators to intertwine technologies into diverse dimensions of pedagogical practices in a formal educational context.

Since ICT is a crucial element in the advancement of 21st-century society, every person especially teachers and other professionals needs to become ICT-competent (Tan et al., 2017; Hue & Jalil, 2013). This is in line with Hepp et al., (2015), who state that:

> The society of the early twenty-first century is characterized as the knowledge society. Schools cannot afford to remain detached from the fast-moving changes that are taking place…… While knowledge and mastery of digital tools and processes are guarantees of equity in the education system, schools also have to face the challenge of making digital tools and applications available to all their learners without neglecting any aspect of their educational function'. At the same time, teachers must also involve themselves in the digital competences that are the unavoidable landmarks of the education of today and the future (p. 30).

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[5] Refers to the 1990 World Conference on Education for All, held in Jomtien, Thailand (Ainscow, 1995).

The concept of competency here is used to refer to knowledge, skills and attitudes of using ICT as pedagogical tools so that teacher educators could teach prospective teachers how to use them towards facilitating appropriate learning environments. Competency development does not segregate persons with visual impairment and upcoming teachers. Consequently, teaching prospective teachers how to use ICTs as pedagogical tools and thereafter use it as a strategy for teaching learners with visual impairment is significant. For example, in Oslo, a person with visual impairment showed me new technology that has been developed for people with visual impairment. I noticed that there is a new technology that can be used by people with visual impairment for a myriad of activities, such as scanning, reading, writing, interpreting, transcribing from print to braille, and vice versa, self-learning among other uses.

Prospective teachers need to learn skills for operating different and complex ICTs, for example, computers and associated adapted soft wares, PowerPoint projectors and CCTVs, smartphones, mobile telephone soft wares, if they are to use them towards facilitating a meaningful learning environment and process. These types of environments are perceived as those which enable learners to construct deep and connected knowledge that could be applied in real situations (Ertmer & Ottenbreit-Leftwich, 2010). ICTs influence many aspects of human life, for example in workplaces, education, communication, business, and entertainment among others (Mikre, 2011; Jung, 2005). Merely learning an ICT skill is not adequate, but learning pedagogy-technology integration during teacher education to improve work and learning becomes important (Majumdar, 2015).

The type of preparation required during teacher education should be robust but flexible, based on close discussions and interactions between stakeholders (Teo et al., 2016; European Union, 2015). Stakeholders in Uganda that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools for learners with visual impairment are curriculum developers, MoES, MoICT, teacher educators, persons with visual impairment, and any other stakeholder deemed important. The integration of teaching prospective teachers how to use ICTs as pedagogical tools for learners with visual impairment requires even closer and thorough discussions amongst stakeholders involved. The reason for this is that ICT holds great promises for learners with visual impairment as it can lessen or remove several barriers that would otherwise weaken their participation in day-to-day activities including school activities thus promoting inclusion (Stendal, 2012). This could be done to enable stakeholders involved in teacher education to identify the value of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment.

In the next section, I am describing policies regarding ICT teaching in Uganda, the commencement of teaching ICT to prospective teachers and how prospective teachers are taught how to use ICTs as pedagogical tools. In section 2.3.2 below, I have deliberated policies on ICT teaching in Uganda.

2.3.2 Ugandan policies on ICT teaching in teacher education

The Ugandan MoES developed a policy on ICT in education in 2003 that was considered by Cabinet in 2007 (Farrell, 2007). Nevertheless, UNESCO (2014; 2015) notes that Uganda, like other nations in the world, has been recognized for its determinations to integrate ICT in teacher education. Policy concern was on the teaching of ICT competencies to teachers as well as using ICT to teach across the curriculum subjects and to foster research in applications of ICT in education. This policy was to be applied to all education sub-sectors, including non-formal education, and it included strategies for digital learning content development.

To fulfill these shifts as addressed in the policy draft, essential elements in the use of ICT as a pedagogical tool needed to be included in the curriculum to enable teachers to acquire knowledge and skills in its use during teaching (Pavan, 2014). Kyambogo University, being a teacher education curriculum developer, ratified its ICT Policy in 2014 (Kyambogo University, 2014). Objective No. 7.5 of this policy states that ICT teaching among other things should aim at strengthening the capacity of innovations, use of the technology and general workflows. Among the ten (10) strategies listed to actualize Objective No 7.5 is Strategy No. (vii) which aims at harnessing ICT potential in enhancing online and distance learning to maximize flexibility in education and reach out to wider coverage of prospective learners.

The element of using ICT as pedagogical tools towards facilitating appropriate learning environments needs to be recognized in the policy to embrace the goal of lifelong learning. Objective 2 of the policy addressed literacy improvement and human resource capacity-building. Secondly, the policy recognized the integration of ICT into mainstream educational curricula as well as other literacy programs to provide for equitable access for all students, regardless of their abilities (Farrell, 2007). An additional issue in the policy was the development and management of ICT centers of excellence to provide basic and advanced ICT education.

Another policy is the Ministry of Information and Communications Technology (MoICT) *National ICT Policy* (2013). Section 5.3.2 of the National ICT Policy (2013) had several recommendations, including to review curricula from primary to tertiary levels to improve the quality of education by introducing new teaching and learning methods, such as the use of ICTs as ped-

agogical tools towards facilitating appropriate learning environments; to improve the level of funding to improve learning while using ICT equipment, including software as well as broadband connectivity from primary through to tertiary institutions; to impart teachers with the necessary ICT skills to enable them how to use them during teaching and learning processes; to establish educational networks for sharing educational resources; and to create opportunities and provide assistance for the disadvantaged, including people with special needs, to acquire ICT skills. Through the guidance of this policy, the government of Uganda to promote connections among teacher education institutions and between PTCs to enhance ICT skills transfer (Ahimbisibwe, 2018). After the development of the policies, the Government of Uganda and other interested organizations were motivated to start the teaching of ICT during teacher education.

2.3.3   The motivation for teaching ICT in teacher education

The introduction of ICT in teacher education is since modes of teaching are changing and teachers at the center of controlling the teaching and learning process (Guma et al., 2013). Guma et al., identify three objectives that guided the teaching of the use of ICT in teacher education. The first objective they identified was that ICTs can be subjects of study and thereafter leaners can be taught how to use ICT tools in their daily life. The second objective they identified is that ICT in education can be learned and used as an aspect of discipline or profession and applied in professional or vocational purposes. The last objective they identified is that ICT can be used as a medium of teaching (pedagogical tool) and it should focus on its use towards enhancement of teaching and learning process.

In the Ugandan context, as mentioned in section 2.3.2, after the development of the policies, Kyambogo University was mandated to develop the curriculum in collaboration with MoES and thereafter, the teaching of ICT in teacher education took effect. The objectives of teaching ICT to prospective teachers were: to appreciate that ICT skills act as catalysts to improving access to quality education. The second reason is that the teaching of ICT to prospective teachers could create opportunities for integrating them as pedagogical tools to enhance the learning process of learners. Thirdly, its teaching in education could adopt suitable procedures for the planning and procurement of ICT resources. Another reason is that the teaching of ICT during teacher education could be used as a way of exploiting the interactive potentials through efficient management and maintenance of ICT infrastructure. Last but not least, ICT teaching could be used as an avenue of putting in place environmentally-friendly procedures for the disposal of its (ICT) resources. Lastly, the teaching of ICT could be used as an avenue for establishing a framework for monitoring and evaluation of ICT utilization programs. The development of the guiding objec-

tives led to the 2012 curriculum review, and in 2013 some PTCs started teaching ICT to their prospective teachers.

Väyrynen (2000) states that curricula developed and used for teaching ICT should be flexible enough to enable teacher educators to prepare teachers to accommodate varying learning, social, and emotional aspects amongst all learners. This is in line with Lock (2007) who says that:

> With the infusion of ICT in our personal and professional lives, educators in teacher education programs are challenged to provide learning environments whereby prospective teachers learn how to learn and learn how to teach with and through digital technology (p. 576).

With this in mind, institutions that prepare teachers should be made aware of the importance of developing ICT competencies amongst prospective teachers by integrating teaching how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. The majority of prospective teachers and teacher educators have a positive attitude towards teaching using ICT (Netshirando, 2014). Prospective teachers and teacher educators believe that if they acquire the skills of using ICTs as pedagogical tools, they could use them when teaching, which could make learners learn better and more easily (Netshirando, 2014). The above assumption could be proven if prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairments. This type of learning may require an ideal ICT classroom. In the next section, I am going to discuss, in my perception what I think an ideal classroom is.

2.4   An ideal ICT classroom for teaching learners with visual impairment

ICT is one of the parts of technology whereby ICT is an extensional term of communication technology that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals) and computers, as well as necessary enterprise software, middleware, storage, and audiovisual systems, that enable users to access, store, transmit, and manipulate information (Das, 2020). This is because much has been said and reported about the impact of using ICT tools especially computers, smartphones and other gargets during teaching and learning in education (Jhurreev, 2005). Teachers' and learners' approach to ICT use in education is that the teachers are expected to gain teaching outcomes while using it whereas the learners are expected to gain some knowledge during learning (Kingsley, 2017). The question then was 'What could be an ideal ICT environment that may facilitate a favorable learning environment for learners with visual impairment?'

Before the COVID-19 crisis, the MoES of Uganda, just like the Ministry of Education (MOE) in Trinidad and Tobago (Kalloo et al., 2020), had already embarked upon some ICT-driven initiatives such as the provision of an online platform, school hardware and infrastructure and continuous professional development in ICT integration, however, there was not an emphasis before COVID-19 on using online teaching. In January 2020 the World Health Organization (WHO) declared the outbreak of the new Coronavirus disease a public health emergency of international concern. The outbreak of the Novel Covid-19 caused Ugandan institutions of learning from lower primary, secondary education, other Tertiary Institutions following a presidential directive on 20th March 2020 in a bid to avoid the possible rapid spread of new infections of COVID-19 (Mulenga & Marbán, 2020; Nabukeera, 2020). As the COVID 19 pandemic continued to spread across the globe, schools were closed nation-wide in 192 countries leaving an estimated 1.58 billion children, which include an estimated 15,000,000 from Uganda, out of school (Mulenga & Marbán, 2020; World Back, 2020; Nabukeera, 2020).

After the closure of the institutions of learning which was followed by the lockdown, some institutions of learning opted for online teaching and learning. Because of the outbreak of COVID 19, some schools of thought argued that there has been quicken decolonization of curriculums a shift from traditional teaching and research would open opportunities for collaboration (Mulenga & Marbán, 2020; Nabukeera, 2020). The closure of schools has forced teachers across the country to re-evaluate their approach to education whereby both teachers and learners now have to adapt to a new learning environment (McKenzie, 2020).

In some countries, the use of WhatsApp, skype, learning management systems (LMS), videoconferencing, google classroom, zoom groups were urgently created for coordinating the strategy and teaching staff is supporting one another (Nabukeera, 2020; Mulenga & Marbán, 2020). I noted that there was an increase in online lessons, especially teachings on televisions, sharing classwork on WhatsApp, sending work through email and other media that were conducive for sighted learners than learners with visual impairment. In Uganda, teachers formed a project which they named E-learning project Uganda.

Through this project, teachers teaching particular subjects in both primary and secondary schools agreed with television stations to teach particular subjects during the allocated time. For example, Top TV, a television station for one of the Pentecostal pastors in Uganda, suggested that through his TV, primary seven pupils are taught between 0600 and 0900 hours. On the same note, the proprietors of Gugudde television, one of the private television stations in Uganda, suggested that O'level mathematics be taught between 0900 hours and 1000 hours. During the teaching

process, I noted that the closure of schools put children with disabilities at even greater risk of being left behind. It also served as an opportunity to re-think how emergency educational plans could better include children with disabilities.

Whereas the Republic of Uganda recommended that during this period of the lockdown, selected teachers all over the country teach learners through television and local radio stations, the Pakistani government recommended that teachers use video zooming while teaching their learners. This was done to encourage teachers to be in contact with their learners during the COVID 19 lockdown. This is in line with UNESCO (April 2020) that observes that there are several applications, platforms that may help parents, teachers, schools, lecturers and school administrators to facilitate student learning and provide social care and interaction during closure these include. The resources identified by UNESCO are to provide psychosocial support, digital learning management systems, systems built for use on basic mobile phones, systems with strong offline functionality, massive open online course (MOOC) Platforms, self-directed learning content, mobile reading applications, collaboration platforms that support live-video communication, tools for teachers to create of digital learning content and external repositories of distance learning solutions.

In the Uganda context, I noted that this kind of teaching and learning benefited sighted learners more than those with visual impairment. Regrettably, during that time, the beneficiaries of education through TVs were those from urban. Those who benefited from the rural areas are those who come from areas where there is electricity or have alternative power e.g. generators or solar power. Still, most up-country learners missed out on this because they lacked access to TV for one reason or the other.

However, there are numerous ICT resources adapted to facilitate the learning of learners with visual impairment. These resources include: telescopes that are mainly used to provide an enlarged image for near and distant sight while at normal viewing distance; video magnifiers such as pocket viewer which is held over a text to be viewed and the video camera captures magnified text image which is 7 times the original text, displayed on the built-in flat screen for one to read; refreshable braille displays for reading text from the computer screen; text-to-speech conversion software and Digital Access Information Systems (DAISY) for the audio output format of reading materials; text-to-Braille transcription software for example by using Duxbury braille translator (DBT) software and embossing using a Braille printer. Hersh and Johnson, (2008) argue that such ICT resources are very handy for teaching in schools. What could be favorable learning environments for learners with visual impairment?

In my perception, an ICT classroom that may facilitate beneficial learning environments for learners with visual impairment is that which uses appropriate ICT equipment operated by skilled personnel during teaching. I can imagine that this is a kind of environment that is filled with hope, trust, respect, interest, positive attitudes and creativity to facilitate favorable learning environments for learners with visual impairment. Such classrooms may have numerous human and nonhuman actors (various ICT equipment, supporting software and appropriate furniture or handling procedures). The human actors cannot be limited to skilled teacher educators, prospective teachers, and technicians but could be extended to those outside the school setting, to contribute ideas towards facilitating beneficial learning environments towards the use of ICT during teaching and learning. The nonhuman actors may include equipment, stable power supply for example stable electricity, standby generator or solar power, content to be taught, and equipped and accessible classrooms, which may work together for prospective teachers to be taught how to use ICTs as pedagogical tools. Unavailability of any of the above actors may necessitate the opening of boundaries to enable recruitment of missing actors into the network which may enable the teaching of ICTs to prospective teachers how to use ICTs as a pedagogical tool to create appropriate learning environments for learners with visual impairment.

Additionally, an ideal ICT classroom for learners with visual impairment may have skilled personnel and a variety of ICT appliances, such as tablets, desktops, laptops, smartphones/touch screen telephones, and other relevant or adapted equipment that may facilitate appropriate learning environments for learners with visual impairment. The applications that could be installed to this equipment and used to teach prospective teachers ICTs towards facilitating an ideal learning classroom for learners with visual impairment are summarized herein: Jaws and none visual desktop access (NVDA). These are the most popular screen readers for windows machines; Android or iOS accessibility and other software that teachers could be taught during their teacher education. These are packages for android and iOS phones. These packages contain Google talkBack for screen reading, screen magnification and other gesture utilities. These packages could be taught to teachers towards facilitating conducive learning environments among learners with visual impairment take place.

Other applications that could be taught during teacher education towards facilitating an ideal classroom for learners with visual impairment are screen readers and Text Aloud. Screen magnifiers and readers that could be used by people with visual impairment are Zoom, Zoom text, Desktop zoom, Magic and google classroom among others. These applications may enable the conversion of text into audio for listening on any device. Other applications that could be put in

class towards facilitating conducive learning environments are Kurzweil for converting images into recognizable text by screen readers; Balabolka and talkback feature which is used to convert text to audio; VoiceOver is a screen reader for iPhones; and TextGrubber and other software like E-Sight and GPS tools. This software recognizes text on pieces of paper using android devices. I assume if classrooms have all the above, classrooms may become conducive for learners with visual impairments.

Additionally, teachers in an ideal ICT classroom may be able to teach learners with visual impairment to make voice calls, write short message services (SMS) if they could be taught skills of using them as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairments. Teachers could also be taught how to use still cameras, operate a video recorder and/or player, use a voice recorder and/or player, play a radio on a phone, search a music player, use a multi-media service, use word processing, write spreadsheets, make a presentation using a phone, use Bluetooth, and connect to the Internet on a phone or any equipment with Bluetooth, among other uses (Pernia 2008). While some learners could be good at learning through auditory means, others may be great visual learners. The use of an interactive whiteboard by the teacher may allow everyone, including those with visual impairment, to follow and understand the lesson. The teachers' use of interactive whiteboards during teaching may enable learners with low vision to benefit from both visual and auditory presentation, whereas learners who are blind may learn more through the audio presentation. Hence, the use of interactive whiteboards may enable the learning needs of every learner to be sufficiently addressed by the teacher.

2.5 Conclusion

The concept of teaching and teacher education is not a new phenomenon in the African context. Before the introduction of the western type of teacher education and the coming of European teacher educators, Africans had their people who were teachers and teacher education. Nevertheless, pre-service teacher education programs need to develop a plan to teach, and students learn about a wide range of educational technologies across their professional preparation, from introductory and foundation courses to student teaching and professional development experiences with ICT towards facilitating conducive learning environments for learners with visual impairment.

3 Chapter Three:Literature Review

3.1 Introduction

This study investigated ICT teaching in teacher education towards facilitating appropriate learning environments for learners with visual impairment. The aim was to find out how preservice teachers are taught how to use ICTs as pedagogical tools for learners with visual impairment. This research was guided by three research questions. The first research question sought stakeholders' perceptions of teaching ICT to prospective teachers. The second question focused on how teacher educators are engaged in preparing prospective teachers to develop skills of using ICTs as pedagogical tools towards facilitating suitable learning environments. The third research question sought how institutions are working together in an attempt to prepare prospective teachers on how to use ICTs as pedagogical tools towards facilitating appropriate learning environments. Figure 1 below is a summary of the key concepts from the research questions.

Figure 1: Areas with abundant general literature (no intersections) and minimal literature (intersections).
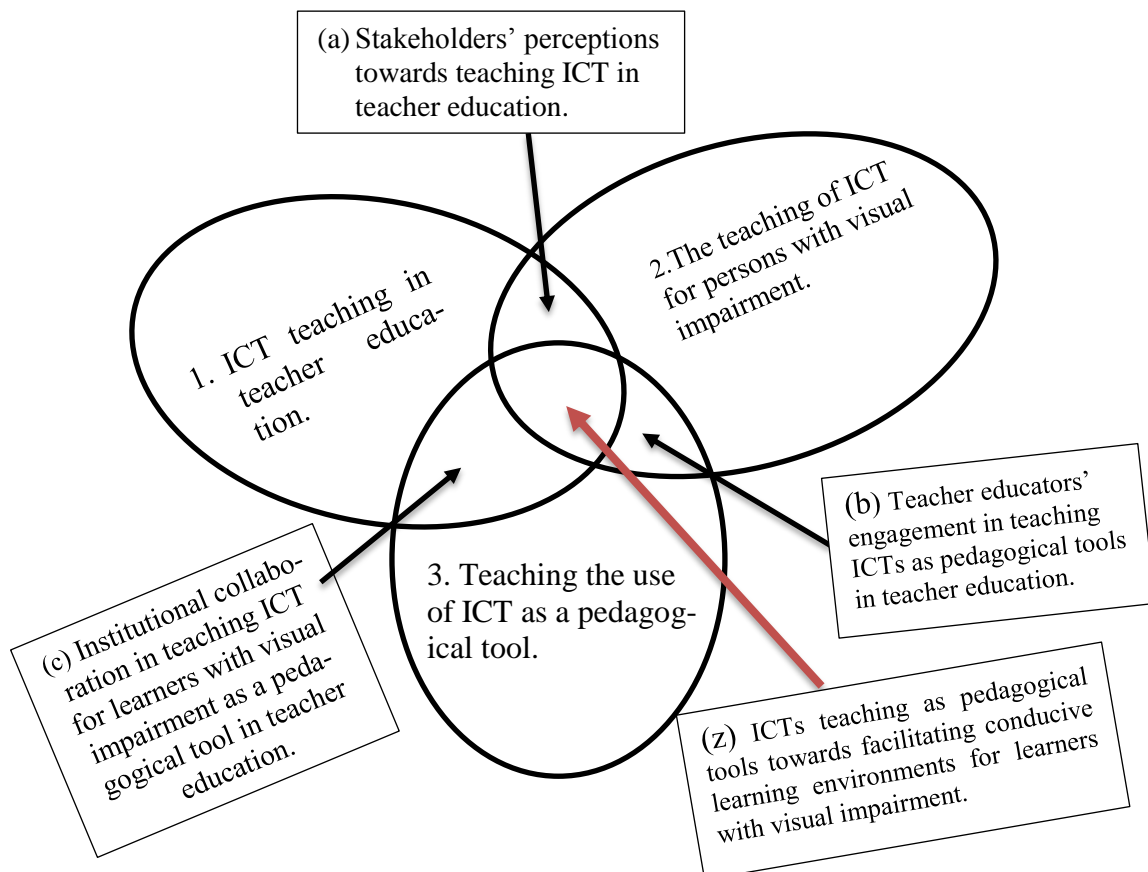
Source: Self - developed

In this chapter, I am reviewing literature related to teaching the use of ICTs as pedagogical tools towards facilitating suitable learning environments for learners with visual impairment. Figure 1 above shows three independent circles numbered 1, 2 and 3. The three circles (1, 2 and 3) repre-

sent areas where there is abundant literature concerning teaching and learning using ICT. I read the literature about these areas to get a general overview of ICT in teacher education, the teaching of ICT for persons with visual impairment and the use of ICT as a pedagogical tool for sighted learners. Between these circles, there are interconnecting points between circles 1 and 2, circles 2 and 3, and circles 3 and 1 which are represented by letters (a), (b) and (c). These intersections formed the research question. The second intersection marked by the letter (z) (where circles 1, 2 and 3 intersect) was the focus of the study.

The key terms I used to search databases were "teacher educators"- "teacher education" - "ICT skills" - " learning" - "visual impairment" - "engagement" – "collaboration" – institutional". I put these terms in a search string. For example, "teacher educators" AND "ICT skills" AND " learning" AND "visual impairment". Sometimes this failed and I used synonyms to search some of the terms by putting OR between these terms and brackets around, e.g ("teacher educators" OR teacher* OR) AND "ICT" AND " learning" AND "visual impairment"

For the literature search, this study was delimited to the following databases accessible to me, namely, the University of Oslo Library, Kyambogo University E-Library, the Education Resources Information Center (ERIC), JSTOR, SAGE Knowledge, SAGE Online Journals, EBSCO, Google search engine, Wiley Library, Oria, ProQuest, Google Scholar and Web of Science. I mostly relied on books, peer-reviewed articles, peer-reviewed journals and book chapters to obtain the literature for my study.

3.2   Stakeholders' perceptions of teaching ICT in teacher education

To bring to light the perceived usefulness of teaching ICT in teacher education, I have written this sub-chapter using three sub-sections. Perception is the process of interpreting and organizing the surroundings into a meaningful condition that covers the user's feeling of like or dislike towards something and it includes positive and negative opinion (Nisa et al., 2020). Therefore, perceived usefulness is the degree to which a person believes that the use of a particular system would be effortless (Elatrachi and Oukarfi, 2020). Research question one sought to know the perceptions of stakeholders towards teaching ICT to prospective teachers. In the first sub-section, I have reviewed the literature on the trends in the development of ICT teaching in teacher education. This is followed by general literature about ICT teaching in teacher education in Uganda supported by other relevant literature. In the last sub-section of this sub-chapter, I have written literature about the perceived usefulness of ICT teaching in teacher education.

3.2.1   Trends in the development of ICT teaching

The beginning of modern-day ways of delivering education has brought significant changes as to how the world views education and teaching (Rosa, 2016). Globalization, innovation and the use of ICT in education has become widespread, continually growing and have led to increased use of ICTs in all sectors of human endeavor with education being no exception (Gbemu et al., 2020; Das, 2020; Ojok, 2018; Celebi, 2019; Rosa, 2016). Teacher preparation in the use of ICTs is the starting point in a country's ICT policy because they (teachers) are considered the cornerstone in the adoption and integration of new technologies (Elatrachi & Oukarfi, 2020). The impact of ICT on learning spaces depends on teachers' expertise to use them, their ability to put them at the service of new communication scenarios, and their skills to adapt them to their students' cognitive and social characteristics (Casillas Martín et al., 2020). With the ways things are done, education needs to follow likewise.

Consequently, the preparation of teachers in this 21st century without integrating the much-required skills like those of applying ICTs during teaching would, therefore, mean wastage of resources (Kayange & Msiska, 2016; Gill et al., 2015). According to the World Summit of the Information Society (2003; 2005 as cited by Ojok, 2018), ICTs should be used in all sectors of education as technical skills are essential for citizenship. Apart from the growth of professionalism, teacher education today must consider teaching ICTs to prospective teachers for their future use during teaching (Krumsvik, 2014 as cited by Tusiime et al., 2019) because teachers have significant roles to play in the application of ICT in the classroom (Singhaviand Basargekar, 2019). Nevertheless, teachers play a decisive role in the successful use of ICT in schools, and their experiences in teacher education programs are a crucial factor in influencing how they subsequently use technology (Instefjord, & Munthe, 2016).

With the rapid movement of the world into digital media and information, the integration of ICT into teaching and learning practices is becoming more and more important and this importance has continued to grow and develop in this 21st century (Alemu, 2015; Albion et al., 2015). Examples of ICT specifically in education are, desktops, mobile telephones, projection technology, digital recording equipment, software applications, multimedia resources, information systems, Intranet, Internet, tablet, PCs, e-readers, laptops among others provide a lot of opportunities, as well as challenges for education in general, particularly teaching and learning process (Singhavi & Basargekar, 2019; Lawrence & Tar, 2018). Despite the above, Aslan and Zhu (2015) say that integration of ICT in teacher education is complex and a challenging issue and as far as pre-

service teacher education is concerned, this becomes critical because they need to be equipped with the competencies of using it for their future teaching practices. This is because it is very important to link education with ICT (Das, 2020).

Although there are many vital components of successful ICT integration in education, perhaps the most important of them, as well as the least emphasized one, is the process of teacher education (Cuhadar, 2018). Cuhadar adds that "no matter how much convenient the components of integration might be, from the ICT infrastructure to the legal and administrative issues, the implementers are teachers and achievement is directly equivalent to his/her relevant capacity and performance" (p.61). This is because the quality of teachers and teaching depends on prospective teacher education programs in which prospective teachers have been enthusiastic to gain competencies among teachers (Siddique et al., 2017). Consequently, teacher's perceptions of using ICTs are important as it forms a tendency that helps them to be favorable or unfavorable towards the usage of the most modern ICT in the field of education (Qasem & Viswanathappa, 2016). The reason being that in this age of globalization, liberalization and privatization, teachers should be well equipped with content knowledge, pedagogy, effective teaching skills, competency and capacity to facilitate the learners to meet the demands of the emerging ICT oriented knowledge-society (Dey & Roy, 2019). If teachers are to use ICT to promote learning, it would be necessary for them to receive professional preparation which should be associated with the curriculum and teaching syllabus (Esfijani & Zamani, 2020). Professional preparation would be promoted during teacher education which could be facilitated using appropriate teaching and learning tools.

The advocacy of teaching ICT in teacher education made Ghana introduce ICT into teacher education curriculum in September 2007 following the recommendations of the ICT4AD document and the Anamuah-Mensah National Education Review Committee Report of 2002 which highlight the importance of integrating ICT into the curriculum at all levels of education (Derke, 2019). As a result of the recommendations from these documents, various teacher education institutions in Ghana are increasingly paying attention to teaching as well as advocating the use of ICTs in teaching and learning (Gbemu et al., 2020; Derke, 2019). Additionally, the government of Ghana and other institutions have and are invested enormous sums of money in procurements of computers and the establishment of computer laboratories in most post-secondary institutions (Derke, 2019).

In Uganda, educational changes have led to a transformation in teacher education. Some teacher education institutions in Uganda have made some transformations in their teacher education by introducing and making the teaching of using ICTs as pedagogical tools towards facilitating advantageous learning environments to all preservice teachers. Referring to Lenhart and Horrigan, (2003 as cited by Ojok, 2018), access to ICT by PWDs including those with visual impairment is steadily increasing and is now seen as a human rights issue, but disabilities like visual impairments remain one of the grounds for being unable to access both ICT. The integration of ICT into education remains a crucial issue for both teachers and students to perform effectively since ICT seems to be an important tool to support new ways of teaching and learning whereby teachers are required to be competent in its use (Aslan, & Zhu, 2015; Ojok, 2018). Competencies in a range of ICTs and the pedagogical abilities to apply them during teaching are now a mandatory element of many teacher education programs across the world (McGarr, & Ó Gallchóir, 2020).

3.2.2 ICT teaching in teacher education

Uganda was one of the first countries in sub-Saharan Africa to implement full inclusion of learners with disabilities in general, and those with visual impairment in particular, into ordinary classes (Charema, 2010). The knowledge of teachers about using different ICTs would help in addressing the learning needs of different categories of learners in the classroom. For example, if a teacher is being prepared to teach in an inclusive class that has learners with visual impairment, this teacher needs to gain skills on how to use different ICTs as pedagogical tools towards facilitating advantageous learning environments that could meet their learning needs. The integration of Information and Communication Technologies (ICT) into the inclusive classroom requires competent teaching staff from both the technological and pedagogical points of view (Fernández-Batanero et al., 2019). In case a class has learners with low vision, the teacher should know the font size, the screen backgrounds, or any other adaptations that each learner works with comfortably.

In most teachers colleges in Uganda, teacher educators experience several barriers/obstacles in the integration of ICT in their classrooms such as lack of knowledge about ways to integrate ICT in lessons, lack of self-confidence among teachers, lack of access to resources, lack of training opportunities, lack of time, technical problems like power cuts, poor administrative support and inadequate teaching content in the curriculum. Most of these hindrances are similar to those identified by Johnson et al., (2016). Therefore, for successful inclusion of learners with visual

impairment, a teacher needs to have the skills of altering teaching strategies to minimize barriers to participation in the classroom.

To meet the needs of all learners in a classroom while using ICTs, teacher education programs play significant roles in preparing prospective teachers towards the integration of ICT into education (Aslan, & Zhu, 2015). Aslan and Zhu add that an important factor for teachers to integrate technology into instruction is being trained on how to integrate technology into education (Aslan, & Zhu, 2015). The introduction of inclusive education called for the teacher education stakeholders to modify curricula to prepare teachers for inclusive education. The ICT content in the PTC curriculum should aim at the professionalization of teachers on how to use ICTs as pedagogical tools and the development of teachers' careers (Hepp et al., 2015). Compared to their predecessors, today, almost all pre-service teachers around the world have an ICT training component in their program and they are in a better position to make ICT part of their teaching (Batane & Ngwako, 2017).

A study was carried out in Malaysia entitled teachers' acceptance of ICT and its integration in the classroom. This study aimed to identify factors that affect teachers' motivation to use information and communications technology (ICT) in the classroom (Mirzajani et al., 2016). The results revealed that adequate support from administrators, with directives to teachers to use ICT, appropriate ICT skills and knowledge as well as adequate resources were important factors that influenced the utilization of ICT in the classroom. Findings also showed that insufficient technical support discouraged teachers from using ICT in teaching while increasing adequate equipment and technical support in schools encouraged teachers in this respect.

Most institutions of learning in developing countries including Uganda are trying to implement the teaching and use of ICT in institutions of learning. Despite the above, most of these countries are encountered by some obstacles. For example, Wilson Pholld Mwakyusa from Tanzania Institute of Accountancy, Mbeya Campus, together with Neema Venance Mwalyagile from Mzumbe University, Mbeya Campus, carried out an empirical review of 18 relevant pieces of literature to find out the most critical obstacles to the adoption of E-Learning in higher institutions of learning in Tanzania (Mwakyusa & Mwalyagile, 2016). This empirical review found that there is a serious problem of technological infrastructures including lack of computers in HLIs to save students all time, low internet bandwidth, low ICT- competence among the educational stakeholders which impede successful e-learning implementation. In this context, infrastructure is one of the crucial variables to integrate ICT into education (Aslan, & Zhu, 2015). Mwakuya

and Mwalyagile (2016) found that most of the HLIs had no e-learning policy operational as a result there is a lack of technical and managerial support towards the new e-learning technology.

Similarly, Deryakulu and Altun-Akbaba, (2014) carried out a study that examined the classroom management problems that Turkish public middle school Information and Communication Technologies (ICT) teachers face in computer laboratories and classroom management strategies that these teachers employ. They conducted a content analysis on 44 videotaped ICT lessons and the results were similar to those found by Mwakyusa and Mwalyagile, (2016) in the study they carried out in Tanzania. Results from these studies showed that the majority of computer laboratories were ill-suited for teaching ICT.

The Australian Professional Standards for Teachers (2016) uses three domains within their guiding framework: Professional Knowledge, Professional Practice and Professional Engagement (Tondeur et al., 2018). Tondeur et al., (2018) say that in each of these domains in ICT are both overt and implicit, with respective examples as Implement teaching strategies using ICT to expand curriculum learning opportunities for students. Secondly, demonstrate knowledge of a range of resources, including ICT, that engage students in their learning; Understand the relevant and appropriate sources of professional learning for teachers (Tondeur et al., 2018). Internationally, therefore, ICT is conceptualized as a pedagogical tool rather than a skill-based competency. The need for ICT-based expansion, especially to the area of teacher education, is a global resolution that has been and would remain to be a subject of great significance to all mankind for many years (Barakabitze et al., 2019; Siddiq et al., 2017).

I believe that a change in the level of knowledge and awareness and development of competencies of using ICTs as pedagogical tools by late and early career teachers is quite essential. This could be achieved if teachers are prepared to develop skills for using ICTs as pedagogical tools to gain skills in facilitating convenient learning environments for learners with visual impairment. This may happen if the teaching modes could lead to changes and hence support teachers who missed out on their preservice teacher education's ICT component. Secondly, I assume that if teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment, it would provide specific reasoning and problem-solving strategies that are relevant, effective, and efficient to achieve the lesson objectives. Although many teachers come to schools and PTCs with self-taught ICT, the introduction of all its aspects as a pedagogical tool towards facilitating a practical learning environment would enable them to tackle classroom challenges.

As Uganda adopted ICT teaching in preservice teacher education, there were benefits but also the same challenges faced by most developing countries (Farrell, 2007). If ICTs are not designed for PWDs, then it can become a barrier (Busuulwa, 2015). Busuulwa adds that:

> (F)or PWDs in developing countries, this barrier is twofold as it includes, apart from design, all the disadvantages inherent in the developing world, such as the difficulty of gaining good internet access (p. 1).

This becomes an issue when teachers are expected to use ICTs as pedagogical tools to gain skills in facilitating convenient learning environments for learners with visual impairment. It is imperative to examine, analyze, and discuss the conditions of how preservice teachers are taught how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment.

A conducive environment for teacher preparation could also be created by helping pre- and inservice teachers to acquire skills to help all learners, including to gain skills that may enable them towards creating convenient learning environments for learners with visual impairment, and help these categories of learners to develop their full potential, rather than looking at these learners' impairments.

3.2.3 Perceived usefulness of ICT teaching in teacher education

The success of any initiatives to implement ICT in an educational program depends strongly upon the support and attitudes of teacher educators involved (Rana, 2016). Attitude refers to a psychological inclination expressed in appraising an entity with some degree of favorability or unaffordability which could be based on cognitive, affective and behavioral components (Paños et al., 2020). Attitude towards ICT is acknowledged as; "perceived usefulness, computer confidence, preparation, … knowledge about computers, anxiety and confidence and liking" (Teo, 2008, p. 414) and other ICT equipment and content. Therefore, the growth of ICT is changing the way society transmits information whereas the digital transformation is changing not only society but also education and it is believed that it makes learning entertaining and enhances the effectiveness and productivity of teaching (Rana & Rana, 2020; Flórez-Aristizábal et al., 2019; Siddiq et al.,2017; Baydas, & Goktas, 2016;). Teachers' attitudes towards ICT have implications in its use and implementation in the classroom (Teo, Zhou & Noyes, 2016; Netshirando, 2014; Teo, 2008). The concept of perceived usefulness of ICT concerns what a person (e.g. a teacher) believes about the benefits of using ICT to achieve curriculum goals and meeting the

expectations of the learners, the teacher who is teaching and institutional administrators (Gud-mundsdottir & Hatlevik, 2018).

Secondly, the attitudes of teacher educators are likely to affect how preservice teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. The attitudes of teacher educators play vital roles in the integration of ICT into preservice teacher education curricula (Netshirando, 2014). Attitude, in turn, constitutes various dimensions like perceived usefulness, computer confidence, training, gender, preparedness, knowledge about computers, anxiety, confidence, and the liking of computers and other ICT equipment and content (Rana, 2016). Perceived usefulness represents the degree to which a user believes that using technology would enhance his/ her work quality and performance as an important determinant for user acceptance (Teo, Fan & Du, 2015). In this study, the concept attitude is used to refer to perceptions towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairments. Hence, the attitude of preservice teachers towards using ICTs as pedagogical tools refers to their ability to learn it and later use it as a pedagogical tool towards facilitating practical learning environments during teaching (Aslan & Zhu, 2016). The attitudes of teachers who are specially prepared to teach learners with visual impairment are more positive to special class/unit placement than that of teachers without specialist training (Dakwa, 2015). Therefore the inclusion of the teaching of ICT for persons with visual impairment in teacher education as a pedagogical tool towards facilitating conducive learning environments depends entirely on teacher educators and prospective teachers' attitudes.

ICT is useful for creating new ways of teaching and learning, which may make teachers teach ad give learners with disabilities opportunities to engage in basic drill and practice, simulations, and exploratory or communication activities that are matched to their individual needs (Yeni & Gecu-Parmaksiz, 2016; Fernández-López et al., 2013). According to Aslan and Zhu, (2016) and Tondeur, van Braak, Siddiq, and Scherer, (2016 as cited by McGarr, & Ó Gallchóir, 2020), there are growing concerns globally that the adoption of ICT in education is superficial and, when used, tends to support pedagogical practices that are quite structured and teacher-centered rather than student-focused. It is perceived that ICTs are important for the educational process whereby teachers should play the main role in the adoption and integration of ICTs in the teaching-learning process in influencing this process (Baş et al., 2016). The principal intention of any educational initiative is to equip learners with skills, knowledge, competencies and attitudes that can make them function efficiently in society (Amankwah et al., 2017). This same principle

could be applied if prospective teachers are to be taught to use ICTs as pedagogical tools towards facilitating conducive learning environments for persons with visual impairment.

One of the important aspects to note is that changing and advancing conditions like the use of ICT in the area of education have caused transformations in learning and teaching environments as in several other areas because this transformation contains several elements from the technological infrastructure of the schools to the teacher skills (Göksün & Kurt, 2017). Strong infrastructure in addition to providing equal access for all is highly important to integrate ICT in education successfully because it is one of the crucial variables to its integration into education to facilitate ease of use and employing technical staff to help users (Aslan & Zhu, 2015).

As I have stated in section 1.2, and subsequent sub-chapters, to teach the knowledge and skills needed in the 21st century, educational systems around the world, in both developed and developing countries, are under pressure to integrate ICTs into preservice teacher education programs so that prospective teachers could develop skills of using them as pedagogical tools (Aziz & Quraishi, 2018; Baş et al., 2016; Bhattacharjee, & Deb, 2016; Hepp et al., 2015; Gill et al., 2015). The integration of ICT into preservice teacher education is the very idea of teaching and learning always places pedagogy over technology (Majumdar, 2006).

Ferro and Martínez y Otero (2009 as cited by García-Alcaraz et al., 2019), say that there are some advantages of using ICT in education and some of these are:

> (B)reaking time and space barriers in teaching and learning activities: In this way, educational institutions can offer courses or programs online, improve communication between participants of the teaching-learning process; ICT improve synchronous and asynchronous communication between teachers and students, Personalized teaching: the teaching-learning process that uses ICT enables the possibility of adapting the information to the needs and characteristics of the students, quick access to information: both, students and teachers can use ICT to have faster and more efficient access to information, thus reducing the degree of obsolescence, obtaining relevant formation, as well as increasing its degree of authenticity, the possibility of interacting with information; when ICT is incorporated into the teaching-learning process, the student ceases to be only an active information processor (reception and memorization), turning into a significant constructor; increase the interest and the motivation of the students: The ICT motivates the students and captures their atten-

tion so that it incites the activity and thought, ICT facilitate the professional updating

of teachers in an easy and faster way. (pp. 146-147).

The above advantages could be taught to prospective teachers so that as they learn ICT, they are in a position to apply it as pedagogical tools to facilitate conducive teaching and learning environments for learners with visual impairment.

There are, however, barriers to the adoption and use of ICTs in education, including work environment; inadequate ICT infrastructure, such as computers, poor internet connections, and so on; teachers' attitudes toward ICTs; and lack of digitally competent teachers (Chisango et al., 2020). A work environment may also be a barrier to the use of ICTs in teaching and learning. For example, in schools where school administrators do not support teachers in the use of ICTs, technologies may not be probably implemented. A lack of digitally competent teachers is another hindrance to the use of ICTs in teaching and learning (Chisango et al., 2020). Notwithstanding the above barriers, I had to ask participants whether teacher educators are engaged in teaching prospective teachers ICT. The responses are presented, interpreted, analyzed and discussed under.

3.3   Teacher Educators engagement in ICT teaching in teacher education

ICT in the modern world is not only a tool but also an environment that opens up new opportunities to learning at any convenient time, continuing education, among others (Bilyalova et al., 2019, May). The subjective concept that guided this research question was engagement, derived from the verb engage. To engage is a subtext that refers to the involvement, commitment, passion, enthusiasm, preoccupation, engrossment, zeal, dedication, and energy to do something (Schaufeli, 2014). "Something that engages us is that that draws us in, attracts and holds our attention", (O'Brien & Toms, 2007, p. 938). According to Fredricks, Blumenfeld, and Paris, (2004 as cited by Kim et al., 2015), engagement is defined in this research as behavioral, cognitive, and emotional participation. Without engagement, learning hardly occurs (Kim et al., 2015).

Positive engagement of teachers at work may positively impact their attitudes towards their job but in the process, teachers may experience burnout during their career, which may negatively impact their professional learning opportunities (Fiorilli et al., 2020). By finding out how teacher educators were engaged in preparing preservice teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment, I aimed to find out how teacher educators were involved, committed, passionate, enthusiastic, and engrossed in preparing preservice teachers how to use ICTs as pedagogical tools. ICT in education

refers to the use of computers, laptops, tablets, interactive smartboards, overhead projectors, and other forms of technology that are used in classrooms for educational purposes (Hart & Laher, 2015). All these equipment should be geared towards facilitating conducive learning environments for all learners including those with visual impairment in a classroom.

3.3.1 Commitment to ICT teaching in teacher education

Extensive research has been carried out on the teaching of ICT, mostly aiming at the preparation of in-service teachers (Drossel et al., 2017; Baş et al., 2016; Bhattacharjee, & Deb, 2016). Some of these researches have paid attention to preservice teachers, especially their engagement and attitude towards its teaching and learning (Zhou et al., 2010). In the case of preservice teachers, their competencies in teaching using a particular pedagogical approach like using ICTs as a pedagogical tool can be developed during their teacher education, supplementing their aspirations or expectations that they have before entering the teacher education program (Nghia & Tai, 2017). Tondeur et al., (2018) note that there are six strategies to develop pre-service teachers' ICT competence. The first strategy they identify involves teacher educators acting as role models because pre-service teachers preferred approaches in which academics exhibit various technologically supported teaching methodologies specifically related to curriculum domains. Tondeur et al., (2018) believe this modeling could be important as pre-service teachers tend to adopt the teaching styles they were exposed to during teacher education.

The second strategy that Tondeur et al., (2018) identify is discussing and reflecting upon successful uses of technology in practice. They express this strategy as the use of an online community where preservice teachers have the opportunity to share, develop and critique learning resources to help them integrate technology in their lessons. Tondeur et al., (2018) add that this strategy may help preservice teachers see the utility, value and feasibility of using particular ICTs and/or teaching strategy and later furthering their abilities in differentiating between model and appropriation, enabling deeper more critical thought about technology integration.

According to Tondeur et al., (2018), research also suggests that providing pre-service teachers the opportunity to learn about technology integration by (re-)designing curriculum materials (Strategy 3) can also be a promising strategy (Lee & Lee, 2014). In several studies, pre-service teachers stated that technology integration required additional planning and preparation because they had no prior knowledge about or experience with the design of ICT-supported learning activities (e.g., Polly et al., 2010). Many studies have demonstrated that group work (Strategy 4) might mitigate these feelings of insecurity when teachers need to design technology-related cur-

riculum materials (Tearle & Golder, 2008). As a fifth strategy, pre-service teachers may also apply their knowledge of educational technology in authentic settings (Sang et al., 2010; Valtonen et al., 2015). These types of engaging experiences lead pre-service teachers to a better understanding of the link between theories and teaching practices (Sang et al., 2010). Finally, the sixth strategy involves on-going and process-oriented feedback, which has been proven to be beneficial for pre-service teachers' abilities to use technology in the classroom (Banas & York, 2014). These strategies need to be infused as a systemic aspect throughout the entire program rather than presented in separate "stand-alone" courses (Polly et al., 2010; Strudler et al., 2003) so that pre-service teachers can understand the reasons behind using technology.

An important issue to note here is that the quality of education learners with visual impairment largely depends on the quality of teachers; that is an academic qualification, professional training, commitment and dedication (Mugambi, 2011). Nevertheless, little research is available on how preservice teachers are taught how to use ICTs as pedagogical tools towards facilitating a suitable learning environment for learners with visual impairment, which affected this study's search for relevant literature.

Before and during teaching ICT to preservice teachers, teacher educators need to find out information about their students' home and academic backgrounds. This could act as a baseline to which teacher educators could refer to start teaching preservice teachers ICT skills and knowledge that would enable its use while working with diverse learners in their classrooms (Hepp et al., 2015).

Teaching the use of ICTs as pedagogical tools, just like using it in other professions, such as engineering and health, is a highly complex and skilled practice that demands commitment, engagement and applied knowledge. If teachers are not well prepared in its use, it may become a challenge. For example, just like an obstetrician who uses an ultrasound machine to get accurate results must learn how to use the scanner, the same would apply to a teacher who wants to use ICTs as pedagogical tools towards facilitating suitable learning environments. When one learns ICT, the intention should then diverted to how the acquire knowledge in ICT could be used during teaching. To overcome hindrances that could be encountered while using ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment, teacher preparation plays a decisive role. This is because the possibilities of using ICT during teaching to transform education and its impact on all aspects of society over recent years are becoming common (Instefjord & Munthe, 2016).

According to Bernadowski et al., (2013), while preparing pre-service teachers, teacher educators need to pay attention to three domains: knowledge, personality and performance/pedagogy. The purpose of paying attention to the three domains is to prepare prospective teachers diverse and varying ICT skills at multiple grade levels (Bernadowski et al., 2013). If teachers are taught how to use ICTs as pedagogical tools towards facilitating appropriate learning environments, it makes it easier for them to plan and prepare for a lesson in advance as well as designing appropriate equipment for teaching (Mohanty, 2011).

The embracing of the philosophy of inclusive education by most countries, including Uganda, has led to the enrollment of learners with visual impairment into schools closer to their homes. Since preservice teachers are taught ordinary ICT, there is a need to include ICT content for learners with visual impairment in the preservice teacher education curriculum. Experience from teacher education programs is a factor that could influence new teachers' use of ICT as pedagogical tools (Instefjord & Munthe, 2016). This could enable preservice teachers to be prepared to use it as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment because many teacher educators have low levels of ICT knowledge and attitudes about its use in classroom environments (Pilten et al., 2017).

To address such shortcomings of teacher education while preparing future teachers to teach with technology, teacher education programs should not concentrate only on developing technological skills through educational technology courses, but should also focus on how technology can be used for teaching and learning (Zhou et al., 2016). In the next sub-section, I review the literature related to the Importance of engagement during teaching ICT to preservice teachers. In summary, teaching pre-service teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments should aim at necessitating them to be competent in using various categories of ICT in the classroom (Aslan & Zhu, 2017). These categories could be visual ICTs, auditory ICT, touch ICTs or ICTs that could be used during teaching learners with visual impairments in the classroom.

3.3.2 Importance of engagement during teaching ICT to preservice teachers

The characteristic of education delivered by the government to all people defines its success. The UNESCO ICT competency framework for teachers (2002) identifies three basic characteristics of professional teachers: (i) the ability to learn using ICT; (ii) the ability to solve complex real-world problems using ICTs; and (iii) the ability to create new knowledge using ICTs (Stronge, 2018; Kihoza et al., 2016). Preservice teachers who are guided on how to integrate the

use of ICTs as pedagogical tools in meaningful ways have a deep understanding that teaching must be transformative (Nelson et al., 2009). Additionally, Stronge, (2018) states that other specific characteristics of teacher responsibilities and behaviors that contribute directly to effective teaching are listed for each of the following categories: (i) the teacher as a person; (ii) classroom management and organization; (iii) organizing and orienting for instruction; (iv) implementing instruction; (v) monitoring student progress and potential; and (vi) professionalism.

Transformation is a word frequently used in connection with modern educational changes, particularly when such changes involve new technologies and education for the information society (Fisher, 2006). Fisher said that, since the word transformation in education is used in connection with modern educational changes brought about by ICT, it should not mean mere change but should mean more, for example, complete change. Such change should be a radical, profound and fundamental one if institutions have transformed. The transformative applications of using ICTs as pedagogical tools towards expediting satisfactory learning environments in education refer to non-traditional emerging uses, where exposure to and deployment of ICTs fundamentally change the way education is conceived and delivered to students (Rodrigo, 2003). This quality of openness to change is defined by the teachers' level of enthusiasm and comfort with the inclusion of new teaching methods, even when they entail the possibility of taking risks and making mistakes (Badia et al., 2013). This is determined by the curriculum developed and the kind of preparedness of the teacher that is carrying out implementation.

Therefore, Guma et al., (2013) say that for successful integration of using ICTs as pedagogical tools into the teaching-learning process, factors that may positively influence teachers' and administrators' use of ICT in education include teachers' attitudes, ICT competence, computer self-efficacy, teaching experience, education level, professional development, accessibility, technical support, leadership support, the pressure to use ICT, government policy on ICT literacy, and technological characteristics. They add that the presence of all the above factors may increase the probability of excellent integration of ICT in teaching-learning process. Therefore, teacher preparation on how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment should be increased if teachers are to be convinced of the value of using ICT in their teaching-learning process. Sometimes this type of teaching and learning may take place where there is a collaboration between different entities like institutions.

3.3.3   Determinants of ICT teaching to prospective **teachers**

ICT teaching as pedagogical tools to prospective teachers towards facilitating appropriate learning environments needs to be fully infused into the entire preservice teacher education program. This is to enable preservice teachers to learn about and with ICT and later incorporate it into their teaching towards facilitating a practical learning environment. Teaching prospective teachers how to use ICTs as a pedagogical tool towards facilitating appropriate learning environments for learners with visual impairment depends in part upon the advocacy, support and attitude of those involved in its inclusion into the teacher education program (Teo, 2008; Jimoyiannis & Komis, 2007; Society for Information Technology and Teacher Education, 2002). Secondly, teachers' attitudes towards learning ICTs have implications in its teaching, learning, use and implementation (Teo et al., 2016; Netshirando, 2014). Attitude represents a person's disposition toward performing a certain behavior (Gyamfi, 2017; Teo et al., 2016: Okwaput, 2013).

The development of attitudes and beliefs about the abilities to use ICTs to transform instruction for the better is necessary but not enough (Zyad, 2016). Research studies have shown that having a positive attitude towards ICT is necessary but not sufficient by itself in achieving effective ways of its use in education (Tezci, 2011). Hence, the teacher's attitude towards using ICT is quite significant, in that the applications they learn and competencies they acquire are slightly different from those needed by other professionals, such as veterinary doctors and stenographers, among others. Many teachers could have positive attitudes towards using ICTs as pedagogical tools towards facilitating appropriate learning environments, but they might not consider themselves qualified to effectively integrate it into their instruction (Jimoyiannis & Komis, 2007). ICT learning during teacher education could limit preservice teachers to given programs, which they may find challenging to apply them as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment. Inadequate teacher preparation and experience could be considered one of the main reasons why teachers have negative attitudes toward computers and using them in their teaching and learning (Jimoyiannis & Komis, 2007). Other determinants are the perceptions of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating beneficial learning environments. This would be discussed from two perspectives: the perceived usefulness of teaching ICT to prospective teachers and factors to consider when teaching ICT as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment.

3.4 Institutional collaboration in teaching ICT as a pedagogical tool

Teaching ICT is a collaborative effect of governmental and non-governmental institutions as well as individuals, intending to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairments. Several institutions, for example, MoES, PTCs, curricula developers, MoICT are involved in teaching ICT to prospective teachers. Others like UNAB could also be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This could happen if the preservice teacher education curriculum was written in collaboration with other sister institutions to harness its inclusiveness. The type of teacher preparation required is that which is robust but flexible and based on close discussions and interactions between stakeholders to enable these changes to take place (Teo et al., 2016; European Union, 2015).

Friend and Cook (2007) and Turnbull, Turnbull, Erwin, and Soodak (2006 as cited by Ricci et al., 2017) define collaboration as an umbrella term encompassing a variety of interactions between professionals with distinct expertise and mutual goals, with these individuals participating equally and actively in joint endeavors. Collaborative mentoring in teacher education, according to Wang (2001), Hobson, Ashby, Malderez, and Tomlinson (2009) and Mathur, Gehrke, and Kim, (2013 as cited by Dorner, and Kumar, 2016) is one of the most important strategies to support apprentices learning to teach and helps to improve confidence, self-esteem, and the ability to problem-solve. ICT in teacher education has a multiplier effect throughout the school system, by; enhancing learning and providing students with new sets of skills, reaching students with poor or no access, facilitating and improving the training of teachers, increasing the possibilities of communication and reinforcement of the development of skills of coordination and collaboration between peers and minimizing costs associated with the delivery of traditional instruction (Haji et al., 2017).

Collaboration during teacher education should focus on sharing knowledge expertise, discussing subject contents and reflecting on teaching practices and in the process, pre-service teachers and mentors learn from each other, subsequently improving their ability to identify and explain their teaching practices (Liu et al., 2015). Liu, Tsai, and Huang add that meaningful collaborative relationships between pre-service teachers and mentors should enable a focused dialogue on teaching and learning.

This is in line with the Jasper Project (Cognition and Technology Group at Vanderbilt, 1997), which stated that teaching preservice teachers an activity like using ICTs as pedagogical tools to enable advantageous learning environments needs collaboration between different institutions that could have shared roles, such as specialized teaching and supplying equipment, among others. What brings about the collaboration between different institutions is the project being worked on, for example, the intention or motivation to achieve the goal of teaching preservice teachers how to use ICTs as pedagogical tools towards facilitating beneficial learning environments for learners with visual impairment. As Gourneau and Lazar (2020) say, the goal of teacher education preparation programs is to prepare future teachers who will be able to successfully demonstrate knowledge of content, skills, and pedagogical practices for the diverse learners in their classrooms. Therefore, when planning lessons, teachers need to include differentiated instructional strategies as well as the integration of technology to improve learner's learning and for that reason, teacher educators must prepare prospective teachers to use digital technology tools in educational and purposeful ways (Gourneau & Lazar, 2020). This, therefore, calls for different institutions to come together so that preservice teachers could be taught how to use ICTs as pedagogical tools towards enabling advantageous learning environments for learners with visual impairment.

Ngwoke, Aneke and Ibiam (2020) carried out a study in Nigeria entitled "Inclusive education and learning difficulties among special needs children in Nigeria: the case of the visually impaired". After analyzing data and extensively reviewing the literature, they deliberated on the status of inclusive education and identified numerous challenges to the implementation of inclusive education programs in Nigeria. The challenges Ngwoke et al., (2020) identified during their research that affected the education of children with visual impairment included poor funding, poor teacher preparation, lack of school counselors, poor infrastructure, lack of adequate collaboration among regular and specialized personnel and families, unwholesome attitude or stigmatization among others. They also noted that to make the education of learners with visual take place, the above challenges have to be addressed.

Collaboration between institutions that could be involved in teaching preservice teachers how to use ICTs as pedagogical tools would come together after studying the content in terms of how it was or could be generated, its relevance to meet the purpose, how it could be transmitted, and how networks could be built to implement its teaching (Hepp et al., 2015). To identify institutions that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards expediting advantageous learning environments would begin by identifying the

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institutions involved in teacher education, in light of their relevance, their input into the program, and prospective teachers' and teacher educators attitudes, towards learning it. This is because teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment cannot be assigned to PTCs alone instead, it would be done hierarchically. Teacher educators need to find out what prospective teachers already know and start teaching from what they already know.

Another reason for the collaborative preparation of teachers who teach learners with visual impairment is that it requires longer and more thorough preparation than the ordinary teachers because the preparation of teachers to teach learners with visual impairment requires additional skills (Ponchillia & Ponchillia, 1996). During the collaboration, different institutions could bring together ideas that could provide different levels to enable the teaching of ICTs to prospective teachers to take place, to improve their skills of using them as pedagogical tools towards facilitating advantageous learning environments for teaching learners with visual impairment.

Basing on the literature, it is evident that, in teacher education, the reality of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable teaching environments for learners with visual impairment has not been looked because ICT looked at if it is made for a given purpose e.g. telecommunication but not how it is used in teaching and learning.

3.5 Conclusion

To carry out a study, which focused on ICT teaching during preservice teacher education, there was a need to review what other writers have found out about its teaching. I started by writing what other writers' perceptions of ICT Teaching in Preservice Teacher Education. Literature reveals that in other parts of the world, ICT is being taught to prospective teachers because of its usefulness in being used as a pedagogical tool. Literature shows that one of the determinants of teaching prospective teachers ICT as a pedagogical tool is the attitude of both the teacher educators teaching it as well as those being taught. Most of them had a positive attitude towards its teaching and learning as it could help them facilitated appropriate learning amongst learners.

Secondly, literature shows that while ICT is being taught as a pedagogical tool there needs to be a collaboration between different institutions. These institutions should be from the government to nongovernmental organizations. This is helpful in that it tends to bring together people with different ideas and skills which can make teaching practical, especially concerning teaching preservice teachers ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment.

4   Chapter Four: Theoretical Framework

4.1 Introduction

This study investigated ICTs teaching in facilitating favorable learning environments for learners with visual impairment. The intention was to find out how prospective teachers are taught to use ICTs as pedagogical tools. The research questions that guided this study are: What are the perceptions of stakeholders towards teaching ICT in general to prospective teachers?; How are teacher educators engaged in preparing prospective teachers to develop skills of using ICTs as pedagogical tools towards facilitating a conducive learning environment for learners with visual impairment? The third question is, how are institutions working together to prepare prospective teachers on how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment?

In this chapter, I have explained Actor-Network Theory (ANT), the theory that guided this study. I have started this chapter by giving an overview of the concept of ANT and its founders. This is followed by the clarification of the terms that I have used in this chapter. Although ANT is having many terms, I chose four thus actor, network, actor-network, and translation, as concepts of the description on how prospective teachers are and could be taught to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. Since ANT involves the applicability of socio-material (human and nonhuman) entities, it is very helpful in finding out the roles of human and nonhuman actors in teaching ICT. This is followed by a discussion of ANT as a theory that guides the teaching of ICT to prospective teachers in Uganda.

4.2 An overview of Actor-Network Theory (ANT)

Given the complexity of ANT, I have elaborated on the general overview of ANT using three subsections. In the first subsection, I have written about the origin of ANT and how different actors work in an actor-network (4.2.1). I have also clarified ANT concepts (sec. 4.2.2) that I have applied in this study. At the end of this sub-chapter (sec. 4.2.3), I have described an understanding of ANT.

4.2.1   The origin of ANT

Actor-Network Theory, abbreviated as ANT, also known as enrolment theory or the sociology of translation, was found in the 1980s by Bruno Latour, Michel Callon and John Law (Jessen & Jessen, 2014; Montenegro & Bulgacov, 2014; Barry, 2013; Allen, 2012; Jóhannesson, & Bærenholdt, 2009; Dankert, 2010; Davey, 2007; Callon & Latour, 1981). It (ANT) is a sociological

theory that can be applied in a myriad of studies in both academic and non-academic fields (Jiang, 2016; Allen, 2012; Fenwick &Edwards 2010). ANT originates from the studies of Science, Technology and Society (STS) in which the knowledge production dynamics are investigated considering human and nonhuman actors (Allen, 2012; Jóhannesson, & Bærenholdt, 2009; van der Duim et al., 2013; Cavalcante et al., 2017). It is a theoretical and methodological approach to social research where everything (humans and nonhumans) in the social, as well as the natural world, exists and constantly extending networks of relationships. Allen, (2012) observes that ANT, despite the name, does not describe a theory, but rather a method of describing the how assemblages hold their shape rather than why they do so; or how they fall apart.

ANT was developed as one perspective amongst others in the sociology of science and technology (SST) from the 1980s onwards (Allen, 2012; Fox, 2005; Callon & Latour, 1981; Callon & Law, 1982; Callon, 1986; Callon, 1986a; Latour, 1990; Latour, 1991; Law, 1992). The linkage of ANT to sociology is because of its ability to trace networks of diverse relationships between human and nonhuman actors and understand their interactions, without imposing particular roles to any of them (Pollack et al., 2012; Allen, 2012; Walsham, 1997). The users of ANT take on that nothing exists outside the social network of relationships between the human and nonhumans. This is in agreement with Latour's (1999) argument that the ability of human action is enabled through spread chains of uncountable others, many of which are rarely observed let alone acknowledged and it is through this enmeshment of fibrous networks that the ability of humans to act is made possible. The opinion of ANT users is that objects, processes, ideas and any other relevant factor are seen as important in creating the network with the humans to accomplish a task.

The development of ANT resulted from the need for a new social theory linked to scientific and technological studies (STS) as an attempt to understand the processes of technological innovation and scientific knowledge-creation (Jessen & Jessen, 2014; Montenegro & Bulgacov, 2014; Van der Duim, et al, 2013; Dankert, 2010; Jóhannesson, & Bærenholdt, 2009; Davey, 2007; Callon & Latour, 1981). The development of ANT was inspired by the work and ideas of the French philosophers such as Michel Serres, Gilles Deluze, and Felix Guttari although it (ANT) can further be traced to Michel Foucault's theory of power and micro-politics of 1977, the John Law's Modern Organization of 1994 and Douglas' semiotics (Michael, 2016; Cressman, 2009; Jóhannesson, & Bærenholdt, 2009; Callon & Latour, 1981).

Although Callon, Latour and Law are claimed to be the founding fathers of ANT, Miettinen (1999) says that ANT has its roots in French philosophy, particularly in material semiotics. Its

linkage to material semiotics is because of its emphasis on relations between human and non-human entities in an activity and how they form various networks. Miettinen's view was that humans cannot do anything independently without involving the nonhumans. Miettinen adds that in an ANT viewpoint, everything is an effect of interactive practices between the human and nonhuman actors. For example, for teaching to take place, a teacher (human actor) should be in place. Teaching may take its course is there is the use of appropriate teaching and learning materials like textbooks, chalk, teaching plans and ICT equipment (nonhuman actors).

Notwithstanding, while looking at ANT, its components are materially dissimilar relations which are mixed with semiotic tools. This means that ANT approaches the world as consisting of heterogeneous relations and practices through which humans and nonhumans alike are treated as possible actors (Johannesson, Rene & Ren, 2012). ANT explores the relational ties within a network which comprises a gathering of different dissimilar things that comprise of both human and nonhuman. Another component of ANT is asymmetrical indifference to the truth or otherwise of what it is looking at. ANT is also concern with the productivity of practice; an interest in circulation; and the predisposition to exemplary case studies" (Law, 2009, p.144). Law adds that entities take their form and acquire their attributes as a result of their relations with other entities. For example, if a learner with visual impairment is to be taught using ICTs as pedagogical tools, the teacher has to look at his or her ability to use these tools and the ability of the learner to learn while using them. Even though ANT is having many concepts, I decided to choose four of them to apply and guide this study. These concepts are as elaborated in section 4.2.2 below.

4.2.2 Clarification of ANT concepts used in this study

Different ANT concepts can be used for description in a study. In this study, I used three terms: actor(s), network, and actor-network, as well as the notion of translation and its four moments, which are discussed in detail in section 4.6. This was decided on because the challenge with ANT terms is that they are nearly similar to one another. Their meanings appear familiar and similar in that it is difficult to explain one term without referring to the other. Hence, while using these terms in this study, none of them stands in isolation; instead, each is understood by referring it with the other.

Actor

An actor refers to an element or entity that works with the other to accomplish a task. Latour (1999) says: "an 'actor' (an actant) in ANT is something that acts or which activity is granted" (p. 373). Latour and Callon (1981) say that: "by the term 'actor' we mean 'whatever unit of dis-

course is invested with a role'; as the notion of force, it is in no way limited to human" (pp. 301-302). Actant means all that generates an action that produces movement and difference (Cavalcante et al., 2017). Per (1996) says that:

> The importance of the concept of an 'actant' is that it cracks the wall between the social actors (who possess reasons and intentionality) and the artifacts (which may act but without the purpose of their own) (p.64).

It is a term used to refer to any agent, collective or individual that can associate or disassociate with other agents. Barry (2013, p.414) says that: "the actor does not refer to an individual agent, but rather an entity whose existence depends upon their network of alliances within a shifting, heterogeneous and expansive relational field". Actants join the network without any intentions but it is while in the network that they can determine what they can do or contribute the network whereas some join the network with intentions (Latour, 2005). The term 'actor' or 'actant' can, therefore, be used to refer to a plant, a person, a machine, a germ or a weather system (Allen, 2012). Actors become significant in a network only with the availability of other actors. For example, Dawey (2007) says:

> (R)ather than saying Newton 'founded' the theory of gravitation seemingly as though he were alone in a vacuum, Actor-Network Theory emphasizes and considers all surrounding factors [because] no one acts alone (p.1).

The strength and diversity among actors in a network bring about representativeness to social, political, psychological, bureaucratic, and/or economic levels with varying degrees of commitment, skills, prejudice, and restrictions. The more human and nonhuman actors are mobilized and recruited, the stronger, diverse and durable the network (Miettinen, 1999). The teacher educator's ability to use ICT equipment for persons with visual impairment to implement the curriculum-following policies and well-established institutions could lead to the preparation of a skilled and knowledgeable early career teacher.

In this study, an actor or actors are teacher educators, ICT equipment, prospective teachers, and any other entity that could be used to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment.

Network

A network is an assemblage of materials brought together and linked through processes of translation to perform a particular function (Fenwick & Edwards, 2010). A network consists of a set of actors or nodes along with a set of ties of a specified type (such as friendship) that link them (Borgatti, & Halgin, 2011). They add that ties interconnect through shared endpoints to form paths that indirectly link nodes that are not directly tied. The pattern of ties in a network yields a particular structure, and nodes occupy positions within this structure. Networks are defined in terms of connections rather than distance and extension of scale which can be elaborated on by following actors into translation (Buzelin, 2005). They (networks) comprise of complicated systems of lines, tubes, roads, nerves, people (either single or in groups), equipment/devices, or companies to exchange information so that tasks could be accomplished.

From an ANT perspective, a network is used to refer to an entity (an agent, an actor, an activity) or an assemblage of materials that could be useful in a network, brought together and linked through processes of translation to perform a given task (Fenwick & Edwards, 2011b; Latour, 2011). Likewise, I use 'network' to refer to connections between equipment and its accessories, prospective teachers, teacher educators, and other institutions to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment.

Actor-network

This is one of the core ANT concepts. A network in an entity can either be seen as an actor or as a network, hence actor-network (Latour, 2011). Latour says that in actor-network:

> (T)here is no net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineates, explains, files, lists, records, marks or tags a path that is called a network (Latour, 1996, p. 378).

In this context, while prospective teachers engage in the act of learning skills of using ICT as a pedagogical tool, networking with ICT teacher educators, equipment and other actors may facilitate the teaching of skills of using ICT as a pedagogical tool. It is only by following the way activities are performed that the networking of actors is identified. Domingo et al., (2015) say :

> An ANT perspective … [should] focus on the connections between actants (actor) through their interactions to understand how [and]… why they do what they do ... that is what we can call an actor-network, [which is] …. defined by the network of relationships—or translations, in ANT terms—that can be traced (p. 58).

Despite ANT's supposition that all actors in a network play equal roles, humans are the main actors and controllers of the network thus they are the actants. Per (1996) argues that the importance of ANT is that actors are represented by skilled personnel whom he refers to as spokespersons that act in the name of all actors in the network. This is because the nonhuman actors act following human operation. Hence human actions influence nonhumans to meet the desired goals. If teachers are to use ICTs pedagogical tools for learners with visual impairment, there is a need to prepare them so that they are in a position to use them while teaching. As a result, human actors are major in every network because they cause actors to act.

Translation

Another concept that I have used repeatedly in my study is translation, which is an ANT concept that relates to the process of interpreting and transforming other actors, their goals, and their intentions to accommodate one's own best interests and needs (Johannesen, 2013). As translation is the main concept of analysis, I have discussed it in detail in section 4.6.

4.2.3   An understanding of ANT

It is difficult to summarize, define, or explain ANT given the circumstance that its complexity means that different authors explain it according to their understanding (Cressman, 2009). To my understanding, I equate the complexity of ANT to that of a motor vehicle fueling station. In ANT, the central feature is to search for relationships, or networks, between all things, appropriate to the phenomenon (Allen, 2012). Allen adds that despite the name, ANT does not define a theory, but rather a method of describing how assemblages hold their shape, or how they fall apart rather than the why assemblages hold their shape, or how they fall apart.

Although ANT was first developed by Latour and Callon to explain complex networks within the scientific research settings, it has been used in both public and private sectors to investigate science and technology development outside the laboratory. Nevertheless, in education, ANT has been used to investigate as well as a mode of intervening in or interrupting educational programs. In this study, I have used ANT to investigate how ICT is taught to prospective teachers whereby there are different relations between the human and nonhuman actors. The use of the term 'socio-material approach' in this study is used in a situation whereby to teach ICT to prospective teachers, the environment should be conducive to enable its teaching to take place with adequate relationships between human and nonhuman entities.

In this study, the phenomenon is how ICT is taught prospective teachers to use ICTs as pedagogical tools towards facilitating beneficial learning environments for learners with visual impair-

ments. All material and semantic structures, things, persons, dialogs, etc. that influence ICT teaching in teacher education are referred to as actants. To relate ANT to a motor vehicle fueling station, for the act of fueling a car to take place, several actors (a motor vehicle, driver, the pump attendant, bank/fuel card or money, cash register, fuel, and stable power supply [electricity, standby generator or solar power to run the machine, etc.]) have to be in place. They have to network for the activity of fueling a motor vehicle to take place.

In a network like the above, some of the actors are visible, whereas others are invisible (Nimmo, 2011). For example, stable electricity, standby generator, or solar power could be both visible and invisible. The visibility of power is noted when the power goes off, the fueling machines stop running, and its invisibility is noted when there is smooth running of the fuel station. The same would apply when teaching prospective teachers how to use ICTs as pedagogical tools as an approach towards enabling favorable learning environments for learners with visual impairment. For example, when teaching prospective teachers how to use ICTs as pedagogical tools towards expediting advantageous learning environments for learners with visual impairment, the visible actors are teacher educators, ICT equipment and an invisible actor are power. A fueling activity cannot be purely a social activity in that all social phenomena also articulate in complex ways with nonhuman objects, systems, machines, timetables, etc. This is because what we have during fueling activity is a complex materially heterogeneous assemblage which is both coherent and at the same time emergent (Franklin, 2012).

ANT however distinguished itself from other forms of socio-technical network approaches according to the equal importance that humans, texts and objects play in the construction of actor-networks (Allen, 2012). Though ANT is social science-oriented, its emphasis is not the 'why' question but on 'how' social arrangements are held together (Johannesson et al., 2012; van der Duim, et al., 2013). Therefore, it is not interested in why something works but how it is assembled, decreed and ordered to perform a task (Johannesson et al., 2012). For example, as stated earlier, a study like this one whose intention was 'ICT teaching in teachers: towards facilitating conducive learning environments for learners with visual impairment', ANT's interest was not in why ICT is taught in teacher education but how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

With this in mind, Ren, Johannesson and van der Duim (2012) say that the way of seeing the "world as composed of continually constructed relations-gone-solid, which can never be defined as purely social, natural, technological or cultural, but only-and always-as hybrids" (p.14). This

is in line with Mewburn, who says that "An actor-network is not a diagram or a description but an effect brought about by work performed by various actors" (Mewburn, 2010, p. 365). Accordingly, the result of fueling a motor vehicle in a fueling station is an effect of a network of different actors.

4.3 The applicability of ANT in teacher education

Despite the availability of numerous theories that could be applied in educational research like this one, I chose to use ANT as an analytical theory in my study. As I have stated in section 4.2.1, the decision to use ANT in this study was because of its ability to enable it to find out 'how' prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment rather than finding out 'why' they (prospective teachers) are taught ICT during their preservice teacher education. This is in line with Johannesson et al., (2012) who say that ANT guided studies are interested in 'how' social arrangements are assembled and ordered to perform a task but not 'why' that thing works. The second reason as to why I decided to use ANT in this study because of its guidance to approach ICT teaching as consisting of heterogeneous relations and practices through which humans and nonhumans alike are treated as possible actors (Johannesson et al., 2012). This is because the principle of generalized symmetry assumes that things (nonhumans) are not secondary to humans but it is through their being together with the humans that actions like teaching and learning become possible (Fenwick & Edwards, 2010). This principle (generalized symmetry) is discussed in detail in section 4.5.2.

In education, Fenwick and Edwards (2010) say that:

> ANT analyses trace how things that are taken to be natural, social or technical are more accurately a messy mixture of things which are enacted in webs, how they associate, exercise force and how they persist, decline and mutate (p. viii).

To 'enact' means to "take part in and make use of something" (van der Duim et al., 2013, p.4). For ICT teaching to take place in teacher education, there are heterogeneous associations of entities for example human and nonhumans have to be bundled together with a purpose. Montenegro and Bulgacov (2014) say: "Intentional actions and intentionality are not properties of objects or people. They are institutional properties. Objects can only contrast subjects and vice versa" (p. 112).

Using the guidance of ANT, one would be able to examine and consider the relational effects between human and nonhuman actors and how they are or could be involved in teaching pro-

spective teachers how to use ICTs as pedagogical tools towards facilitating a favorable learning environment for learners with visual impairment. This is in line with Coe and Yeung (2015) who say that ANT is an analytical approach that emphasizes how different entities in networks are shaped and understood through their relationships with other entities. I decided to use ANT to guide my study because I assumed that it's guidance would make it possible for me to establish the interrelated overlapping steps necessary to explain or implement events and innovations of human and nonhuman actors in a network (Kraal, 2007) involved in teaching prospective teachers how to use ICT towards facilitating conducive learning environment for learners with visual impairment.

Secondly, I applied ANT because I thought it would enable me to explore, define, and redefine the actors' boundaries, trace and identify the silent actors as well as identify possible actors that could be recruited or eliminated from the network. I used ANT with the assumption that its use in my study could enable me to identify and hence may guide implementers to actively involve all actors (human and nonhuman) deemed important when teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments. These actors include but are not limited to, social, political, technical, or bureaucratic actors. This is supported by Miettinen's (1999) statement that the "strength and successful application of ANT lie in the ability to bind together forces, to make them compatible and equivalent" (p. 172). The following actors may lead to the identification of those that may be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment. It may enable actors to become visible from the process of planning to implementation.

Therefore, by establishing the kind of actors to be included and excluded, it is possible to plan the implementation of a program, such as teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for a given group of learners. This is because actors involved in preparing teachers on how to use ICTs as pedagogical tools can be identified, included, eliminated, or reawakened during the preliminary phases of preparation (Law & Hassard, 1999). To find out how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment, there is a need to look at how it is done through power relations among the actors involved and how the actors relate to one another.

What influenced me to use ANT in my study was the possibility of involvement of both human and nonhuman actors in teaching prospective teachers how to use ICTs as pedagogical tools to-

wards facilitating favorable learning environments. ANT has been used to discuss and enlighten the role ICT plays in shaping the relational outcome of networks between technologies and people in an activity (Cordella & Shaikh, 2006). Every actor in a network plays a role, depending on the power vested upon it. For example, a teacher educator and an ICT technician, who are human actors, depend on the knowledge and skills of each other to accomplish the task of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating reasonable learning environments for learners with visual impairment. Therefore, voluntary involvement of human actors influences forceful recruitment or stops particular actors from taking part in an ongoing activity (Domingo et al., 2015).

For this study, acquisition of ICT knowledge and skills by prospective teachers to use it is a pedagogical tool towards facilitating advantageous learning environments is the end product of hard work in which bits and pieces of human and nonhuman entities are fitted together and converted (Law, 1992). Furthermore, Law says that knowledge could be seen as a product or an effect of a network of heterogeneous materials, such as agents, social institutions, machines, and organizations.

In this study, an actor who mediates the teaching of the use of ICT is a skilled teacher educator equipped with the technical skills of using ICTs as pedagogical tools to interprets the curriculum content leading to the preparation of teachers referred to as 'hybrid teachers and teacher educators'. These categories of teacher educators and early career teachers are extraordinary because they have a component of ICT knowledge with them compared to the old teachers who qualified before the introduction of ICT. If this group of teachers is well prepared, they can change the mode of teaching and learning and be in a position to use multifaceted skills and techniques of teaching. The possession of skills of using ICTs pedagogical tools towards facilitating favorable learning environments for learners with visual impairment by teacher educators may enable the teaching of prospective teachers to gain the same skills is well facilitated.

Through the guidance of ANT, I was able to analyze the content in the curriculum, its development and implementation in PTCs while relating to the Ugandan educational policies concerning teacher education. This is because most academic curricula emphasize excellence, equity, efficiency, and freedom (Fenwick & Edwards, 2010; Vergari, 2015). This is in line with Montenegro and Bulgacov (2014) when they say: "We believed that perhaps intentional actions and intentionality are not properties of objects or people. They are institutional properties [and] objects can only contrast subjects and vice versa" (p. 112). Most curricula are developed to promote excellence, equity and efficiency during teaching and assessment.

Fenwick and Edwards (2010) identified several potential benefits of ANT in educational research. The first benefit of ANT is that it inspires studies to trace the ways educational standards achieve and maintain some durable forms as a consequence of the relations between the humans and nonhumans in which they are located and performed between policymakers and implementers. For this study, the use of ANT could help me to find relations between the human and non-human actors, from curriculum planning and development through to implementation, to help prospective teachers gain the skills of using ICTs as pedagogical tools to facilitate an applicable learning environment for learners with visual impairment.

ANT is also beneficial in educational research because it helps locate the inclusions, exclusions, and collaboration factors that occur during the assembly of the network of actors. Without ANT, these actors can easily be disguised about standards that appear to exist as inevitable and stable (Fenwick & Edwards, 2010).

The application of ANT in educational research helps in revealing the uncertainty of principles as bases for judgment in the governance of educational activities (Fenwick & Edwards, 2010). During planning and implementation of the teaching of the use of ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment, the ANT guided me to analyze and interpret the content in the curriculum, the objectives of its teaching, and who the beneficiaries would be. ANT would make it easier to understand the multiple dissimilar possibilities that are embedded within the formal copies of documents, such as curriculum objectives and policy papers (Fenwick & Edwards, 2010).

The use of ANT in educational research highlights the often forgotten things in evaluating different roles played by the nonhuman actors that collaborate with human actors when teaching (Fenwick & Edwards, 2010). I assumed that the use of ANT in this study would help me to identify both human and nonhuman actors involved and those that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating an appropriate learning environment for learners with visual impairment. This would make me appreciate the role each plays. For example, power interruption in the process of teaching could make it impossible for the lesson to continue because computers would not be operational.

ANT is beneficial in the investigation of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. This could be done by evaluating and accounting for activities performed by human and nonhuman actors in the teaching environments, such as classrooms, school-community net-

works, and educational policy committees, among others (Fenwick & Edwards, 2010). For example, beneficial learning environments may have numerous human and nonhuman actors, such as a skilled ICT teacher educator, prospective teachers, equipment, stable power supply, and content to be taught. Teachers should make classrooms accessible by working together to achieve the skill of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. Unavailability of any one actor could necessitate the opening of the boundaries to enable the recruitment of new actors into the network.

Importantly, Latour (2005) observed that when using ANT one should emphasize and consider all the surroundings rather than look at one factor, because no one acts alone. The guidance of ANT could help to identify and expose the importance of every actor towards the implementation of a task at hand. Non-availability or non-participation of any of one or more actors may make the network incomplete, thus hindering teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. This being an ANT guided study, there is a need to look at the relationships between the human and nonhuman while prospective teachers are being taught ICT as pedagogical tools towards facilitating useful learning environments for learners with visual impairment. This is what is referred to as the social material approach. This approach is elaborated on in section 4.5 and the subsections that follow.

4.4   The perspective of ANT

In this sub-chapter, I have explained how the aspect of ANT as a relational effect of humans and nonhumans. This is followed by a justification of how I have used ANT in this study and I conclude this chapter by explaining how ANT is an actor, a network and how it is an actor, network and actor-network effect.

4.4.1   How ANT operates

ANT is a relational effect whereby all actors (human and nonhuman) are treated as mixtures and seen as a gyrate between different actants in networks (Jóhannesson, & Bærenholdt, 2009). When ANT was first developed by Latour and Callon, the aim was to explain complex networks in scientific research settings (Williams-Jones & Graham, 2003). Williams-Jones and Graham note that although Latour's writings of 1988 and Latour and Woolgar's work of 1979 say that ANT was concentrated in the laboratory setting, de Laet and Mol (2000) and Law and Callon (1982) expound how ANT has been used to investigate science and technology development outside the laboratory in public and private sectors. In education, ANT is a way of intervening in

or interrupting an educational program rather than simply a different way of representing education (Fenwick & Edwards, 2010).

From an ANT perspective, any network of actors, whether human and human, human and nonhuman or nonhuman and nonhuman, is equally important. The proponents of ANT believe that entities take their form and acquire their attributes as a result of their relations with other entities (Law & Hassard, 1999). For example, food may not get cooked without any source of heat and there must be humans in place to control the extent of heat that can make the food cooked. Blok and Jensen (2011) support the above statement by stating that:

> No one entity is significantly [sic] in isolation but instead attains meaning through its numerous—and changeable—relations to other entities. Often these multitudes of relations are called actor-network and this constitutes the foundation of the theoretical tradition known as Actor-Network Theory (ANT) with which Latour's name is intimately associated. Such actor-networks are hybrid, which means that they consist of both human and material objects and everything exists within actor networks—including, of course, Bruno Latour himself (p.3).

The above viewpoint is that what counts as a human is an effect generated by a social network of heterogeneous, interactive, and material objects (Law, 1992). The ANT standpoint is that machines and other objects involved in an activity are as many actors in the network as humans (Alcadipani & Hassard, 2010; Stanforth, 2007). This is in line with Hetland (1996), who refers to a claim made by Latour (2004, p. 91) that "without the nonhuman [for example air], humans would not last a minute". Hence, any element of the material and social world (technology, social rules and nature) can be an actor in the same way as humans are (Jessen & Jessen, 2014). This is supported by the social construction of technology (SCOT) theory, which came into existence as a result of technological determinism (Bijker et al., 1987). Technological determinism is a belief that technology shapes society in some way including social aspects like learning (Oliver, 2011). According to SCOT, to understand the reason for acceptance or rejection of a technological device, one should look at the social construction (Bijker et al., 1987). SCOT argues that technology does not determine human action, but rather human action determines technological actions. For ICT to be used as a pedagogical tool to create conducive learning environments for learners with visual impairment, a teacher should be in place who knows how to use these tools.

In ANT, the networks of human and nonhuman actors, which are sometimes referred to as a hybrid of the social, technical and personal that contain everything that exists in a network, have to extend their abilities to accomplish a task (Habib & Wittek, 2007; Latour, 1993). Hetland (1996) states: "When humans extend their abilities to act by the application of technology, they create new forms of hybrids" (p. 4). Hetland (1996) adds that ANT not only concentrates on the interpretation of text and meaning but on their relational effects and what they do. For instance, if a teacher has been taught to use ICT as a pedagogical tool, a teacher has to examine and compare, while using ICT as a pedagogical tool and using other pedagogical styles, which has created a learning effect in a child with visual impairment.

Remarkably, while networks are important for social movements, how networks are constituted in areas of education, such as teaching, play a significant role in shaping roles allocated to each actor, how they could be linked to each other, and the procedures to recruit other actors into the network (Nicholls, 2009). For example, teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment may not run smoothly if skilled personnel (human) and equipment (nonhuman) are not available. The skilled personnel, equipment, college administration, relevant ministries, and other actors who interact socially may make it possible for prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. Teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment may require to apply ANT as a social material approach that pays attention to the relationships between human and nonhuman entities.

4.4.2   ANT and its relevance to this study

In circumstances where prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment, actor-networks would involve human and nonhuman actors. The human actors would be represented by teacher educators, support personnel and prospective teachers whereas the nonhumans would be represented by objects, artifacts, and tools, among others, applied by a skilled human to perform a task at hand (Mifsud, 2014). These humans and nonhumans have to connect to accomplish a task teaching prospective teachers ICTs towards facilitating favorable learning environments. These connections are referred to as networks. Katz et al., (2004) say that:

> A … network consists of a set of actors ('nodes') and the relations ('ties' or 'edges') between these actors. The nodes may be individuals, groups, organizations, or societies. The ties may fall within a level of analysis (e.g., individual-to-individual ties) or may cross levels of analysis (e.g., individual-to-group ties) (p.308).

A network is not limited to the relations between only humans; instead, it is always a combination of human, social, and technological elements in addition to many other actors that are deemed relevant in the network (Williams-Jones & Graham, 2003; Latour, 1996; Callon & Latour, 1981). Williams-Jones and Graham (2003) note:

> If we wish to know the origins of power and structure in a network, that is, what derives the network or brings it into being, we need to consider all the components that collaborate, co-operate, compete, and lead to proliferation, persistence or perishing of that network (p. 273).

A network is formed when actors connect, associate, or even work together on a one-to-one basis, one-to-group or group-to-group basis. Human and nonhuman actors may collaborate in a given task.

To relate it to the fueling station, it is always humans that try to manage and organize or order their world, but unfortunately, such actions have to take place in a world of humans and nonhumans that are already subject to preexisting order (Franklin, 2012). van der Duim et al., 2012 say that activities like teaching can always be done otherwise by adding actors and intermediaries to the already existing network. Therefore, an 'actor' could be a person, a plant, a machine, a weather system, a germ, or any other thing that action has been imposed on (Whittle & Spicer, 2008). Comparable to a fueling station above, teaching is an activity that needs the involvement of both human and nonhuman entities. For example, in an ordinary classroom for learners with visual impairment, one is most likely to find Perkins Braillers, hand frames and styluses, braille paper and a teacher who has knowledge and skills in using all the above.

For actor-networks to be functional, rules, resources, and power, including information to aid the accomplishment of tasks, are mobilized. Actor-networks involve heterogeneous networks of aligned interests framed through the translation of interests by creating a network of intended and unintended consequences that could stretch across the network's temporal boundaries (Warf, 2015; Walsham & Sahay, 1999). In this context, the concepts of actor and network may not be understood and utilized independently, as all actors are also networks and vice versa (Vicsek et al., 2016). However, in this study, I use ANT to establish and explain how different human and

nonhuman actors could come or could come together while prospective teachers are being taught how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment.

4.4.3 Actor, Network and Actor-network effect

In every endeavor, there is a range of players, both human and nonhuman. From an ANT perspective, these players are referred to as actors. They coordinate and work together to accomplish what is at hand. This working together is what Latour refers to as networking. Latour (1999) states that ANT is not a property of humans but of associations of actors that come together for meaningful technical mediation. Additionally, Katz et al., (2004) note that these networks:

> Include communication ties (such as who talks to whom, or who gives information or advice to whom), formal ties (such as who reports to whom), affective ties (such as who likes whom, or who trusts whom), material or work flow ties (such as who gives money or other resources to whom), proximity ties (who is spatially or electronically close to whom), and cognitive ties (such as who knows whom) (2004, p. 308).

The key players in a network are actors/actants, which can be human, non-human or both (Dankert, 2010). Human beings are not the only entities that exert influences on their actions. The actions are mediated by the interconnected effects of 'actants', namely the hybrid actors which are composed of human and non-human entities (Jiang, 2016; Fenwick & Edwards, 2010). Williams-Jones and Graham (2003) say that "to understand how these relations create meaning and describe the various actors …, it is useful to think in terms of networks of relations, or more specifically, actor-networks" (Williams-Jones & Graham, 2003, p.273). For example, for the action of writing to take place, there must be someone (a human actor) who knows how to and is interested in writing using a pen and paper or a computer (nonhuman actors). Hence, actors are not necessarily human entities but material things or equipment granted the authority to perform a task with the aid of a human entity. Hence, other actors (nonhuman) to facilitate writing are an exercise book or material to write in or on, a functioning pen, pencil, or writing material, an appropriate seat to sit on and a table where the book can be placed to write properly, and a proper posture, among others. Hence, the determinant of the work is neat and interesting depends on all the above actors (human and nonhuman). A person (human) cannot write without a pen or any writing equipment (nonhuman) and vice versa.

In educational research, it is important to note that many factors affect the outcomes of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating beneficial learning environments for learners with visual impairment. Where obstacles occur, there is a need to look at the system's big picture to determine the factor(s). "Non-humans …. interact with humans on account of key processes, such as translation, articulation, delegation and displacement to other areas or levels" (Montenegro & Bulgacov, 2014, p. 112).

For the case of this study, I used ANT as an intervening tool on how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating gainful learning environments for learners with visual impairment. Hence, ANT is more like the name of a pencil or a brush than the name of a specific shape to be used in drawing or painting (Latour, 2005). I used ANT in this study because it emphasizes more on an inductive description of the actors that are or could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards enabling practical learning environments rather than a deductive explanation of how the actors function (Jiang, 2016). For an activity to be performed, there should be order among the materials thus ordering and materiality. In section 4.5.3, I have explained how ordering and materiality are important during teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment.

4.5 ANT as a socio-material approach

Having justified the choice and use of ANT in this study, I have to go further and discuss ANT as a social material approach (section 4.5.1). The socio-material approach emphasizes the relationships between human and nonhuman entities in a social surrounding. To understand the concept of the social material approach, I have discussed this section using three subsections namely: the socio-materiality approach of ANT, the principle of general symmetry, and ordering and the materiality. I have started this sub-chapter by discussing the socio-materiality approach of ANT while relating it to the teaching of ICTs in teacher education as pedagogical tools towards facilitating useful environments for learners with visual impairment and thereafter discuss successive subsections.

4.5.1   The socio-materiality approach of ANT

The socio-materialists, such as B. Latour, J. Law, M. Callon, and T. Fenwick and R. Edwards, asserted that both human and nonhuman actors work hand in hand in an activity. Although several theories could be related to socio-material approaches, Fenwick et al., (2011) identify four of them that fall within this category: complexity theory (CT), ANT, cultural-historical activity

theory (CHAT), and spatiality theory (ST). Despite these theories sounding different or coming from different theoretical backgrounds, they share a common ground that socialization is important towards the achievement of a goal. Relating these theories (CT, CHAT and ST) to ANT, for an activity like teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating acceptable learning environments to take place, there should be a social network of many actors. What distinguishes ANT from these other theories (CT, CHAT and ST) is that ANT emphasizes not only people but also objects, making it a heterogeneous network that contains many dissimilar elements but all working together for a purpose (Gershon & Malitsky, 2010). Therefore, ANT does not pretend that such categories of networks do exist but highlights that their existence is the effect of much ordering of work carried out by heterogeneous actors (Johannesson et al., 2012). These networks comprise of human and nonhuman which have to network for the teaching of ICT as a pedagogical tool to take place.

The socio-material approach, being one of the concepts of ANT, pays attention to the interdependence between humans and nonhumans in a network (Mifsud, 2014; Watts, 2008). This is because a considerable amount of materiality is entailed in an ICT classroom that includes but is not limited to equipment, desks, chairs, stable power supply like electricity, standby generator or solar power, books, and so on. In the socio-material approach, both human and nonhuman actors are brought together, under their positions, to bring meaning into the network (Law, 1999; Akrich & Latour, 1992). Therefore, the question is, how can different human and nonhuman entities be brought together to see to that prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment? This brings about the notion of actors as immutable mobiles and what they are or may do during teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating worthwhile learning environments for learners with visual impairment.

Secondly, in the socio-material approach, attention is engrossed on how the social and thus the human and material objects (nonhuman) come together to act. The socio-material approach emphasizes on the relations between the human and the nonhuman actors in a task, such as teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. An aspect to note is that the socio-material approach shifts the attention to the connections and relations between different human and nonhuman elements that are assembled (Knappett, 2008). However, Van der Leew (2008) says that *things in the material world are carriers of potential information, and it is their link with concepts in the world of ideas (knowledge) that transforms them into objects that do carry signifi-*

cant information (author's italics). Objects carry information or can be used to pass over information but they need to be transformed so that they can pass over intended information to the targeted beneficiary. For example, one can buy a mobile phone for communication purposes but it can as well be modified and used as a teaching platform.

Concerning teaching prospective teachers how to use ICTs as pedagogical tools for learners with visual impairment, the material-semiotics approach helps to discuss how important material objects are. This approach could help guide humans to enlist nonhuman actors that could enable the creation of stability in a network of actors that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment.

In ANT, human and nonhuman actors are seen as the ones that lay the foundation of every activity (Law, 2009). All these actors, human and nonhuman, have expected roles to play in an activity (Knappett, 2008; van der Leeuw, 2008). For these actors to perform, they have to form a network of actors referred to as immutable mobile (Law, 2009). These actor-networks have to move or be moved to different places to perform an act that they are aimed at. Regarding teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating useful learning environments for learners with visual impairment, the socio-material approach guides one to pay attention to how human and nonhuman actors entangle with what seems to be a single object or activity. The entanglement of actors may extend connections that spread out to include other actors who were there but there was a possibility of their contribution going unnoticed (Knappett, 2008). It is therefore necessary to understand the importance of both human and nonhuman during teaching prospective teachers ICTs towards facilitating agreeable learning environments for learners with visual impairment. The major assumption of the social material approach is that humans and nonhumans are treated equally, which Latour (1987) refers to as the 'principle of generalized symmetry'. This brings about the principle of generalized symmetry.

4.5.2   The principle of general symmetry

ANT is usually linked with the equal treatment of human and non-human actors by assuming that all entities in a network could and should be discussed in the same terms. This is referred to as the principle of generalized symmetry (Latour, 1987; Allen, 2012; Hetland, 1996). The principle of generalized symmetry is an ANT term used to explain the existence of both human and nonhuman actors in a network without distinguishing their identity. Symmetry is treating human and nonhuman elements as equally interesting, important, and capable of exerting force upon

each other as they come together (Fenwick & Edwards, 2010). The principle of generalized symmetry asserts that the concept of 'actor' should also be extended to non-human actors (Allen, 2012; Hetland, 1996). In the actor-network of teaching ICTs in teacher education as pedagogical tools towards facilitating conducive learning environments, each actor is important and has a role to play for the activity to be achieved.

In generalized symmetry, it is believed that all actors, whether human or material, be treated in the same way, with humans accorded no special attribute of the agency; rather, the agency is generated through the network of relations itself and is not presupposed (Allen, 2012; Hetland, 1996). ANT characterizes the principle of generalized symmetry by equally linking the performances and linkages of human and nonhumans, rather than distinguishing them according to some essential a priori features (Fenwick & Edwards, 2010). This is because one cannot work without the other hence they are equally important.

Through the guidance of the principle of generalized symmetry, actors in a network do not have the powers to say what the result of something could be (a priori status), but they are part of the network (Fenwick & Edwards, 2010). With this principle, humans and nonhumans are treated equally (Latour, 1987) they have to work with other actors to get the result. Though this principle places humans among materials, they (humans) are not above materials (Sørensen, 2009). This principle intends to help to avoid a priori discrimination of either social or technical aspects of technology use in an activity (Johannesen, 2013).

As an analytical move, the principle of generalized symmetry is an important aspect of ANT, as it forms the basis for alternative socio-material analysis (Johannesen, 2013). For example, when teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment, the principle of generalized symmetry may help to see the action of humans on nonhuman as they work together. Hence, nonhuman actors are not secondary to human actors they are equally important. It is through their being in a place that prospective teachers could be taught how to use ICTs as pedagogical tools towards enabling beneficial learning environments for learners with visual impairment. It is during the process of teaching prospective teachers how to use ICTs as pedagogical tools that a network of human and nonhuman actors could identify the value of each other because the result may not come out without the active involvement of the other.

In this case, the principle of generalized symmetry is a basis for asking how attributes of some entities in a network are assumed to be stable or natural, while others are open to negotiations

(Fenwick & Edwards, 2010). For example, although ICT is included in the curriculum and is being taught, there is still a need to negotiate with the curriculum developers and teacher educators for the aspect of ICT for learners with visual impairment to be included in it so that its teaching is implemented. This could happen if there was networking between the actors that are or could be involved in teaching the use of ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. With this in mind, there is a necessity to look at the effect of networking between different actors thus the actor-network effect and its implication in ICT teaching to prospective teachers.

In ANT, human and nonhuman actors are seen as the ones that act to make an action take place each of them have to play their parts. These elements function only if they have formed a network of actors referred to as immutable mobile. These actor-networks have to move or be moved to different places to perform an act that they are aimed at. In the same line, the socio-materialists, such as B. Latour, J. Law, M. Callon, and T. Fenwick and R. Edwards, asserted that both humans and nonhuman actors work hand in hand in an activity to perform a task like teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Rather than using the whole of ANT, I chose translation as an analytical concept.

4.6   Translation as a tool for analyzing teacher education

Though ANT is broad and complex, I have used ANT's concept of translation as an analytical concept. I have discussed this section using three sub-sections namely: the concept of translation, moments of translation, and translation as a concept of critical analysis. Each of these subsections is deliberated below.

4.6.1   The concept of translation

Translation is an ANT concept that relates to the process of interpreting and transforming other actors, their goals, and their intentions to accommodate one's own best interests and needs (Johannesen, 2013). For Callon and Latour, translation always implied modification (Barry, 2013). It is sometimes referred to as the sociology of translation (Jessen & Jessen, 2014; Montenegro & Bulgac ov, 2014; Barry, 2013; Dankert, 2010; Davey, 2007; Callon & Latour, 1981). It is a process before the results whereby actors relate to one another by persuading one or more actors into coexistence to bring interconnection (Sehlola & Iyamu, 2012; Fenwick & Edwards, 2010; Gad & Jensen, 2010; Latour, 2005; Buzelin, 2005; Brown & Capdevila, 1999; Latour, 1987; Callon, 1986). Translation is a central concept of ANT in which innovators attempt to create a

forum, a central network in which all actors agree that the network is worth building and defending. Translation should not just be understood as a form of empire-building, which leads to the progressive enrolment of human and non-human allies into ever more durable relations but it should be looked at as a process of replication or imitation *and* differentiation at the same time (Barry, 2013, p.415). It (translation) "generates ordering effects such as devices, agents, institution or organization" (Law, 1992, p. 366). Barry (2013) adds that:

> by translation, we understand all the negotiations, intrigues, calculations, acts of persuasion and violence … to which an actor or force takes or causes to be conferred on itself, the authority to speak or act on behalf of another (p. 414).

Despite the above, translation is a complex concept in ANT that relates to the process of interpreting and transforming other actors, their goals and their intentions to accommodate one's own best interests and needs (Johannesen, 2013), Latour (1994) uses translation and mediation concurrently, but I used the concept of translation to guide my study. In my study, I use the concept of translation to interpret how ICT is taught in teacher education and later transformed towards facilitating conducive learning environments for learners with visual impairment. During translation, the interaction between actors becomes the main building block of actor-networks and their exhibition takes place (Callon, 1986a; Callon et al., 1985; Latour, 1987; Barry, 2013). This is because it is during translation that roles are defined and distributed, and scenarios are explained.

During translation, recruitment of an actor or actors into a network is achieved through sequences that are also referred to as the four moments of translation (Callon, 1986), as discussed in 4.6.2. This could be done by tracing connections in an educational system like teacher education, is an effect of a matter of creating connections to ascertain actor-networks in a field of study, for example, ICT in teacher education that may be endorsed through diversity (Ren et al., in van der Duim et al., 2012). These actors could be identified through translation and followed, whereby some can be persuaded and recruited into the network (Johannesen, 2013). Translation aims to examine how actors in a network fully connect, partially connect, or fail to connect to form or not to form nets or webs of activity, and how these things change through their connections (Fenwick & Edwards, 2010).

In this study, I use the concept of translation to find out how different human and nonhuman actors in teacher education are connected fully or partially while teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating a convenient learning environment for learners with visual impairment. The concept of translation involves four moments, thus prob-

lematization, interessement, mobilization and enrolment (Callon, 1986a; Fornazin & Joia, 2016). In the section that follows, I have described the moments of translation followed by how I applied them as concepts of analysis.

4.6.2 Moments of translation

As I have stated in section 4.6.1 above, translation involves four moments (Callon, 1986a; Fornazin & Joia, 2016). The first moment is problematization, which involves identifying the problem or where something sets itself as a problem and the obligatory passage points (OPP) to which actors should converge to state a problem or activity so that a particular discourse takes place (Callon, 1986a; Fornazin & Joia, 2016). For this study, the problem is ICT teaching in teacher education towards creating conducive learning environments for learners with visual impairment. To reach the early career teachers the (OPP) is primary teachers colleges.

The second moment of translation mentioned by Callon is interessement, which involves the mapping of the actors' identities, preferences, alliances, and their possible relationships with the OPP (Fornazin & Joia, 2016; Abramson, (1998). It is at this moment that an actor's interests concerning other actors' sets of interests are drawn. Interessement could be used as a way of identifying the kind of ICTs that could be taught as pedagogical tools and their relevance in teacher education, those of preference to taught as compared to others. Lastly, through the OPP, other ICTs could be incorporated into teacher education towards facilitating conducive learning environments for learners with visual impairment.

As stated in section 4.2.1, ANT, also known as enrolment theory (Jóhannesson, & Bærenholdt, 2009). This is the third moment that is identified by Callon, which is the point where negotiations and coordination of actors concerning the preferences take place. During enrolment, one asks him or herself, what is the problem? Who are interested? Who, then can be enrolled in the problem so that the problem can be solved? For the case of ICT in teacher education, interested actors can be enrolled so that prospective teachers could be taught to use ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment.

The fourth and final moment of translation is mobilization (Callon, 1986a). During mobilization, the consolidation of the group's interests is done together through the representation of a spokesperson who acts as an OPP to ensure that the objective is attained (Callon, 1986a). Through mobilization, interested actors could be enrolled in the network of teacher education so that prospective teachers could be taught to ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

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Despite the variations in the descriptions of the moments of translation, I used Fenwick and Edwards' (2010) description of translation to guide me to find relations, interests, and linkages between the actors involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. Although translation is a process of making equivalent multiple things that are not the same, it *"tells us nothing at all about how it is that links are made"* (Law & Hassard, 1999; p. 8) [in italics in the original document]. Translation assumes nothing about the similarities or different links and how conflicting interests are kept consistent within the network (Bueger & Bethke, 2014; Law & Hassard, 1999). In this study, I used translation and its four moments to find out how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment.

4.6.3   Moments of translation and its effects on teacher education

I used translation to reflect on the relations between the human and nonhuman actors and how they could be applied to form a network to enable prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating gainful learning environments for learners with visual impairment. The notion of actor, network, actor-network, and translation makes it easier to understand the problem and how actors could be persuaded and inspired to solve a problem like that of teaching prospective teachers how to use ICTs as strategies towards facilitating practical learning environments for learners with visual impairment. During the process of translation, what is important is how the actors are balanced, irrespective of their nature, origins, changes, and getting them involved towards creating optimistic learning environments as if they were identical. Through the moments of translation, I would be able to identify and analyze interrelated overlapping steps that discuss the actors, networks, as well as actor-networks and how they could come into the establishment (Kraal, 2007).

At the moment of problematization, key actors attempt to define the problem and roles of other actors to fit the proposed solution. This is made by the key actors (Sehlola & Iyamu, 2012). During problematization, actors in the network converge and transform complex and ambiguous situations where many entities are involved in well-defined problems and viable solutions presented to the implementers (Farías & Mützel, 2015; Jessen & Jessen, 2014; Fenwick & Edwards, 2011b). It is at this moment that a focal actor is identified to frame the problem and defines the identities and interests of other actors inconsistent with its interests (Shin, 2015). It is at the level of problematization that I was able to trace how ICT teaching could be initiated and its content included in the primary teachers' college curriculum to teach it to prospective teachers. Its inclu-

sion could enable its teaching to prospective teachers as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment.

The process of problematization also guided me to find out the origin of teaching ICT to newly graduating teachers and where the gap of not including that for persons with visual impairment. Through interaction with some actors and reading through the available literature, I was able to establish who suggested the inclusion of ICT into the primary teachers' education curriculum. Studying the network-enabled me to identify the problem which could be solved by talking to the OPP through the guidance of problematization. This led to the identification of other probable actors that could be recruited into the network to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. This, therefore, led me to interessement.

After problem definition, interests among other actors needed to be developed. This can be done by convincing probable actors to recognize the existing problem and make it theirs too by attempting to impose and stabilize their identities in the network (Farías & Mützel, 2015: Fenwick & Edwards, 2011b: Mähring et al., 2004; Murdoch, 1997). This is what is referred to as interessement (Murdoch, 1997; Latour, 1987; Callon, 1986). Williams-Jones and Graham (2003, p. 276) refer to Callon (1986), who says interessement as "the group of actions by which an entity … attempts to enforce and stabilize the identity of other actors it defines through problematization" (p. 208). It is at this level that different entities are attracted and/or invited to join the network. Before joining the network, they may negotiate their positions and roles they would play in the emerging network, which not only determines and selects the entities to be included but also those to be excluded.

Interessement aims to ensure that the correct actors who may give suggestive solutions to the problem are identified, convinced, and suggestively recruited to the network passed over to them (Jessen & Jessen, 2014; Mähring et al., 2004). Through interessement, the tracing of actors responsible for curriculum development happened. After that suggestions for the new actors to be recruited into the network to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment to take place. This moment was also helpful in identifying the interest group of participants to be interviewed since the study area was more specialized.

After examining the interest groups and how the convincing can be done, the third moment of enrollment happens. Through enrollment, sufficient bodies of actors and interested actors are

identified and enrolled such that they can act to sustain the network (Bueger & Bethke, 2014). It is at this level of enrollment that actors to be included are recruited and enrolled in the network (Murdoch, 1997). It is during the process of enrollment that actors that have shown interest to engage in the network and have shown commitment they would have to be enrolled in the network. "Enrolment [is a process through which human and] nonhuman [actors] are seduced, manipulated or induced into the collective" (Latour, 1999, p. 104). Callon (1986) uses the word enrollment to refer to how other human and nonhuman actors are converted into allies, as their interests and identities are stated in terms of the common problem. During enrollment, multilateral negotiations, trials, and tricks that accompany interessement to take place (Kraal, 2007).

Enrollment determines the level where one becomes part of the network and what the existing or new actors can do or contribute to support the network (Jessen & Jessen, 2014; Latour, 1999; Murdoch, 1997). Enrollment of actors to the network can happen at the initial stages of planning or during implementation (Jessen & Jessen, 2014). Successful enrollment into the network leads to network stability, as the outlines of linkages remain largely stable over time. Nonetheless, in the process of translation, actors that could be enrolled in the network may change their identities, and boundaries may be redrawn and/or modified to align more with that of the network (Wong, 2015).

The fourth and last moment identified by Callon (1986) and Murdoch (1997) is mobilization. A successful network would, however, emerge only if the fourth stage of translation process is achieved. It is at the moment of mobilization that all actors are enrolled (Murdoch, 1997). This is the moment where actors come together to put whatever they had planned into action. Mobilization guides the prescribed objectives and roles assigned to actors to maintain the established network (Farías & Mützel, 2015; Jessen & Jessen, 2014). It is this level of mobilization that guided me to know how the actors came together, interacted with each other, and decided who was responsible for what and at which level (Mähring et al., 2004).

Concerning teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment, mobilization takes place when curriculum developers design it with support from other actors, such as experts, while the government and other actors take up the roles assigned to them, such as financing its teaching as pedagogical tools towards facilitating expedient learning environments. Teacher educators perform the act of implementing the prescribed curriculum while prospective teachers engage in the act of learning how to use them as pedagogical tools towards facilitating appreciated learning environments for learners with visual impairment.

4.7 Conclusion

The application of ANT in this study was to make it probable to understand the multiple dissimilar possibilities embedded within any formal copy of documents, such as policies and the objectives therein, that guide the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment. For this study, the possibilities of teaching ICT for learners with visual impairment emerged when participants gave their views as to why prospective teachers should be taught in general and as pedagogical tools in particular towards creating satisfactory learning environments for learners with visual impairment.

ANT may help to highlight often-overlooked things in evaluating different roles played by human actors, such as skilled personnel, in collaboration with nonhuman actors, towards facilitating convenient learning environments for learners with visual impairment. ANT may enable the discovery of visible and invisible actors that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment and appreciate the role each plays. For example, during data collection, there was a power interruption, which affected the teaching of ICT because the equipment could not operate. This affected teaching ICT to prospective teachers and revealed how power supply and other entities that could be taken for granted are important actors in teaching ICTs to prospective teachers the teaching of towards facilitating agreeable learning environments for learners with visual impairment.

Nevertheless, ANT is also beneficial in investing areas that aim at evaluating actions while taking into account roles played by different actors, such as infrastructure (e.g., classrooms and computer laboratories), college-community networks, educational policy committees, curriculum content, personnel, and power supply, for example, electricity, standby generator or solar power, among others. Actors that are found in an entity could be used to find out how prospective teachers are taught how to use ICTs as pedagogical tools towards creating favorable learning environments for learners with visual impairment may include, but are not limited to, skilled teacher educators, ICT equipment, prospective teachers, stable power supply, for example, electricity, standby generator or solar power, appropriate content, accessible classrooms, and well-equipped computer laboratories, among others. The guidance of ANT in teacher education may enable expansion of boundaries, which may in turn help teacher education institutions to find ways of developing the content and identification of skilled personnel to guide in teaching prospective

teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment.

The use of the ANT is twofold. The first reason is that ANT was used as a guide to find out how both human and non-human actors work together while prospective teachers are taught ICT during their teacher education. As a methodology, I used ANT as a guide to the methodology of the study and thereafter during data collection, presentation, analysis and interpretation to justify responses from different participants.

5   Chapter Five: Methodology

5.1 Introduction

This study investigated how ICT is taught to prospective teachers in Uganda towards facilitating advantageous learning environments for learners with visual impairment. With the guidance of ANT, this study aimed to find out how ICT is taught as pedagogical tools to prospective teachers in Uganda to facilitate conducive learning environments for learners with visual impairment. ANT studies find how something happens as opposed to why it happens. The aim of this study and the research questions are shown in figure 2 below.

Figure 2: The aim of the research and research questions.
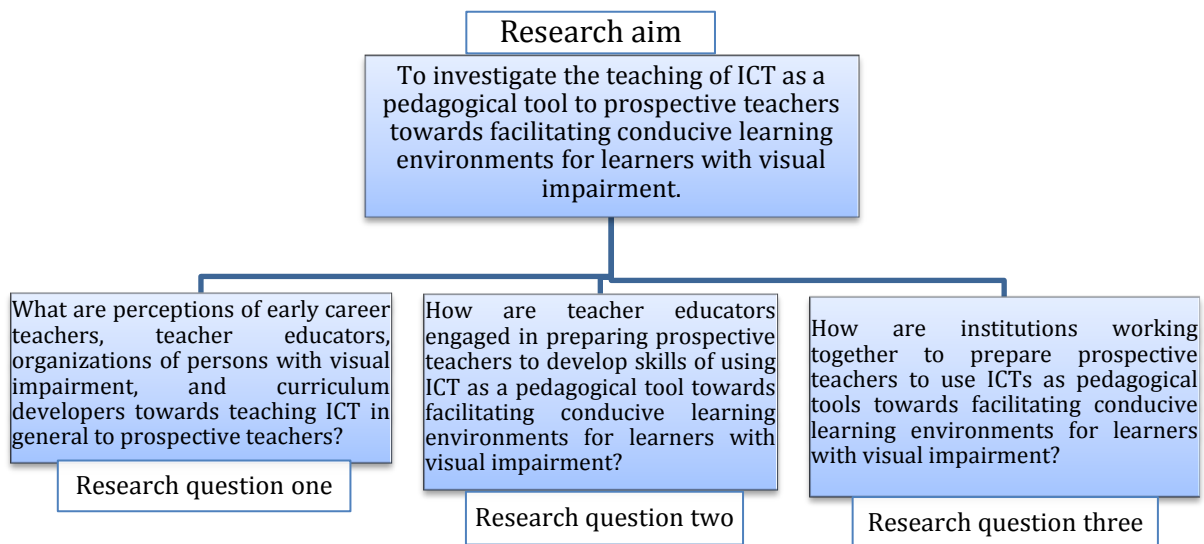
Source: Self-developed

In this chapter I discuss the method that guided this study, starting with a reflection on the philosophical position guided this study and I conclude with an explanation of how the networks were built during data collection. This is followed by the research approach and the design that guided this study. The population, research sites, and sampling techniques, and the rationale used to select the sample are also examined. I also explain how the instrument used for data collection was piloted, the findings of the pilot as well as the lessons learned. Issues to do with data analysis, validity and reliability, ethical considerations, and confidentiality are explained too. This chapter concludes by explaining power relations as well as cultural issues taken into consideration during the study.

5.2 The philosophical positioning of the study

Since I am using ANT, which is a social constructivist theory as well as methodology, I positioned this study in the philosophy of social constructivism also referred to as the philosophy constructionism. Latour (2005) observes that constructivism should not be confused with social constructivism. Latour (ibid) adds that when one says that a fact is constructed, it means that one accounts for the solid objective reality by mobilizing various entities whose assemblages could fail whereas social constructivism means that we place what the reality is made of with some other stuff, the society in which it is built from.

Despite Latour (2005) having a sharp distinction between social constructivism and constructivism, I used the phenomenon of social constructivism to guide my study. Just like ANT, the social constructivists claim that knowledge, in some areas, is the product of our social practices and institutions, or the interactions and negotiations between relevant social groups (Audi, 2009). The social constructivists believe that individuals seek to understand the world they live and work in by relying as much as possible on the participants' views of the situation being studied (Bryman, 2016; Creswell, 2014; Creswell, 2013). Another belief of the social constructivists is that there is no truth or knowledge outside the knower's experience (Lincoln & Guba, 1985). In this regard, the knower interprets and constructs actuality based on their experiences as they interact with the environment. This, therefore, means that knowledge is something that each individual constructs through experiences rather than something that exists in the physical world. In this regard, the mind plays an active role in constructing knowledge and experiences.

Given that his study is investigating the teaching of ICT in teacher education towards facilitating conducive learning environments for learners with visual impairment, participatory methods of data collection, for example, interview, were thought to be appropriate to find out the interaction between the human and the nonhuman and their perceptions about the research problem under study. The decision to position this study within the social constructivism was based on the assumption that being in the field where participants are taught and are teaching, poisoning this study in the above philosophy could provide an opportunity of getting in-depth information regarding the topic under study through interacting with other persons (Creswell, 2014; Creswell, 2013). The advocates of the social constructivists pay attention to individuals, the context in which they live and work to understand their setting. I used social constructivism because I wanted to know how prospective teachers are taught ICT during their teacher education, their views towards its teaching and how they could be taught as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Creswell (2014) identifies three assumptions concerning constructivism and the researchers that are oriented to qualitative research. The first assumption Creswell (2014) identifies is that qualitative researchers tend to use open-ended questions so that participants can share their views. Secondly, Creswell assumes that qualitative researchers tend to understand the settings of the participants by visiting their places of work to collect information and later interpret it according to their own experiences. The third assumption Creswell (2014) identifies is that qualitative research is largely inductive hence the researchers generate meaning from the data collected from the field.

Although this study is using a qualitative research approach (as decribed in 5.3 below), I applied all the three assumptions and these are: using open-ended questions so that participants can share their views; understand the settings of the participants by visiting their places of work to collect information and later interpret it according to their own experiences; the third assumption is that qualitative research is largely inductive whereby the researchers generate meaning from the data collected from the field. During data collection, I used an interview guide with an open-ended question. During data collection, I visited the two colleges where I collected data from one at a time as well as the schools where early career teachers were teaching. This was done with the intent of collecting in-depth information from the participants.

Lastly, after collecting data, I had to present, analyze, interpret and discuss it to generate meaning out of it. Having used interviews during data collection, I was aware that my behavior as a researcher and the face-to-face contact with the participants may impact the behavior or even overstep on to the rights of the participants. However, in an attempt to minimize this, it was necessary to make ethical considerations as described in section 5.13 of this chapter.

5.3 Research approach

A research approach is a plan and the procedure for research that span the decision and analysis and it involves the intersection of philosophical assumptions, design and specific methods (Creswell, 2014). It is a general orientation to the conduct of social research (Brymam, 2016). There are fundamentally three different research approaches: qualitative, quantitative and mixed-method research. For the case of this study, I adopted a qualitative research approach. Qualitative studies support investigations in which an individual or a group attributes meaning to a social or human problem (Creswell, 2014; Silverman, 2014; Bryman, 2016). Therefore, I used the qualitative research approach because I thought that it was more likely than the other two approaches to guide me to answer the research questions, meet the aim, answer the research ques-

tion and meet the purpose of my study hence yield the conclusion. The idea behind qualitative research is to purposefully select participants or sites, documents, or visual materials that would best help the researcher understand the problem and the research question (Creswell, 2014). Gall et al., (2003) say that in qualitative research approach is grounded in the assumption that individuals construct social reality in the form of meanings and interpretations, and that these constructions tend to be momentary and situational.

While using a qualitative research approach, the process involves emerging questions and procedures, where data is collected typically in the participants' settings and data analyzed inductively by building themes from particular to general (Creswell, 2014). This approach enabled data collection to be done in a natural setting and inductively analyzed, as themes and patterns were established during analysis (Creswell, 2014).

The reason I used a qualitative research approach is that could guide me in choosing the design that could guide me to select participants where I could obtain rich data in terms of direct quotations and clear elaboration of the situation through interaction with participants during data collection hence answer my research question. The qualitative research approach empowered me to reflect on the participants' responses to the questions I asked while making sense of the data on the participants' viewpoints towards teaching ICT to prospective teachers how to use as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. It also enabled me to understand the views of teacher educators, early career teachers, curriculum developers, and the ICT personnel at the Uganda National Association of the Blind on how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating accommodative learning environments for learners with visual impairment. This approach enabled me to develop interest, generate data, gain experiences, and create self-awareness towards this study. Being present in the research setting enabled me to get actively involved as well as to obtain the first-hand experience while interacting with the participants (Silverman, 2014; Creswell, 2014; Patton, 2002). Last but not least, the qualitative approach facilitated me to uncover the ICT content in the primary teacher education curriculum, the pedagogical approaches used, and the participants' views towards its teaching as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment and further improvement. This is in line with Gall, Gall and Borg (2003) who say that one of the dominant mythological issues in the qualitative research approach is to discover meanings and interpretations by studying cases intensively in natural settings and by subjecting the resulting data to analytic orientation.

5.4 Research design

A research design is a framework or structure within which the collection and analysis of data take place (Bryman, 20016; Yin, 2014). Bryman adds that the choice of the research design reflects decisions about the priority being given to a range of dimensions of the research process which is influenced by the research question that guides the study. With the above description of the research design, I used a case study design to guide this study. A case study is an empirical study that investigates a contemporary phenomenon (the case) in-depth and within the real-world context (Yin, 2014; Cresswell, 2014; Bryman, 2016). Bryman (2016) adds that this design (case study) entails the detailed and intensive analysis of a single case though sometimes it is extended to include the study of two or three cases (multiple case studies) for comparative purposes. The common geographical levels of analysis while comparing educational studies are between countries whereas in another comparison could be continents, states, provinces, districts, counties, schools/institutions, or classrooms.

The classical definition of a case study usually center on individual persons, but other cases may include organizations, processes, programs, neighborhoods, institutions and or events (Yin, 2014). Case studies principally deal with how and why things occur and, thereby, provide an opportunity to explore the realities about an event, a process, or a problem relating to the case (Anderson, 1998). In this study, I used multiple cases. The cases I used were two institutions (primary teachers' colleges) that have implemented the teaching of ICT to prospective teachers.

Information about the teaching of ICT to prospective teachers in general and that for persons with visual impairment as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment were collected from two primary teachers' colleges. Case studies are not methodological choices but they are choices of what is to be studied by any method (Yin, 2014; Creswell, 2014; Stake, 2000). However, for social sciences studies like this one, the choice is often qualitative (Bryman, 2016; Creswell, 2014; Silverman, 2011). Therefore, in this study, a qualitative case study approach was adopted as a strategy to select the research setting.

What necessitated the choice of the case study design arose out of the aspiration to carry out an in-depth study that could lead to an understanding of the teaching of ICTs for persons with visual impairment as pedagogical tools to prospective teachers towards facilitating conducive learning environments for learners with visual impairment in two primary teachers' colleges. Each college represented a case being studied to find out how ICTs for persons with visual impair-

ment are taught as pedagogical tools in primary teachers' colleges towards facilitating conducive learning environments for learners with visual impairment. Data collected from these two cases are included in this study. This is because, through case studies, the status quo of a phenomenon is understood through the description that could provide an understanding of the realities as they are experienced and perceived by the participants. Therefore, the selection of settings or cases for this study was purposeful while the selection of participants was both purposeful and snow-ball sampling techniques to get the sample whereby participants linked me to other participants. This was done because the funding of the study is from a collaborative project between Kyambogo University, Kenya Institute of Special Education (KISE), University of Dar es Salam and the University of Oslo (ENABLED project) which was partly paying consideration on the preparation of teachers in Ugandan primary teachers' colleges towards facilitating conducive learning environments for learners with sensory impairments.

5.5 Research sites

To meet the aim and to answer the research question in research of this nature, careful selection of the research site is one of the most important aspects. For educationally-oriented research studies, the most appropriate sites are academic institutions and other institutions that are educationally-oriented (Gall et al., 2003). Currently, there are 51 PTCs dispersed in all five administrative regions of Uganda. Forty-five are government-funded, while four are private and funded by religious institutions. All these primary teachers' colleges are expected to implement the policy of teaching ICT to prospective teachers.

Since all colleges could not be used, this study purposively selected two of the government-aided/funded colleges. These are college A in Kibubuura (pseudonym) district in mid-western Uganda and college B in Nabukakara (pseudonym) district in south-western Uganda). The two colleges I identified teach ICT fully to all the prospective teachers during the two years of pre-service teacher education because all colleges have not implemented its teaching. Secondly, the two colleges have adequate ICT equipment.

College A is located in the urban setting whereas college B is located in the rural setting. Both of them are public institutions and they are categorized as core primary teachers' colleges. As core teachers' colleges, these institutions are expected to provide teacher education for candidates who are fresh from secondary school (preservice teacher education) and for teachers who are already employed in the teaching profession (in-service teacher education). The playing of dual roles by the two colleges implies that they have somehow more resources as compared to ordi-

nary prospective teachers' colleges. The two primary teachers' colleges were selected because they have well-established ICT laboratories to facilitate the teaching of the use of ICT to all prospective teachers they admit. The second reason for choosing the two colleges is that in the above two colleges and districts, teacher educators who teach ICT and early career teachers who completed their studies between 2013 and 2016 could be identified to participate in the study. They also had full-time ICT teacher educators, who were available and willing to participate in the study. Lastly, though the two colleges were located in two different settings, they were both accessible using any means of transport available for example by Boda Boda (public motorcycle transport).

To fulfill the aim of this study, MoES, the curriculum-developing institution, the PTCs, and the UNAB were involved in the study. As this study was guided by ANT, reference was made to Blok and Jensen (2011), who observe that no one entity is significant in isolation but instead attains its meaning through numerous and changeable relations to other entities. Since entities do not work in isolation, I included the UNAB in the study, as it has an interest in improving the competencies of teachers who teach children with visual impairment in the country. Moreover, sometimes teacher education institutions are consulted by the UNAB for input towards teacher education towards facilitating suitable learning environments for learners with visual impairment.

The involvement of multitudes of relations, as explained in chapter four, is called actor networks. Importantly, actors are tracked down if their paths become visible when performing actions while interacting with other actors. In educational research of this nature, ANT is used as a guide to consider that all organizations that are important in the development and implementation of teaching ICTs in PTCs participate in the study. This led to continuous representation and involvement of human and nonhuman actors in academic and non-academic institutions to come up with the kind of teachers needed towards facilitating satisfactory learning environments for learners with visual impairment.

The study also sought research data information from the curriculum-developing institution, because it determines the teaching content to be included in the curriculum. Secondly, it prepares teacher educators who are employed by or in PTCs, which implement the approved curriculum. Thirdly, this institution certifies the teachers who have completed their teacher education. Since I could not use the whole population in these institutions, I had to sample a few to represent them. How did I come up with the sample? In the section that follows, I am going to discuss the sampling procedure that I used to come out with the sample of the study.

5.6 Population and sample

To carry out a study of this kind, I had to decide on the type of population from which I had to get the sample of the study. In research, a population is a universe of units from which a sample is to be selected (Bryman, 2016). In the next subsection, I am describing the population that I used while I was carrying out this study.

5.6.1 Population

To carry out a study like this one, I had to determine the kind of population from which to select the participants of this study. Referring to Ren et al., (2012), since this is an ANT guided study, I was provided with an opportunity to use an unusual population (thus from the public and private sector) so that I can collect diverse data from which I could base my presentation, interpretation and analysis on. Referring to Bryman's (2016) definition of a population, the nature of my study and the research questions, my population comprised of curriculum developers, ICT teacher educators, all early-career teachers from the two target colleges who graduated between 2013 and 2016, and the ICT coordinator from UNAB as shown in table 1 below:

Table 1: The population of the study

Institution	Category population	Total Population
Primary teachers college A	Teacher educators	39
Primary teachers college B	Teacher educators	16
Graduates from college A between 2013 and 2016	Early career teachers	720
Graduates from college B between 2013 and 2016	Early career teachers	840
UNAB	All staff	15
Department of teacher education	Teaching staff	18
Total		**1648**

The above table is a summary of the presentation of the population, their categories and the sites where they were got from. As shown in the table, college A had a population of 39 teacher educators. 22 of the 39 are on the government payroll whereas 17 are paid by the college.

Between 2013 and 2016, this college (college A) was admitting and passing out 180 newly qualified teachers. For the four years (2013 – 2016) which was the target population of early career teachers who qualified within that time, the college had passed 720 teachers. The total population of teacher educators and newly qualified teachers from college A was 759. However, the

number of students to be admitted has dropped drastically because, from 2017, one has to join a primary teachers' college only if she or he has a credit pass in the English language. This has affected the number of prospective teachers being admitted to primary teachers' colleges. Despite the above, the number of teacher educators has remained constant. Out of 39 teacher educators, only one teacher educator was teaching ICT. This one was in the category of those who are employed and paid by the college.

College B was having a total of 16 teacher educators. Out of these 16 teacher educators in the college, one was teaching ICT. By then, the college used to admit and pass out (graduate) 210 newly qualified teachers every year. For the four years (2013 – 2016) my concentration was on the population of 840 newly qualified teachers. In this college, I got a total population of 856.

The department of teacher education, in the curriculum developing institution, has 18 teaching staff. They work hand in hand with the teacher educators and other stakeholders for example from the Ministry of Education and Sports develop it. The organization of persons with visual impairment has a population of 15 staff. Therefore, my total population from the teacher educators from college A and B, newly qualified teachers from the two colleges, the curriculum developing institution and the organization of persons who are blind was 1648. The reason for the choice of this population was that I wanted to use a population rich with information. It was out of the above population that I had to get a sample to find out how prospective teachers are taught ICT towards facilitating beneficial learning environments for learners with visual impairment.

5.6.2 Sample

Since the whole population could not participate in the study, I had to get a small group thus a sample to represent them. Cohen et al., (2011), define a sample as "a small group or subset of the total population in such a way that the knowledge gained is a representative of the total population" (p.143). Out of a population of 1648, I got a sample of twenty (20) participants to represent a population of 1648 as shown in table 2 below:

In table 2 below, I have indicated the categories of the population and the gender from which I got a sample of 20 participants that represented a population of 1648. The sample comprised 16 early-career teachers, who had been taught ICT during their preservice teacher education. This decision was taken because in qualitative research, the sample size is typically small (Gall et al., 2003). Out of the above population, I have explained the sampling procedure that I used as explained in section 5.7.

Table 2: The sample that represented the population

Institution	Category population	The target population in numbers	Total Sample	Gender
Primary teacher college A	Teacher educators	39	1	Male
Primary teachers college B	Teacher educators	16	1	Male
Graduates from college A between 2013 to 2016	Early career teachers	720	6	4 Males 2 Females
Graduates from college B between 2013 to 2016	Early career teachers	840	10	4 Males 6 Females
UNAB	All staff	15	1	Male
Department of teacher education	Teaching staff	18	1	Male
Total		**1648**	**20**	**12 males** **8 females**

To obtain a sample of 16 early career teachers, a careful selection of the participants from the population of one thousand five hundred and forty (1540) of early career teachers was made by asking them when they completed the teacher education course. This is explained in detail in section 5.8 on how I identified and obtained the contacts of the participants. These teachers were contacted using their mobile phones. Those who had completed before 2013, even if they had learned ICT or not, they were not interviewed, since they did not belong to the target population. This is because before 2013 ICT was not taught in primary teachers' colleges because it was no ICT curriculum in the PTCs.

I stopped collecting data from early career teachers when I realized that there was nothing new that I was getting from them thus saturation. Saturation is a term used in grounded theory which means that one stops collecting data after realizing that there is no longer new information being bought forward by the participants during the interview (Creswell, 2014; Cohen et al., 2011). Though saturation is an idea that comes from grounded theory, I had to apply in this study whereby I had to stop conducting interviews when I realized that there was no longer new information being bought forward by the participants (Creswell, 2014; Cohen et al., 2011).

Two teacher educators (one from college A and another from college B) participated in the study. This was because each PTC had only one ICT teacher educator and hence is implementing the curriculum. Secondly, these teacher educators were selected as they had been in these colleges for more than three years. Lastly, these teacher educators should at least know the teachers who graduated from the selected colleges within the targeted timeframe (2013–2016) and know the whereabouts of a few of them.

In the curriculum developing institution and the association of the blind, one participant was interviewed. The participant from the curriculum developing institution participated in the study because this participant had knowledge of ICT teaching in primary teachers' colleges. The second reason for the participation of the curriculum developers in this study is because they established guidelines and determined the content to be included in the curriculum and they could give reasons about the content they included in the ICT curriculum out of a vast array of the content and equipment available.

A participant from the organization of the blind was included because this organization has knowledge of the ICTs that are appropriate towards the teaching and learning of perons with visual impairment and could be taught to prospective teachers to use as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. Secondly, the organization of people with visual impairment is, sometimes, involved in refresher courses that teach in-service teachers who have children in their schools to teach these children ICT. As a result, I thought that they could have input to this study.

In the process of data collection, I encountered some constraints. One of the constraints is that it was not easy to get some participants as the areas of study were new to me. Secondly, since I was meeting most of the participants for the first time, they were not free to give me information regarding the teaching of ICT to prospective teachers until I assured them of the purpose of the study and confidentiality. And thirdly, there was power disconnection when I went to college A for a non-formal observation, This affected how I could verify the claims of the early career teachers that teacher educators were committed to their work of teaching ICT to prospective teachers.

Regardless of the constraints of purposive sampling and snowball procedures, I used it because I thought it could be the best possible way of getting the participants I required for the study as shown in table 2 above and expounded below.

5.7 Sampling techniques

To get the representatives of the population to participate in the study, I had to use a given procedure or technique to select a small group of people (sample) from the population. The procedure of section is what is referred to as sampling (Bryman, 2013). Sampling is the process of selecting members of a research sample from a defined population, usually with the intent that the sample accurately represents the population (Gall et al., 2003). I used two sampling techniques,

thus purposive and snowball sampling techniques, to get a representative sample of participants of this study. The reasons for the choice of these techniques are discussed in section 5.7.3.

5.7.1 Purposive sampling

Purposive sampling is key to qualitative research (Cohen et al., 2011). This is a technique where a researcher deliberately selects participants from a specific population of interest (Vellutino & Schatschneider, 2011). In purposive sampling, the researcher handpicks the cases and participants to be included in the sample-based ion the judgment of their typicality or possession of the particular characteristics being sought (Cohen et al., 2011). Purposive sampling enabled me to access knowledgeable people by their knowledge, role, expertise and experience (Cohen et al., 2011). The purpose is to select the case, or cases that are likely to be information-rich about the study, develop a deeper understanding of the phenomena and the purpose of the study (Gall et al., 2003). As a result, purposive sampling enabled to access participants who have in-depth information about the teaching of ICT to prospective teachers. As its name suggests, I chose purposive sampling because; teacher educators selected because they know the content that is in the curriculum and they implement its teaching;, early career teachers were selected because they were taught ICT during their teacher education and they remember the content that was taught to them during their preservice teacher education; the curriculum developers were chosen because they decide on the ICT content that included be in the curriculum during curriculum development and review; and a representative from the organization of the blind because sometimes they get involved in in-service teacher education and they know the ICT content that could be taught to prospective teachers as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Cohen et al., (2011) identify six types of purposive sampling. These are typical case sampling, extreme or deviant case sampling where the sample includes the most typical cases of the group or population under study extensive sampling in which the most extreme cases e.g. success, failure, drug abuse, etc. are studied to expose issues that might not present themselves; maximum variation sampling whereby samples were chosen possess a very wide range of characteristics in connection with the topic under study; homogeneous sampling in which the samples are chosen because of their similarities; and reputational sampling is where participants are selected on the recommendations of key participants or because the researcher is aware of the characteristics of the participants (Cohen et al., 2011).

Other types of purposive sampling techniques categorized under sequential sampling by Cohen et al., (2011) are: theoretical based or operational sampling in which cases selected yield greater insight into the theoretical issues under investigation;, confirming and disconfirming case sampling whereby samples are selected from those that do and do not conform to typical trends or patterns to study the causes or reasons for their conformity and disconformity;, opportunistic sampling whereby further individuals are or groups are sampled as the research develops or changes and which as validity and reliability dictate should include; and snowball sampling in which the researcher uses social networks, participants and contacts to put them in touch with further individuals or groups.

For the case of this study, I use reputational sampling whereby participants were considered to participate in the study after getting a recommendation from the key participants who were the ICT teacher educators for the case of early career teachers.

5.7.2 Snowball sampling

Another technique I used during data collection is snowball sampling. Snowball sampling, is a technique where the researcher initially samples a small group of people relevant to the research question, and these sampled participants propose other participants who have experience or characteristics relevant to the research (Bryman, 2016). This technique involves asking participants/cases that have been interviewed to recommend suitable participants/cases for the phenomena under study, who then, after being interviewed, recommend another person who is suitable for example a friend, colleague, or classmate to participate in the study. Thereafter interviewing this participant/case whom the interviewer has been referred to, she/he also recommends the interviewer to another potential participant/case and the process continues until the desired sample size is achieved (Bryman, 2016; Merrill & West, 2009; Gall et al., 2003). The snowball sampling technique enabled the involvement of earlier career teachers who completed their teacher education courses between 2013 and 2016. I stopped collecting data when I realized that there were no new findings, insights, or properties being revealed by the participants, thus data saturation (Bryman, 2016; Creswell, 2014).

During data collection, I realized that snowball sampling relied on strong interpersonal relations, whereby known friends or reputational contacts were used (Farquharson, 2005). Hence, participants had control over whom to refer or recruit to participate in the study. The sampling techniques were used for the representativeness of the population being studied. Nevertheless, Merrill and West (2009) observe that snowball sampling is not sufficient because of its inadequate

representativeness. I noted this during data collection, reference was really on the technical know who because friends referred me to friends.

5.7.3 Justification for using purposive and snowball sampling

Since the qualitative approach of researches work with smaller numbers of participants who are often obtained through purposive or snowball sampling procedures, they tend to attract criticism for not allowing for generalization of the results to a larger population (Bryman, 2016). Despite the above criticism, purposive and snowball sampling techniques were used and have led to theoretical generalization, whereby critical areas of investigations have disclosed gaps in findings and brought about the possibility of hypothesizing the existence of previously unknown phenomena (Cohen et al., 2011). Additionally, purposive and snowball sampling techniques pay attention to particular groups and characteristics of participants that one is interested in. For example, I intended to find out the perceptions of teacher educators who teach ICT, early career teachers who completed their teacher education between 2013 and 2016, curriculum-developing institutions and a member of from the organization of persons with visual impairment towards teaching the use of ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment in PTCs in Uganda. The results obtained from the above persons and institutions may be used for theoretical generalization to other similar persons and institutions that teach the use of ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment.

The use of these sampling techniques (purposive and snowball) was to achieve representativeness to enable comparisons to be made concerning the responses flowing in and to focus on specific but unique issues under study (Cohen et al., 2011). This is based on the typicality or possession of particular characteristics being sought to build up a sample that can satisfy the study's needs (Cohen et al., 2011).

Purposive and snowball sampling techniques were useful because it was difficult to identify participants, due to lack of a readily available list at either the district offices or PTCs showing the placement or whereabouts of the target group of early career teachers. As a result, the teacher educators and the early career teachers identified first helped to identify other participants for the study, and the administrative personnel from the university and the UNAB were asked to refer me to those they thought could give information concerning the topic under study. These techniques were applied by explaining to initial participants and the institutional administrators the study's purpose and aim, which in turn was explained to the new reference person they got in

touch with or referred me to. After interviewing the participants I was referred to, and in case I needed any other person, I asked them to refer me to others they knew could give information regarding the topic at hand, thereby creating a snowball. A combination of purposive and snowball sampling techniques during data collection led to the building of a network. The building of the network started with the OPPs. In the process of data collection, tracking of actor-networks and their associations involved in teaching the use of ICT needed the identification and pre-imposition of OPPs. These acted as reference points and they helped me access other human and nonhuman actors. In this case, while the college administration acted as OPPs to trace early-career teachers, the teacher educators acted as micro-OPPs that I used to find how early career teachers could be identified and contacted.

5.7.4 The procedure used in purposive and snowball sampling

To get access to the participants, there were steps I had to follow. The first step was to visit the institutions, get primary information about the institution and the participants, and the possibility that these participants have the knowledge or is participating basically or ideologically in teaching how to use ICTs as pedagogical tools to prospective teachers towards facilitating auspicious learning environments for learners with visual impairment. Secondly, I visited these institutions to ascertain whether they have an idea on the presence of ICT content in the primary teachers' college curriculum and whether its teaching as pedagogical tools to prospective teachers towards facilitating conducive learning environments for learners with visual impairment is taking place.

To get to this, I had to go through managers or supervisors of the selected institutions. The institutional administrators and MoES staff at district levels, for example, the District Education Officers (DEOs) or the District Inspectors of Schools, the PTCs' principals, the UNAB secretariat, and, in some instances, the administrators of the schools where these early career teachers are employed, were the OPPs through whom I obtained access and contact with the participants. The use of the OPPs in this study comes from ANT whereby I had to go through supervisors or managers to get to the participants.

During data collection and analysis, I noticed that most participants were male because the first participants to be interviewed at the PTCs (the teacher educators) was male, who then referred me to their male counterparts. Hence, very few male participants referred me to their female counterparts, making gender balance a problem. Secondly, although I was studying the perspectives of teachers who graduated between 2013 and 2016, I realized that through snowball sampling, early career teachers referred me to teachers who qualified the same year. Those who

qualified in 2015 and 2016 were the majority of participants, with only a few from 2013 and 2014. The teacher educator could proficiently recall those who completed in 2015 to 2016 compared to those who qualified in 2013 to 2014. As a result, most of the participants I was referred to by the teacher educator either referred me to those who were either in the same class with them or a year after or before them. This made it impossible to get the pioneers (the 2013 group) of the ICT course unit.

5.8 Pilot study and lessons learned

A pilot study is a mini version of the study that aims at developing, testing, or refining the planned instrument for data collection or procedure that would later be used in the study (Bryman, 2016; Bodens & Abbot, 2016; Yin, 2014). Piloting (pre-testing) of the instruments was carried out for validity reasons. The pilot was principally done to find out the reliability, validity, and practicability of the instrument and the sampling procedure (Cohen et al., 2011). Bryman (2016) contends that a pilot study may help the research to avoid some of the problems that would arise in an attempt to implement the research design.

When I carried out the pilot study, the research questions that were in the proposal were: How have teacher educators been engaged in ICT teaching and competence development amongst the student-teacher?; What prior ICT skills do student teachers possess to determine the kind of support teacher educators to acquire specialized ICT skills?; What ICT content for persons with visual impairment is taught to student teachers that are relevant to their practice as teachers?; and what approaches are being used to deliver ICT for persons with visual impairment in teacher education?

A pilot study is important because it helps to establish the validity of the instrument and to improve questions and to become familiar with the format of the interview guide. Secondly, the purpose of the pilot study was to gauge the relevance of the questions in the interview guide to be used during the study; to find out whether the instrument would give the responses that are expected; to determine the appropriateness, manageability, and acceptability of the sampling procedure; and to see whether there was a need for additional interview questions where the need arose.

In this study, the pilot study was carried out in one teacher's 'college in Uganda. The pilot study was carried out from 15–23 January 2016 (8 days' duration) in mid-western Uganda with seven early career primary school teachers. The initial intention was to carry it out at Bwimbi primary teacher's college in Kabimpiri district. College selection was based on four basic criteria. The

first one is that it was accessible: secondly, ICT is being taught; thirdly, there is a teacher educator teaching ICT; and lastly, it is a government-aided primary teachers college. On reaching the college, however, the principal informed me that they did not teach ICT to all prospective teachers, due to inadequate ICT equipment. Instead, it was taught to a few students who had an interest. Secondly, the college did not have an ICT teacher educator. The principal referred me to PTC A in Kibubuura district where ICT is taught to all prospective teachers and where they have a teacher educator and adequate equipment. I, therefore, carried out the pilot study at PTC A in Kibubuura district with seven early career teachers and one teacher educator.

5.8.1 The procedure of data collection during the pilot

Before data collection, I made prior contact with the principal, early career teachers who completed from that college and continuing students, which would have made it easy to build up a sample using purposive and snowball sampling techniques.

On reaching college A, where I carried out the pilot study before I interview the participants, I had to study the timetable to ascertain its allocation. This was done because as stated in section 4.9 above, some primary teachers' colleges do not teach ICT to their prospective teachers. Individual interviews were conducted with one teacher educator, four second-year prospective teachers and three early career teachers. The teacher educator was interviewed because he is responsible for the implementation of the curriculum.

Secondly, they know the content that is included in the curriculum; and thirdly, they know when practical lessons and non-practical lessons are taught to prospective teachers and how the prospective teachers would benefit from it. Early career teachers were interviewed because one, to find out the practicability of the ICT knowledge they learned after their teacher education; the benefit of the ICT they learned during their teacher education to teaching; and to find out how the teaching of ICT could be improved. Lastly, the second-year students were included in the pilot study for three reasons. The first one is that they are still undergoing teacher preparation. The second reason is that the current timetable that is being followed in the two primary teachers' colleges have more time than the previous one as stated by the teacher educator; and thirdly, I got them being taught ICT and their expected benefit. Therefore, during the pilot study and before the main data collection, I had to go through some documents I got access to from the colleges as discussed below.

5.8.2 Document study for the pilot study

During the pilot study and before the main data collection, I had to access some documents. I requested the documents from the deputy principal who then referred me to the director of studies, who is the custodian of all academic documents in the college. While requesting the documents, I assured the administrators of the two colleges where I collected data that the information that I intend to get from the documents would be kept confidential and will only be used for the study. For that case, the study of the documents was carried out within the college premises hence I sought permission in case I wanted to photocopy any of the documents. The documents I accessed and observed during the pilot and the main study were:

- The curriculum for primary teachers' colleges
- Module 1 and 2 for professional educational studies
- The general college timetable
- Lecture notes

The purpose of studying the documents was to gather information about the availability of ICT content in the curriculum and the two modules and its relevance to the study. Secondly, I wanted to find out the allocation of ICT into the curriculum.

5.8.3 Lessons learned from the pilot study

The lesson I learned from the pilot study is that most questions were not necessary (Appendices V, VI & VII). From the first to the sixth question the answers were "no". I had assumed that prospective teachers were being taught how to use ICTs as pedagogical tools for learners with visual impairment while teaching. The questions were specifically geared at finding out how prospective teachers were taught how to use ICTs as pedagogical tools while teaching learners with visual impairment. This, therefore, aided me to adapt questions from more specific questions to general ones, to find out their perceptions about teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This, therefore, necessitated me to change the research questions and the questions in the interview guide that I used for the main study. Another question I asked was their views towards the introduction of the teaching of ICT into the preservice teacher education curriculum. The pilot study also revealed variation in teaching ICT in PTCs in Uganda in that some colleges taught it whereas others did not

Another lesson learned from the pilot study is that the government had not equipped PTCs with ICT equipment. Those who had them received them as donations from non-governmental organ-

izations or individuals. I also observed that there was very limited time allocated towards the teaching of the use of ICT during the two years of teacher education. The first was a three-hour course that was all theory, and the next was a six-hour course which was half theory and half practical. The practical part mostly paid attention to the computer keyboard, basic application of Microsoft word and web-browsing. During the pilot study, I noted there was no ICT content on how to instruct prospective teachers how to teach while using ICT for learners with visual impairment in the curriculum. This, therefore, led to the modification of the research questions and the interview questions from centering on the teaching of ICT (known) to their perceptions towards the teaching of ICT for learners with visual impairment (unknown) as stated herein: What are the stakeholders' perceptions towards teaching ICT in teacher education? This question arose from the experience that ICT is taught in some primary colleges in Uganda.

This led me to the second question which is more specific and centers on the study aim. The question is: How are teacher educators engaged in preparing prospective teachers to develop skills of using ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment? This question intended to find out how teacher educators are preparing prospective teachers on how to use ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment.

The third research question is: How are institutions working together in teacher education to prepare prospective teachers to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment? Teacher education in Uganda is a government program with input from different institutions. One main institutional actor that works towards preservice teacher education is the MoES.

Though the content of ICT for persons with visual impairment was not in the curriculum, following the focus of The NORHED-Enabled project that was being carried out in Kyambogo University in Uganda, Kenya Institute of Special Education (KISE) in Kenya and the University of Dar es Salaam in Tanzania, which was aiming at finding out how primary school teachers are prepared during their prospective (initial) teacher education to teach children with sensory impairments in primary schools.

The pilot study also clarified the value of using purposive and snowball sampling techniques. The purposive sampling technique was used because of the study aimed at interviewing teachers who completed their studies between 2013 and 2016. The snowball sampling technique was used, as it was not easy to locate early career teachers. The teacher educators helped to identify a few

early career teachers, but if more were needed, I had to ask the ones I interviewed to identify further potential participants. During the pilot study, the idea of following the actors as applied in ANT was used taking into account the pre-understanding and assumption that ICT was being taught in PTCs. This aimed at finding out whether ICT was taught as pedagogical tools to prospective teachers during their teacher education towards facilitating expedient learning environments for learners with visual impairment. The guidance of ANT enabled me to note that all human and nonhumans involved in an activity are all treated as equally important. The importance of human and nonhuman entities is that they work together to achieve a goal.

After correcting the interview guide following findings from the pilot study, I had to pretest them and thereafter went for the main data collection. During data collection for the main study, I used the procedure I have discussed in section 5.7.4 and the one I used in the pilot study. In section 5.9 below, I have expounded in detail the procedure I used during the main data collection.

Despite the above differences, I did not change the research design. The reason for not changing the research for two major reasons. The first is that the population remained the same. Secondly, since ICT is an issue of concern in education, I could not change the design and the method of data collection. The intention was to get the views of early career teachers, teacher educators, curriculum developers and organizations of people with visual impairment towards its teaching in teacher education.

5.9   The procedure of data collection for the main study

In data collection, some procedures were followed. A procedure is also referred to as steps that one follows while doing something. For the case of this study, the procedures that I followed involved preparation before data collection, gaining entry into the research site and real data collection. The three procedures are discussed below.

5.9.1 Preparation for data collection for the main study

Before I left the University of Oslo to Uganda for the data collection, I had to develop the interview guide and pre-tested it (5.8). After pretesting it, obtained an introductory letter (appendix V), which I used to introduce myself to participants and the gatekeepers. I as well wrote my introductory letter and consent forms for OPPs (gatekeepers) and participants and I attached to the one from the University of Oslo.

When I reached Uganda, I had to visit Kyambogo University, the institutions that develop the preservice teacher education curricula prepare teacher educators to implement all the curricula

they develop, examines and certifies prospective teachers that have completed the course. This was done to ascertain the colleges that are teaching ICT to prospective teachers. From Kyambogo University, I visited district offices where colleges that teach ICT are located. From the district offices, I visit the colleges as well as schools that have employed teachers that were taught ICT. To enter these institutions, I followed some procedures as presented below.

5.9.2 Gaining entry

Research ethics emphasizes that it is necessary to ensure that entry into the college and participants is got in a way that does not seem to be interfering with the participants and institutional activities. Most primary teachers' colleges in Uganda are not implementing the teaching the use of ICT as a pedagogical tool for prospective teachers. To get to know the colleges that teach ICT to prospective teachers, I visited the department of Teacher Education at Kyambogo University for guidance. This department is in charge of preservice teacher education. It develops the curriculum, and implementation by examination, and marking examinations well as the issuance of certificates.

I consulted them for guidance, which led me to the identification of two colleges that have implemented the teaching of ICT to prospective teachers. After identifying the two colleges, in May 2016, (nine months before actual data collection) I visited each of them.

There were three reasons why I visited the two colleges. The first reason is to ascertain whether ICT is taught to prospective teachers in the two colleges. The second reason is to ascertain whether they have teacher educators qualified to teach ICT. Thirdly, the visits were meant to introduce myself to the college administration and plan how to carry out my study in the two colleges. During the visits, I made an informal discussion with the principal, the deputy principal and the ICT teacher educators of the two colleges. The discussion helped me to ascertain when ICT is teaching was implemented in each of the colleges, available equipment, content taught and its allocation in the time table. The informal visit was useful because it provided me with the opportunity to obtain information that would prepare instruments and to plan the pilot as well as the main study.

5.9.3 Data collection for the main study

Before I got to the participants whom I collected data from, there were steps I followed as illustrated in figure 3 below:

Figure 3: A summary of data collection through purposive and snowball sampling during data collection.
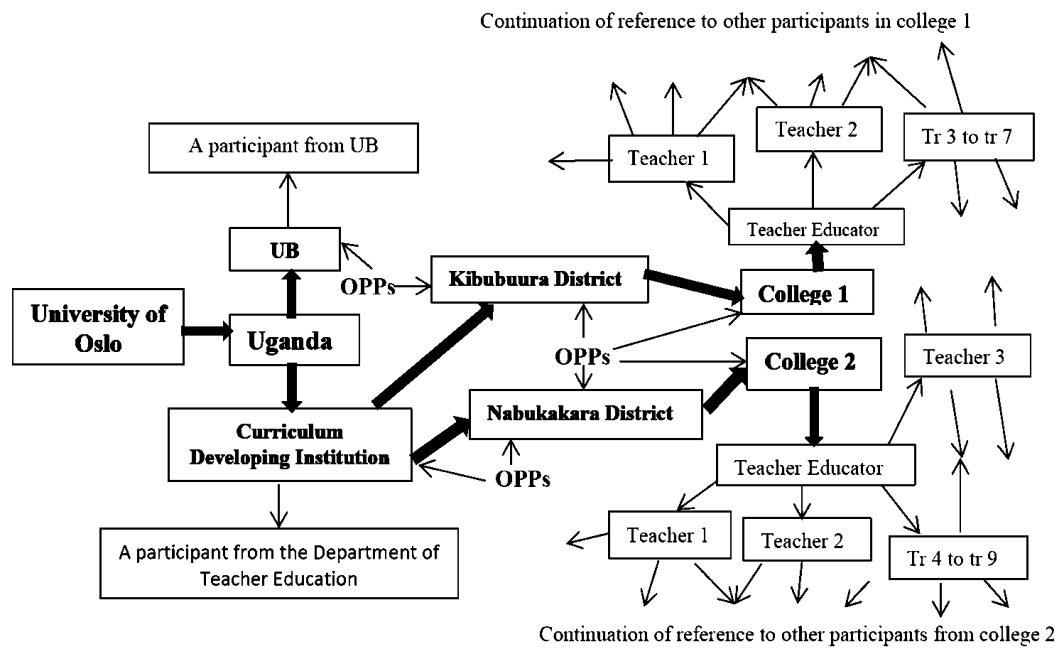
Source: Self-developed

I started data collection on 24th January 2017 and completed it on 18th September 2017. The figure above is an illustration of the steps I followed during data collection. The dark triangles are the institutions that I went to both in Norway and Uganda whereas those that are white are the participants. The big arrows show how I was referred to from one institution to another whereas the small arrows show how I was referred by one participant to another. Where two small arrows meet, it means that two or more participants had referred me to the same person and I had to tell them that those people had already been referred to me.

In the above figure, the big arrows show how I moved from one institution to another whereas the small ones (arrows) show how I got from participant to another through referral by already interviewed participants. For example, on arrival in Uganda, I went to Kyambogo University, Faculty of Education, Department of Teacher Education to get to know the primary teachers' colleges that teach ICT. This was done because Kyambogo University oversees the preservice teacher education in Uganda. The head of the Department of Teacher Education, At Kyambogo University, referred me to college A (1) in Nabukakara District and college B (2) in Kibubura District (not real names). I went to each one of the two colleges one at a time.

Actual Data collection started with a visit to each of the two district education offices of the two districts. Before I could get to college, I first went to the district education office to get permission from the District Education Officer (DEO). During the visit, I introduced myself to the DOE (a gatekeeper to institutions of learning in the district), I briefly explained to him the pur-

pose of my visit, and I gave each of them an introductory letter from the University of Oslo and the one I drafted to the DEO and I gave them ample time to read. They accepted by signing the consent form, which allowed me to carry out my study within their jurisdiction's district. After getting clearance, I went to each college at a time.

I started data collection from college B (2). On arrival at the college, I met the college principal, introduced myself to the college administrators (gatekeepers) and briefly explained to them the purpose of my visit. Thereafter, I gave the principal an introductory letter from the University of Oslo and that one I drafted myself to the teacher educator and I gave the principal ample time to read. When the principal agreed, I requested him to sign the consent form and thereafter, I sought guidance from him to identify for me the ICT teacher educator, which they did. They then connected me to the ICT teacher educators. I followed the same procedure when I went to college A. I stayed in each of these two colleges for two weeks though data collection went on thereafter because I constantly consulted the participants thereafter for follow up information. This stay was determined by the responses that I was getting from the participants. In two weeks, there was nothing new coming from the participants hence I had to stop collecting data.

When I met the ICT teacher Educators, I explained to them the purpose of my visit. I gave each of them an introductory letter from the University of Oslo and that the one I had developed. I gave them ample time to read. After each of them reading through the two letters and accepting to participate in the study, I requested them to sign the consent forms. After signing the consent form, I agreed with the participant on the appropriate time and place of conducting the interview. Before the interview commenced, I told them that a recorder would be used to capture information during the interview process. Each interview session with the teacher educator lasted between thirty minutes (30) and one hour (1 hour).

To reach the early career teachers, the teacher educators acted as the OPPs. After interviewing the teacher educators, I requested them to refer me to an early career teacher who had studied ICT between 2013 and 2016. The ICT teacher educators identified a few early career teachers, whom I met one at a time. I began all interviews with an introduction and a brief description of myself and the study's purpose. After briefing them, with the support of the introductory letters, they accepted by signing the consent forms. Just like the teacher educators, I agreed with the participant on the appropriate time and place of conducting the interview. Before interviewing them, I also told them in advance that a recorder would be used to capture information during the interview process. After the interview, I requested each of them to refer me to their classmates that did ICT which they did. This procedure of referring me to other participants went on and on

which made it practical to carry out a study in each one of the two primary teachers' colleges. This is because each participant interviewed in turn referred me to another they knew until I reached saturation. This is a stage where I was receiving the same information from the participants I could be referred to (Creswell, 2013; 2014). The same procedure was repeated in college A in Nabukakara district.

To reach out to the curriculum developing institution and the organization of the blind I went through the Academic Registrar of Kyambogo University and the Director of the organization of the blind. As I wanted to know whether ICTs are taught prospective teachers as pedagogical tools towards facilitating an advantageous learning environment for learners with visual impairment, I talked to the Academic Registrar, who referred me to the Faculty of Education, where the department in charge of teacher education is attached. The Dean of the Faculty of education referred me to the Head of the Department of Teacher Education, who then linked me with the person who drafted the ICT content in the curriculum. Just like the other participants, after signing the consent form, I agreed with the participant on the appropriate time and place for conducting the interview.

To reach the UNAB's ICT coordinator, I met the Executive Director, who then linked me to the participant. I met the participant, and since he was blind, I read all the introductory letters and a consent form to him. After that, he put a thumbprint accepting to be interviewed. After signing the consent form, I agreed with the participant on the appropriate time and place for conducting the interview.

5.10 Interview and non-formal observation as techniques of data collection

Having decided that this study would be qualitative, there was a need to decide on the methods of data collection. The methods of data collection were determined after carrying out the pilot study. Therefore, after the pilot study, I decided that the techniques I could use during data collection are interview and non-formal observation. These two techniques are discussed in subsections 4.10.1 and 4.10.2. I have started this sub-chapter by describing what an interview method entails and the kind of interview method that I used during data collection.

5.10.1 Interview method

An interview is an interchange of views between two or more persons conversing about a theme of mutual interest to produce knowledge and emphasize the social situation of research (Cohen et al., 2011). Latour (1987) refers to interviews as 'stuff' or ways of getting information from the participants.

There are two categories of interview guides thus unstructured and semi-structured interview guides. An unstructured interview guide is that interview guide that has a list of brief memory prompts of areas to be covered whereas a semi-structured interview has a somewhat structured list of issues to be addressed (Bryman, 2016). For the case of this study, I used a semi-structured interview guide during data collection though both of them involve the researchers' immersion into the situation and have been commonly used in educational research, (Stahl & Hartman, 2011; Kvale & Brinkmann, 2009). Secondly, I used semi-structured interview guides because of their flexibility. The flexibility enabled me to alter questions during the interview process. This is supported by the argument that "in qualitative research, the researcher is the instrument" (Patton, 2002, p. 12). The interview questions aimed at helping me to understand pre-service teachers' thoughts regarding the link between their perceptions and their learning practices (Aslan & Zhu, 2015). As a result, I was able to adjust the interview questions depending on the way the participant responded. Following Bryman's (2016) guidance, the guidance of the statement of the problem and the aim of the study, a list of questions related to how prospective teachers are and could be taught how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment were structured in form of semi-interview guides (appendices I, II, III, and IV) which I used during data collection.

The use of semi-structured interviews also enabled the building of rapport between me and the participants in advance, since it involved face-to-face interaction and active listening (Silverman, 2014). The building of rapport enabled participants to easily refer me to other participants. Lastly, there were minimal restrictions when I wanted to go back to participants for clarification of particular areas of findings in situations where the need arose.

In the process of data, semi-structured interviews enabled me to collect in-depth data. I conducted interviews following the guidance of ANT on building networks (5.14) which are nearly the same as snowball sampling (5.7.2). Network building approach and snowball sampling guided me to identify participants that could give me data related to the study who referred me to other participants they thought could give me information, I wrote, and/or recorded events and found ways of understanding the outcome that could take place by involving different actors in this action-oriented study (Latour, 1987). Semi-structured interviews also enabled me to inter-relate stories of participants as they told their experiences and shared their perceptions on how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. I began interviewing participants with the assumption that their responses were meaningful, knowable, and made the inves-

tigation meaningful. This is in line with Latour (1987), who said that when one has the right material, he or she cannot be afraid of going out there.

The guidance of ANT's concept of following actors, during interview sessions helped me to find out how human, nonhuman and allies (institutions) negotiated, inspired and work together to form a network to fulfill the act of teaching prospective teachers how to use ICT. Law (1999) said that actors are network effects that take the attributes which they include. As ANT considers both human and nonhuman actors equal, teacher educators, early career teachers curriculum developers, and a member of staff from the organization of the blind clarified the use and role of equipment while teaching prospective teachers how to teach while using ICT. The interviews enabled teacher educators and early career teachers to explain the importance of ICT equipment complemented by skilled human actors while teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. This is clarified by Blok and Jensen (2011) who noted that in actor networks everything that consists of both skilled human and material objects exists within actor networks. A critical issue is the relevance and importance of nonhuman as well as human actors for successful teaching the use of ICTs as pedagogical tools to prospective teachers towards facilitating satisfactory learning environments for learners with visual impairment. Teaching becomes incomplete with the incompetency of one actor, either human or nonhuman, which may affect its teaching because the network is incomplete.

Like every method of data collection, interviews have their advantages and restrictions, which I encountered. The first advantage was that participants provided information that could not have been possible to get if I had used other methods, such as surveys, which rely on questionnaires or observation. I applied probes like "mmh", "ooh", and "okay", etc., which encouraged participants to talk and further clarify the information they were giving. Secondly, interviews made me adapt questions during the interview process to make participants obtain a clear picture of the questions and make it viable for them to give as much information as possible about what was asked. It enabled me to extract very sensitive and personal information from the participants. As participants were interviewed on an individual basis, they were able to talk about the gaps in how ICT is being taught in PTCs. Many participants do not like exposing the negative side of the story while in a group. Lastly, a higher response rate was obtained through interviews. It was difficult for participants to turn down their participation or to ignore me.

The restrictions of interviews included the travel expenses, as this involved traveling to different locations to meet participants, whereby I needed a standby means of transport. The reason for

this was that some participants were in rural areas where transport was not readily available. Secondly, sometimes participants were ready and waiting, whereas some were not readily available because they could be in a class teaching or doing other activities, hence I had to reschedule the appointment depending on when they would be available. I could go to some places two or more times before a carry out an interview.

Another restriction was the difficulty of obtaining factual responses for example, participants talked about how good their teacher educator was good at teaching ICT. It was not easy to get factual responses that could have been obtained more accurately through other methods, such as observations because whenever I fixed for non-formal observation to observe how the teacher educator teaches ICT, there was no power. Participants talked of how teacher educators were good at their work, but I could not verify the claim because every time I went to each of the two colleges, there was no power supply, for example, electricity, standby generator hence there was no practical teaching taking place

While interviewing participants and carrying out no-formal observations I noted that when participants realized that I was from Kyambogo University, once a teacher like them and pursuing a Ph.D., they were readily available to provide information. This is because most were early career teachers who were aspiring to upgrade their careers. They thought I could aid them to be easily admitted into Kyambogo University teacher education programs. I thought that this could easily tempt them to give incorrect information to please me, thus concealing the correct information as regards ICT teaching in primary teachers' colleges.

Lastly, when participants realized that a person in an administrative position in the district and at the college, for example, the district education officer and the college principals had referred me to them, they agreed to participate in the study without hesitation. This made it easy for me to collect data. As a result of the above, I thought that fear of people in positions could affect the provision of accurate information (Creswell, 2014). I thought that this could jeopardize data collection if participants gave information that was not correct which could put the research at risk, compared to if I met these participants without going through college and district administrators. For example, when participants realized that I had been referred to them by the college's Deputy Principal, they tended to say how good and knowledgeable the teacher educator was and how the college administration was so helpful during their time of study as well as emphasized the availability and use of ICT equipment during teaching. This, therefore, necessitated me to organize for a non-formal observation to find out whether what they were saying was taking place.

5.10.2   Non-formal observation

During and after data collection, I carried out a non-formal observation at the college to find out how prospective teachers are taught ICT. This is in line with Yin (2014) who says that because a case study should take place in a natural setting of the case, there is a need for direct observation. The observation was carried out because during the interview: participants said that there is inadequate equipment like computers and other ICT equipment to teach ICT to student teachers. Another reason for carrying out observation is to find see the nonhumans involved in teaching ICT to prospective teachers. Since I managed to interact with the humans, there was a need to see the nonhumans that are involved in teaching ICT in primary teachers' colleges. I carried out a non-formal observation because I wanted to justify what participants had said. For example participants from college A said that they have 180 students in year one and the same number in year two. Students in these classes are divided into two streams of 90 students per stream whereas the college computer laboratory has 45 working computers. As a result, students are taught in two shifts of 45 per shift. If a lesson was taking two hours, each shift takes one hour and so if a lesson takes one hour, each shift takes thirty minutes.

Secondly, the participants also mentioned power outage which affected the practical teaching of ICT to prospective teachers as there was no standby alternative power supply. This was noted when I wanted to observe how practical teaching of ICT to prospective teachers was taking place. Whenever I could go to college, there was electricity outage and there was no alternative power supply. The purpose of this observation was to ascertain the reality of the responses as stated by the participants.

5.11   Data processing and analysis

In this chapter, I have described how I analyzed data, I have explained this process using two sub-heading thus data processing and data analysis as discussed in section 5.11.1 and section 5.11.2. This being an ANT guided study, data processing and analysis was guided by Adams and Tatnall's (2006) research process as represented in figure 4 on page 109. In section 5.11.1 below, I am explaining how I processed data before analysis.

5.11.1   Data processing

There are several ways that data could be analyzed. For the case of this study, I used thematic data analysis. The thematic analysis enabled the creation of themes out of the text I had collected (Silverman, 2014). Data analysis turned the large data masses into smaller masses of summarized data, and it permitted me to discover patterns and themes in the data and link them with

other patterns and themes (Bryman, 2016; Onwuegbuzie & Mallette, 2011). I analyzed and presented the data following the research questions that guided the study. During analysis, I read each transcript thoroughly so that data were treated in such a way that each data item threw light onto the others. All the similar participants' responses have merged with the themes they belonged to, which involved looking at small, independent bits of data and merging them to form a full picture of the data. I concentrated on small, similar pieces of data one at a time. Data was presented in quotations to preserve the originality and the 'flavor of the original'. This helped to make the data picture more complete by cross-checking different participants' data. For example, one theme that emerged was the inactive involvement of most governmental and nongovernmental institutions towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment.

With the guidance of ANT's concepts of following networks and the notion of translation, I was able to compare how one participant's data could be related to the next and the next. Johannesen (2013) refers to Ebeltoft (2003), who says that following actors via interviews in ethnographic research has become a methodological issue in how ANT scholars have approached educational research. This helped me to see how networks, either simple or complex, were connected and how they exchanged ideas to accomplish the goal of teaching ICT to prospective teachers. Some follow-up questions in this study related to the later questions, to avoid monotony and repetition.

Through the guidance of ordering, I noted that though ANT did not draw for me the boundary, as a method it guided me to draw temporary boundaries, which would be expanded or reduced later. This also helped me to systematically expand the network by identifying other probable actors to be documented and recruited into the network (Latour, 1999). I applied this criterion in this study while I was conducting interviews, in which I noted that participants were mentioning particular individuals whom I had not intended to interview, but I noted that they could give the information needed. I, therefore, made a follow-up and interviewed them. Johannesen (2013[6]) refers to Ebeltoft (2003), who says that following actors via interviews in ethnographic research has become a methodological issue in how ANT scholars have approached education research.

I began data analysis by examining the written data while listening to the recordings to find out whether the research's aim and questions had been answered. Referring to section 3.5, ANT helps to guide how to go about systematically recording the world, building the abilities of the sites to be documented and registered (Austrin & Farnsworth, 2005). The prime task of ANT in

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[6] Ebeltoft, dissertation is written in Norwegian and some parts were translated by Johannesen; that is why I refer to Johannesen instead of referring directly to Ebeltoft.

data analysis is to trace the influence of likelihoods of events or trace interactive practices of actors and the way they are ordered into more or less stabilized networks into real life (Ren et al., 2012).

Individual audio-recorded interviews were transcribed by hand and each generated three to four pages of data. The transcription process was time-consuming but beneficial because it helped to understand the data and offered an appropriate opportunity for identifying codes and themes used during data analysis (Silverman, 2013). Transcription also offered an opportunity to refer to what participants were saying during the interview sessions and made it easy to relate to what had been said to the research questions.

Reading the transcripts and listening to the audio-recordings helped me to get acquainted with the data collected concerning the research questions and to identify some aspects used during follow-up questions. The process of listening to the audio recordings while reading through the transcripts enabled identifying themes and codes that served as a guide to data analysis and theory updating. Lastly, while reading through the transcripts, the audio-recordings were being listened to all over again, which helped in crosschecking all the information generated from the transcripts of individual interviews, including the capturing of the 'talk overstatements' (Bryman, 2016). This helped to get clarity where, by coincidence, I and the participant were talking at the same time.

During data analysis, I identified themes and subthemes. Themes were identified during the presentation, interpretation, analysis, and discussion. These themes and subthemes emerged when I compared the outcome of the findings I put similar ones together. The development of themes and subthemes provided a means of sorting data so that materials on a given topic could be physically separated and merged according to data similarities. One main theme that emerged clearly during data collection and process was the non-teaching of the use of ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment to prospective teachers. While reading un-interpreted data, certain words, phrases, patterns of behavior, and participants' ways of thinking were revealed, and information that was the same was identified and merged using their relationships and how they networked.

During data analysis, I examined whether there are new information and participants that are emerging who may give information. When this happened, I had to go back and interview them. In some places this did not happen, I had to continue with data analysis while looking at the key ideas/themes that emerged from the study (identify key moments/themes) and build up the links

while finding out whether there are missing links. When I found the missing links, for example, some participants were not clear with their explanation, I reconsidered interviewing some participants twice to get clarity on what they were saying.

Since I did not see any new ideas they could bring to the study, I went ahead and build the whole picture of my report. While doing this, in some instances I could find the missing links and in some, I could not. Where there was a missing link, I went back and examined data to find what was missing. If they are there, I had to look for their transformations thus looked at its linkage to the problem. If they had, I then asked myself these questions following the other three moments if translation; is it interesting?, can they be enrolled as part of the participant?, and is it easy to mobilize them to participate in the study?. If they were relevant, I followed them by interviewing them. If they were not, I went ahead with the final analysis of my findings and write my final thesis. Finally, I had to discuss the limitation of my study.

5.11.2   Data and analysis

Data analysis involves going into the data, analyze, see its flow, where there were missing links or missing information, I had to go back to and three occasions, I called the participants for clarification on the information that was not clear in the data as indicated by arrows in figure 4 below.

Figure 4: The process of data collection and analysis.
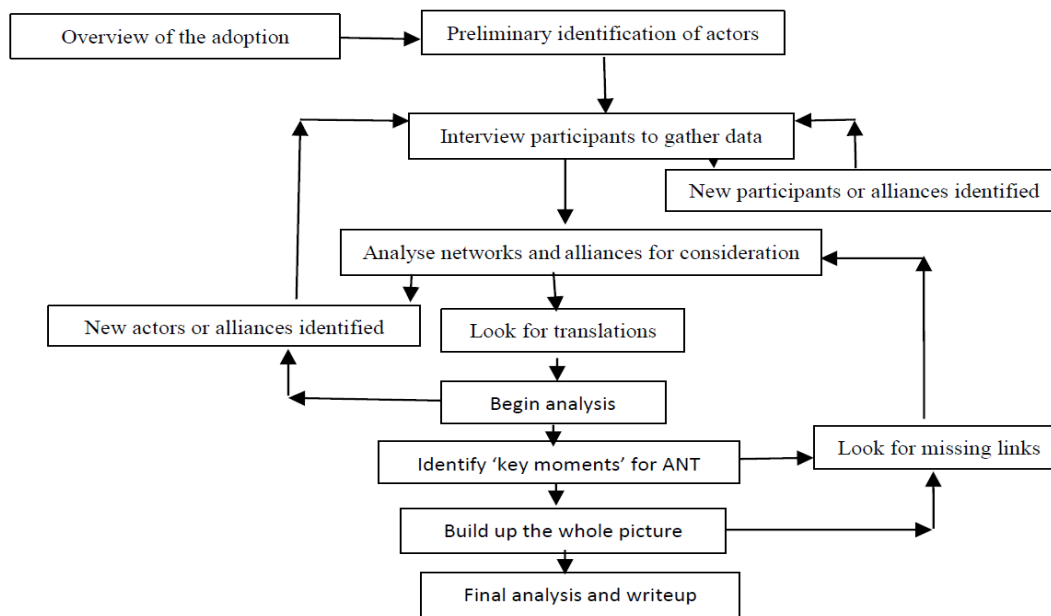
Source: Adam and Tatnall (2006)

Figure 4 above summarizes the process that guided data analysis. The first box is used as a presentation of the introductory part and the major sub-topics of this method and the theory as

was adopted to suit this study. The second box indicates how I identified the participants referred to as actors in ANT terms. After identifying the participants, interviews were organized and carried out. Using purposive and snowball sampling, I identified actors whom I assumed have rich information regarding the teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Before interviewing them, I had to examine the relevance of these participants (looking for translations) whether they were taught ICT during teacher education. After collecting data from the participants, I had to analyze the data.

5.12 Validity and reliability of the study

Validity and reliability are important aspects of any research. I derived the validity and reliability of this study after fulfilling some requirements, including the preparation of the data collection instrument. I prepared the interview guide carefully under the research advisors' guidance and piloted it at Kabimpiri PTC in Bwimpi district, in Uganda. After the pilot study, I made the necessary adjustments and refinements for further improvement before I commenced data collection.

The ecological validity involved describing places where data were to be collected while taking into account the participants' and institutions' privacy and anonymity. Based on my experience as a teacher, it was easy to find colleges where data was to be collected. I also increased the ecological validity of the study by researching a geographical area that I was familiar with. Despite knowing the sites very well, I built rapport with participants by establishing confidence to avoid the possibility of making them anxious and becoming uncomfortable, especially when they felt uneasy with the topic under discussion.

To overcome cultural blindness, I had to avoid bias by paying attention to the study purpose while minimizing other interferences that could arise in the course of data collection. Cultural blindness is a situation whereby the researcher may become blind to what he/she experiences every day among communities where data is being collected (Brock-Utne, 1996). I also used my personal experience concerning how ICTs are used as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment to enrich the research finding but not as a basis for interpreting the responses thus avoiding bias due to cultural blindness.

Another aspect of validity and reliability is trustworthiness, which can be divided into four aspects: internal validity, transferability, dependability, and credibility or confirmability (Bryman, 2016). To achieve credibility for my study, I had to take the transcribed data to the participants

for confirmation and validation. Where an aspect was not clear, they were able to clarify and add more information where they felt that it was relevant for the study.

The second aspect of validity and reliability is transferability or external validity (Bryman, 2016), which is intended to lead to a good match between the data, the theoretical ideas developed and whether the results can be transferred to other settings. To enable the transferability of the results I had collected, I collected data from the two sites and combined it into one broad descriptive document that included all the details. This led to the creation of a database that could make it possible for me to transfer findings to similar settings (Bryman, 2016). For example, data from the two colleges that took part in the study indicated that the teaching of ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment was not taking place due to the absence of its content in the curriculum, inadequate equipment as well as knowledge and skills by the teacher educators. Hence, results could be transferred to similar settings.

Dependability is another aspect to consider (Bryman, 2016; Bryman, 2016). To ensure the credibility of my study, I formulated the study aim and research questions. Secondly, I selected research participants, carried out and recorded the interview proceedings, transcribed them, reviewed the transcripts and decided how I could analyze the data. As recommended by Bryman (2016), I gave the transcripts to my fellow student to read through taking into account its validity to the study. Trustworthiness was created through confirmability and objectivity of the results (Bryman, 2016). To confirm what I had collected as true, I took the transcribed results back to the participants. This was to seek confirmation that what was transcribed was exactly what is in the transcripts. This was done to develop trust between me and the participants.

5.13 Ethical considerations

Ethical issues cannot be ignored when conducting research, since the study results relate directly to the study's integrity and the people and institutions involved. In this study, ethical issues served to protect the participants' and institutional privacy and working relationships with the researcher. Ethical considerations help to increase the study's credibility (Bryman, 2016; Hoyle et al., 2002). Before data collection in the field, I ensured that all the ethical issues were systematically followed, including entry into the institutions, the participants' consent, confidentiality, power relations, and cultural issues, which are discussed below.

5.13.1 Entry into the institutions

Before going into the field, I obtained ethical clearance from the Norwegian Social Science Data Services (NSD) in Norway and the Uganda National Council Science Technology (UNCST). A letter of introduction, the research proposal and the data collection instruments were submitted to the UNCST for clearance.

Access to the schools, colleges, or other institutions where participants were to be interviewed institutions and the participants were gained through someone in authority, the 'gatekeepers' (Creswell, 2014). I gained entrance into the PTCs and schools where early career teachers were placed after getting clearance from the two districts' DEOs. I contacted the participants in colleges and primary schools after getting permission from the DEOs, the college principals, and the headteachers. Entry into the UNAB was through the organization's Executive Director. This took into account that the teacher educators, the early career teachers, and the ICT coordinator at the UNAB were interested and volunteered to participate in the study.

5.13.2   Participants' consent

I sought consent from the participants on an individual basis, as it was needed before undertaking data collection (Creswell, 2014; Silverman, 2014; Silverman, 2013; Cohen et al., 2011; Kvale & Brinkmann, 2009). I sought written permission from the gatekeepers to make participants and I secure. In institutions where the gatekeepers were no longer available or had been transferred, the reference would be made to the previously signed consent forms.

The participants' consent was sought by giving them my self-designed introductory letter and consent form, and the introductory letters from NSD, the respective district education offices, and the University of Oslo. I allowed them enough time to read through, and I explained the study's nature and aim. I told participants that, as stated in the consent form, their participation in the study was voluntary, free of any coercion or inflated promise of benefits from participation, and that they were free to withdraw their participation whenever they wished. Participants chose either to participate or not after being informed of the facts that would likely influence their decision as recommended by Cohen et al. (2011). Those who agreed signed or put a thumbprint to indicate their agreement. This was done before the interviews to allow them to set a time and venue that were convenient for their interview.

Ensuring that participants responded to questions without fear helped towards facilitating a mutual and respectful relationship between me and the participants. In situations where participants were busy, I gave them introductory letters and consent forms in advance to enable them to con-

sider their participation. All the participants I was referred to by the teacher educators, the fellow early career teachers, participated in the study willingly.

Power relations and cultural issues

Social science research is based on human interactions leading to the building of relations between the persons involved. Therefore, during data collection, I had to find ways of building good relationships between me and the participants. This is what is referred to as power relations.

Since my study involved interviewing the participants, the issue of power relations was addressed as follows: Before carrying out the interview, I deliberately explained to the participants who I was, where I come from, what I was doing, the research's aim and the study's significance. I told participants that I was from Kyambogo University, a Ugandan by nationality but a Ph.D. candidate at the University of Oslo, Norway. I shared my background and professional experience and growth with the participants before going into the study's details. This helped to reduce the social distance between me and the participants to some extent since most were teachers like me and were ambitious to get more information from me as I was to get from them.

Being aware that the participants possessed the information needed to complete my study, as a researcher, I had the power to set an agenda and pose questions, while the participants had the power to convey the information needed from them. I built rapport with the participants so that they could feel free to share information that could help to reduce the imbalance between me and the participants.

The participants' right to withdraw during the interview session or not to impart information on a question they felt uncomfortable with was emphasized. I assured them that their views were required to address the aim of the study and the research question.

Since Uganda is a multi-cultural state, in order not to jeopardize the whole process of data collection, I was conscious of the cultural norms of the communities where the participants came from in order not to upset them due to cultural differences. For example, in most communities in Uganda, it is a norm to serve a visitor with something to drink or eat before one embarks on the reason for the visit. Turning it away or refusing an offer could be seen as a sign of disrespect for their cultural norms. As a result, all the cultural norms like the above were adhered to so as not to get involved in a situation whereby I could be seen as not respecting other people's cultures.

Lastly, the use of the English language during the interview helped to equalize power relations between me and the participants, as there was no language barrier. This, as well, helped me to

easily transcribe, analyze, interpret and discuss data during and after data collection to meet the aim of the study and to answer the research questions. After creating confidence among the participants, there was a need to assure them of confidentiality. This was achieved as discussed in section 4.14.3 below.

5.13.3 Confidentiality

One of the principles of ethics in research, if data to be collected is sensitive and personal, is confidentiality. Assuring participants' privacy and confidentiality in social research such as this is an important ethical issue that I took into consideration. During data collection, I informed participants that the information they gave would be for the study's purpose and would be kept confidential and not disclosed without their consent (Kvale & Brinkmann, 2009). I also assured them that their identity would not be revealed in any way during data analysis or the research report. To anonymize the findings, I used pseudonyms in the transcripts and beyond to protect the identity of the participants and the institutions involved in the study (Bryman, 2016; Kvale & Brinkmann, 2009). During transcription of the interviews, I also altered specific details that could make a participant identifiable, for example, the school they were teaching in, the college they went to and the districts where the schools or colleges were located (Bryman, 2016).

To protect the integrity of the participants, institutions, and districts, during data analysis and presentation, I used pseudonyms. The pseudonyms also help to ease analysis and presentation as well as an identification model for the participants. Where participants of the same category were more than one, letters and digits were used, for example, ITE1 and ITE2. Where there was only one, only letters were used, for example, UNO and ICD. Names of districts and colleges were not mentioned. Districts and PTCs were represented by the following pseudonyms, for anonymity purposes: PTC A in Kibubuura district, PTC B in Nabukakara district and Kabimpiri PTC in Bwimpi district. I excluded Kabimpiri PTC in the study because, first, they did not have an ICT teacher educator. Secondly, ICT was taught to those who had an interest in learning it but not to all students. Information from the study was safely stored so that no one can access it easily. In the next subsection, I discuss the considerations of power relations as well as cultural issues during data collection.

5.14 Application of ANT in the methodology

I applied ANT in this study mainly during data collection through following the actors (population). To make follow-ups to build the network of participants from the actors, during data collection, I started with curriculum developers whom I viewed as the OPPs because they were at

the center. The curriculum developers referred me to the districts where colleges are found from where they identified early career teachers who were taught ICT during their teacher education in 2013 and 2016. Ren et al., in van der Duim et al., (2012) say that:

> (T)o follow the actors, close studies of the actors and networks tell how these synchronously emerge, connect and align while simultaneously creating the place (or other) in and through which they may be studied (p.20).

The selection of participants was based on ANT's translation concept, which influences the choice of participants to build a network that involves institutions, individuals, and equipment.

The four moments of translation, as explained in section 3.4, guided the application of ANT in this study. These moments helped to find out how associations, roles, and actors came together, were recognized and became constant within the network, especially when it came to teaching prospective teachers how to use ICTs as pedagogical tools for learners with visual impairment while teaching. The moments also helped to see how actors formed associations with other actors and actor networks from the OPPs to the periphery. For example, the moments helped me to discover the curriculum developers, the implementers (the teacher educators in PTCs), and the early career teachers, as the network went on building. Just as Latour (1987) observes, in science, there is a need to follow the movement from the center to the periphery if we are to follow something to the end. Following Callon's (1986) explanation, the four moments were used, because through them actors speak, act, and represent others by defining roles and deleting scenarios (Ren et al., 2012), such as, for example, how they came to decide that ICT should be taught in PTCs, how the curriculum was developed, how it was sent to the PTCs to be implemented, and how early career teachers could be monitored to see its benefit during their teaching, which is all presented by following and interpreting moments of translation.

The hierarchy that I chose to follow was the top-bottom hierarchy. The choice of this hierarchy was my innovation because in most instances there were gatekeepers in places where participants were found. Those who agreed to be interviewed were interviewed there and then, while others fixed a later date or time.

5.14.1 Ordering and materiality

Other important aspects to mention while applying ANT in a study like this one that investigates how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment are ordering and materiality. van der Duim et al., (2012) say that in regards to the network of relations, ordering is defined

as those who are taken into account and those who are not by establishing boundaries within which interactions may take place. They (van der Duim et al., 2012) add that things can always be done otherwise by adding actors and intermediaries to the already existing network.

Ordering is the organization of materials or elements that compose the order. For ordering and materiality to take place, actors must belong to a place, be stable, and be in place for a long time (Law & Hassard, 1999). Teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating appropriate learning environments for learners with visual impairment requires the availability of all actors that could be used during teaching to be in place and the understanding of how missing ones could be recruited to the network.

To relate ordering and materiality in the teaching of ICTs o prospective teachers towards facilitating conducive learning environments for learners with visual impairment, it would be human action that would determine technological actions. Such organizations have to take place in a world of humans and nonhumans that are already subject to preexisting ordering (Franklin, 2012).

The notion of ordering and materiality helped me to scrutinize what is in place and stable during the teaching of ICT in primary teachers' colleges. Through the guidance of ordering, I noted that though ANT does not draw a boundary, as a method it may guide one to draw temporary boundaries, which would be expanded or reduced later. This may also help to systematically expand the network by identifying other probable actors to be documented and recruited into the network (Latour, 1999). The application of ordering and materiality may enable the following up and recruitment of unintended actors into the network. Johannesen (2013[7]) refers to Ebeltoft (2003), who says that following actors via interviews in ethnographic research has become a methodological issue in how ANT scholars have approached education research. Method and analysis are complexly constitutive of the object of study because the method performs the social and in the process makes it in a particular way (Michael, 2016).

My application of ANT in investigating ICT teaching to prospective teachers on how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment has to help me to find out how actors (human and nonhuman) negotiate, inspire, and work together to form a network towards its teaching. I also hoped that if I used ANT, I would be able to find out other actors could be identified through direct or indirect interaction This is in line with Johannesen's (2013, p. 34) reference to Ebeltbolt (2003, p. 35), who said that

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[7] Ebeltoft, dissertation is written in Norwegian and some parts were translated by Johannesen; that is why I refer to Johannesen instead of referring directly to Ebeltoft.

> (W)hile the theories of diffusion of innovation focus on how increase happens from the center to the periphery and represent a technological determinism approach, ANT, as based on the idea of translation, focuses on customization, modification, and delegation.

In this context, actions move in time from one actor to another. This happens through actors who are active users of the artifacts, which enables viewing "at a variety of distinct relationships [of] technological enterprises and other aspects of human activity" (Bimber, 1990, p. 333). This makes ANT the basis to become a main methodological rule that follows the actors (Latour, 1987).

Referring to Latour (1999), I note that the potential of ANT as a social theory and research method is still largely untapped in Uganda. Latour explains that the applications of ANT as a research method do not claim to explain the actors' behavior and reasons but only to find the procedures which render actors to be able to negotiate their way through other actors while building networks. With this guidance, I went to the district where the colleges were and obtained clearance for my research from the respective districts. Thereafter, I met the college administrators, who allowed me to carry out my study with their former students. Although the officials from the district and the college administrators were not interviewed, they enabled me to build my network easily. This acted as a way to make contact with participants to be interviewed and discover others that are or could be involved in finding out about the teaching of using ICTs as pedagogical tools to prospective teachers towards facilitating auspicious learning environments for learners with visual impairment.

5.14.2 Network building approach

The motivation to introduced ANT's concept of 'network building approach' in this chapter (methodology) is because of its similarity to snowball sampling. In both the network building approach and snowball sampling, there are associations of actors and for this case, humans. Both network building approaches and snowball sampling, which guided me during data collection are committed to detailed levels of practical experiences and allows the researcher to find out and elaborate on collaboration between actors (London & Pablo, 2017).

The network building approach is so common in the concept of translation. In my research, I used ANT's concept of translation (Callon, 1986) to discuss how I used the network building approach to address how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment.

The concept of building a network of actors and the concept of translation was used to collect and analyze and elaborate the teaching of ICT for learners with visual impairment to prospective teachers during their teacher education so they may use it as a pedagogical tool towards facilitating convenient learning environments for learners with visual impairment. While building networks using the guidance of ANT, through translation and its moment of mobilization, actors could be mobilized around a common objective called an obligatory passage point (OPP) to establish links (networks) between actors (Callon, 1986).

Translation was used because it enables delegation of roles whereby actors recruited into a network accept roles, rules of acting, a work view, and a path to follow to meet the desired goal (Jessen & Jessen, 2014). For example, during data collection, I was told that MoES, whom I refer to here as the first actor, delegated the act of teaching ICT to prospective teachers to Kyambogo University (the second actor). Since actor two (Kyambogo University) could not perform the act of actual teaching, it drafted an ICT curriculum while planning who could implement it. They thought of and recruited the third actor (PTCs) that was mandated to implement its teaching to prospective teachers. Hence, actor two passed over the curriculum to actor three (PTCs), whose purpose was to implement it thus came the concept of network building approach.

The third actor (PTCs) commenced the act of teaching after being assured by the second actor (the curriculum-developing institution) that they would prepare teacher educators while the first actor (MoES) would employ teacher educators, build computer laboratories, and provide ICT equipment to teach prospective teachers how to use it to further expedient learning environments.

The third actor (PTCs) drew up an implementation plan by including it in the college timetables (see Appendix VIII). These steps could be achieved through the guidance and operationalization of the four moments of translation and building a network, as shown in section 3.4 of this study. The network building approach was adopted because it can enable continuous recruitment of actors during data collection to give their perceptions towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The network building approach helped me to understand how different actors in form of human and nonhuman may create a network or can network to teach ICT to prospective teachers so that they can use it as a pedagogical tool to expedite conducive learning environments for learners with visual impairment after their teacher education.

In this study, the network building approach was essential because teacher education in Uganda involves several actors, comprising human, nonhuman and other entities. Of all these entities,

none works in isolation. The network building approach helped me to put together the ideas and skills of different actors regarding the teaching of ICT to prospective teachers to enable favorable learning environments for learners with visual impairment. The guidance of the four moments of translation directed the building of stable networks of actors to develop and put together ideas before the implementation of the teaching of ICT to prospective teachers towards facilitating advantageous learning environments for learners with visual impairment.

While using the ANT and translation concept of the network building approach, I noted that boundaries are not predetermined at the beginning, because the following of actors is encouraged. ANT's methodological explanation of following the actors (Latour, 1987) allowed me to go beyond the predefined participants. This was done through the building and following of other participants through networks and through determining the relevance of other groups of learners that may influence teaching prospective teachers how to use ICTs as pedagogical tools towards expediting expedient learning environments for learners with visual impairment. This happened as results continued to unfold during the study. Participants, referred to in ANT as actors, became part of the network (Callon, 1991), and those who could be potential participants were recruited into the study.

The following actors allowed me to build up a network of participants by following the flow of interview data and the recruitment of new participants to the study. I allowed new participants to give their views on how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The four moments of translation (see section 4.6) were fundamental towards the identification of potential actors to be involved in its teaching. This happened because it is during the process of teaching that actors within the network can decide on what ICT content to include in the curriculum, who to teach, the methods to be used, and/or the way teacher educators can be prepared to teach and development of the future plans.

5.15 Conclusion

In this chapter, I present the methodology that guided this study. This study aimed at investigating the teaching of ICT to prospective teachers to facilitate a convenient learning environment for learners with visual impairment. It was guided by the Actor-Network theory. As a result, I framed this study within the philosophy of social constructivism. This study is a qualitative approach whereby a case study design was used. I used two cases in the mid-western and south-western part of Uganda. This chapter has also presented the research setting, population, sample

and sampling techniques. Two sampling techniques were used thus purposive and snowball sampling techniques. I used interviews during data collection whereby different officials and participants in different organizational settings were used. It also included non-formal observation of organizations especially primary teachers' colleges to establish the availability of ICT equipment and the power supply as well as the teaching process in the two primary teachers' colleges. The framework of the methodology has served as a basis to judge the scientific value of the study, issues of reliability and validity of the data and adherence to ethical principles applied while carrying out research. Data collected and the multifaceted issues that emerged during data collection made every process puzzling. Data analysis is presented in the three chapters following the three research questions. In chapter five, I present, analyze, interpret and discuss findings on the perception of stakeholders in the education of learners with visual impairment and others that could be involved in teaching ICT in general to prospective teachers. Chapter six I present, analyze, interpret and discuss findings on teacher educators' engaged in preparing prospective teachers to develop skills of using ICT as a pedagogical tool for learners with visual impairment. In this question, I intended to find out how teacher educators can prepare prospective teachers to transform from general to adaptive ICT for learners with visual impairment and use it as a pedagogical tool. In chapter seven, I present, analyze, interpret and discuss findings on how different institutions are working together during teacher preparation on how to use ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment.

5.16 Study limitations

In this study, I investigated the contribution of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment. The government of Uganda, through Kyambogo University, wrote guidelines on the teaching of ICT to prospective teachers. In 2012, the curriculum was reviewed to include ICT. In 2013, some primary teacher education colleges implemented its teaching, and since then teaching has been taking place.

I limited this study to the teaching of ICT in PTCs. Since Uganda adopted the policy of providing Education for All and its implementation of Universal Primary Education (UPE)[8] in 1997, with priority given to children with disabilities, this study paid attention to ICT for one group of

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[8] UPE policy, which lead to the abolition of school fees, is considered an effective strategy to achieve equal access to primary education for all, which is a part of Education for All (EFA) goals
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learners—those with visual impairment. That is the area I am specialized in as well as an important part of the larger project, NORHED-Enable that my study is part of. Some of the limitations encountered in this study may yet be relevant for other groups of learners, however.

There are numerous limitations to a study on teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. The first is that the curriculum is too scanty, and there is no content for persons with visual impairment in it. The content in the curriculum and time allocated is minimal, so that what is taught is more like an introduction. There are no specific objectives or content in the curriculum on how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment. Besides, not all PTCs are teaching ICT. The reason is that there are inadequate facilities, such as computers and other ICT equipment, to facilitate its teaching, as compared to the numbers of prospective teachers enrolled. As a result, prospective teachers are taught in shifts, which affect the whole teaching process because much time is wasted in the process of changing shifts.

Another limitation is that no person in the PTCs is specialized in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. This is a result of the employment of computer experts with few pedagogical skills in teacher education. This personnel teaches ICT as required in the curriculum with minimal or no modifications to the content. Electricity rationing was another limitation; its supply was not regular, and most colleges do not have standby generators to provide alternative power. This observed practical lessons quite difficult because one could not predict when power would be available.

Since ICT is not examined and graded nationally, most prospective teachers learn it for their benefit but not as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment. They go to the computer laboratories when they are free after having most of their time with examinable subjects, and ICT is therefore learned for leisure purposes. These factors have led prospective teachers to have a low attitude towards learning to apply ICT as a pedagogical tool towards facilitating advantageous learning environments for learners with visual impairment. The reason behind it is that some participants said that even if they learned it they would not apply it anywhere, since most schools do not have the equipment, power supply like electricity, standby generator or solar power, or computer laboratories, and enrollment in most schools is very high with a very high pupil-teacher ratio. Most participants were not aware that using ICT as a pedagogical tool would make teaching and learning easy for

both the teachers and the learners. Some PTCs are teaching all their prospective teachers how to use ICT, while some teach it only to those who are interested. In both kinds of modules, prospective teachers were examined internally by the college concerned, and certificates were designed and given to those who completed the module successfully.

6 Chapter Six: Perceptions Towards ICT Teaching in Teacher Education

6.1 Introduction

This study intended to investigate ICT teaching in teacher education towards facilitating convenient learning environments for learners with visual impairment. In this chapter, I present, analyze, interpret and discuss research question one. This question sought the perceptions of early career teachers, teacher educators, organizations of persons with visual impairment and curriculum developers towards ICT teaching to prospective teachers. Each question I asked during the interview was used as a theme to capture data from which sub-themes were derived from.

6.2 Participants of the study

To get the results to answer the research question, twenty participants participated in the study. In table 3 below, I am presenting the participants that participated in the study and the pseudonyms that I allocated to each of them. The sampling procedure that I used to get the participants below is clarified in section 5.7 of this dissertation.

Table 3: Presentation of the participants and their pseudonyms

	Category	Number
Gender	Male	12
	Female	8
Occupation	Early career teachers (private primary school	4 (NTR12, NTR13, NTR14 and NTR15).
	Early career teachers (public Primary schools)	12 (NTR1, NTR2, NTR3, NTR4, NTR5, NTR6, NTR7, NTR8, NTR9, NTR10, NTR11 and NTR16).
	Teacher Educators	2 (ITE1 and ITE2)
	Curriculum developers	1 (TCD)
	Non-governmental organization	1 (UNB)
Work experience	Early career teachers	16: – 1-3 years
	Curriculum developers and experience	1: - 18 years
	ICT coordinator at UNAB and experience	1:- 10 years
	Teacher educators and experience	2:- 3 years

In the above table, I presented the gender of the participants, their occupation and where they work. To cover their identity, I anonymized them. This was done by allocating pseudonyms as shown in table 3 above to anonymize their identity during data presentation, interpretation, analysis, and discussion. The development of pseudonyms involved the use of both letters and numerals. The pseudonyms I gave to participants were as follows: ITE1 and ITE2 for teacher educators; UNB for the official from the organization of the blind; NTR1 to NTR16 for early career teachers, TCD for the teacher education curriculum developer and UNB for a participant from the organization of the blind. Common characteristics, traits, professional, and other factors be-

tween the participants helped to break down some of the cultural barriers between me and the participants that could have prevented them from taking part in the study, due to cultural differences in Uganda. For example, in the communities where I collected data, one is not supposed to refuse an offer, such as food whereby denial means one is antisocial. Since advance appointments were made, they offered me a snack that I did not refuse, and this created confidence between myself and the participants.

During data collection, I stressed the gender issue for representativeness. This was analytically looked at because during data collection there was a tendency for male participants to refer me to their male counterparts, and the same applied with female participants. This was not done to compare differences in terms of gender but to find out the trends of ICT teaching from the time of inception (2013) to 2016. The categories above also helped me to compare the male participants' to the female participants' responses, as well as from those who qualified earlier to those who were newly qualified. Nevertheless, differences were not identified during data presentation, interpretation and analysis.

The verbatim of the data are presented to illustrate direct responses from the participants towards teaching prospective teachers ICT in general and ICT for persons with visual impairment towards facilitating practical learning environments for learners with visual impairment in particular. To understand how prospective teachers could be taught to develop competencies in using ICT, the discussion of the data is guided by ANT's notion of translation (refer to section 4.6), which supported me to understand how networks human and nonhumans actors could be created and how those actors could be used in supporting the development of skills of applying the use of How to use ICTs as pedagogical tools amongst prospective teachers towards facilitating favorable learning environments for learners with visual impairment.

Furthermore, I discuss the development of competencies in using ICT and strategies to develop ICT competencies among prospective teachers. Other issues I discuss in this chapter are intrinsic and extrinsic factors that affect the teaching of prospective teachers ICT as a pedagogical tool, its assessment, and hindrances to teaching its use. I begin by presenting findings on the participants' perceptions in ICT teaching as pedagogical tools to prospective teachers towards facilitating favorable learning environments.

6.3 Perceptions about the teaching of ICT into teacher education

The teaching of ICT to prospective teachers is linked to UNESCO (2002; 2006) and other development agencies, such as the World Bank (2007) that called on governments to consider its inte-

gration into preservice teacher education. UNESCO recommended that all newly graduating primary school teachers needed to be taught ICT skills during their preservice teacher education and thereafter use it while teaching to meet the need of all learners in an inclusive classroom (UNESCO, 1994). Following the above recommendation in 2003, Uganda initiated the teaching ICT in PTCs. Therefore during data collection, I asked participants about their views on the teaching of ICT in teacher education. I asked this question because according to Aslan and Zhu (2015), views of pre-service teachers and other stakeholders towards:

> ICT integration in teacher education is highly important to investigate whether the programs for teacher education are sufficient to prepare pre-service teachers to acquire and integrate ICT competence in their pre-service education and their prospective life (p.97).

Three sub-themes emerged from this question and these are the need to build ICT laboratories in colleges, accessibility to ICT equipment for practice and employment of skilled personnel. The main reason I asked this question during the interview is to ascertain the thoughts of participants regarding the link between their perceptions and their teaching in teacher education.

6.3.1 Construction of accessible ICT laboratories

The first issue that emerged during data analysis on perceptions towards the teaching of ICT in teacher education is the need to establish ICT laboratories and access to its equipment. Participant TCD said:

> It is very important to first let alone these laboratories where someone teaches. There is [a] need to work on accessibility because some laboratories are upstairs and having several corners, for example, the Faculty of Education at Kyambogo University. Computers that are in the computer laboratories do not meet the needs of people with visual impairment, although among the tutors trained in Kyambogo University there are those with visual impairment yet computers that can meet their needs are not there. I would say that inclusion should be there to help those who are visually impaired not to be left out.

The above response stressed accessibility to fixed and mobile infrastructure as means of teaching ICTs to prospective teachers towards facilitating favorable learning conditions for learners with visual impairment. According to the response, accessibility comes in two threefold. The first being that some ICT laboratories are not accessible because they are upstairs with several corners making it difficult for prospective teachers or learners with visual impairment to access them.

The second hindrance is that during the day, prospective teachers are busy with examinable subjects hence go for practice at night after completing assignments of other subjects. The third one is that ICT laboratories are closed during the day and hence prospective teachers have access to them at night. All these affect how prospective teachers could be taught to use ICTs as pedagogical tools towards facilitating practical learning environments.

In the education of persons with visual impairment and the general education system, accessibility to fixed and mobile infrastructure is a necessity. I received a similar response from NTR1. According to these participants, accessibility to equipment and ICT laboratories is an obstacle towards teaching and learning ICT in primary teachers' colleges.

I agree with the responses of the above participants because, in some institutions especially primary teachers' colleges, computer laboratories are upstairs which makes it difficult for people with disabilities and specifically those with visual impairment to access. Accessibility and adoption of various ICTs by society provides clear practical opportunities for enhancing quality teaching and learning (Natia, & Al-hassan, 2015). Accessibility to ICT is defined as the extent to which ICTs can be used by all persons irrespective of whether the person is having a disability or not to reach a certain specific goal (Natia, & Al-hassan, 2015).

Apart from access, the responses from the above participants showed that equipment for example desktops used for teaching do not meet the learning needs of people with visual impairment. Their view was that there is a need to install appropriate ICT software into these computers to make them accessible for people with visual impairment. Secondly, Akbulut et al. (2011 as cited by Aslan & Zhu, 2015) claim that strong infrastructure should be put in place in addition to providing equal access for all, taking precautions to facilitate ease of use and employment of technical staff to help students to use them. Rather than teaching prospective teachers to use only computers, they could also be taught to use laptops, tablets, interactive smartboards, smartphones, overhead projectors, and other forms of technology that could be used during teaching for educational purposes (Chisango et al., 2020; Hart & Laher, 2015).

This is because the development of ICT infrastructure is understood to be one of the areas for the integration of ICT into education to take place (Aslan & Zhu, 2015). Indeed, most equipment in these primary teachers' colleges cannot meet the educational needs of people with visual impairment. Computers and other available ICT equipment are designed in a way that they meet the needs of sighted people but not those people with visual impairment.

This, therefore, shows the need to set up the appropriate infrastructure to aid the teaching of ICT for learners with visual impairment in PTCs. For its teaching to take place, teacher educators and actors involved need to become familiar with technological equipment that could be used. This could then be used towards facilitating teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

6.3.2   Accessibility to ICT equipment for practice

Regarding the view of participants towards access into the ICT classroom, NTR3 stated: "*It is mostly at night. We go there once a week*". The statements from the above participants indicate that prospective teachers do not have regular access to the ICT laboratory. Corresponding responses were received from NTR14. These participants said that they do access ICT laboratories once in a week and mostly at night. They also said that sometimes they go in there if they are not occupied with other lessons. A state from one participant NTR1 was:

> I think if I have access to the computer… plus being taught, and maybe if there was also a chance of including these computers in the other classroom environment we could be helped.

The views of these participants were that they were taught computer skills but there is a need for them to get more time to get access to the laboratory. This response shows that the access of prospective teachers to the ICT laboratory is limited. They said that there is limited time for them to get access to ICT equipment which affects their learning.

I noticed this when I went to the colleges during data collection and for the non-formal observation. I noted that the ICT laboratory was closed as long as there was no lesson going on in there. Most of the time I have visited the college, the computer laboratory remained closed hence limiting their access to the ICT equipment. This is what Mueller, Wood, Willoughby, Ross, and Specht (2008) refer to as environmental barriers (e.g., equipment-based issues such as limited access, technical problems, and malfunctions). Therefore, this shows how important nonhuman actors are concerning teaching, learning, and retaining ICT knowledge learned through practice.

Surrounding factors amongst actors enable the teaching of ICT as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment may affect teacher educators who teach prospective teachers the skill of using ICT. These factors include the need for skilled human actors with the capability of conceding that nonhuman actors are not quite the same from situation to situation; instead, they are adapted in their use between practices.

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This should be done by mapping the social relations between human and nonhuman actors who could be treated as agentic entities that form a broad network of objects. The more human and nonhuman actors are mapped, mobilized, and adapted to aid in teaching prospective teachers ICT skills as pedagogical tools, the stronger, more diverse, and more durable the network. For example, rather than looking at a computer keyboard as being used by and beneficial to people who are sighted, it should be seen that the same keyboard can be adapted towards facilitating satisfactory learning environments for learners with visual impairment. Every adaptation should expose the importance of an actor towards the need at hand.

Teaching prospective teachers how to teach while using ICT may take place if the supply of ICT equipment is regularized. In this case, the government, through the OPPs, should take an initiative to make sure that there is adequate ICT equipment in all PTCs to teach prospective teachers how to use ICTs as pedagogical tools. Secondly, there is a need to adjust ICT equipment to suit the need for teaching prospective teachers how to teach ICT. Adjustments needed in the equipment are the installation of software that is compatible with visual impairment for example Zoom text for people with low vision and JAWS for people who are blind.

There could be a need to take into consideration that during the preparation of teachers with visual impairment to gain knowledge and skills of using ICT as a pedagogical tool. This is in line with the study by Alvis et al., (2009) who emphasize the importance of ICT in the teaching and learning process of learners with visual impairment if both the teacher and the learner were familiar with them.

6.3.3 Employment of skilled personnel

The second issue that came out when I asked participants about their perceptions of the inclusion of ICT for persons with visual impairment in the preservice teacher education curriculum was a need to employ skilled personnel in PTCs. This personnel should be those who have the skill of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Participant NTR8 said:

> The only way tutors can help us is by making sure that computers are available so
> that they can take us for practical lessons. By this, we can be taught to acquire skills.
> These skills, I think, can help us to teach pupils with visual impairment effectively.
> However, this is possible if we get skills on how to operate ordinary as well as talk-
> ing computers.

The above response indicated that prospective teachers need to have access to computer laboratories so that they could practice what they have learned. Respondents NTR3 and ITE2 had comparable responses. These participants said that during teacher education, teacher educators, whom they have referred to as tutors need to help prospective teachers by making computers available for prospective teachers so that they can practice how to use them hence acquire skills of using it.

I agree with the above respondents because since ICT is more of a practical subject, access to equipment and doing practice is very important. This can only happen if computers are made available to prospective teachers so that they can practice hence acquire skills of using ICT during teaching learners with visual impairment. Besides, teacher educators need to acquaint themselves with skills of using ICTs and teach prospective teachers how to use as pedagogical tools for learners with visual impairment.

The guidance of the four moments of translation thus problematization, interessement, enrollment, and mobilization could help in understanding all the negotiations, calculations, intrigues, acts of persuasion, and violations that need to be deliberated on. This is because the authority to speak or act on behalf of other actors or forces could make it possible for the act of teaching prospective teachers how to use ICTs as pedagogical towards tools facilitating a conducive learning environment for learners with visual impairment to take place. It may enable close relations between actors which may enable the forging of a way on how prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment.

Secondly, my usage of the concept of translation to help in reflecting the relations between the human and nonhuman actors and how they form a network to enable prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating the learning environments for learners with visual impairment. The notion of actor, network, actor-network, and translation makes it easier to understand how actors are persuaded and inspired to teach prospective teachers how to use ICTs as pedagogical tools as strategies of facilitating conducive learning environments for learners with visual impairment. During the process of translation, what is important is how the actors are balanced, irrespective of their nature, origins, changes, and getting them involved in creating conducive learning environments for learners with visual impairment as if they were identical. Through the moments of translation, I would be able to identify and analyze interrelated overlapping steps that discuss the actors, networks, as well as actor-networks and how they could come into the establishment.

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6.4 Procedures for teaching ICT in teacher education

Having asked participants their thoughts towards ICT teaching to prospective teachers, I had to ask them procedures that are or they think could be used while teaching it to prospective teachers. I asked this question intending to find out what works or which methods are used while teaching ICT to prospective teachers. If mentioned, which ones could be adapted and be used in teaching ICT for persons with visual impairments to prospective teachers. The question of 'what works' is typically answered with investigations or would-be-investigational studies designed to be copied and generalized with the focus on identifying whether interventions narrowly defined, could produce measurable increases in learner achievement (Ross, 2017). The responses are presented stated in section 6.4.1 and 6.4.2 below.

6.4.1 Speculative as well as practical teaching

Having asked the participants the approaches that are or could be used by teacher educators while teaching ICT to prospective teachers, participant NTR4 said:

> It is taught in two ways. The first way is through theoretically, whereby a tutor comes in class with prepared notes, textbooks, or any other related educational material. Then he/she explains some terminologies and gives out notes, which prospective teachers write in their books. The second way is that it is taught practically. This is where the tutor takes the students into the computer laboratory, then learners access and learn how to use the computers in the laboratory.

Response from participants NTR5 was:

> It was taught in the evening time on the timetable according to how it was scheduled, due course it was taking place by calling class to follow the years as we follow the years to go to study.in that case, they used to teach us on some of the parts but not all of them like introducing the computer use and some of the other computer programs, we studied only like six programs e.g. how-to on it, how to use the mouse, how to put the information on the computer and how to check information in the computer.

The above extracts from participants exhibited that ICT is taught in primary teachers' colleges. They said that some participants teach theoretically. Before teaching starts, teacher educators prepare notes, give students textbooks and use any other way to deliver the content and thereafter, the teacher educator gives notes to students to copy into their notebooks. In this study, I have used the word speculative teaching instead of theoretical teaching.

Early career teachers use the word 'theory' to mean 'speculative teaching'. This is where the teacher educator comes into the classroom with prepared notes, and guides students through them while giving illustrations. Thereafter, prospective teachers go to the computer rooms or laboratories to put into practice what they had been told while they were in the classrooms. The statements show that after teacher educators preparing notes, they taught prospective teachers speculatively.

Apart from being taught speculatively, prospective teachers were taught practically. This means that prospective teachers are sometimes taught practically whereby they have to put into practice by going to the computer laboratories. I received matching responses from nine other participants thus NTR6, NTR7, NTR8, NTR9, NTR11, NTR12, NTR13, NTR14, and NTR16. Additionally, like the previous participants, these groups of participants said that ICT is taught in primary teachers' colleges. They too said that apart from ICT being taught speculatively, prospective teachers were taught practically. These participants' views were that there was extensive use of speculative lessons supplemented by practical ones while ICT was being taught.

I agree with the findings that ICT is being taught to prospective teachers. The choice of the method of teaching depends on the actors involved, that is, the teacher educators, time available, number of prospective teachers in a class, and the ICT equipment to be used. While the teacher educators engage in the act of teaching prospective teachers ICT, prospective teachers engage in the practical aspect of learning how to teach while using ICT equipment. Whereas some prospective teachers may go to the computer room to learn ICT without consulting the teacher educator, others may need the teacher educator's guidance during the whole process.

Pre-service teachers are educated via many diverse and distinct courses which promote diverse and distinct pedagogical approaches to the knowledge presented although in some instance lack of program cohesion, particularly when it comes to linking the theory and the practical in pre-service teacher education, has often been seen as a barrier to well-trained, responsive teachers (Reynolds, et al., 2020). Practical teaching could be one way of tracking the input humans put into nonhuman entities in helping prospective teachers to gain knowledge and skills using trails that become visible thereafter. For example, the importance of both human and nonhuman actors could be tracked down whereby the actions of every actor becomes visible when practical lessons are being taught and skills gained.

Interaction between the teacher educator, the prospective teachers, and the equipment enables the acquisition of ICT skills. The teacher educators are at the center (the OPP) of linking pro-

spective teachers with the ICT equipment by explaining what is to be learned, and thereafter the teacher educators conduct guided and independent practical lessons. For the former to teach the latter, there should be an order of elements to be used. The understanding of the notions of ordering and materiality as used in ANT assisted in finding out the network relations between different actors while prospective teachers were taught ICT to acquire the skills for using it.

Therefore, the availability of personal computers, laptops, touch screen telephones, and other ICT equipment makes it possible for prospective teachers to acquire skills using ICT. Although most are self-motivated to learn ICT, they require additional guidance from expert personnel, such as teacher educators, for them to develop relevant ICT skills to be used in teaching. Teaching methods used and the motivation of teacher educators to teach may help prospective teachers to expand their ICT knowledge and skills.

Although some participants had said that they were taught how to use ICTs as pedagogical tools both practically and speculatively, participant ITE1 stated:

> In Uganda, there is ICT in the curriculum but it is not under implementation. For us, in Primary Teachers College A we discussed with the administrators and we asked ourselves, "What can we teach the students? Because [to be] good enough we [need to] have facilities to teach them. We sat and selected some packages we saw can be useful to our students. Those are the ones we agreed that we teach. We teach ICT like any other course subject that is taught at college. We have it on the timetable. If it is to be facilitated, we tell prospective teachers to come to the computer laboratory and we teach.

The statement from the above participant indicated the availability of ICT content in the primary teachers' college curriculum is quite important though its teaching is not taking place in most places. For this particular college which was select for the study, the content that is in the curriculum was analyzed. After the analysis, they found out that the available content may not be adequate to make the teachers competent enough in ICT.

The availability of ICT equipment in this college enabled the ICT teacher educator to come to decide on the content they thought was important to be taught to prospective teachers. For example, this participant said that the first package that they teach to their prospective teachers is an introduction to ICT, which covers the definition of ICT, what a computer is, and its major components. Examples of the introductory components this participant gave are the hardware, which includes the mouse, the system unit, the screen, the monitor, the keyboard, and their func-

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tions. The second package is starting, booting and shutting down the computer. The others are classification of computers, computer viruses, hardware, and software as well as the operating system, Windows XP.

Having seen the content in the curriculum, I agree with the perception as well as the decision of the teacher educator of college A of additional content into the scheme of work and lesson plan because the content in the curriculum was so scanty. The aim of adding this content into the teaching content was to enrich the content so that they could teach their prospective teachers. In another way, I disagree with the decision of adding more content to be taught to these teachers in this particular college. The reason my disagreement is that since these teachers were being prepared using a national curriculum, the decision of adding was unnecessary because when it came to testing them, the national curriculum was used to measure their competency.

In the teaching mode, this participant said that it was taught in the classroom where the teacher educator explains to prospective teachers after a given topic. After that, they go to the computer room/laboratory to practice what they have been guided on during speculative teaching. The ICT teaching excludes instruction on software installation. This participant said that considering the number of prospective teachers, all these packages were taught using PowerPoint presentations. In this interview, two viewpoints were expressed: practical teaching and learning in groups and from one another.

As mentioned in section 4.7, ANT's concept of translation guided me to obtain information on how associations came together and how the roles and functions of actors and intermediaries were distributed and stabilized within the network in the process of teaching prospective teachers how to teach learners with visual impairment using ICT. Interviews, as a method of data collection, enabled me to find out about the collaboration between human and nonhuman actors involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Humans pay attention when they are allowed to interact with nonhuman actors during teaching and learning. This interaction between human actors (teacher educators and prospective teachers) and nonhumans (ICT equipment) may be seen through practical lessons, as the teacher educators guide prospective teachers on how to teach using ICT equipment. Skilled human actors can facilitate the unskilled human actors to gain more knowledge and skills, which they intend to learn when both the human and the nonhuman actors are properly manipulated and instructions adhered to. The teaching of ICT as pedagogical tools does not make sense if it is not patterned with

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networks of dissimilar but appropriate materials. There should be patterning of both human and nonhuman objects for the teaching of ICT as pedagogical tools to prospective teachers to take place.

Despite the inadequacy of nonhumans in the form of equipment to facilitate teaching the skill of using ICT as a pedagogical tool, skilled teacher educators use the available equipment while teaching. The quality of teacher education one receives may influence the teachers' capabilities to bring about the desired outcomes of learners' engagement and learning even among those learners who seem not to be motivated to learn (Chigona, 2015). Being a practical subject, ICT teaching involves the availability of skilled human actors and appropriate nonhuman actors in the form of equipment and other nonhuman actors. All these bits and pieces (social, technological, conceptual, and textual) should be linked and converted (translated/problematized) to help prospective teachers gain the skill of using ICT as a pedagogical tool. This works better if there is a network of actors involved and created to facilitate its teaching and learning by prospective teachers after their teacher education course. Unavailability of any one of the actors in the network may affect how prospective teachers can develop skills for teaching while using ICT. Nevertheless, an aspect of teaching prospective teachers how to teach while using ICT for learners with visual impairment is the identification and recruitment of appropriate actors that may create a network.

6.4.2 Teaching from known to unknown

Regarding how prospective teachers could be guided to combine ordinary pedagogical skills and pedagogical skills in ICT towards facilitating satisfactory learning environments, the main aspect that came out from the findings was that they should be taught how to teach while using ICT, from known to unknown. For example participant, NTR2 said that:

> You know, they say that when you are going to count any sum, you start where you are. This means you start from known to unknown. Such are the basics to follow for one to help me learn something new. The same approach would help me to catch up with ICT for learners with visual impairment.

The above response gives the impression that for teaching to take place, teachers need to know what learners know (thus the zone of proximal development, [ZDP]). The ZDP helps a teacher to know the starting point by establishing what learners could do alone without help and what they could do with help. I received similar views from participant NTR5, NTR7, ITE1, UNB, and TCD. These participants too, said that before ICT teaching is introduced to prospective teachers,

the teacher educator needs to know what these prospective teachers know about the content that is going to be taught to them. The idea behind knowing what the learners already know is to decide on where to begin to teach ICT to prospective teachers, it is better to know the knowledge they already have so that teaching can start from known to unknown.

I agree with the above response in that background knowledge is important if one is to be taught anything new. The intention of teaching from known to the unknown is that before you introduce any new thing to someone, there is a need to know what the person knows first. During teaching, teachers as facilitators need to know learners' prior experiences and value them while in the classroom setting by putting them into use (Fenstermacher et al., 2015). Therefore, before teaching, some teachers tend to find out prior ICT knowledge which could be helpful while teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Teachers who went through the combined teacher education programs in which general education and special needs education curricula are infused had a significantly more positive attitude towards teaching learners with disabilities in inclusive classes than early career teachers who went through programs that separate the two (Kim et al., 2011).

With this in mind, teacher educators and prospective teachers who have prior ICT skills may apply it by referring to their prior knowledge, skills, and experiences while integrating ICT for learners with visual impairment into their learning. The use of prior knowledge may influence the development of skills in using ICT, especially when it involves its introduction and integration into teacher education.

Findings showed that the transformation of other actors, goals, and the intentions of teaching ICT to prospective teachers may help to accommodate the interest and needs of the other actors. These interested actors who could be taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment. The teaching of ICT to prospective teachers was introduced because the kind of teachers expected to graduate was determined by the transformation of ICT equipment to accommodate their needs of enabling them to teach with the use of ICT. These transformations may involve delegation of roles to appropriate actors, such as knowledgeable peers, skilled human actors, and adaptation of nonhuman actors by installing computer programs compatible with usability. For example, adapted nonhuman actors may in turn be used by teacher educators and other skilled personnel to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments. In the process, time may come when there is a need towards creating net-

works of actors to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment. The creation of links of networks that did not exist before to some extent may guide the modification of other elements that may be needed, as represented in Figure 5 below.

Figure 5: Networking of skilled human and adapted nonhuman actors for specialized ICT.
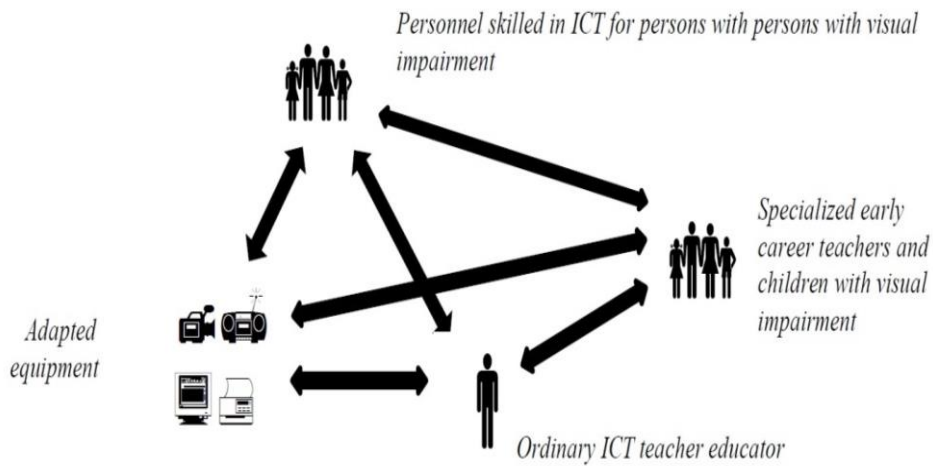
The networking of the above actors in teacher education may enable the preparation of prospective teachers who are in a position of creating a conducive learning environment for learners with visual impairment. Although Mewburn (2010), says that "actor-network is not a diagram or a description but an effect brought about by work performed by various actors" (p. 365), I decided to use a diagram (figure 5) above to represent how different actors may work together to teach ICT to prospective teachers towards facilitating conducive learning environments for learners with visual impairment. This is because the focus of ANT is not on a straight line but on the connections that are made and remade by human and non-human entities that are part of the issue at hand thus ICT teaching in teacher education.

The above figure presents how ICT for persons with visual impairment could be taught to prospective teachers as pedagogical tools towards facilitating expedient learning environments. This my perception of how actors may network in an attempt to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for persons with visual impairment to teach them how to use it as a pedagogical tool. On the left, there is equipment adapted for persons with visual impairment which they may use for learning. In the above figure, there is a representation of persons skilled in ICT for persons with visual impairment. This personnel works with ordinary ICT teachers educators (below) to decide on what could be

taught to prospective teachers in primary teachers' colleges to come out with early career teachers who are skilled in using ICTs as pedagogical tools towards facilitating conducive learning environments for persons with visual impairment. These early-career teachers would then teach learners with visual impairment using them as pedagogical tools towards facilitating practical learning environments.

Relating the above to the findings, after knowing what prospective teachers already know about ICT, the teacher educators may ascertain where to begin their teaching from. It may then help the teacher educators to link the knowledge they have gained to more specialized ICT for persons with visual impairment.

Therefore, for prospective teachers to be taught how to use ICTs as pedagogical tools, there is a need to examine how the content was generated and transmitted and how the networks were built to promote collaboration and cooperation at work (Hepp et al., 2015), as teaching prospective teachers how to teach children with visual impairment requires longer and more thorough preparation than for the one-time ordinary teachers (Ponchillia & Ponchillia, 1996). These one-time ordinary teachers underwent teacher preparation that enabled them to teach sighted or learners without disabilities. Teaching prospective teachers how to use ICTs as pedagogical tools require institutions to provide different services at different levels to ensure that its teaching takes place intending to help prospective teachers to gain these skills.

6.5 Aspects that may stimulate ICT teaching in teacher education

I asked participants about the aspects that may influence the teaching of ICT to prospective teachers. Two themes emerged: human and nonhuman aspects (Table 4). I came out with these factors because some of them are directly linked to human action whereas others are nonhuman. They only act after human intervening. Despite the support and encouragement provided by policies and/or administrators, teachers educators and other teachers, might by some means, reject technology adoption because motivators advanced by policies in ICT integration are presented and interpreted in two primary categories; Human factors and Nonhuman factors.

Table 4: Human and nonhuman factors that may aid the teaching of ICT as a pedagogical tool

Human aspects	Nonhuman aspects
Attitude change	Supply of equipment
Personal inspiration	Curriculum review
Preparation and employment of skilled personnel	Assessment
	Refresher courses
	Establishment of specialized institutions

In the sections that follow, I presented, analyzed, interpreted and discussed each of the factors above. I begin the analysis, presentation, interpretation and discussion of these aspects with the human and thereafter the nonhuman aspects.

6.6 Human factors

Among the human factors I noted in the findings that influence the teaching of ICT in teacher education are; teacher beliefs, teacher change, availability of professional development, self-efficacy, teaching styles, and cultural considerations. I have merged and divided these aspects into three human factors which I have termed as self-motivating factors. The three self-motivating factors that emerged from the findings and these are the attitude, personal inspiration through refresher course and preparation and/or employment of skilled personnel. Attitude towards the human and nonhuman factors affects how one could be taught how to use ICTs as pedagogical tools to facilitate learning. The first human factor is:

6.6.1 Attitude change

When I asked participants strategies that could be used to teach ICT to prospective teachers to develop competencies of using ICT as a pedagogical tool towards facilitating convenient learning environments for learners with visual impairment, a response from participant NTR2 was:

> There should be [a] change in attitude. Let teacher educators change their attitudes. …... When [their] attitude is changed positively, then you look to the measures of looking for materials to facilitate the learning of these people. Talk to the government and say this is needed, …. because the modifications that are needed, they start with the educators. And modifications when they are built right away from the teacher educators, obviously, … I hope there could be positive changes right away from the attitude, so I think there could be a change of attitude, we know that these learners are also very important to the communities; they would need to perform like any other learners.

The above response indicated that teacher educators' attitudes need to be changed positively so that they could be able to see the value of using ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Six other participants (NTR3, NTR4, NTR5, NTR9, ITE1, and ITE2) had comparable responses. These participants too said that there is a need for stakeholders in education and teacher education, in particular, to change their attitudes towards ICT teaching so that prospective teachers could be taught to use it

as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment.

Findings further reveal modification of the environment and equipment is another strategy that could be used by teacher educators to develop competencies among prospective teachers how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. I agree with the statement that modification of the environment and equipment may enable the teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments. Whereas modification of the environment and equipment is important, there is also a need for people to develop a positive attitude among prospective teachers towards using ICTs as pedagogical tools and how they could be used to facilitate convenient learning environments.

I agree with the findings that attitude is one aspect that participants that could be used to develop competency among prospective teachers and teacher educators to be taught how to use ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment. If one has to do something, he or she has to develop an interest in it. For example, for prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments, is determined by their attitude.

Attitude, which is a general feeling or evaluation, represents a person's disposition toward performing a certain activity, object, or towards someone or something (Teo et al., 2016; Junior et al., 2018; Gyamfi, 2017). One's attitude is an expression of his or her values, beliefs and expectations over something. Attitude is relational where the object is used to include things, people, places, ideas, actions, or situations, either singular or plural (Gure, 2015). One most vital feature of the attitude is preparation or readiness for the response, to objects, ideas, individuals, things among others. According to Gure adds that attitude is not actual behavior, not something that a person does instead it is a preparation for behavior, a predisposition to respond in a particular way to the object. Therefore, a positive attitude may not solve every problem but it makes solving any problem a more pleasant experience whereas a negative attitude is vice versa. Having a positive perception of computers, their use and significance in a classroom increase the likely hood of adoption of the innovation by teachers (Mwendwa, 2017).

The approaches applied and the attitudes displayed by the teacher educators while using ICTs as pedagogical tools determine the approaches applied and the attitudes displayed by early career teachers during their teaching displays. Attitudes are personal feelings or perceptions about

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something (Okwaput, 2013). The attitudes prospective teachers attain are expected to impact their abilities to use ICTs as pedagogical tools towards facilitating valuable learning environments for learners with visual impairment. For the case of this study, attitude is used to refer to perceptions on how prospective teachers and teacher educators perceive the value, mental state, or views towards teaching and learning ICTs so that prospective teachers become competent in using it during teaching.

These participants' views were that if the attitudes of the teacher educators are changed positively, they would be able to find ways of teaching prospective teachers how to use it as a pedagogical tool. The second issue that emerged from the responses was that there is a need to involve the government in the modification and these modifications should start with teacher educators before the environment. They said that if these modifications are made, it may help in the change of attitude, learners with visual impairment may benefit when ICT is used during teaching.

Attitudes include evaluative or emotional components (how one feels about something), a cognitive component (what one knows or believes), and a behavioral component (what one is likely to do) (Kalat, 2005). Attitude is a relatively enduring orientation that individuals develop toward the various objects and issues they encounter during their lives, which they express verbally as perceptions (Bohner & Wänke, 2002; Fontana, 1981). Fontana added that attitudes contain elements of value and beliefs as well as degrees of factual knowledge, which is partly conscious and partly unconscious, whereby the two could sometimes conflict with each other. One aspect that influences behavioral intentions during learning is the attitude toward it, and this could be supported by norms regarding what is to be learned and perceived behavior control towards it (Lafreniare & Cramer, 2012).

Attitudes may not be limited to prospective teachers but may include the attitudes of teacher educators and other human actors that take part in teacher education. Even if prospective teachers came to colleges with negative attitudes towards learners with visual impairment, a study by Sosu et al., (2010) shows possibilities of the change of attitudes and preconceived beliefs of prospective teachers towards teaching learners with disabilities after being taught about disability. Secondly, the attitudes of prospective teachers may change after being provided with experience role models with disabilities which may raise their expectations about their roles as teachers (Mullen, 2001).

Callon's fourth mobilization moment (see section 4.6.1) may be used to know actors and their attitudinal inclinations, assessed on what they may and may not do. During mobilization, the ac-

tors' attitudes may be identified. Those with a negative attitude may be sensitized to change for all actors that are and could be, involved in teacher education to know the value of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment while teaching. If these actors' attitudes were transformed for the positive, it might help the future teachers to learn ICT easily, because it would have become the norm of the education system.

Mobilization may also enable prescribed objectives and roles to be assigned to actors to establish and maintain the established network so that every actor has a role to play. Through mobilization, actors may be organized to come together and interact with each other, and it may also help decision making on who should be responsible for what and at which level, so that prospective teacher may be taught how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment.

Either way, attitudes need to change so that teacher educators can see the value of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Attitude change may be of significance to an individual's way of thinking and feelings on why teachers should be taught how to use ICTs as pedagogical tools towards facilitating expedient learning environments. This could be through the persuasion process, which could involve actors deciding who to communicate to, what to communicate, and the medium of communication during persuasion to influence them to perform actions that counter the existing way of thinking. In this case, the participants mentioned that there was a need to develop a positive attitude among all actors involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments especially for learners with visual impairment in teacher education and thereafter. This is because, as far as the participants were concerned, prospective teachers, teacher educators, and other stakeholders have reserved perceptions about teaching using ICT as a pedagogical tool towards facilitating practical learning environments. These reservations were as a result of the inadequacy of ICT equipment, personnel, and limited space.

6.6.2 Personal inspiration

The second aspect that came out from the responses was a personal inspiration through refresher courses. Participant NTR2 stated:

> We need refresher courses to learn how to teach these blind children ICT; so, once they make refresher courses and train us, we can be able to teach them well.

Related to the above response was a response from NTR7 which stated that:

> Getting refresher courses to teacher educators that can add in more knowledge such that can combine the computer, the ordinary knowledge, and this one of people with visual impairment [sic].

The above statements from NTR2 and NTR7 were more particular on organizing refresher courses for teacher educators so that they could gain skills of teaching prospective teachers how to teach using ICT for learners with visual impairment as a pedagogical tool towards facilitating convenient learning environments for learners with visual impairment. I received comparable responses from eight other participants (NTR3, NTR4, NTR9, NTR12, NTR14, UNB, TCD, and ITE2). This group of participants too said that there is a need to organize refresher courses for teacher educators so that they may gain skills of teaching prospective teachers ICT for persons with visual impairment towards facilitating conducive learning environments for learners with visual impairments. Refresher courses could be necessary after teacher education for teachers to develop new skills of teaching learners with visual impairment using ICT as a pedagogical tool. A common statement from the above participants was a need to organize refresher courses for teacher educators and early career teachers if they are to get skills of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Apart from the teacher educators, responses show that even teachers who were not taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments of learners with visual impairment need to be encouraged to undergo refresher courses so that they may get skills of teaching these learners using it.

I agree that refresher courses are needed in the area of teacher education. Much is known about the use of refresher courses as an extrinsic means of motivation to achieve particular goals, whereby comparative successes or failures in doing something are assessed regarding performance standards (Frederickson & Cline, 2015).

With the changing trends in education, these courses need to be organized and taught to teacher educators and early career teachers with the intention of either reminding teachers of the earlier knowledge that they have learned or to impart new ideas. New ideas like teaching ICT for learners with visual impairment to teacher educators to make sure that prospective teachers gain skills of using it towards facilitating expedient learning environments for these categories of learners. This, therefore, calls for a need to identify which ICT equipment is needed to be used during refresher courses and how they could be taught to gain skills towards facilitating expedient learn-

ing environments for learners with visual impairment. Appropriate ICT equipment should be compatible to conduct refresher courses. Secondly, organizers of refresher courses need to have had the prior skill of teaching while using the identified ICT equipment, which they should be able to demonstrate to teacher educators towards facilitating practical learning environments for learners with visual impairment.

It is important to note that we are living in a changing world where there are rapid technological changes taking place (Qasem &Viswanathappa, 2016). According to the above statement, I agree with the above participants that refresher courses are needed to help teachers meet the changing needs of the world. To catch up with these changes, refresher courses are needed so that those who have not learned the new skills or new ideas that have been invented can be taught. Motivation through refresher courses can prompt teacher educators, prospective teachers, and other human actors how to use ICTs as pedagogical tools towards facilitating conducive learning environments (Steinmayr & Spinath, 2009).

Therefore, the motivation of humans, such as teacher educators, prospective teachers, and other human actors in an activity, such as teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment is through refresher courses. These courses would be organized for a short time, such as a week. During the course, some participants might improve their skills or change their attitudes towards teaching using ICT as a pedagogical tool towards facilitating practical learning environments for learners with visual impairment.

In an ANT-guided study, such as this one, there is a need to find out internal factors that influence the action that needs to be taken to motivate one to develop an interest in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. Other internal factors that create interest could be traced to establish which factors influence what, who influences or is influenced by whom, what implementations have to be taken, and what negotiations are ongoing between the actors or may be commenced within the network for teaching to take place. This could help to know the network of actors that are sometimes referred to as a hybrid of social, technical, and personal (Habib & Wittek, 2007; Latour, 1993). These hybrids contain both skilled human and material objects in addition to everything that exists within a network of actors. If actors are identified and recruited into the network, they could extend their abilities to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Actors would be motivated to join the network of teaching and

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learning how to teach while using ICT, either by being guided to change their attitude or by being provided by refresher courses. Teacher educators and prospective teachers could be rewarded with certificates, assurance of ready employment opportunities, physical gifts, praise, or referring to teachers who have successfully used ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment.

Another point to note is that apart from including it in the curriculum, refresher courses motivate actors through social relations. Since ANT is a theory that maps the social relations between people, objects, and ideas while treating all of them as agentic entities that form a broad network, through refresher courses prospective teachers could be motivated to learn how to use ICTs as pedagogical tools towards facilitating conducive learning environments. This could happen when teacher educators taught during refresher courses become interested in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment.

Secondly, refresher courses help in identifying the value of teaching ICT to prospective teachers on how to use ICTs as pedagogical tools towards facilitating convenient learning environments for this category of learners. Refresher courses also help to motivate other actors, such as the MoES curriculum developers, and financial agencies, to participate in teaching prospective teachers how to use ICTs as pedagogical tools in the process of teaching and learning.

Finally, prospective teachers could be motivated to learn how to use ICTs as pedagogical tools if they are to look at the attainment and convenience values of ICT. The values of attitude change and refresher courses are important because they help prospective teachers to motivate themselves and teacher educators to motivate prospective teachers by telling them the importance of gaining the skill of using ICTs as pedagogical tools to facilitate convenient learning environments.

Besides, attitude change and refresher courses may help teacher educators, prospective teachers, and other interested actors to gain new skills on how to teach while using ICT. They may also help to motivate prospective teachers in establishing that learning how to teach with the use of ICT may help them advance their career and achieve the larger goal of including learners with visual impairment in ordinary classes.

By and large, the introduction of refresher courses to teacher educators could be achieved by enabling them to achieve the same level with what they missed out during their teacher education.

Since teacher educators are some of the network's actors, if the ICT content was included in the curriculum, it might require that they are given refresher courses and followed up over time.

6.6.3   Preparation and employment of skilled personnel

Participants said that is to develop competencies among prospective teachers on the use of ICT towards facilitating conducive learning environments was the preparation and employment of skilled personnel. Participants (n=10 out of 20) said that to overcome the barriers that hinder the development of competencies among prospective teachers in using ICT in teaching, there was a need to prepare and employ skilled personnel. A typical response from participant NTR1was:

> There is [a] need for the government to employ tutors who have skills of teaching computer skills to prospective teachers on how to use ICTs as pedagogical tools during teaching.

The word 'computer' was used by the participant to refer to ICT. The above statement and subsequent statements from other participants showed that there is inadequate qualified personnel in primary teachers' colleges to aid the teaching of ICT to prospective teachers. Nine other participants (NTR5, NTR6, NTR7, NTR8, NTR9, NTR10, NTR12, NTR13, and NTR15) had comparable responses. These participants too said that the government of Uganda, through the Ministry of Education and Sports employs teacher educators in primary teachers' colleges to aid its teaching.

I approve with the abov findings because during the pilot study and data collection for the main study, I realized that most primary teachers' colleges do not have qualified teacher educators to teach ICT. The colleges that were having teacher educators had employed instructors who were not having any pedagogical skills. This, therefore, implies the need to prepare more teacher educators who have the competence of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments.

Employment of competent teacher educators may take place if they were prepared to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Through building networks of relations among human and nonhuman actors, these teacher educators may be recruited into the network to organize the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments specifically for learners with visual impairment. Following these teacher educators into colleges where they are teaching may make it possible to understand the teacher educators' competencies and the relevance of ICT equipment in teaching

prospective teachers how to use ICTs as pedagogical tools while teaching. This is because no entity is significant in isolation, but they instead attain meaning through numerous and changeable relations with other entities. These actors may have to network with each other to teach prospective teachers how to teach while using ICT towards facilitating favorable learning environments for learners with visual impairment.

6.7   Nonhuman factors

To teach prospective teachers ICT towards facilitating conducive learning environments for learners with visual impairment, the second theme that emerged from the findings is the issue of the nonhuman factors. Nonhuman factors are factors that come from outside or external that push one to do something. Nonhuman factors that emerged were: preparation and employment of skilled personnel, the supply of equipment by government and other agencies, curriculum review, carrying out the assessment, refresher courses, and establishment of specialized institutions. Each of these factors is discussed below.

6.7.1   ICT equipment

The supply of equipment was another issue that came up. Responses from participants showed that to develop competencies of using ICTs among prospective teachers, there was a need to supply more computers and other ICT equipment to PTCs. Participant NTR1 said:

> More computers should be bought for colleges and be made accessible to the teachers. There should be a magnification of computers such that the visually impaired learners can be able how to use them.

The above statement indicates that computers are available in primary teachers' colleges. Secondly, results show despite their availability, they are not compatible with teaching learners with visual impairment. These computers need to be modified to suit the needs of learners with visual impairment. Thirdly, findings showed that though computers are there, they are not enough hence there is a need to buy more to facilitate the teaching of ICT to prospective teachers. Nine other participants (NTR4, NTR5, NTR8, NTR9, NTR10, NTR13, NTR15, NTR16, and UNB) had compatible views. The above group of participants as well said that there are computers and other ICT equipment in primary teachers colleges to facilitate teaching ICT to preservice teachers.

I agree with the above findings because when I visited the sites where I collected data, I noticed that the number of computers and other ICT equipment was quite limited as compared to the

student teachers. Secondly, apart from computers, there were no variations in the equipment that were used for teaching ICT to prospective teachers.

Secondly, if newly graduating teachers are to acquire competencies of using ICT as pedagogical tools towards facilitating conducive learning environments for learners with visual impairments, there is a need to purchase a variety of equipment. After purchasing relevant equipment, they should be availed to prospective teachers to enable them to gain skills of using them as pedagogical tools towards facilitating favorable learning environments. The availability of adequate and appropriate ICT equipment during teaching is important in developing competencies while prospective teachers are being taught to gain skills of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

According to the findings, the procurement of equipment in these institutions might help to fill the gap of ICT equipment inadequacies in PTCs so that this equipment may be used in teaching prospective teachers to teach using ICT equipment. In this case, the strategy is the identification of institutions and other interested actors who may provide support by equipping the colleges with ICT equipment. These actors may equip colleges with hardware and software, which may aid the teaching of ICT to prospective teachers towards facilitating expedient learning environments for learners with visual impairment.

To achieve the goal of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, interaction with a variety of equipment could be appropriate. There is a need to aid prospective teachers through self-engagement, participation in a lesson, having experiential input, and obtaining opportunities for their input and output to take place. It may make them learn more on their own and discover by doing rather than being told. In the process, prospective teachers may be able to get extra time to learn and gain more ICT skills on their own and be able to update themselves with new technological developments that are taking place. It may also give them opportunities to engage in basic drills and practices, simulations, exploratory, or communication activities that are matched to the individual needs and abilities of learners that they are being prepared to teach.

6.7.2 Compulsory teaching of ICT

Apart from the supply of ICT equipment, the findings from participants also showed that need to make ICT compulsory not only in teacher education but at all levels of education. Participant NTR9 said: *"They should come in to make it compulsory, not only in colleges but also in other levels".*

The response from this participant is an interpretation that that ICT is taught but it is not compulsory, thus those who want to teach it can teach and those who do not want could leave it out. I received matching responses from NTR11, NTR13, NTR14, NTR15, UNB, and TCD. The views of these participants were that there is a need to make the teaching of ICT compulsory in teacher education to prepare prospective teachers ICT in teacher education. In the Ugandan education system, any subject that is made compulsory is seriously taught and the government and other stakeholders take serious action towards its teaching.

I do agree with the above statements because if ICT teaching is made compulsory in all institutions of learning, its teaching would be prioritized in the primary teachers colleges. There is a need to make the teaching and learning of ICT compulsory in all institutions of teaching and learning, including PTCs. This, therefore, calls for the emphasis on curriculum implementation to include specialized ICT content into the PTC curriculum so that it can be taught to prospective teachers towards facilitating practical teaching and learning environments.

6.7.3   Curriculum review

While carrying out a non-formal observation, I had access to the curriculum. Having gone through it, findings showed that ICT for learners with visual impairment was not included. Its inclusion may necessitate the building of a network of actors who could be involved in developing the content appropriate towards facilitating conducive learning environments for learners with visual impairment. This could happen after the identification and pre-imposition of an alternative OPP who could be involved with other participants in developing the curriculum. This would be intended to obtain their views on the exclusion and inclusion of the ICT content that could enable the teaching of ICT towards facilitating convenient learning environments.

For curricula review to take place, there is a need to create networks between human and non-human entities. These network channels would help to connect me to or recruit the curriculum developers, other people, such as those from the organization of the blind, and those with a stake or interest in teaching prospective teachers how to use ICTs as pedagogical tools while teaching in the network (Fenwick & Edwards, 2010). These network channels could guide what and how to develop relevant content of ICT, which may be used to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments when teaching children with visual impairment. This is important because they might not need everything to ICT towards facilitating favorable learning environments for learners with visual impairment, but particular components relevant to them as teachers.

The socio-material approach, being one of the concepts of ANT, pays attention to the interdependence between humans and nonhumans in a network (Mifsud, 2014; Watts, 2008). This is because a considerable amount of materiality is entailed in an ICT classroom that includes but curriculum. In the socio-material approach, both human and nonhuman actors are brought together, by their positions, to bring meaning into the network (Law, 1999; Akrich & Latour, 1992). This is in line with Van der Leew (2008) who says that *things in the material world are carriers of potential information, and it is their link with concepts in the world of ideas (knowledge) that transforms them into objects that do carry significant information* (author's italics). Objects like curricula carry information or can be used to pass over information but they need to be transformed so that they can pass over intended information to the targeted beneficiary.

Before the 2012 primary teacher education curricula review, there was already a call to make the education of learners with visual impairment inclusive. This was because there was an identified need to prepare teachers to meet the requirement of inclusion of all learners into ordinary schools. The agenda of including ICT into the curriculum was a response to UNESCO's (2002) call to make all graduating primary school teachers ICT-literate. Since there was already an initiative to prepare all teachers to manage all learners including those with visual impairment in an inclusive setting, I was interested to find out whether prospective teachers could be ICT towards facilitating satisfactory learning environments was included in the PTCs curriculum during the 2012 review.

The involvement of different interest groups who may advise in understanding what is needed in practice would help prospective teachers become ready to learn the skills of facilitating tangible learning environments using ICT. During planning, the identification of different interest groups may help in supporting curriculum developers to develop the content for future curriculum improvement. This may enable the input of contributors and participants who may extend their contributions to curriculum development to accomplish the task of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments.

6.7.4 Assessment

Another factor that emerged from the findings is that there is a need to assess teaching. The same question on strategies to develop competencies among prospective teachers of using ICTs as pedagogical tools towards facilitating satisfactory learning environments was that it should be assessed at the end of the course. Participant TCD stated that:

> We also need to look at the assessment. How do we assess, because nothing is done towards the assessment of ICT because in Uganda we take an assessment to be the guiding factor in teaching. If the assessment of ICT is not taking place, it should be introduced and made compulsory that all learners who study should be assessed [sic].

The above respose gives the impression that the assessment of learners is an important aspect. For the case of preservice teacher education in Uganda, the examining body is Kyambogo University. If ICT is learned by prospective teachers, it must be assessed/examined by Kyambogo University. At the end of every level or if a one is to be considered qualified for a given profession, they must go through a summative assessment as set by the examining body of that professional course.

The statements from the participants were of the view that after teaching ICT there is a need for it to be assessed/examined at the end of the term, a year or final examination. I agree with the above statement because, in the Ugandan context, assessment of learning in every activity and specifically when it comes to a taught subject is taken seriously. In education, assessment is defined as the process of information gathering, collation and analysis based on the curriculum, program implementation and general educational policies uniquely designed for decision making (Aderonmu & Ejeba, 2020). Aderonmu and Ejeba, (2020) add that assessment is a process designed to identify, collect and interpret information on the knowledge, skills and attitudes achieved by the students whereby there is a systematic collection, analysis, interpretation and use of information about learning outcome.

Aderonmu and Ejebu (2020) identify five types of assessment thus dynamic assessment, summative assessment, formative assessment, diagnostic assessment and synoptic assessment. To find out whether prospective teachers have learned ICT as a pedagogical tool, there is a need to carry out a synoptic assessment. A synoptic assessment helps to test prospective teachers' capability of applying the knowledge and understanding gained in ICT to increase their understanding as a pedagogical tool or across the program as a whole (Aderonmu & Ejebu 2020). Examination and synoptic assessment are at the center of improving achievement in examination-oriented education systems (Aderonmu & Ejebu; 2020; Yan & Cheng, 2015).

On the other hand, I do not agree with the emphasis that the assessment of ICT teaching and learning should be taken as a serious option. This is because the role of the teacher towards the integration of ICT tools for assessment cannot be overemphasized ((Aderonmu & Ejebu; 2020). Instead, emphasis could be put on the procurement of appropriate ICT equipment and other

teaching and learning materials that may facilitate its teaching to enable prospective teachers to facilitate conducive learning environments of learners with visual impairment. Since most of the prospective teachers being taught today know using ICT equipment, exposing them to a variety of equipment may enable them to gain skills of using them as pedagogical tools.

Secondly, though assessment is taken as an important aspect, I do not agree that wherever a subject is assessed, its learning would automatically take place. Some may just take it for the sake of passing examinations and thereafter and may not apply it during teaching to help children learn with the help of ICT. Assessment may be used as a process of evaluating the effectiveness of a sequence of instructional activities like teaching and learning ICT after the instruction is complete (William, 2011). In general, the assessment helps in finding out the competencies of learners and teachers during teaching and learning but it could not be used to evaluate competencies of its use during the teaching and learning of a given subject. It may also help to establish whether the learners have learned a subject like ICT/or their perceptions towards its teaching. Application of oral assessment may as well help in finding out the feelings of the learners towards its teaching which may not be found if written assessments are used.

6.7.5 Specialized institutions

The establishment of specialized institutions is another factor that emerged to teach prospective teachers ICT as a pedagogical tool towards facilitating conducive learning environments. Participants UNB, NTR9 and NTR10 said that there was a need to establish specialized institutions that teach prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment. Participant UNB said:

> I think if there are agencies like those which are specially set up like UNAB [and] Kyambogo university because [they are] stakeholders to visual impairment services. They should provide motivating environments that can help prospective teachers learn ICT because combining the ordinary and that of learners with visual impairment, one might concentrate on one thing and pay little attention to ICT adapted for visual impairment. I think they can be more motivated [sic].

The participants (n=3) said that instead of teaching prospective teachers how to use ICTs as pedagogical tools for learners with visual impairment in a general primary teacher education system, specialized institutions should be set up to facilitate its teaching. The above statement and that from the other participants is that specialized institutions should be set up to teach teachers to use ICTs as pedagogical tools.

I do not agree with this suggestion because the teachers who are being prepared today is after getting a teacher who can attend to all learners in an inclusive class. Specialized institutions tend to take up smaller groups whose intentions are to prepare teachers who are going to particular schools or organizations of their interest. Secondly, these institutions tend to be centralized in that sometimes it is challenging for them to get teachers to teach particular skills. This may not work effectively as compared to primary teachers' colleges which tend to take bigger numbers of prospective teachers.

Considering all the above, the aspects of translation in educational research like this one may provide a guide to highlight the often forgotten aspects in evaluating different active roles played by human and nonhuman actors to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments. By wearing the glasses of translation, the planner and implementer may guide the discovery of actors that could be involved in the network beyond the prescribed boundary to be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment. The use of ANT may encourage the consideration of all surrounding factors rather than looking at one factor because no one acts alone. In line with the above statement, participant NTR6 said:

> By combining sighted learners and those with visual impairment, give them a room where they can meet so that they can study together and know each other.

The response from this participant was that if learners with visual impairment are combined with sighted ones, it may enable these two categories of children to share ideas when they are in the same classes hereafter help one another during teaching and learning. This participant encourages inclusion whereby learners see the value in one another as they learn. This participant's perception was that to teach the prospective teacher how to use ICTs as pedagogical tools to facilitate advantageous learning environments for learners with visual impairment, teaching both ICT for people with visual impairment and ordinary ICT could take place concurrently. This may enable them to differentiate the two ICTs, as they are being taught how to use them while teaching.

Apart from the above, the view from participant NTR10 was that the only way early career teachers and other educators could be engaged in teaching prospective teachers to combine the ordinary knowledge and practice of ICT was by searching for information. This participant stated: *"I just make research from other people and then build on my knowledge I had before"*. The

above statement emphasizes the search for new knowledge from those who know then later build it from there to learn new knowledge. The response from this participant was that he could identify people who knew ICT for people with visual impairment and learn from them. This is in line with the notion of following actors. This participant aimed to follow actors (human or nonhuman) who were knowledgeable in using ICT, which actors may in turn teach other actors those skills. The following actors aim at understanding how things that involve several networks happen or are done and the influence they have. This is in line with Liu (2017), who states that:

> A great teacher is a continuous learner. They continuously read and apply the newest research in their classroom. They are never satisfied whether they have taught for one year or twenty. They seek out professional development opportunities, research ideas online and subscribe to multiple teaching-related newsletters (p. 29).

The prime task of ANT as a method is to trace the relational practices of actors, old or new, and how they are ordered into more or less stabilized networks that often appear as black boxes in real life when prospective teachers are being taught how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. Generally, in an actor-network perspective, actors involved and those that could be involved in a network of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment should devote themselves to life-long teaching.

Therefore, there is a need to identify how actors, who are and could be involved in ICT teaching, could relate with one another. There could be also a need to persuade more actors into the coexisting network to facilitate teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. This could be done to bring change and thus the implementation of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments when teaching children with visual impairment. Achieving the above might require the persuasion of human and nonhuman actors to be networked with those that may have implemented or may be involved in the implementation of preparing teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments. Potential participants might be persuaded into the network using the four moments of translation: problematization, interessement, enrollment, and mobilization (see section 3.6.1). The success of the whole process involves the identification of OPPs and those to be involved in teaching, to which all should converge and design identities, preferences, and alliances with their possible relationships with the OPP. Those to be

involved may hold negotiations to maintain or alter their preferences through the OPP to ensure that the objective is attained. After writing the findings on strategies to develop competencies among prospective teachers on how to teach learners with visual impairment using ICTs as pedagogical tools towards facilitating satisfactory learning environments, I presented the data on factors that hinder how teachers could be taught how to use ICTs as pedagogical tools while teaching the above learner categories.

However, the guidance of translation guides the identification of the problem and actors that are or could be interested in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments. This, therefore, leads to ANT's concept of interessement. The development of interest among actors may lead to convincing them to recognize the existence of the problem and the importance of solving it. Hence, each actor may be held responsible for the problem theirs. it is during interessement that actions may take and which actor to solve the identified problem. Enforcement plans, stabilization, and the contribution of each actor toward teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating expedient learning environments need to be enlisted.

6.8 Conclusion and the application of the concept of translation

In the next chapter, I discuss the data that arose from research question two: How teacher educators are engaged in teaching prospective teachers ICT towards facilitating practical learning environments during their preservice teacher education. Just like this chapter, I used thematic analysis in the next chapter to find out teacher educators' engagement in teaching ICT to prospective teachers.

The concept of translation is the main concept of analysis and discussion for this chapter. Through translation, I was able to identify actors involved or that could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments. This is because the use of translation enables studying the network's possibilities and establishment. Translation helps in problem identification. The concept of translation helped me identify human and nonhuman entities that may be involved in activities, such as teaching, and how they relate to one another while performing a task. Nevertheless, the four moments of translation, identification, and persuasion of actors into coexistence who could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments could take place. It also shows how other interested actors may be enrolled through the OPPs into the network to solve the problem.

Even though all the four moments were important, identification and enrollment of viable actors into the network for its sustainability is quite important. This would be solved through multilateral negotiations, trials, and tricks that accompany the interessement to take place. Thereafter, other actors outside the boundaries may be recruited into the network for practical teaching of ICT to prospective teachers towards facilitating satisfactory learning environments while teaching learners with visual impairment.

7   Chapter Seven: Teacher Educators' Engagement in ICT Teaching

7.1 Introduction

This study aimed to investigate ICT teaching to prospective teachers in Uganda on how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. The attention was on prospective teachers who are being prepared to teach primary schools in Uganda. Twenty participants participated in the study (Table 3). The sampling procedures that made me get the number of participants presented below are clarified in section 5.7 of this dissertation. Like in the previous chapter, in this chapter, I anonymized the participants by allocating pseudonyms as a means of hiding their identity during data presentation, interpretation, analysis, and discussion. The development of pseudonyms is explained in the previous chapter.

In this chapter, I presented, analyzed, interpreted and discussed findings for research question two which intended to find out how teacher educators are engaged in preparing prospective teachers to develop skills of using ICTs as pedagogical tools towards facilitating satisfactory learning environments for learners with visual impairment. By finding out how teacher educators were engaged in preparing prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment, I aimed to investigate how teacher educators were involved, committed, passionate, enthusiastic, and engrossed in preparing prospective teachers how to use ICTs as pedagogical tools. I also intended to find out how much attention are teacher educators putting into the act of teaching prospective teachers and the time they dedicated to preparing themselves before and during teaching prospective teachers to gain competencies of using ICTs as pedagogical tools towards facilitating favorable learning environments of learners with visual impairment.

7.2 Teacher educators' engagement in teaching prospective teachers ICT

Having clarified the concept of engagement, I present, analyze, and discuss participants' perceptions of the teacher educators' engagement in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. I asked participants about their perceptions of the teacher educators' engagement in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for persons with visual impairment. Participant NTR1 said: *"Since*

it was not done [taught], I cannot tell whether they were willing or not". Responses from fourteen out of sixteen (14/16) early career teachers said that ICT for learners with visual impairment was not taught to them and it was not even mentioned during their teacher preparation. Contrary to the above, participant ITE1 said:

> My view is that I would welcome the teaching and learning of how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. I like it because these [i.e. early career teachers] are the people who are going out to help the people [i.e., learners with visual impairment]. You find, as you are saying, people are there, they have visual impairment, they are not going to inclusive schools because there are no people to teach them. They could be there willing to study, but the teachers are not there. But if we give knowledge to these teachers, we never know.

The impression I got from the above statement was that ICT for persons with visual impairment was not taught in primary teachers' colleges. Participants ITE2, TCD, and UNB had the same observation. This group of participants was of the view that teacher educators and other personnel at the college are willing to and they are engaged in teaching and learning ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment.

I agree with these participants that since teachers are prepared to teach all learners in an inclusive class, they need to be taught how to use ICTs as pedagogical tools that could be used to meet the learning needs of all learners in a class. Contrary to early career teachers, the views of ITE2, TCD, and UNB were that prospective teachers need to be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairments. The important thing I noted from their response was that, like the early career teachers, ICT for persons with visual impairment was not taught in teacher education. Secondly, they also noted that ICT for persons with visual impairment is not in the curriculum.

Teaching about inclusion and application of inclusive practices facilitates reflection and leads to improved learning outcomes among prospective teachers (Asham, 2010). This statement by Asham (2010) suggests that to enable prospective teachers to develop competencies of using a skill of using a given pedagogical tool like using ICT towards facilitating conducive learning environments for learners with visual impairments in inclusive settings, teacher education should provide opportunities that may enable them to apply these to achieve a given goal.

In chapters one and two, UNESCO recommended that every teacher needs to be taught ICT to attend to all learners in inclusive classes, no children are going into inclusive schools because teachers have not gained the skills of teaching them in such settings though children are willing to go to such settings. This may only be achieved if prospective teachers are taught skills of managing this category of learners in such settings.

To introduce the concept of ICT towards facilitating auspicious learning environments for persons with visual impairment to prospective teachers, there is a need to create interest among them through the moment of interessement, which at this level ensures that correct human and nonhuman actors are identified as well as recruited into the system to participate in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. This is a helpful point to identify people and institutions that are interested in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. This could be one way of planning to guide prospective teachers on how to use ICTs as pedagogical tools towards facilitating suitable learning environments for learners with visual impairment during and after their teacher education.

Referring to chapter three of this study, and the concept of translation, after identification of people and others that could have an interest in teaching ICT to prospective teachers, enrollment takes place. Human actors (e.g., teacher educators and other skilled personnel) that are required to be involved in teaching ICT to prospective teachers need to be recruited and enrolled in the network so that they take up their positions. In this process, teacher educators who have expressed their interest and commitment towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment are recruited into the network. The purpose is to prepare them, allocate them with roles, and tell them about other actors, i.e., MoES, MoICT, and UNAB, that are in or could be recruited into the network of teaching prospective teachers how to use ICT. In most cases, enrollment of teacher educators into the network can happen at the initial stages of problematization, planning, or implementation. Successful enrollment of teacher educators into the network leads to the network's stability, as the outlines of linkages could remain largely stable over time.

As per the data above, most participants said that teacher educators were not engaged in teaching prospective teachers how to teach while using ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment, because it was not in the

curriculum. To get these teacher educators engaged in teaching prospective teachers, there is a need to approach it in two ways, by linking it to interessement and enrollment[9].

The findings from the study showed that for ICT to be taught in PTCs there is a need to develop interests among all the stakeholders. This could be done by convincing the stakeholders and other interested groups to recognize the idea of teaching prospective teachers how to use ICTs as pedagogical tools (Farías & Mützel, 2015). At this point, different actors, for example, skilled personnel, an assortment of ICT equipment, and unskilled people could be attracted and/or invited to the network to participate in teaching prospective teachers. After inviting and recruiting the actors into the network, negotiation of their connections and roles in the emerging network should come next to determine and select who is to be included and excluded. Subsequently, actions to be taken by the teacher educators and other actors need to be identified and boundaries are drawn and taken into account to enforce and stabilize the roles of teacher educators.

The engagement of teacher educators is brought about by a shift in the ideological orientations and program development in teacher education that is needed to meet the current educational demands that require individual commitment and cultural diversity at levels of concentration, complexity, and to an extent that exceeds anything done before now and that is needed thereafter (Ahimbisibwe, 2018; Gay, 2010). This ideological shift could be met or achieved during teacher education, whereby teacher educators become engaged in preparing prospective teachers to gain a skill, such as using ICTs as pedagogical tools towards facilitating adequate learning environments for teaching learners with visual impairment. Engagement involves an attitude change towards an aspect being taught and its application. It is, therefore, necessary that teacher educators acquire the skills of using ICT as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during their teacher education course and thereafter teach prospective teachers how to use it as pedagogical tools.

Teachers play a key role in the commitment towards the use of ICTs as pedagogical tools in classrooms. Experiences from teacher education programs are crucial factors that influence early career teachers how to use ICTs as pedagogical tools (Instefjord & Munthe, 2016). Rani and Kant (2016) state that "the mission of teacher education is to prepare reflective teachers [who] possess professional knowledge, skills and dispositions necessary for teaching students in a diverse and global society" (p. 3328). This includes preparing teachers to teach all learners, including those with visual impairment while using ICTs as pedagogical tools towards facilitating sat-

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[9] Refer to pages 44 for the description of these concepts.

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isfactory learning environments for learners with visual impairment. In the next theme, I present, analyze, and discuss findings of the significance of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

7.3 The values of teaching ICT to prospective teachers

Despite participants expressing unawareness of the existence of ICT content in the curriculum, I asked them why they thought it was important for it to be taught to prospective teachers. I asked this question because I believe that although prospective teachers are not taught how to use ICTs as pedagogical tools towards enabling favorable learning environments for learners with visual impairment there could be factors that affect its teaching. I asked this question because I thought it could provide an insight into the participants' perceived usefulness of teaching prospective teachers how to use ICTs as pedagogical tools towards aiding satisfactory learning environments for learners with visual impairment. Secondly, it enables me to know the position of the participants towards teaching ICT to prospective teachers (Gudmundsdottir & Hatlevik, 2018).

After analyzing and interpreting participants' responses, several sub-themes emerged about the benefits of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments. Three sub-themes emerged as the playback of teaching prospective how to use ICTs as pedagogical tools towards expediting helpful learning environments for learners with visual impairment and these are:

- job opportunities for people with and without visual impairment
- enable acquisition of knowledge and skills for both people with and those without visual impairment,
- help to change people's approach towards the education of people with visual impairment
- Simplifies work

Each of the above sub-themes is presented, interpreted, and discussed below:

7.3.1 Job opportunities

Though the Ugandan policy on ICT (Government of Uganda, 2003) did not mention the importance of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teacher prepara-

tion, I asked participants why they thought it was important for it to be taught to prospective teachers. Participant NTR4 said: *"I can get employment opportunities. Secondly, I can provide immediate help for those learners with visual impairment".* Another response from another participant was that:

> It will ease their learning. It will help them to get jobs as they have information on the computer, they will be able to use them hence being called upon to have some of the jobs thus good living (NTR5).

The above proclamations from these participants are twofold. These statements show that apart from helping children to learn if prospective teachers are taught ICT for learners with visual impairment, it would help teachers of teaching learners with visual impairment. Participants also have hope that if prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, they may be in a position of giving these learners help during and after teaching. Thirdly, the above statements also suggest that teaching learners with visual impairment while using ICT would help them (learners) to get jobs. A statement from ITE1 was:

> Job opportunities, job opportunities are there once you know, you understand the content you can easily get a job in such institutions because you are increasing their minds of understanding. You know a good thing or bad thing can happen, this can be done like this because this is a new thing to them.

The above confession emphasized that if one gets knowledge of using ICT for persons with visual impairment as a pedagogical tool, there are high chances of getting a job. The responses received from participants who a range of benefits of teaching prospective how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Despite the above, another response was:

Just as we are supposed to live in the world, the so-called good quality of life, some persons with visual impairment, when they acquire such skills, they would be helped to live a better quality of life like any other people. Sometimes when you teach someone and the person excels, you are also praised. And when you are handling such a visually impaired child, you as a teacher you also feel proud because you have prepared someone and set him to be independent (NTR3).

Another participant said the acquisition of additional knowledge might happen through the use of computers, tablets, telephones, radios, televisions, and other ICT equipment. A response from ITE1 was that:

First of all, the goodness of ICT is there, employment is there, there are now jobs since organizations are coming up, institutions are coming up for these specific people, they will be employed. The second benefit is to the community because if someone has skills in something, he can help others. Now if this person is told that these people can also study, the community is helped, you cannot find the pupil at home because he is visually impaired. He will encourage a parent to take the people somewhere, he can study, this and this way which is now useful.

The above assertions and subsequent statements from other participants were of the view that if prospective teachers are taught ICT for persons with visual impairment towards facilitating conducive learning environments, several benefits are ranging from oneself to others. According to the above statement, if people with visual impairment are taught using ICTs as pedagogical tools, as a teacher, you get contended if this particular learner has succeeded. The responses from eight other participants (ITE2, NTR2, NTR6, NTR8, NTR9, NTR13, NTR15 and NTR16) were comparable to the above. One outstanding issue here is that teaching prospective teachers how to use ICTs as pedagogical tools may influence confidence development amongst teachers in that she or he would have helped this particular person with visual impairment to develop confidence in oneself. Their view is that prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. They stated that if prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for persons with visual impairment, it may enable them to get jobs, create jobs, and/or compete in the job market since it is a rare aspect in teacher preparation.

I do agree with the findings that since ICT is becoming part of life and is becoming common in education, prospective teachers need to be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. I guess, if prospective teachers acquire skills of using ICT as a pedagogical tool, in the process of using it during teaching, learners with visual impairment may learn how to use it in their daily lives in addition to using to learn. Secondly, while ICT is taught as pedagogical tools towards aiding favorable learning environments for learners with visual impairments, these learners may also apply it when they are teaching this category of learners.

Notably, in recent times, one requirement to get a job in Uganda was that one should have ICT skills. Grimus (2000) points out that teaching ICT skills in higher educational institutions pre-

pares learners to face future developments based on proper understanding. This is because unemployment is one of the challenges that most newly graduating teachers face.

It is worth noting that teacher education programs aim to prepare teachers who have professional values that can be learned or improved during teacher education. There is also the realization that ICTs can help create new jobs while transforming firms and streamlining work practices (Busuulwa, 2015). Optimal results could be yielded if teachers who go through the system qualify to have the skills of applying ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment. Acquisition of the skill of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment requires the involvement of different actors, i.e., curriculum developers, teacher educators, MoES, and UNAB, during planning, implementation, and allocation of resources.

In actor networks, there is the mobilization of rules, resources, and power, including information, to aid the accomplishment of a task, such as teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. It involves the creation of a network of intended and unintended partakers that may stretch across the network's temporal boundaries. Therefore, when planning to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, the concepts of actor and network should not be understood and utilized independently instead, they are better understood when they are working together. In this context, while prospective teachers are engaged in the act of learning the skill of using CTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, networking with ICT teacher educators, equipment and other relevant actors is needed.

7.3.2 Knowledge acquisition

Another issue that participants mentioned was that when prospective teachers were taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment it would help them to search for more knowledge which they could teach their learners. Participant NTR3 said: *"This ICT can enlarge your knowledge, in a way that as you are making research about something you are adding [sic]"*.

Another participant said:

> I can get the knowledge on how to use computers when I am with these people who are visually impaired. I think when dealing with these people, the information I get can be used to them, as I get it, it can also be used to these people (NTR7).

The above explications exhibited that one becomes knowledgeable as a result of using ICTs as pedagogical tools through the search for new knowledge. The new knowledge would be useful to the teacher who is teaching as well as the learner with visual impairment who is being taught. I received akin responses from NTR10, NTR11, NTR14, and ITE1. The statements from these respondents show that teaching prospective teachers the skill of using ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment could enable them to acquire additional knowledge, which could be important for their career. The knowledge they acquire during teacher education may enable them to guide learners to acquire functional skills, whereby they would be able to communicate and obtain knowledge on their own.

What I comprehended from these responses is that prospective teachers are not taught how to use ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment. Although its teaching is not taking place, through the guidance of translation, the OPP, and advocacy from the UNAB and the World Blind Union (WBU) through to UNESCO, the initiation of its teaching may take place. Networking between the above organizations could enable arrangements to be made and plans drawn up, whereby the signification, interests, and concerns of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment would ensue.

7.3.3 Mindset change towards people with visual impairment

Another sub-theme that emerged from the findings is the change of mindset towards people with visual impairment. A mindset refers to one's belief that people's traits like intelligence are not fixed, but dynamic and can develop and change over time (Boyd, 2015). One participant TCD said:

> ICT is very important. The first one I mentioned is the mindset. This can help to acquire a positive attitude towards these people. Somebody who has not ventured much may think that people with visual impairment may not need ICT because they cannot see, not knowing that we do not confine ourselves to seeing. So that is the main point. Secondly, the more you venture into something the more you become an expert.

Most people who are experts in ICT are experts for ICT for sighted people. Very few are [experts] for people with visual impairment. Even one may ask whether it is necessary. So, if we go into this area that could mean that student teachers who have ICT for people with visual impairment can benefit. Then also one can be visually impaired, but s/he hears things like music. Music was played and he said [that] this type of music does not need sight yet this music is played by ICT (laptop). A teacher teaches ICT [in] the area he is looking at and the people with visual impairment can pick that one. This does not necessarily mean that you have to be sighted. This is just a sample. This means that this may also be done during physical education lessons. Some of the exercises in physical education can be done without getting tired by the use of music, irrespective of whether we see or not.

An akin response was received from participant NTR12 who said:

I would teach people who have problems with visual impairment. When I teach, I will be able to change the mindset of the people who think the blind cannot use a computer and the blind cannot go with ICT, so there will be a change.

Despite the likenesses in the above findings, in the above statements, participant TCD gave a detailed explanation, which captured the responses of the other two participants on why prospective teachers need to be taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment. A corresponding statement was received from UNB.

These participants (n=3) said that ICT for people with visual impairment may make people change their attitude towards people with visual impairment if at all it is used when they are being taught and they learn using it. For people with visual impairment to learn using ICT, prospective teachers need to be taught how to use it so that they may aid learners with visual impairment to learn using it because its use does not necessarily mean that one should have sight. A statement from participant UNB showed that teaching using ICT simplifies work, it enables one to teach and learn independently, and it makes one cover much work within a short time.

Boyd, (2015) says that motivation or attitudes toward teaching a subject, like ICT in teacher education, can substantially affect how it could be adapted and used as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairments. Therefore, the attitudes of teacher educators play vital roles in the integration of ICT into preservice teacher education curricula (Netshirando, 2014; Jimoyiannis & Komis 2007). By changing the mindset,

these participants meant that teaching people with visual impairment using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment may change the peoples' attitude towards them. In the process, they may be able to see people with visual impairment as any other person.

I agree with the above findings in that because findings of this sub-theme was that teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could attain meaning through numerous interactions with other entities and a changeable multitude of relations that act in a network. Changing the mindset of the teachers is essential to bring about this change (Singhavi & Basargekar, 2019).

From the beginning of this theme, there were variations in responses towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, but all were geared towards personal gains, such as gaining skills to get a job. Liu (2017) evidenced that current teacher preparation needed to emphasize the basic requirements for students' knowledge and skills, on the processes and methods of learning, and on life emotions, characters, attitudes, and values towards what is being taught. With this in mind, prospective teachers need to be guided to change their mindset and be taught how to use ICTs as pedagogical tools towards facilitating valuable learning environments for learners with visual impairment. This could enable all teachers and learners, including those with visual impairment, to construct deep and connected knowledge, which could be applied to real-life situations (Ertmer & Ottenbreit-Leftwich, 2010). Since participants expressed the importance of working together, there could be a need for the creation of a network of actors and writing down rules for the sustainability of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

These actors could be connected and bound together to form a network of aligned interests (e.g., practical teaching or provision of equipment). In these connections, all actors involved are more or less strong or loosely connected during the action of teaching prospective teachers. These links are sometimes called rules that are embodied and institutionalized in forms of guidelines. The network could help in guiding teacher educators and other interested groups in teaching. This would be done to bring in other actors that are knowledgeable and have the skills of teaching prospective teachers the use of ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Another aspect of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment is a change of attitude towards themselves as well as other peoples' towards learners with visual impairment. Respondent NTR1 had the same perception by saying:

> Of course, you become up to date, you become modern. If you have studied computers, you find you are coping up with the ways of living with other people who are developed.

The above response showed that since there is development in ICT and prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating the learning of this category of learners, they would be able in the position of using it as a pedagogical tool while teaching learners with visual impairment as these categories of learners learn while using it. Secondly, the statement from this participant showed that if prospective teachers are taught ICT and they have ably used it during teaching, it may change other people's way of thinking hence help people change their attitudes towards themselves as well as towards people with visual impairment. This may lead to the acceptance of people with visual impairment. Other members of society may become involved in using ICT as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment and other people with visual impairment.

After problem definition, interests which are also referred to as interessement, among actors need to be developed. This could be done by convincing prospective teachers and other stakeholders to recognize the value of learning how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The interest could be achieved through OPPs, who convince other actors by explaining why prospective teachers should be taught ICT towards facilitating practical learning environments for learners with visual impairment.

The objective of interessement is to ensure that correct implementers are identified and recruited to implement the program. When they get interested, the action of its teaching has to be taken by the identified actors in an attempt to implement and stabilize the involvement of other actors, as is defined during enrollment. These identified groups may help in getting other actors whose attitude may be changed after being sensitized after understanding the value of teaching prospective teachers ICT.

Successfully initiation and implementation of the teaching of ICT for educational purposes in educational programs depend strongly on teachers' support and attitudes. If the teachers' atti-

tudes are positive toward the use of ICT as a pedagogical tool during teaching, then they can easily provide useful insight about its adoption and integration into teaching and learning processes (Guma et al., 2013). Therefore, when prospective teachers are prepared how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, some degree of change is required along the following dimensions: beliefs and attitudes, pedagogical knowledge and ideologies, content knowledge, knowledge of instructional practices, and adapted instructional resources, equipment, and/or materials.

To teach prospective teachers the component of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, the ANT rules could be used to discuss and enlighten the importance of a network of skilled personnel, appropriate equipment, and shaping of the relational outcome of the interplay between them. Generally, findings showed that participants expressed the need for prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This could succeed if rules were set and human and nonhuman actors were linked to create relational effects of networks.

7.3.4   Simplifies work

Another aspect that came out from the findings is that if prospective teachers are taught how to use ICTs as a pedagogical tool, it simply the work of the teachers during teaching. A typical response from participants NTR16 was:

> I think ICT simplifies work to the users at all levels at different categories including teachers themselves and in any case, it would be the teachers to more often use the ICT.

The proclamation above indicates that if prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating convenient learning environments, it may simplify their work. It shows that teachers' work could be simplified if they learn how to use ICTs as pedagogical towards facilitating a conducive learning environment for learners with visual impairment.

I agree with the above participant because when teachers know how to use ICT, they may teach from wherever they are and it may make their work simple. Secondly, they may be able to teach their learners with visual impairment at any time they want and cover more content even if they are not in school through self-reading.

Acquisition of ICT knowledge and skills by prospective teachers to use it is a pedagogical tool towards facilitating conducive learning environments is the end product of a lot of hard work in

which bits and pieces of human and nonhuman entities are fitted together and converted (Law, 1992). Furthermore, Law says that knowledge could be seen as a product or an effect of a network of heterogeneous materials, such as agents, social institutions, machines, and organizations.

Prospective teachers who are guided on how to integrate the use of ICTs as pedagogical tools in meaningful ways have a deep understanding that teaching must be transformative (Nelson et al., 2009). ICT is useful for creating new ways of teaching and learning, which may make teachers teach and give learners with disabilities opportunities to engage in basic drill and practice, simulations, and exploratory or communication activities that are matched to their individual needs (Yeni & Gecu-Parmaksiz, 2016; Fernández-López et al., 2013).

Despite participants describing the benefits of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, participants mentioned some factors that hinder teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments.

In the next section, I present, analyze, interpret and discuss participants' views about the teaching of ICT to prospective teachers towards facilitating conducive learning environments for learners with visual impairment. Their views are explicated below.

7.4 Deterrents to Teaching the Use of ICT in Teaching

After asking participants the significance of teaching the use of ICT as a pedagogical tool towards facilitating practical learning environments for learners with visual impairment among prospective teachers, I was obliged to ask them deterrents, limitations or hindrances (challenges) that could affect its integration into teacher education. I asked this question, because the integration of ICT teaching into the education system, like teacher education, brings with it some interference that could affect its teaching (Hepp et al., 2015). This is because the level of teaching prospective teachers how to use ICTs as pedagogical tools in a given country could be affected by several factors, such as cost of facilities, infrastructure, literacy level, human resources, cultural attitudes, and ignorance (Kessy et al., 2006).

After analyzing the responses, I categorized the aspects that came out into two and these are the human and nonhuman actors as presented in table 5 below. These actors came following Latour's (1999) observation where he says that "an 'actor' (an actant) in ANT is something that acts or which activity is granted.

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Table 5: Actors that hinder the teaching and learning of ICTs among prospective teachers.

Human and nonhuman actors that hinder ICT teaching in teacher education	
Human actors	**Nonhuman actors**
Poor beliefs and attitude towards ICT teaching and learning	Inadequate equipment and infrastructure
Inadequate skilled personnel	Inadequate reference materials
Prospective teachers not taught ICT	Lack of assessment

According to the findings, actors that hinder ICT teaching in teacher education are categorized into two thus the human actors that come out as a result of human action and the nonhuman factors that come as a result of other factors that are out of the human action. This is similar to a which was carried out by Jamil, Jamil, and Bano (2015) about the challenges that educationalists face while teaching ICTs and they categorized these challenges into two. The first category is within the teachers (Human) and material (nonhuman). Human challenges relate to the individual teacher (teacher-level) for example poor beliefs and attitude towards ICT teaching/learning and inadequate skilled personnel (teacher educators and ICT technicians) and nonhuman challenges relate to the institution (administrative-level) (British Educational Communications and Technology Agency (Becta, 2003) as well as inadequate equipment and infrastructure, inadequate reference materials and lack of assessment.

Similarly, in this study, as I presenting, interpreting, analyzing and discussing factors that hinder ICT teaching in teacher education in Uganda, I presented, analyzed, interpreted and discussed the human factors and then nonhuman factors that hinder ICT teaching ICT in teacher education in the Uganda primary teachers' colleges as presented below:

Poor beliefs and attitude towards ICT

According to the responses from the participants, another barrier that hampered teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating inspiring learning environments for learners with visual impairment was poor beliefs and attitudes. Participant NTR2 reported that:

> Attitude, because, once people see that these people are visually impaired, they develop an attitude that these people cannot perform so they would better leave them and concentrate on those that have better sight, so I think the negative attitude is a problem.

Apart from the above, participant NTR9 said: *"Negative attitude by those who do not need it".*

Whereas ITE2 said: *"Mindset".*

The above responses express people have a negative attitude and people's mindset towards learning ICT for people with visual impairment is very poor. They said that once sighted people realize that one is having a visual impairment, an attitude develops is that these people cannot do anything. They assume that once one is having a visual impairment, then they cannot perform in any activity or cannot do anything hence not teach them. Instead, concentration is diverted towards people who are sighted. The above statement was corresponding with the responses I received from NTR11, NTR14, UNB, and TCD. These participants also said that people with visual impairment have poor beliefs and attitudes towards learning to use ICT as pedagogical tools towards facilitating favorable learning environments for people with visual impairment.

I agree with the participants that one of the issues that affect the education of persons with visual impairment is a negative attitude. Sighted people, who constitute the majority of the service providers sometimes, have negative attitudes towards people with visual impairment. They always assume that once a person has acquired a visual impairment, they may not do anything valuable and become dependents. Therefore, when any program is developed towards helping this category of people, fewer tend to support its development or interest in it.

In the Ugandan context, when one develops a visual impairment or is blind, people tend to have a negative attitude towards them.

Attitudes, either positive (sec. 6.5) or negative, are some of the factors that could exhibit interest or disinterest if prospective teachers are to be taught how to use ICTs as pedagogical tools towards facilitating auspicious learning environments for learners with visual impairment. In this case, the participants stated that there was a negative attitude which participant TCD referred to as the 'mindset' among teacher educators and prospective teachers towards teaching and learning how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. Human actors like teacher educators, prospective teachers, and other personnel could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment to make it possible or easy to teach it. This kind of belief hinders its teaching towards facilitating conducive learning environments and is exhibited by the inadequacy of knowledge, skill, and content in both the curriculum and how it could have been taught, especially regarding specialized ICT for learners with visual impairment (Adegbenro et al., 2017). This could even become well if it is used towards facilitating conducive learning environments.

The application of the moments of enrollment and interessement, as explained in translation, are significant at this level towards facilitating conducive learning environments for learners with visual impairment. During enrollment and interessement, relevant skilled personnel, appropriate equipment and interested institutions could be seduced, manipulated, or induced into the system or program, so that the problem of poor beliefs and attitudes towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments could be reduced. During these two moments, the conversion of teacher educators, curriculum developers, prospective teachers, and other interest groups could be achieved so that they come in towards facilitating conducive learning environments for learners with visual impairment. During enrollment, decisions can be taken to determine who should become part of the network. Enrollment and interessement of actors to the network happen at any level; for example, at the planning stages or during implementation. Successful enrollment and development of interest among different allies that could lead to the networks' stability and durability as the outlines of linkages could remain largely stable over a while.

Participants' beliefs and attitudes and their knowledge and skill levels remain barriers to the teaching of ICT as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment in Uganda. The multidimensional components of beliefs and attitudes identified in my findings were emotional responses, beliefs, and behavior regarding its teaching to and learning by prospective teachers on how to use ICTs as pedagogical tools towards facilitating conducive learning environments which may affect how they would use it. The first issue is that, on the emotional side, there was shyness and a negative attitude towards its learning because in the Ugandan context, very few people want to associate with people with visual impairments. The second belief was that even if it was introduced and taught, there were no possibilities of getting employment. On the side of behavior, participants assumed that stakeholders had a negative attitude towards teaching prospective teachers how to use ICTs as pedagogical tools and its learning towards facilitating conducive learning environments for learners with visual impairment. This is because prospective teachers could not see any value of learning it as pedagogical tools towards facilitating conducive learning environments.

7.4.1 Inadequate skilled personnel

Another factor that participants said hindered the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment was inadequate skilled personnel, namely teacher educators and support per-

sonnel, such as ICT technicians instructors, and ICT technicians. One participant said: *"There is [a] lack [of] [or] inadequate trained/skilled teachers or personnel to handle ICT2"* (NTR3)

I received a corresponding response from another participant who said: *"Tutors who have computer skills at the college, they are also not many. You may find that you have one attendant whereby he cannot manage the student ratio"* NTR1.

The responses from these participants expressed a lack of or inadequacy of personnel in primary teachers' colleges as the major hindrance to teaching prospective teachers how to use ICTs as pedagogical tools as a pedagogical tool. I received corresponding responses of inadequacy or lack of qualified teacher educators from the following participant: NTR4, NTR5, NTR6, NTR7, NTR8, NTR9, NTR10, NTR11, NTR12, NTR13, NTR15, NTR16, UTI2, and TCD. These participants (n=15) too said that there was a lack of or inadequate skilled/qualified personnel in PTCs to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

I agree with the above responses about the inadequacy of ICT teacher educators in primary teachers' colleges. In the two colleges where I carried out my study, the personnel who were teaching ICT to prospective teachers were ICT specialists but have no experience of teaching. It is even worse on the side of ICT for persons with visual impairment. Most of these teacher educators did not have any skill of using ICT or even did not have the idea of the existence of ICT for persons with visual impairment. Since these teacher educators did not have any knowledge in the existence, teaching, or use of ICT for persons with visual impairment, it even affects further how they could teach it. For them to teach it, they needed collaboration with other stakeholders who know of its existence and use.

This is in line with Sullivan and Glanz (2005) who say that meaningful knowledge and learning are centered on the learner and are best constructed through collaboration and reflection around personnel experiences. Secondly, the Ugandan MoES (Uganda MoES, 2008) notes that in Uganda, teachers often fail to relate what they have learned about ICTs to their practice. Personal experiences from teacher educators are relevant when teaching perspective a subject like ICTs pedagogical tools towards facilitating favorable learning environments for persons with visual impairment. Since most of these early-career teachers joined primary teachers' colleges with some basic knowledge in ICT, the education they get in teacher education should not separate their former educational experiences from what they are learning (Johnson, 1992). Johnson posits that:

(T)eacher education must provide avenues for teacher trainees to understand the clues, attitudes and beliefs they bring to preservice teacher education and then plot and monitor their professional growth (p. 134).

To ensure that prospective teachers have acquired the values and attitudes desirable to support children with visual impairment using ICTs as pedagogical tools, the type of teacher education they go through should aim at changing their attitudes and beliefs. The teacher education institutions need to have teacher educators have ICT knowledge that is essential for shaping the digital landscape and promoting ICT -enhanced teaching in both preservice teachers and fellow teacher educators (Figg, & Jaipal-Jamani, 2020). Teacher education programs should aim at addressing diversity to enable prospective teachers to develop pedagogical skills that enhance diversity in a classroom (Arnesen et al., 2010).

The issue of inadequacy of technical personnel may be solved through mobilization. PTCs, through the OPPs, would identify, mobilize, and give suggestions about the qualifications of personnel needed to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating helpful learning environments for learners with visual impairment. The identified personnel must have an interest in teaching prospective teachers on how to use ICT. If they do not have any required skills, they should be prepared to acquire them to teach prospective teachers to be able how to use ICTs as pedagogical tools towards facilitating supportive learning environments for learners with visual impairment. Through mobilization, personnel who have skills in using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could be identified, recruited, and assigned to the role of teaching prospective teachers. Notably, it is at this level of mobilization that actors could come together, interact with one another, and decide who is to take responsibility for what and at which level.

This is in line with Hu and Yelland (2017) who say that hindrances to teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairments are lack of sufficient guidance on how to use ICTs during teacher education, the limited ICT equipment (e.g., computers and tablets) and software in practicum sites, inexperienced teacher educators to teach prospective teachers how to use ICTs as pedagogical tools, inadequate support, and inadequate provision for planning time and classroom management issues that occur as a result of incorporating appropriate use ICTs as pedagogical tools in teaching towards facilitating practical learning environments for learners with visual impairment.

Similarly, Adegbenro et al., (2017) observe that two in-service and prospective teachers' methods in solving computer technical problems indicated that teachers relied on trial and error methods and that this group of teachers that did not have access to technical skills and resources often avoided using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. In the next section, I discuss the sub-theme of poor beliefs and attitudes towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating inspiring learning environments for learners with visual impairment.

7.4.2 ICT not taught as pedagogical tools

In addition to practical teaching where prospective teachers apply what they learned during speculative teaching into practice, three participants said that nothing was happening at their colleges now. Participant TCD said:

> The situation is not yet okay. I would say not yet okay because it is yet to come out as an independent subject. It somehow cuts under educational technology as a core subject. It is yet to be examined. The challenge we have here is when something is not examined, when it does not come out as an independent paper, it does not have due attention. You may find college X takes it [as] very essential because they are endowed with resources, or they have been helped and bought computers, and college Y does nothing at all because it does not have resources and after all, it is not examined. Some colleges have implemented [this, even] though they do not have even computer laboratories. For those who have implemented, as if it is for leisure. Someone goes there to have leisure. So that is the position. But if it comes out as a subject, we shall put more emphasis.

The responses received from ITE2 and UNB had similar views. The responses from this group of participants showed that ICT was taught in some PTCs and not in others and was not being examined or assessed. I also noted this when I visited the school for a non-formal observation. Relating to the responses I got from the above participants, I realized that after curriculum development, its implementation was carried out just for the sake of fulfilling UNESCO's 2002 and 2006 calls (UNESCO 2002, 2006). Neither did the government of Uganda policy (Government of Uganda, 2008) specify whether prospective teachers could be taught ICT as pedagogical tools nor did it mention of the procedure that should be used for assessment.

Despite other participants saying that ICT was being taught both practically and speculatively, the above participants said that ICT was not taught in PTCs. TCD, whose institution was man-

dated to develop the curriculum, prepare teacher educators, assess prospective teachers as well as certify newly graduating teachers, observed that ICT was not seriously taught because it was not examined, due to uneven distribution of equipment (both software and hardware). The same view was aired by UNB and ITE2, who said that there was nothing and the situation was not pleasant as far as teaching the use of ICTs as pedagogical tools to prospective teachers towards facilitating conducive learning environments for learners with visual impairment.

In conclusion, in this study factors that hinder teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment were similar to those identified by Özdemir (2017), Jain (2006) and Cullen (2003). Factors that inhibit the teaching and learning of ICT as a pedagogical tool at any level were identified and categorized by Koçak, Usluel, and Yildiz (2012), as translated by Özdemir (2017) into four categories, and these are "pedagogical belief", "skill", "technical support", and "tools-infrastructure" (Özdemir, 2017, p. 507). Other factors that hinder the teaching of ICT to prospective teachers are the lack of skilled and trained manpower, lack of hardware, lack of appropriate course content in the curricula, lack of in-service teaching, inadequate support from institutions concerned, and the high cost of access to telecommunications; government policy towards ICT; underutilization of existing technologies; limited indigenous base; teachers' and learners' beliefs or attitude and motivation toward ICT teaching or learning ICT as pedagogical tools, inadequate teacher educators, as well as learners not being open to innovations, thus affecting its teaching to prospective teachers (Koçak et al., 2012; Özdemir, 2017; Jain, 2006; Cullen, 2003). Other hindrances mentioned by Jain (2006) were inadequate ICT exposure in schools; lack of a national ICT policy; poor communication infrastructure; ignorance of ICT benefits; expensive ICT equipment, and resistance to change. If all the above hindrances are minimized, prospective teachers could be taught how to use ICT as pedagogical tools towards facilitating conducive learning environments.

Having analyzed, presented, interpreted and discussed the human factors that hinder the teaching of ICT, below are the nonhuman factors that affect the teaching of ICT to prospective teachers towards facilitating conducive learning environments for learners with visual impairment:

7.4.3 Inadequate reference materials

The findings also showed that there were inadequate reference materials that could be used to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. For example, participant NTR10

mentioned *"Inadequate reference materials for ICT and lack of enough computers in the ICT room"*. I received a corresponding response from another participant NTR11 who said: *"ICT is not allocated on the timetable and should be included in the college curriculum"*.

The responses from these two participants showed that there were no reference materials like textbooks in which teacher educators and prospective teachers could refer too were not there or if they were there, they were inadequate. They also said that colleges are not supplied with computers and if they are there, they are inadequate. Other concerns they put forward are that ICT is not allocated in the timetable as well as ICT for persons with visual impairment not being in the curriculum.

I received matching responses from NTR15 and TCD. These participants said that there was inadequate reference material in PTCs to support the teaching of ICT to prospective teachers. Although participants mentioned numerous factors that impeded how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, there was inadequate reference material (e.g. textbooks) in PTCs to support its teaching. I noticed a lack of ICT reference materials when I visited the computer laboratories which also act as teaching facilities as well as the college libraries where students and teachers can get textbooks.

To some extent, I do not agree with these participants because, with the digital world, one cannot claim a lack of teaching material. There is a lot of free reference material that can be used in teaching ICT to prospective teachers. Teaching materials are available in different forms. These materials are available in text form whereas some are in video form. Interested personnel can access all these teaching information free of charge.

The implication of reference materials could be noticed using their trails, which become visible when ICT is being used as a strategy of facilitating conducive learning environments for learners with visual impairment. This happens when prospective teachers are seen interacting with ICT to obtain the skills of using it as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. For example, the effects of inadequate reference materials affect its teaching to prospective teachers as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This claim could be tracked when teaching is taking place, whereby the reference materials become visible or invisible from the process of planning to implementation.

7.4.4   Inadequate equipment, and infrastructure

From the findings, another factor that came out that hinder teaching prospective teachers how to use ICTs as pedagogical tools, participant NTR1 said: *"There are inadequate or inappropriate computers in PTCs for every student to get access to and do practice".*

The above statement indicates that there are fewer computers in primary teachers' colleges to aid the teaching of ICT to prospective teachers. Secondly, the above statement indicates that if the equipment is there, they are inappropriate to aid its teaching. A response from another participant was:

> There are inadequate appropriate materials on how to teach prospective how to ICTs as pedagogical tools because sometimes these people need special material to facilitate their learning which may not be readily available or if available, not enough for them, because in a class of you find that you have like two and you have like six or seven learners, you find it a very big challenge (NTR2).

The response I received from ITE1was:

> The first big challenge as I can say ICT for persons with visual impairment is not there now. It needs to be introduced. Secondly, when it is introduced, can they be provided with what is needed for it to be taught because at present there are no computers and other ICT equipment to the colleges to facilitate its teaching? Then after there, things would be working out.

These participants gave elaborate responses in that the issue of materials came out clearly. The above statement indicates that though ICT is being taught in primary teachers' colleges, the equipment used for teaching is inadequate in addition to the inappropriateness of the teaching materials. A statement from one participant was:

> Inadequate computers because in our colleges, you would find only like 10 and the number of students was like three hundred. So we would compete, like let me be the first, so in the end, you find that those who have acquired the skills are very few (NTR3).

These participants said that there is a lack of/or inadequate equipment in primary teachers' colleges. This issue was emphatically said by most of the participants which could affect how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. These responses had likeness-

es with the responses I received from twelve out of twenty (NTR3, NTR4, NTR5, NTR6, NTR8, NTR9, NTR10, NTR12, NTR13, NTR16, UNB and TCD) participants. These participants too said that there is a lack of equipment and infrastructure in primary teachers' colleges to enable the teaching of ICT to prospective teachers to take place.

I agree with these findings because during data collection I carried out a non-formal observation at the college. What I observed was that there were very few computers and other ICT equipment as compared to the number of students whom they were teaching. As a result, during practical teaching, prospective teachers go into the computer laboratory in shifts because the computers that are in these facilities are few for every prospective teacher to have one to put what they have learned onto practice. Secondly, there are no reference books for ICT in college libraries to read so that prospective teachers could enrich their knowledge and skills after the lessons.

Correspondingly, teaching and learning ICT by prospective teachers needs to be done practically. It involves the availability and use of human and nonhuman actors. In this case, the results showed that there were inadequate nonhuman actors, such as computers, in PTCs to aid the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The availability or unavailability of any of the above actors in addition to other relevant actors could affect its teaching.

One of the participants (ITE1) expressed that although the curriculum is there, it is not implemented because of a shortage of teaching equipment, which could be solved if PTCs could introduce a fee that could be used to furnish computer laboratories with ICT equipment. Inadequate appropriate ICT equipment and materials like textbooks in PTCs are the main hindrances to teaching prospective teachers to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment.

The response from ITE1 is in harmony with Özdemir (2017), Alvarado et al., (2020) and Nikolopoulou, (2020) who say that the main barriers identified in the ICT literature were "lack of appropriate software/materials, lack of basic ICT knowledge/skills, lack of hardware, and lack of basic knowledge/skills for ICT integration" (p. 506). This is in line with Hart and Laher, (2015) who say that ICT in education refers to the use of computers, laptops, tablets, interactive smartboards, overhead projectors, and other forms of technology that are used in classrooms for educational purposes Inadequate opportunities to access and use ICT equipment, software, and hardware hinder teacher educators from innovation, which could also affect teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environ-

ments for learners with visual impairment. This is consistent with Özdemir (2017) who said that ICT teaching is affected by:

> (L)ack of technical support, lack of appropriate course content and curriculums, inadequate managerial support; teachers' beliefs, attitudes and motivations toward ICT and the use of ICT as a pedagogical tool, not open to innovations, not knowing [how] to use ICTs as pedagogical tools is in harmony with [the] subject area (p. 506).

There is evidence that one of the important barriers towards teaching prospective teachers how to use ICTs as pedagogical tools are inadequate qualified teacher educators (Joshi, 2015; Jimoyiannis & Komis, 2007; Kessy et al., 2006). Joshi (2015) adds that, as a result, most teacher educators who taught ICT were not willing to introduce new ICTs to themselves, and subsequently to their students.

The notion of translation, which is guided by its four moments (see section 4.6), guided me in identifying the gaps, how they could be filled, and by who. This may necessitate the identification of the problem; partners who are or could be interested in solving it; how these partners could be enrolled and later mobilize the equipment, personnel; space; and content and reference materials among others. Through the process of translation, obligatory OPPs that consist of people within and outside the institutions could be actively involved in teacher education. The OPPs are critical passage points through which all actors that have an interest in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. These OPPs are gateways to PTCs. The identification of OPPs, guided by the four moments of translation, could help to identify the problem, the actors interested in solving it and mobilize and enroll them to join the network.

In the Ugandan context, the OPPs in teacher education is the MoES and Kyambogo University, including the staff therein. This could help to coordinate the supply of equipment that could be used to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. If OPPs cannot perform the monitoring themselves, they delegate powers to another actor to do it. Any logistical support, either internally or externally aimed at improving teacher education, is channeled through the OPPs. This is to ensure that the relevant hardware and software that could be used to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment is provided in PTCs.

The degree of participation in teaching prospective teachers how to use ICTs as pedagogical tools in a given country could be affected by several factors, such as the cost of facilities, the infrastructure, literacy level, the availability of human resources, cultural attitudes, and ignorance (Kessy et al., 2006). Hence, the adoption and integration of ICT into teaching and learning in institutions of teaching and learning depend in part on the availability and accessibility of ICT resources, such as hardware and software, to teachers and learners (Buabeng-Andoh, 2012). Buabeng-Andoh (2012) added that if teachers and learners could access the above-named resources, then they might not have the skills of using them as a pedagogical tool, because access to ICT equipment, updated software, and hardware are key elements for the successful adoption and integration of ICT in teaching and learning.

7.4.5 Lack of assessment

Another barrier that participants mentioned that affects the teaching the use of ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment is lack of assessment. Participant TCD said:

> We also need to look at the assessment. How do we assess, because nothing is done towards the assessment of ICT for people with visual impairment because in Uganda we take an assessment to be the guiding factor in teaching. If it (assessment) is not there, it (curriculum) will be there and kept.

The above statement showed that though ICT is being taught, it is not taken or taught seriously because of a lack of assessment. What this meant was that for any subject to be put into consideration during teaching and learning, assessment is the determining factor. Any subject which is not assessed at the end of the course is not taken seriously since most take it as a by-the-way. Teachers teaching and learners learning take it as a waste of time to concentrate on it.

I agree with the above finding that ICT is not assessed thus lacks standard parameters of measurement at the end of the course. The Ugandan education system takes standard parameters of measurement (summative assessment) at the end of the course as a measure to check one's level of achievement. If the course is not assessed and certified by the examining body, its teaching and learning are affected. Findings show that the reason as to why it is not assessed is that it is embedded in professional studies. The second reason is that ICT is not taught in all primary teachers' colleges due to lack of computer and other ICT equipment, personnel to teach it, as well as reference materials. As a result, assessment if ICT is not taking place to find out or grade

teachers according to their performance as they are taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

The above findings are corresponding to the findings of Mwakyusa and Mwalyagile, (2016) when they carried out an empirical review to find out obstacles of E-learning adoption in higher learning institutions of Tanzania. They found out that in institutions of higher learning in Tanzania, there was a lack of computers in HLIs to save students all time, low internet bandwidth, low ICT- competence among the educational stakeholders which hinder the successful e-learning implementation. Others similarities in these studies are that there was no ICT policy in operation as a result there is a lack of technical and managerial support towards the new ICT teaching and learning in both Tanzania and Uganda.

Similarly, a study carried out in India by Singhavi and Basargekar, (2019) to find out "barriers perceived by teachers for use of ICT in the classroom in Maharashtra, India found the following barriers; using ICT in teaching and learning not being a goal of the school: too difficult to integrate ICT use into the curriculum; lack of confidence by teachers regarding the use of ICT; insufficient technical support for and by teachers; and lack of interest of teachers.

I do agree that during teacher education, prospective teachers face several challenges as they strive to achieve excellence because they must not only prove mastery of the subject matter, but they must also show competence in classroom management, methodology and assessment (Goff-Kfouri, 2013). The hindrances discussed above came out clearly as having effects on the teaching of ICT to prospective teachers as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairments. The barriers that affect the teaching of ICT in teacher education are similar to those that Chisano et al., (2020) mention. Chisano et al. say that the barriers that may affect the adoption of teaching and use of ICTs in education, including work environment; inadequate ICT infrastructure, such as computers, poor internet connections, and so on; teachers' attitudes toward ICTs; and lack of digitally competent teachers. Another barrier that Chisango et al., cite is the work environment which can also affect the use of ICTs in teaching and learning. It is argued that schools where administrators do not support teachers in the use of ICTs, technologies would probably not be implemented. A lack of digitally competent teachers is another hindrance to the use of ICTs in teaching and learning (Chisano et al., 2020). As Dey and Roy, (2019) state, ICT integration in teacher education programs should aim at helping professionalism grow among prospective teachers. This is because ICT advances are here to stay, and crises such as the current coronavirus pandemic only come to highlight the digital defi-

cit not just in terms of supporting ICT or learners' skills, but also and perhaps most significantly as regards teacher perceptions, attitudes, and actual preparedness (Ferdig et al., 2020).

These hindrances to ICT teaching in teacher education cut across three order challenges as summarized by Hepp et al., (2015) and Buabeng-Andoh (2012) that if not put into practice, may hinder the preparation of a competent teacher who could use ICT as a pedagogical tool. The first orders challenge that Hepp et al., and Buebeng-Andoh identify is that initial teacher preparation programs should largely emphasize on developing the competencies that teachers need to use ICTs for teaching purposes. They add that this should be organized around the teacher's autonomous learning that incorporates preparation and implementation strategy that is based on work carried out by teams of teachers.

The second-order that Hepp et al., (2015) and Buabeng-Andoh (2012) identify is that emerging ICTs that have brought about new ways of thinking and doing things as well as new ways of learning and accessing knowledge. They add that, these teachers to be prepared to abide by a set of professional ethics and standards that require them to work individually and collectively to conceptualize the educational role that should be played by digital technologies.

The last order challenges that Hepp et al., (2015) and Buabeng-Andoh (2012) identify is the world changes that require the creation of teaching centers models that incorporate pedagogical innovations and open, flexible, creative, real and participatory digital projects where ICT can be the best cause for innovation that encourages creativity in the classroom to introduce cross-disciplinary and organizational changes during teaching and learning. To address the above challenges, there is a need for networking between different actors. Through networking, prospective teachers could be taught ICT that may open up to other actors like skilled personnel, organizations of people with visual impairment who can serve as advisory purposes and preservice teacher education curricula developers.

Through the OPPs, sufficient bodies of actors and interested actors may be identified and enrolled such that they may act so that the attitude could be changed for assessment to take place. During enrollment multilateral negotiations and trials towards teaching and assessment of the teaching of the use of ICTs as pedagogical tools towards facilitating conducive learning environments could take place. This is the level were entities that would give guidance on how assessment and what to assess could be enrolled in the program. These calls for persuasion of skilled personnel, procurement of materials (both software and hardware), an adaptation of viable institutions outside the prescribed boundaries, which could network with those that have im-

plemented or wish to be involved in assessment after implementation of teaching prospective teachers to be taught ICT towards facilitating conducive learning environments for learners with visual impairment.

Secondly, through mobilization, the processes of assessment of prescribed objectives and roles may be assigned to actors for the network's stability and maintenance or for changes that need to be made. This level needs knowledge of how the prescribed contributor came or may come together, the value and contribution of each entity involved, how they interact with each other while prospective teachers are being taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment and a decision on who is responsible for what and at which level of teaching.

Lack of standard parameters to measure (assess) the quality of education is one of the great challenges for quality control (Joshi, 2015). From the findings, I noted that one of the hindrances to teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment was a lack of assessment.

7.5 Conclusion

Teacher educators' engaged in teaching prospective teachers ICT during their teacher education. The findings showed that teacher educators are engaged in teaching prospective teachers ICT and what prospective teachers think are the benefits of being taught ICT. some of these are opportunities to get jobs, knowledge acquisition and simplification of work. though teacher educators are engaged in teaching ICT to prospective teachers, they stated some of the hindrances to its teaching. One of the major issues that came out prominently is poor beliefs and attitude towards ICT by prospective teachers. Secondly, findings showed that there is inadequate skilled personnel to teach ICT to prospective teachers. Other issues that came out are inadequate reference materials, inadequate equipment and infrastructure and lack of assessment of which all affect the teaching of ICT to prospective teachers.

Through the guidance of ANT, actors (human and nonhuman) who are silent and are deemed necessary for successful implementation of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment in PTCs could be reawakened. These actors could be social, political, technical, or bureaucratic. Notwithstanding this, the successful application of ANT in tracing actors would lie entirely in the possibility to bind together forces by making them compatible to achieve its aim. Therefore, by linking the kind of actors to be included and excluded, the possibility to plan the

implementation of a program, such as how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, could be realized.

8   Chapter Eight: Institutional Collaboration While Teaching Prospective Teachers ICT

8.1   Introduction

This study aimed to investigate ICT teaching in teacher education towards facilitating conducive learning environments for learners with visual impairment. This chapter is a continuation of the presentation, analysis, interpretation and discussion of the findings related to research question three. This question sought to find out how institutions were working together so that prospective teachers could be taught how to use ICTs as pedagogical tools for learners with visual impairment. This is in line with Opertti and Belalcázar (2008), who says that it is important to strengthen the link among universities, teacher-education programs, and curricula reforms as a way of supporting educational institutions and teachers to develop inclusive educational practices. To answer the above question, I sought perceptions from teacher educators, early career teachers, curriculum developers, and officials from the UNAB on how MoES, MoICT, UNAB, and the PTCs are working together (collaborating) while teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment. I presented, analyzed, interpreted and discussed the responses I received, according to the organization, to enable me to discuss the views of participants. I started this process by looking at the role played by MoES in teacher education while prospective teachers are taught how to use ICTs as pedagogical tools towards facilitating inspiring learning environments for learners with visual impairment.

8.2   Ministry of Education and Sports

The Ugandan Ministry of Education and Sports (MoES) is the one that oversees the education systems at every level (preprimary, primary, secondary, or post-secondary) and makes suggestions on what is to be taught in each level. In case there are any curricula changes or any innovations to be made at any level of education, it has to go through MoES for approval. Apart from approval of the programs to be taught, MoES finances and supplies teaching-learning equipment into these institutions. It was, therefore necessary to ask participants the role this ministry plays towards the teaching of ICT in primary teachers' colleges. As a result, I asked participants to mention the role played by MoES towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. After analyzing data, the major subthemes that came out are that MoES is involved

whereas others said that they do not know about MoES' involvement. Each of these two sub-themes is analyzed below:

8.2.1 MoES involved in teacher education

After asking participants to state the roles that are played by MoES in teacher education towards facilitating conducive learning environments for learners with visual impairments, participant TCD stated that:

> MoES first of all it is in charge of the curriculum. You know Kyambogo University develops the curriculum and we do it on behalf of MoES. Secondly, MoES plays a very great role regarding partners; so far, we have UNESCO which has come out with [the] Chinese Trust Fund. This organization has started furnishing PTC with the training of tutors and computers ... Yes, some of these tutors are the efforts of the PTCs, but others when they go to PTCs, then MoES does some training on how to handle the students/subject. Another role of MoES regarding the teaching and learning of ICT falls under acceptance [allowing] individual PTCs to charge a fee; if the PTCs are allowed to charge a certain fee, these fees can be for ICT development.

The response from the above participant heightened some responsibilities handled by MoES as regards teaching ICT to prospective teachers. Despite the above, the data further suggest that MoES pays salaries of the teacher educators who teach ICT to prospective teachers. This is in line with the statement below from participant NTR1 who said:

> Yes, there is a role because it is the Ministry of Education and Sports that provided the computers that we were using at the colleges. And I think when we look at the tutors, they were also paid by the Ministry of education and Sports.

I received a corresponding response from participants but one was that: *"they assess what is being taught by ICT teachers in colleges, provision of ICT equipment like computers"* (NTR7). The responses from thirteen other participants out twenty (NTR2, NTR4, NTR6, NTR8, NTR9, NTR10, NTR11, NTR12, NTR13, NTR14, NTR15, NTR16, and UNB) were corresponding to those received from, TCD, NTR1and NTR7. They said that MoES is involved in the provision of equipment, carrying out assessments of prospective as well as teacher educators during teaching as well as the provision of computers and other ICT equipment. These participants were of the view that MoES takes part in teaching prospective teachers ICT. These responses from these participants indicated that MoES works hand in hand with primary teachers' colleges towards preparing prospective teachers on how to use ICTs as a pedagogical tool towards facilitating

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conducive learning environments. When I carried out a non-formal observation, I was shown the equipment as well as the furniture that was supplied by MoES into the colleges to aid the teaching of ICT to prospective teachers.

I do agree with the above findings that MoES plays a significant role in teacher education. The first role that was mentioned by this participant is that MoES works with Kyambogo University during curriculum development. Whereas MoES is in charge of the curriculum, Kyambogo University develops it on its behalf. Secondly, MoES develops partnerships with other partners in teacher preparation by financing and equipping primary teachers' colleges with equipment and thereafter prepare teacher educators who are going to teach using the equipment that they have procured. In a situation where there is inadequate funding to run a given program, with approval from MoES, primary teachers' colleges with the approval of MoES charge an agreed amount of fee to meet the need for teaching a given subject.

The support they mentioned ranged from the provision of human (e.g. skilled personnel) to non-human (e.g. supply of equipment and building of computer laboratories) among others. Participants also suggested that MoES should supply more ICT equipment to PTCs, employ skilled teaching and support personnel, pay for electricity or provide alternative power supply for example standby generators or solar power, and provide other necessary support.

The visibility of MoES's role in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment can be seen through ANT's terms of ordering and materiality. Ordering is the organization of elements that compose the order. For ordering and materiality to take place, actors must belong to a place, must be stable, and must be in place for a long time. For example, teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment requires the ordering of the actual teaching of the use of ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. There is a need to understand how different institutions could be brought together to build a network so that each institution has a role that is in order.

Secondly, the responses from the participants, the component of the socio-material approach are important. The socio-material approach shifts the attention to connections and relations between different elements, in the form of human and nonhuman actors, in institutions that could be assembled for a given purpose. This is because things in the material world are carriers of potential information, and it is their linkages with concepts in the world of ideas (knowledge) that trans-

form them into objects that do carry significant information. In the socio-material approach, both human and nonhuman actors are brought together under their positions to bring meaning into the network of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. These findings are in line with Blok and Jensen (2011), who states that;

> No one entity is significantly in isolation but instead attains [their] meaning through … numerous – and changeable relations to other entities. Often these multitudes of relations are called actor-network (Blok & Jensen, 2011, p.3).

As mentioned by participant TCD, those who want to participate in teacher education have to join the network through the MoES and Kyambogo University. This means that MoES and Kyambogo University are the OPP for those willing or with intentions to participate in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

MoES is the main funder of most activities in PTCs. During budgeting, a fund is allocated to MoES to support primary school teachers' preparation. Similarly, MoES and Kyambogo University partner with other stakeholders, such as UNESCO, the Chinese Trust Fund and the Government of Belgium to furnish PTCs with equipment for teaching ICT to prospective teachers. 'Partnering' here is used to refer to an arrangement of working together so that the partnering agencies, through MoES, can equip PTCs with ICT equipment to enable them to teach prospective teachers to acquire skills of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Another contribution of MoES in teacher education is to assess what is being taught. A statement from NTR7 was: "*They assess what is being taught by ICT teachers in colleges, provision of facilities on how to use ICT equipment like computers*"**.** The assessment helps MoES see the relevance of ICT content that is taught to prospective teachers. In summary, although MoES is not practically involved in direct teaching, it oversees what is taught to find out whether the aim, objectives and the laws and policies that guide the teaching of ICT are being followed.

Thirdly, the development of an ICT policy in 2003 was followed by an e-readiness assessment carried out by the Government of Uganda in 2004. This assessment revealed that a dedicated and coordinated approach to implement the policy was required (Farrell, 2007). After considering the ICT policy, the committee involved in the e-readiness assessment recommended that an ICT policy for education should be developed. This, together with the development of the national poli-

cy, motivated the MoES to expand its effort on the use of ICT. Meanwhile, the national policy concentrated on the importance of developing the ICT competencies of learners by moving toward a more integrated vision (Government of Uganda, 2008). Among the initiatives that were recommended and noted by the 2005-2006 review sector committees were that an agreement had to be signed with Microsoft to subsidize software licenses for teacher education (Farrell, 2007). Likewise, the committee noted that the teaching of ICT to prospective teachers had already begun in PTCs (Farrell, 2007).

The results from participants showed that some actors came together to network with MoES for the teaching of the use of ICTs as pedagogical tools to prospective teachers towards facilitating conducive learning environments for learners with visual impairment to take shape. MoES and these other actors form networks that involve mobilization of rules, resources, power, and information to accomplish the task of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This involves the creation of a net of intended and unintended implications that stretch across the network's temporal boundaries (Warf, 2015). This is consistent with what Domingo, Masip, and Meijer (2015) say:

> An ANT perspective … [one should] focus on the connections between actants through their interactions to understand how … why they do what they do ... that is what we can call an actor-network: …. defined by the network of relationships or translations, in ANT terms … that can be traced (p. 58).

Since I was investigating the role played by MoES in teaching prospective teachers how to use ICTs as pedagogical tools as a pedagogical tool, findings showed how it (MoES) silently networks with other entities like the primary teachers' colleges, MoICT, and the nongovernmental organization towards teaching ICT to prospective teachers. Although it (MoES) was silent, its involvement in teaching the prospective teacher how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment was revealed as was how involved it was through providing the policy, equipment, and personnel.

8.2.2 No knowledge about the involvement of MoES

Despite most participants stating that MoES played a role in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments, results from other participants (n=2) showed that they did not know the role it played. For example, a statement from participant NTR3 was:

> For the case of [the] Ministry of Education and Sports, they are currently taking ICT in schools………. Currently, I do not know whether in colleges it has reached, but it is now in secondary and primary schools.

I received a similar response from NTR5 who said: *"I am not clear whether they were providing some of the computers"*. These statements indicate that these participants did not know or were not sue whether MoES is taking part in teaching prospective teachers to use ICT as a pedagogical tool. Although the majority of participants stated that MoES plays a role in teaching prospective teachers ICTs, the above three participants stated that there was no clear indication of MoES' participation in teaching prospective teachers.

The above assertions show that there is no sharing of information between the different actors that are involved in teacher education. This is seen from different responses from different participants. Whereas some participants said that MoES plays a role in teaching prospective teachers ICTs, others said that they are not sure of the role played by this ministry.

The power of relations and networking between actors could be of benefit while teaching prospective teachers how to use ICTs as pedagogical tools to facilitate conducive learning environments for learners with visual impairment. During data collection, I noted the inadequacy of the power of relations and networking between the actors like early career teachers and the teacher educators after their teacher education as well as the MoES and the primary teachers' colleges. This was noted because some participants were not aware of MoES's role in teaching ICT to prospective teachers in PTCs. This displayed the existence of inadequacy in the flow of information between the actors involved in teaching ICT in PTCs. Consequently, the functioning of the network of actors as well as the roles allocated or contributions of each actor or some actors in the network were not known or clear to the others.

Notably, Pernia (2008) observed that to solve the problem of equipment shortages, PTCs could be asked to form an association that could ensure and guarantee that the agreed ICT literacy competencies (i.e., foundational knowledge, specialized technical skills, and critical assessment skills) would be introduced or redefined as the desired outcomes of teaching ICT skills. Additionally, Pernia affirmed that the formation of associations could help to set standards that could assist in developing ICT competencies during teaching to and learning of ICT by prospective teachers. Similarly, Pernia (2008) observed that MoES should take the lead in setting standards and mechanisms for assessing competency after ICT was taught. This could motivate the actors

involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

8.3 Ministry of Information and Communications Technology (MoICT)

The development of an ICT policy in 2003 was followed by an e-readiness assessment of 2004, which revealed the need for a dedicated and coordinated approach to the implementation of the ICT policy (Farrell, 2007). As a result, an ICT working committee was set up to look at the policy paper's implementation, and it came up with some recommendations that led to the MoICT's establishment in early 2006 (Farrell, 2007). The major mandate allocated to MoICT was and is to address the convergence of ICT and co-ordinate policy development.

Other mandates that were assigned to MoICT were: to collaborate with the National Planning Authority to spearhead activities for developing sectoral ICT plans for integration into the National Development Plan; to oversee periodic policy reviews for the telecommunications subsector for both mobile and fixed-line telephone, postal, Internet, and e-mail services; oversee and guide the implementation of the Uganda e-Government Strategy Framework by various government ministries and agencies; and to develop and implement a prudent monitoring and evaluation system for the ICT sector (Farrell, 2007). Since the teaching of ICT has been introduced in teacher education, information was sought on the role that MoICT played.

Following the above background, I asked participants the role that MoICT played towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating convenient learning environments for learners with visual impairment. The subthemes that emerged after data analysis are presented and discussed below.

8.3.1 MoICT's involvement in teaching ICT to primary teachers' colleges

A response from participant ITE1was:

> Yah, this one to our college they have done some big role because you saw our computer laboratory, all those computers were provided by MoICT. They are some good machines and they play a good role. They do send people to monitor them, in case we get problems, they send people to monitor them.

The above response indicates that there are several roles that MoICT plays in teaching prospective teachers ICTs. The first role this ministry plays is the distribution or equipping of primary teachers' colleges with ICT equipment. Secondly, MoICT does monitoring of ICT equipment in primary teachers' colleges. During monitoring, they try to find out whether the equipment they

have sent to the primary teachers' colleges is functioning. The response from the above participant was in line with that from NTR9 who said *"It monitors how these machines are used"*. Just like participant ITE1, the response from this participant showed that MoICT is involved in teacher education by monitoring how ICT equipment that is used for teaching in primary teachers' colleges.

Despite the above, participant NTR5 said:

> I think they are taking part in supporting it in terms of bringing the supporters or teachers that know information about computers and TVs to help those who do not know to train them.

The response from NTR5 above was supposition because of the expression of "I think". This indicates that the participant is not very sure of the participation of MoICT in teacher education in Uganda. Despite the above, the statement indicates that MoICT takes part in teacher education by supporting these teachers' colleges by sending them to support in the form of personnel. The involvement of MoICT is not directly by teaching prospective teachers ICTs but through the identification of personnel that is skilled in using ICT equipment and sending them to schools.

Apart from monitoring the use of equipment and employment of personnel, a response from UNB was:

> It is to regulate the implementation of policies including those policies that enable
> the use of ICT in various levels for example secondary, even primary. If really if the
> ICT is to grow stronger. It should be regulated at the primary level that is thinking,
> students from that level should start learning it.

The response from this participant indicates that policy implementation is another role that is played by my MoICT in teacher education towards teaching prospective teachers ICTs. Section 4.6.1.1 of the *First Policy of the National ICT Policy of the Ministry of Information and Communications Technology (MoICT)* (2012), which addresses the mainstreaming of women, youth, and people with disabilities, observed that successful penetration of ICTs within existing social and economic structures depends on its people.

To begin with, when I asked about the roles played by MoICT in teaching prospective teachers ICT and using it as a pedagogical tool there-after, I noted that responses varied from one participant to another. Responses from the above group of participants showed that there was a role played by MoICT when prospective teachers were being taught ICT. Equally, findings show that MoICT provided computers and other equipment that could be used to teach prospective teach-

ers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Besides, findings revealed that personnel from MoICT monitored how computers were used during a teaching in primary teachers' colleges and their working conditions. Last but not least, my findings showed that MoICT employed support personnel, knowledgeable in ICT, to facilitate its teaching.

The draft policy (Government of Uganda, 2012) also observed that although people with disabilities (PWD), among other marginalized groups, constitute a very important segment of society, sometimes there is a continuation of societal marginalization towards this group of people in most activities. In the draft policy, the government expressed the need to address this special group so that they could positively contribute to growth as well as the use of ICTs as an empowerment tool in their daily activities, such as teaching. The recommendations that were put forward by the 2012 draft policy (the Republic of Uganda, 2012) included: to promote ICT as an alternative career for PWDs in the informal and formal educational system; to encourage creativity and innovation around ICTs among PWDs, leading to entrepreneurship development; to enable full and equal participation of PWDs in creating the information society; and to implement special ICT education programs for PWDs.

Concerning ICT in education, section 5.3.2 of the *First Policy of the National ICT Policy of the Ministry of Information and Communications Technology (MoICT)* (the Republic of Uganda, 2012) made the following recommendations: to review curricula at primary, secondary, and tertiary levels to improve the quality of education and introduce new learning methods; to improve the level of investment in educational ICT equipment, and improve the software as well as broadband connectivity of primary, secondary, and tertiary institutions; to impart teachers with the necessary ICT skills to enable them how to use ICTs in the teaching and learning process; to establish educational networks for sharing educational resources; and to create opportunities and provide assistance for disadvantaged people with special needs, women, and youth to acquire ICT skills.

8.3.2 No knowledge on the involvement of MoICT

In contrast to responses from a group of participants in 7.3.1 above, two participants said that they did not know whether MoICT did anything while prospective teachers were taught how to use ICTs as pedagogical tools as a pedagogical tool. Participant NTR2 commented: *"By that time, this ministry was not there because it was only [the] Ministry of Education and Sports. They have only added this technology"*.

Similarly, responses received from NTR7 stated: **"By the time I was at college, it was not there.",**

These participants said that by the time they were undergoing their preservice teacher education, MoICT had not been curved created. Similar responses were received from NTR10 and NTR15 who said that: *"I do not know"* whereas responses from NTR11 and NTR13 were: *"I do not know whether it does anything"*. A response from another participant (NTR12) was: *"I have no idea about what it has played"*. Another response from participant NTR14 was: *"No, that one I don't know. I have no idea about that"*.

Whereas some participants said that MoICT plays a role in teacher education, the statements from the above group of participants show that most of the people did not know the role of the above ministry towards teaching prospective teachers ICT towards facilitating conducive learning environments for learners with visual impairments. As a result, they could not say whether MoICT was involved in teacher education or not. Despite the above, another subtheme that emerged is explained in section 8.3.3.

8.3.3 MoICT could be involved in teacher education through UCC

Unlike the responses stated in sections 7.3.1 and 7.3.2, an analysis from one participant showed that there was a role played by MoICT. Participant TCD said:

> I cannot say much though we have the Uganda Communication Commission (UCC) which is under MoICT. UCC has furnished … a few colleges, I do not know whether PTCs are not yet aware that they can also be helped by UCC because it is under MoICT.

The statement from this participant shows that MoICT plays a role in teacher education through the Uganda Communications Commission (UCC) which is under its docket. This participant observed that UCC equips colleges with computers and other ICT equipment. One thing that this participant doubted is the awareness of primary teachers' colleges to get equipment from that they could use for teaching prospective teachers from UCC. Therefore, a statement from this participant was that MoICT plays a significant role in teaching prospective teachers ICTs. Although there is a possibility of MoICT participating in teacher education, this participant noted that it seems most PTCs are not aware of its participation in facilitating conducive learning environments. Since colleges have not been involved in teaching ordinary ICT, they may have not been involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

From the findings, I noted that there was nothing mentioned on where and when MoICT was or could be involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Given the above, to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, there is a need for the creation of a network between the government and private stakeholders who could work hand in hand to enable its teaching to take place. Particular emphasis could be put on the government sector, for example, universities, and on nongovernment organizations, telecommunication companies, and the business sector, which could provide insights, trends, and data regarding the prospects of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The identified organizations should have personnel who have ideas about using ICTs as pedagogical tools that could be taught to prospective teachers or teacher educators who could in turn teach it towards facilitating conducive learning environments. These networks could bring in a network of human and non-human actors. Some networks should lead to the provision of financial resources (e.g., from banks and telecommunication companies) as part of their cooperation to support teaching prospective teachers how to use ICTs as pedagogical tools and to ensure the sustainability of teaching programs thereafter (Pernia, 2008).

Following a review of the *First Policy Draft of the National ICT Policy of the Ministry of Information and Communications Technology (MoICT)* (the Republic of Uganda, 2012), actions that were necessary if the goal of transforming Uganda from a mere "information society" to one that is knowledge-based were to be realized were identified, including the production of more ICT-literate teachers; the definition of the ICT equipment's minimum technical specifications; the revision of the curricula; routine update of a record of the existing ICT initiatives to avoid duplication; and an update of the legal and security measures for the effective use of ICT in education. Farrell (2007) also observes the following additional actions in the first policy draft: security management is required to ensure that access to confidential data is controlled and authorized; adoption of cost-reducing measures to counter the high cost of ICT equipment, installation, and maintenance, paving the way for more equitable access; streamlining the different ICT providers' operations to avoid duplication and conflict of interest and to secure everyone's co-operation; and to provide the requisite ICT infrastructure to the poor rural schools during the phase of implementation.

8.4 Uganda National Association of the Blind (UNAB)

I asked participants about the contribution of UNAB towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. I received varied responses. Some participants said that UNAB was involved while others said that it was not involved. My analyses are presented below.

8.4.1 UNAB involvement in teacher education

Unlike MoES and MoICT, four participants said that UNAB was involved in teacher education by providing computers to PTCs. Participant UNB clearly said:

> Since 2002, it [UNAB] has endeavored to initiate adapted computer technology although it has not been centralized. It is still at the center. We are trying our best to centralize it at our branches. …. We trained teachers who are handling children with visual impairment with the aim that they going back to teach learners with visual impairment in those schools that have computers. This after learning that the government has put some computers that bind people were not accessing. Also, UNAB is very actively training visually impaired learners.

Similarly, ITE2 stated that:

> They have done so much. Principals have done so much in these PTCs by sending their tutors for training, having tutors for upgrading, allowing Kyambogo University students for college practice by using their premises.

The ripostes that I received from NTR5 and NTR10 were similar when they said that UNAB is participating in preparing teachers to use ICT while teaching learners with visual impairment. Although the above responses showed that UNAB is involved in the teaching of teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments while teaching learners with visual impairment, they were doubtful of UNAB's involvement in teacher education. Students from Kyambogo Univerity who are prepared to use ICT go for practice at UNAB. This is the only organization that has equipment that is adapted for persons with visual impairment

Equally, apart from providing computers to PTCs, participants ITE2 and UNB said that UNAB was involved directly in teaching already qualified teachers from selected secondary schools the skills of using ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment when they go back to their schools. This is in fulfillment of rule

4 of the United Nations (UN) standard rules (UN, 1994), which requires that there should be the provision of appropriate assistive devices for learners with visual impairment so that they can be encouraged to participate in the design and production of appliances.

8.4.2   Non-involvement of UNAB in ICT teaching

Regarding the involvement of UNAB in teacher education, fifteen participants said that UNAB was not involved in teacher education but was involved in providing ICT equipment to some schools and PTCs. A response from participant NTR1 was: *"No, I am hearing of it for the first time",* and participant NTR15 said: *"No, I do not know".*

Another statement from ITE1 *"This one I cannot tell because they do not have the category in the group but I don't know when other colleges have them".* The above statement shows that this participant did not have any idea of what UNAB is or what it does. Despite the above, a response from participant TCD was:

> I would say I do not know much about that because we are doing some of this, for instance, an action under the Chinese Trust Fund or UNESCO but under our observation as Kyambogo University. Commonwealth of learning has also done something and whatever is being done is done with the consent of MOES, Kyambogo University, and PTCs.

These responses showed that these participants were not aware of the existence, involvement, or what UNAB is. I received conforming responses from NTR2, NTR3, NTR4, NTR6, NTR7, NTR8, NTR11, NTR12, NTR13, NTR14 and NTR16. One participant (NTR1) above said that this was the first time to hear about UNAB or they did not know what the organization did. The views from these participants were that UNAB is not involved in teaching ICT in teacher education. Instead, it is international organizations that are involved by equipping primary teachers colleges with equipment that is used for teaching ICT.

I do agree with the above responses because when I went to the two colleges, there was no indication of UNAB participation in teacher education. Secondly, when I visited the UNAB secretariat, they did not show any commitment to their participation in teacher education in Uganda. For example, a response from UNB was:

> We trained teachers who are handling children with visual impairment with the aim that they going back to teach learners with visual impairment in those schools that have computers. This is after learning that the government has put some computers

that bind people who were not accessing. Also, UNAB is very actively training visually impaired learners.

The above response showed that though UNAB is participating in teacher education, they teach in-service teachers but they do participate in preparing prospective teachers who are undergoing their initial teacher education on how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. This is contrary to rule 1 (subsection 4) of the UN standard rules that says: "States should invite organizations to join in public education programs concerning disability matters" (UN, 1994). If this does not happen, the organization of persons with visual impairment's input may not be realized. Hence, there should be the provision of ICT equipment to PTCs so that expertise from the organization of persons with visual impairment could be invited to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

Generally, UNAB is in most cases involved in skilling primary school teachers with the specialized skills for teaching learners with visual impairment towards facilitating favorable learning environments. This is to implement rule 18 of the UN standard rule (UN, 1994), which emphasizes that organizations of people with disabilities should be encouraged and supported to participate in every initiative concerning them by any service provider or the state to skill personnel to meet their learning or daily life needs. To demonstrate the above, participant UNB stated that UNAB gets involved in teacher education by availing the teaching of the use of ICT skills to teachers in the organization but not in the colleges.

As stated in the findings, the similarities, contradictions, and differences that I obtained from participants of the same institution or organization was an indicator that there was no networking between UNAB and the PTCs, MoES, and MoICT. No participant mentioned a fixed role played by UNAB in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. Those who did not know the organization expressed ignorance of its existence and what it did in teaching prospective teachers. Those who knew of its existence said that it was involved in prospective teacher preparation by providing teaching and learning equipment to colleges that have enrolled prospective teachers with visual impairment. In principle, this means that equipment that is taken to such colleges is meant for a particular prospective teacher but not for the entire college community.

8.5 Primary Teachers' Colleges

Under the new PTC professional curriculum implemented in 2013, ICT is supposed to be taught to all newly graduating teachers. Since Uganda encourages inclusive education, PTCs need to introduce the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment instead of it being taught to selected primary and secondary school teachers. This, therefore, calls for all PTCs to teach ICT. Some colleges have implemented this, while others have not yet. This necessitated me to ask participants about the roles PTCs play in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment.

8.5.1 The roles of primary teachers' colleges

Data shows that prospective teachers are taught ICT during their preservice teacher education but findings are not realistic on whether it is ICT for persons with visual impairment or just ICT as usual. This is found when I asked participants the role played by PTCs in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating learning environments for learners with visual impairments. Participant NTR1 said: *"The colleges were the ones teaching us some computer skills. We were introduced/taught writing and saving information as well as starting the computer"*.

The statements from the above participants showed that ICT is taught to prospective teachers. The above statement is consistent with seventeen other responses. A corresponding statement was received from ITE1 who said:

> They are doing a good job. We are provided both some gadgets by the college because the college needs to provide something, for example as per now, it's the college that has to pay the instructor, it's the college that maintains those computers, it's the college that provides alternative power, even the power we have it at college to provide it (ITE1).

Respectively, The responses from seventeen (NTR2, NTR2, NTR3, NTR4, NTR6, NTR7, NTR8, NTR9, NTR10, NTR11, NTR14, NTR15, NTR16, ITE1, ITE2, UNB, and TCD) other participants were that primary teachers colleges take part in preservice teacher education provides equipment, space, implementation of teaching, maintenance of computers and other ICT equipment and provision of alternative power in case there is a power outage. These participants too said that the college is doing a good job by employing the teacher educators and providing pro-

spective teachers with ICT equipment. Secondly, these participants said that the colleges pay the salaries of teacher instructors as well as maintaining the ICT equipment. The response from these participants was that since the colleges do not have reliable electricity, the college administrators provide alternative power to run the equipment in case of an outage.

I do agree with the above findings because the colleges where I collected data from have ICT teacher educators who are paid by the colleges although they are not prepared on pedagogy instead, they are ordinary IT specialists. Secondly, during non-formal observation, I noted that the teacher educator employed at the college was actively involved in monitoring the functioning of the ICT equipment while carrying out minor repairs on those that had minor faults.

Additionally, during data analysis as compared to the non-formal observation that I carried out, I also noted that primary teachers' colleges plan for extra time to see that prospective teachers access the computer laboratory to practice what they had learned during speculative teaching. This is because prospective teachers are taught to start the equipment, open documents, save and shut the equipment in addition to other basic ICT skills but not using them as pedagogical tools.

PTCs are facilitated with laboratory space, teacher educators, and equipment that is used for teaching ICT skills to prospective teachers. All college principals have gone further to send teacher educators to acquire skills of using ICT as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment so that they can teach prospective teachers ICT skills.

Although there is evidence that PTCs are involved in teaching ICT to prospective teachers, one of them (UNB) said that they (PTCs) were not involved. This participant said: *"There is no establishment of ICT training yet put into consideration so that we start some units."* This response was quite critical. This response showed that PTCs are not teaching prospective teachers ICT as pedagogical tools towards facilitating valuable learning environments for learners with visual impairment to the teachers they prepare.

Teaching ICT in primary teachers' colleges towards facilitating conducive learning environments for learners with visual impairment needs stakeholder identification, invitation, and involvement (for example, the education ministry, public and private educational/training institutions, telecommunications industry, ICT service providers, and the business sector) as well as public and private partnerships for ICT literacy education (Pernia, 2008). Pernia adds that this could help to define the continuum of ICT/ICT literacy competencies, skills, and abilities needed by citizens to manage the digital divide. She said that an ICT steering committee could also help

in setting opportunities for optimal learning and continued planning and action related to ICT literacy education/training.

Additionally, Pernia (2008) said that:

> " … specialized educational … institutions or individuals may be tasked or commissioned to develop/revise/update age- and educational level-appropriate content of ICT literacy education … curricula. Curricula should be ladderized, i.e., subsequent modules build upon earlier ones" (Pernia, 2008, p. 19).

Using the above guidance, general ICT knowledge and practices could be used to develop modules or curricula on specialized ICT content, which could later be used as pedagogical tools towards facilitating expedient learning environments for learners with visual impairment. General ICT could be used as guidance towards the development of the foundational knowledge on competencies about technologies, hardware, software applications, and other elements of digital technologies. This could later be adapted and used to develop competencies of using to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment. This could also help in the stimulation of critical thinking on how ICT equipment could be adapted to suit the teaching and learning needs of learners with visual impairment.

Secondly, the development of an ICT policy in 2003 was followed by an e-readiness assessment of 2004, which revealed that a focused and coordinated approach to implement the policy was required (Farrell, 2007). After considering the ICT policy, the committee involved in the e-readiness assessment recommended that an ICT policy for education should be developed. This, together with the development of the national policy, motivated the MoES to expand its focus on the use of ICT. Meanwhile, the national policy focused on the importance of developing the ICT competencies of learners by moving toward a more integrated vision (Government of Uganda, 2008). Among the initiatives that were recommended and noted by the 2005-2006 review sector committees were that an agreement had to be signed with Microsoft to subsidize software licenses for teacher education (Farrell, 2007). Likewise, the committee noted that the teaching of ICT to preservice teachers had already begun in PTCs (Farrell, 2007).

Findings showed though some institutions like MoES is working with primary teachers colleges while prospective teachers are taught ICT, there could be an understanding on what to be taught to prospective teachers to use as pedagogical tools for persons with visual impairment. If actors come together to network with primary teachers' colleges, prospective teachers could be taught to use ICTs as a pedagogical tool for learners with visual impairment to take shape. MoES and

these other actors form networks that involve mobilization of rules, resources, power, and information to accomplish the task of teaching preservice teachers to use ICT as a pedagogical tool for learners with visual impairment. This involves the creation of a net of intended and unintended implications that stretch across the network's temporal boundaries (Warf, 2015). This is consistent with what Domingo, Masip, and Meijer (2015) say:

> An ANT perspective … [one should] focus on the connections between actants through their interactions to understand how … why they do what they do ... that is what we can call an actor-network: …. defined by the network of relationships or translations, in ANT terms … that can be traced (p. 58).

Since I was investigating the role played by MoES in teaching preservice teachers to use ICT as a pedagogical tool, findings showed how different organizations are silently networked with others while ICT is being taught to prospective teachers. Although some organizations are silent, their involvement in teaching preservice teacher to use ICT as a pedagogical tool was revealed as to how involved it was through providing the policy, building ICT laboratories, providing equipment and providing a soft policy on employment and payment of personnel that MoES could not directly employ and include in the pay role.

8.6   Conclusion

Having presented, analyzed, interpreted and discussed the finding on collaboration between different institutions in teacher education, findings from the participants showed that some institutions take part in teaching ICT in teacher education whereas others showed that they did not know. For example, most participants knew the participation of the primary teachers' colleges whereas they did not know what MoICT does. But there was no clear response showing the participation of these organizations in teaching ICT of persons with visual impairments towards facilitating conducive learning environments. This, therefore, calls for collaboration so that there is a clear cut line on what each actor should play towards facilitating conducive learning environments or learners with visual impairment.

9 Chapter Nine: Conclusions, Recommendations and Further Study

9.1 Introduction

This study was designed to investigate ICT teaching in primary teachers' colleges in Uganda towards facilitating conducive learning environments for learners with visual impairment. Three research questions guided this study and these are:

- What are the perceptions of early career teachers, teacher educators, organizations of persons with visual impairment, and curriculum developers towards teaching ICT in general to prospective teachers?

- How are teacher educators engaged in preparing prospective teachers to develop skills of using ICTs as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment?

- How are institutions working together to prepare prospective teachers on how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment?

After reading and rereading the data presented, realized the need to teach and support prospective teachers to develop the skills of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This is because there are numerous hindrances to teaching prospective teachers on how to use ICTs as pedagogical tools as a pedagogical tool. Thirdly, teacher educators are engaged in teaching prospective teachers ICTs towards facilitating conducive learning environments, but there is a need to provide appropriate ICT equipment, skilled personnel, networking with organizations that need to be recruited into the network. Following the findings, I recommend that there is a need for networking during the development and implementation of the ICT curriculum, a need for curriculum review, and a need for the involvement of UNAB, personnel from MoES and Kyambogo University, and an envisioned network for inclusive ICT to implement the study's implications. I conclude this chapter with a brief description of the study's implications for further research, curriculum review, and policy implementation.

9.2 Implications of the findings

Although this study identified the limitations in chapter 7 (sec. 7.4), this study sheds some light vis-à-vis the teaching of ICT in teacher education towards facilitating conducive learning envi-

ronments for learners with visual impairments in Uganda. Basing on the findings, I have identified some implications towards teaching ICT in teacher education and further research. Although the implications I have present may require the allocation of both financial and human resources, some of them may be implemented using the available human resources and equipment that ate used for teaching ICT in teacher education.

9.2.1   Perceptions towards teaching ICT to prospective teachers

After discussing and analyzing the findings, I conclude that first, findings show that general ICT is being taught to prospective teachers in some colleges, whereas others have not implemented its teaching fully. During teaching, teacher educators use mainly speculative teaching supplemented by practice (see section 6.2.1). These strategies are used because of the inadequacy of ICT equipment in PTCs. Practical teaching is hindered by inadequate equipment in most PTCs.

Secondly, to introduce the teaching of ICT for persons with visual impairment to prospective teachers, there is a need to build ICT laboratories as well as employ skilled personnel towards facilitating its teaching (see sections 6.3.1 and 6.3.2). Teacher educators need to become familiar with ICT equipment so that they can teach prospective teachers how to use them as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

The findings also show that elements that can expedite the development of competencies in using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment are both intrinsic and extrinsic. As regards extrinsic factors, the findings show that there is a need to change the attitudes of teacher educators, prospective teachers, and other stakeholders towards teaching and learning how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This would be done with the hope that a change of attitude may expedite ICT teaching and learning how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Secondly, findings show that teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could be expedited by inspiring prospective teachers and other stakeholders through refresher courses.

The findings show that there is a need to supply ICT equipment into the PTCs to facilitate its teaching and learning. Other extrinsic factors that need to be addressed are the preparation and employment of skilled personnel to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

The findings also reveal the need for curriculum review, assessment of prospective teachers, and establishment of specialized institutions that would teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

9.2.2   Teacher educators' engagement in preparing prospective teachers

The findings show that ICT for learners with visual impairment is not mentioned anywhere in the curriculum and it is not mentioned during teaching. Engagement is defined in this research as behavioral, cognitive, and emotional participation. Without engagement, learning hardly occurs (sec. 3.3). Positive engagement of teachers at work may positively impact their attitudes towards their job but in the process, teachers may experience burnout during their career, which may negatively impact their professional learning opportunities (Fiorilli et al., 2020). By finding out how teacher educators were engaged in preparing preservice teachers how to use ICTs as pedagogical tools towards facilitating practical learning environments for learners with visual impairment, I aimed to find out how teacher educators were involved, committed, passionate, enthusiastic, and engrossed in preparing preservice teachers how to use ICTs as pedagogical tools.

This, therefore, shows that teacher educators are not engaged in teaching prospective teachers how to use ICTs as pedagogical tools persons with visual impairment towards facilitating conducive learning environments for learners with visual impairment. Despite the above, findings revealed that there was a willingness to introduce ICTs for persons with visual impairment in teacher education. Findings revealed that there is a need of teaching prospective teachers how to use ICTs as pedagogical tools in teacher education towards facilitating conducive learning environments.

The results also show that if prospective teachers taught ICT, it would create job opportunities or they could become self-employed. According to the findings from the participants, they think that prospective teachers are taught ICTs for persons with visual impairment as a pedagogical tool towards facilitating conducive learning environments, they would readily be employed by the government or be self-employed.

9.2.3   Institutional collaboration while teaching ICT as a pedagogical tool

Regarding institutional collaboration when teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, the findings show that, apart from MoES, Kyambogo University and the PTCs, no other institutions were collaborating in its teaching. This is because there are no clear roles allo-

cated to each institution or factors that encourage networking when teaching the above aspect. Other interested institutions become involved with minimal consultation of MoES.

Nicholls (2009) says that while networks are important for social movements, how networks are constituted in areas of education, such as teaching, play a significant role in shaping roles allocated to each actor, how they could be linked to each other, and the procedures to recruit other actors into the network. For example, teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating favorable learning environments for learners with visual impairment may not be effective if skilled personnel (human) and equipment (nonhuman) are not available and interconnected.

Skilled personnel, equipment, college administration, relevant ministries, and other actors who interact, to form a network and may make it possible for prospective teachers to be taught how to use ICTs as pedagogical tools towards facilitating advantageous learning environments for learners with visual impairment. By and for all, teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment may require to apply ANT as a social material approach that pays attention to the relationships between human and nonhuman entities.

9.2.4   Application of Actor-Network Theory (ANT)

This study is guided by the actor-network theory (ANT) (as explicated in chapter four of this study). ANT is a theory which is also known as enrolment theory (Jóhannesson, & Bærenholdt, 2009). Following the guidance of ANT, the study explores how different actants (human and nonhuman) are, and can be, involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The application of ANT in educational studies, such as this one, especially where human and nonhuman actors are involved, has become common to meet the educational needs of learners with visual impairment (Fenwick & Edwards, 2010). This is possible if teachers are prepared on how to use ICTs as pedagogical tools towards facilitating conducive learning environments and the outcomes of learners with visual impairment are measured.

To understand the processes involved in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment, data collection was guided by ANT's network approach[10]. This was done following the assumption that teaching prospective teachers how to use it towards enabling conducive

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[10] See section 4.3.

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learning environments for learners with visual impairments is more or less a social activity that could better be understood and explained through the patterns of interaction and relations that arise between human and nonhuman entities/actants. All elements involved in teaching and learning are equally important when it comes to guiding prospective teachers on how to use ICTs as pedagogical tools that can help children to learn in their classes. Whereas the nonhumans are not limited to stationary computers or mobile telephones; they could be extended to include other relevant ICT equipment that could be taught to prospective teachers to teach learners with visual impairment how to use it as pedagogical tools towards facilitating conducive learning environments.

9.3 Recommendations

The recommendations for this study are derived from the findings. This study brings out some light regarding the teaching of ICT to prospective teachers towards facilitating conducive learning environments specifically for learners with visual impairment. Based on the findings in chapters six, seven and eight, I have put forward the recommendations and implications for further research for the teaching of ICT for persons with visual impairment towards facilitating conducive learning environments to take place. Although the recommendations I am putting forward may require additional of both human and nonhuman actors which are missing, some of them may be implemented using the available personnel and resources, for example, equipment may need to up-dated whereas personnel could be taken for refresher courses.

9.3.1 Need for networking during curriculum review

Although ICT is being taught in some PTCs in Uganda, ICT for persons with visual impairment is not included. I noted its absence during and after data collection, presentation, interpretation, and analysis that ICT for persons with visual impairment is not taught to prospective teachers due to its absence in the curriculum. There is a need for a curriculum review to get it included in the curriculum. There is a need for a curriculum review. This could be done to introduce the teaching of ICTs for persons with visual impairment to prospective teachers as pedagogical tools so that they may use it towards facilitating conducive learning environments for learners with visual impairment. Its inclusion in the PTC curriculum as well as its teaching to prospective teachers is much larger than just policy development. It is instead an arrangement of organizations, states, and institutions that need to negotiate and come to an agreement on its introduction and implementation.

Secondly, the development of networks of human and nonhuman actors brings strong ties between them which allows the to-and-fro information flow. This is in line with Opertti and Belal-

cázar (2008) who say that "It is important to strengthen the link among universities, teacher-education programs and curricula reforms, as a way of supporting schools and teachers in the practice of inclusive education" (p. 130). Though there are linkages, sometimes there are weaker ties between some actors than the others, yet all aim at solving the same task (refer to sec. 8.6.1).

9.3.2 Supply of equipment and employment of skilled personnel

During data collection, I noted that there are inadequate ICT materials in these two colleges. To teach ICTs to prospective teachers as a pedagogical tool towards facilitating conducive learning environments for learners with visual impairment, there is a need to equip these colleges with appropriate and adequate ICT equipment into PTCs. After supplying equipment, there is a need to prepare and employ skilled personnel to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This is because according to the findings and during observation, I noted that the teacher educators that teach prospective teachers need to be motivated to teach and learn how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

9.3.3 Attitude change

Successfully initiation and implementation of the teaching of ICT for educational purposes in educational programs depend strongly on teachers' support and attitudes. If the teachers' attitudes are positive toward the use of ICTs as pedagogical tools during teaching, then they can easily provide useful insight about its adoption and integration into teaching and learning processes (Guma et al., 2013). All stakeholders need to change their attitude to identify the significance of teaching prospective teachers the aspect of using ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Through the OPPs, sufficient bodies of actors and interested actors may be identified and enrolled such that they may act so that the attitude could be changed for assessment to take place.

During enrollment multilateral negotiations and trials towards teaching and assessment of the use of ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could take place. This may also take place if the curriculum for pre-service teacher education to be reviewed to include ICTs for persons with visual impairment. This should be done to teach prospective teachers how to use them as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

9.3.4   Involvement of UNAB in policy and curriculum development

UNAB, being a WBU member, needs to be involved as an OPP for ICT for learners with visual impairment. This would allow the implementation of recommendations made to member states regarding teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. Uganda, being a member state to most international statutory papers, including those made by UNESCO, has to find the ways and means of taking up the involvement of UNAB during implementation. MoES (an education policymaker) and the Department of Teacher Instructor, Education and Training, would have to guide a curriculum review to include ICT for learners with visual impairment. This is in line with Fenwick and Edwards (2010), who says that at policy levels of curriculum design and implementation in education, curriculum change is hotly debated, particularly in terms of the curriculum's purpose and nature.

In the case of teaching prospective teachers, MoES came up with reasons as to why ICTs should be taught as pedagogical tools towards facilitating conducive learning environments. The involvement of UNAB could give reasons why it is important to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

With the kind of teachers expected in inclusive schools, there is a need to adapt ICT equipment to conform to the need of using it while teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. This could also require the creation of a network that did not exist before, which could also help nonhuman actors to adapt. Actors in the network need to accept roles, rules of acting, and objectives to achieve, and ways in which they could be achieved should also be well laid down. The level of relations should be fully connected before and during policy and curriculum development, so that prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

9.3.5   Involvement of specialist personnel

Another recommendation is that there is a need for the curriculum developers to collaborate with personnel from the Department of Special Needs Studies, Kyambogo University. This collaboration should include the Department of Special Needs Education/Career Guidance and Counseling in the MoES and other relevant personnel. Collaboration with personnel from two or more of these institutions could be of help in advising on the kind of ICT content to be included in the

PTCs' curriculum. Although Kyambogo University collaborates with MoES through the Department of Teacher Instructor, Education and Training, it is tasked to advise on curricula development and review for both pre- and in-service primary school teacher education without the involvement of the Department of Special Needs Education/Career Guidance and Counseling. This is possible through ANT's network-building approach, which seeks to analyze how social and material processes (subjects, objects and relations) become seamlessly intertwined within complex sets. The involvement of the above institutions is to enable guidance on appropriate ICT content to be included in the curriculum and thereafter commencement of its teaching.

Secondly, concerning using ICT as a pedagogical tool towards facilitating conducive learning environments, Opertti and Belalcázar (2008) say that teachers should have the capacity to redefine the use of technology according to the various needs and ways of learning. The use of educational technology in the classroom should be approached in ways that do not promote and increase inequity. The knowledge of teachers about using different technology would help in addressing the learning needs of different categories of learners in the classroom. Where there is a lack of specialist teachers in the school, there could be a need to prepare or recruit additional teachers to offer support (Opertti & Belalcázar, 2008).

9.3.6 Opening up boundaries and expanding networks

Despite UNESCO, MoES, through the Department of Teacher Instructor, Education, and Training, Kyambogo University and the PTCs are involved in teacher education, there is a need to open boundaries to recruit other actors into play. Boundaries could be opened to identify, enroll and enable OPPs to follow possible human and nonhuman actors, who could contribute to curriculum review and its implementation. The identification of possible actors by OPPs could guide the development of a network of actors that represent a preliminary sketch that could consist of human and nonhuman entities. This could help prospective teachers to develop the skills of using ICT as a pedagogical tool for learners with visual impairment. Figure 6 shows some anticipated actors that may have to be involved in a curriculum review to become included and introduced in the PTC curriculum.

Figure 6: Communication lines for curriculum review to make it inclusive.
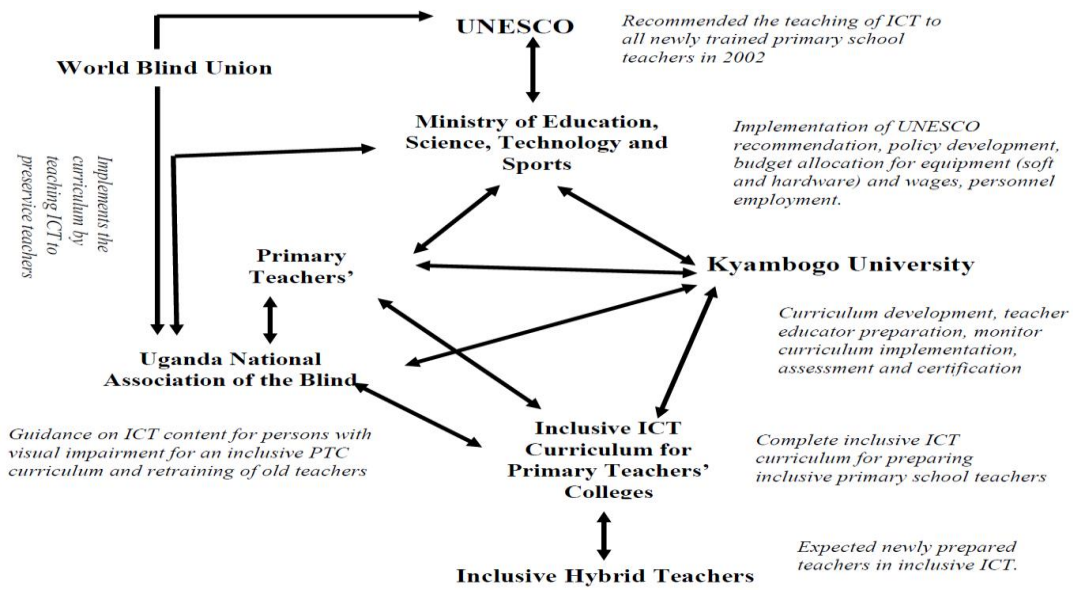
Source: Self – developed

The figure above represents actors and networks that could be involved in negotiations and contributions to the introduction of the teaching of the use of ICTs as a pedagogical tool to prospective teachers towards facilitating conducive learning environments for learners with visual impairment. To avoid unnecessary inclusion-exclusion during program development, there is a need to follow and build a network of informed, uninformed, and skilled personnel, and identification of appropriate equipment. This could be achieved after building durable and stable networks of actors bound together. This network should aim at the actors' network growth and durability in a program.

Each actor in Figure 6 above represents what Williams-Jones and Graham (2003) refer to as black boxes. Black boxes are situations where many elements are made to act as one (Latour, 1987). We do not know what is going on inside each black box until 'we play/unpack/open' it. These black boxes are joined to another by one or more arrows to form a larger network. This is explained by Jiang (2016), who says:

> Rather than delineating knowledge construction within fixed and certain boundaries, or what Fenwick and Edwards (2014) refer to as a 'black box', ANT offers a new theoretical lens to perceive knowledge production as undergoing network assemblages and re-assemblages, and dynamic translations and negotiations among networked entities (p. 519).

These black boxes have many other actors within them, who are significant in the network for the accomplishment of a task. Williams-Jones and Graham (2003) say that "the challenge of ANT is to unpack and better understand the underlying processes and components of actors and networks that may not be easy to see or understand how they work" (p. 273). Despite black-box activities appearing to be easy, the big challenge is opening them to expose the actors and the nature of activities that each actor is contributing to the network's operation. It may as well help to explore the diversity involved in a black box, hence help capacity building leading to the achievement of a given goal. Nevertheless, whatever the relationships between actors in the network, they should aim at reviewing so that prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

9.3.7 Getting the Ministry of Information and Communication Technology involved

There is also a need for MoICT to become involved in the development of the curriculum for ICT to guide the teaching of prospective teachers how to use it as a pedagogical tool for learners with visual impairment. To get MoICT involved, there is a need to create interest, also referred to in ANT terms as interessement, by convincing it to recognize its importance. This could be done by inviting MoICT to become interested in joining the network. Their roles in the network of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could be negotiated to determine their uptake.

Interessement can be achieved through OPPs, who could convince MoICT and other related actors to join the network by explaining the importance of teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The objective of interessement is to ensure that correct participants give suggestive solutions to the problem are identified, convinced, and proposed to be recruited into the network. Though interessement helps in tracing actors responsible for curriculum development, it would also guide in getting new actors to be recruited into the network.

9.4 Issues for further study

Given the advocacy of inclusion of all learners into the schools nearer to their homes, this study attempted to investigate the preparation of prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. The background of this study follows UNESCO's calls of 2002 and 2006, which recommended

the teaching of ICT to all newly graduating teachers. UNESCO echoed what the Salamanca statement (Salamanca statement, 1994), the Government of Uganda (Government of Uganda, 1995), and other policy papers and international conventions had already called for to prepare teachers who could meet the learning needs of all learners in their classrooms. Although no specific areas of concern were mentioned by the Ugandan constitution (Government of Uganda, 1995) and UNESCO emphasized the area of ICT, which has become a global issue.

Considering that ICT is a key component in education and social life (Guma et al., 2013), the need to investigate its teaching to prospective teachers and how it can be used to enhance the education and social participation of learners with visual impairment is crucial. Most of the current studies on ICT in Uganda have tended to pay attention to regular ICT which paid attention to sighted people as compared to teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment. An analysis of the condition of its teaching to prospective teachers is of importance. Further studies on how prospective teachers should be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment could contribute to valuable information that would enhance the teaching, skill development, and attitudes necessary in preparation of teachers.

To sum up, being a qualitative study, this study was confined to two PTCs out of the forty-seven existing in Uganda. This is a very small representation. The two colleges are located nearly in a similar geographical setting. I, therefore, recommend that a similar study is carried out that may involve a bigger number of colleges and a wider geographical scope. It could involve a larger sample compared to mine and take into contemplation the experiences and perspectives of other teacher educators, early career teachers, and prospective teachers from the identified colleges. This could shed more light on how prospective teachers could be taught how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.

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Appendices

Appendix I: Interview Guide for Curriculum Developers

*As part of my Doctor of Philosophy in education, I am undertaking a research project titled **"Teaching information and communication technology in primary teachers' colleges in Uganda to support children with visual impairment".** The project examines the computer competencies teacher educators find among student teachers and the kind of support teacher educators give to these students in primary teachers' colleges, among others. You were purposely sampled to participate in the study because it is presumed that you will give valuable information towards the teaching of the use of ICT in Primary teachers' college. This interview will take approximately 30 minutes or less.*

(i) Background information on ICT teaching

1. What do you understand by the concept of ICT?

2. Explain about the prior ICT knowledge prospective teachers have before joining the primary teachers' college.

3. Which methods do you think are used while prospective teachers are being taught how to use ICTs as pedagogical tools after their preservice teacher education?

4. Name the ICT content that you think is taught to prospective teachers during their teacher education.

(ii) Early Career Teachers' Perceptions About Learning ICT

5. What is your view towards the inclusion of ICT for learners with visual impairment into the preservice teacher education curriculum so that they can be taught how to use it while teaching?

6. How do you think prospective teachers can be helped to develop competencies in ICT for learners with visual impairment during their teacher education?

7. What do you think are the hindrances towards teaching prospective teachers how to use ICTs as pedagogical tools as they were undergoing their teacher education?

(iii) Teacher educators' engagement in ICT for learners with visual impairment teaching and competencies development

8. What do you think are the teacher educators' views towards teaching the use of ICT for learners with visual impairment to prospective teachers?

9. Why do you think that it is important to teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment as they undergo their preservice teacher education?

10. How do you think teacher educators can help prospective teachers to combine the ordinary ICT knowledge and practice and ICT knowledge and practice for learners with visual impairment as they (prospective teachers) are undergoing their teacher education?

11. What do you think are the positive effects for prospective teachers to be taught ICT for learners with visual impairment?

12. What could be the challenges to successfully teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment as a prospective teacher undergo their teacher education?

13. What interventions do you suggest should be put in place to make the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment?

(iv) Institutional collaboration to teach prospective teachers how to use ICTs as pedagogical tools as a pedagogical tool

How are the following institutions collaborating to see to that ICT for learners with visual impairment is taught to prospective teachers?

14. Ministry of Education and Sports (MoES) with Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind and Primary Teachers' Colleges?

15. Ministry of Information and Communication Technology (ICT) with the Ministry of Education and Sports (MoES), Uganda National Association of the Blind and Primary Teachers' Colleges?

16. Uganda National Association of the Blind (UNAB) with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES) and Primary Teachers' Colleges (PTCs)?

17. Primary Teachers' colleges with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES) and Uganda National Association of the Blind (UNAB)?

Thank you for participating in this interview.

Appendix II: Interview Guide for Teacher Educators

As part of my Doctor of Philosophy in education, I am undertaking a research project titled ***"Teaching information and communication technology in primary teachers' colleges in Uganda to support children with visual impairment".*** *The project examines the digital competencies teacher educators find among student teachers and the kind of support teacher educators give to these students in primary teachers' colleges, among others. You were purposely sampled to participate in the study because it is presumed that you will give valuable information towards the teaching of the use of ICT in primary teachers' colleges. This interview will take approximately 30 minutes or less.*

(i) Background information on ICT teaching

1. What do you understand by the concept of ICT?

2. Explain the prior knowledge ICT prospective teacher had before joining the primary teachers' college (PTC).

3. Which methods do you while you teaching ICT to a prospective teacher?

4. Name the ICT content that you were taught during your preservice teacher education.

(ii) Early career teachers' perceptions about learning ICT

5. What is your view towards the inclusion of ICT for learners with visual impairment into the preservice teacher education curriculum so that teachers can be taught how to use it while teaching?

6. How do you think prospective teachers can be helped to develop competencies in ICT for learners with visual impairment during their teacher education?

7. What were the hindrances towards teaching prospective teachers how to use ICTs as pedagogical tools learners with visual impairment during their teacher education?

(iii) Teacher educators' engagement in ICT for learners with visual impairment teaching and competencies development

8. What were your views towards the teaching of the use of ICT for learners with visual impairment in teaching to prospective teachers as they underwent their teacher education?

9. Why do you think it is important to teach a prospective teacher how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment as they undergo their teacher education?

10. In case the prospective teachers had prior ICT knowledge and skills, how can you help your student teachers to combine the ordinary ICT knowledge and skills and ICT knowledge and

skills for learners with visual impairment how to use in teaching after their education as they undergo their preservice teacher education?

11. What do you think are the positive effects for teachers to be taught ICT for learners with visual impairment?

12. What are the challenges to successful teaching of ICT for learners with visual impairment in PTCs in Uganda?

13. What interventions do you suggest should be put in place to make the teaching of the use of ICT for learners with visual impairment in teaching among the prospective teachers successful in PTCs?

(iv) Institutional collaboration during teaching prospective teachers how to use ICTs as pedagogical tools while teaching

How are the following institutions collaborating to see to it that ICT for learners with visual impairment is taught to prospective teachers?

14. Ministry of Education and Sports (MoES) with Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind, and primary teachers' colleges?

15. Ministry of Information and Communication Technology (ICT) with the Ministry of Education and Sports (MoES), Uganda National Association of the Blind, and Primary Teachers' Colleges?

16. Uganda National Association of the Blind (UNAB) with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES), and Primary Teachers' Colleges (PTCs)?

17. Primary Teachers' colleges with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES), and Uganda National Association of the Blind (UNAB)?

Thank you for participating in this interview.

Appendix III: Interview Guide for the Early Career Teachers

As part of my Doctor of Philosophy in education, I am undertaking a research project titled ***"Teaching information and communication technology in primary teachers' colleges in Uganda to support children with visual impairment".*** *The project examines the digital competencies teacher educators find among student teachers and the kind of support teacher educators give to these students in primary teachers' colleges, among others. You were purposely sampled to participate in the study because it is presumed that you will give valuable information towards the teaching of the use of ICT in primary teachers' colleges. This interview will take approximately 30 minutes or less.*

(i)   Background information on ICT teaching

1. What do you understand by the concept of ICT?

2. Explain about the prior knowledge you had in ICT before joining the primary teachers' college.

3. Which methods were used while you were being taught ICT during your preservice teacher education?

4. Name the ICT content that you were taught during your preservice teacher education.

(ii)   Early career teachers' perceptions about learning ICT

5. What is your view towards the inclusion of ICT for learners with visual impairment into the preservice teacher education curriculum so that teachers can be taught how to use it while teaching?

6. How do you think prospective teachers can be helped to develop competencies in ICT for learners with visual impairment during their teacher education?

7. What were the hindrances towards teaching prospective teachers how to use ICTs as pedagogical tools during teaching as you underwent your preservice teacher education?

(iii) Teacher educators' engagement in ICT for learners with visual impairment teaching and competencies development

8. What were your teacher educators' views towards the teaching of the use of ICT for learners with visual impairment to student teachers in the college?

9. Why do you think, it is important to teach a prospective teacher how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teaching as they undergo their preservice teacher education?

10. How can your teacher educators help you to combine the ordinary ICT knowledge and practice and ICT knowledge and practice for learners with visual impairment as you undergo your preservice teacher education?

11. What do you think are the positive effects for teachers to be taught ICT for learners with visual impairment?

12. What are the challenges to successful teaching of ICT for learners with visual impairment in PTCs in Uganda?

13. What interventions do you suggest should be made to make the teaching of ICT for learners with visual impairment among the prospective teachers successful in PTCs?

(iv) Institutional collaboration during teaching prospective teachers how to use ICTs as pedagogical tools

How are the following institutions collaborating to see to that ICT for learners with visual impairment is taught to prospective teachers?

14. Ministry of Education and Sports (MoES) with Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind and Primary teachers' Colleges?

15. Ministry of Information and Communication Technology (ICT) with the Ministry of Education and Sports (MoES), Uganda National Association of the Blind and Primary teachers' Colleges?

16. Uganda National Association of the Blind (UNAB) with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES) and Primary teachers' colleges (PTCs)?

17. Primary teacher' colleges with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES) and Uganda National Association of the Blind (UNAB)?

Thank you for participating in this interview.

Appendix IV: Interview guide for the Official from UNAB

As part of my Doctor of Philosophy in education, I am undertaking a research project titled ***"Teaching information and communication technology in primary teachers' colleges in Uganda to support children with visual impairment".*** *The project examines the computer competencies teacher educators find among student teachers and the kind of support teacher educators give to these students in primary teachers' colleges, among others. You were purposely sampled to participate in the study because it is presumed that you will give valuable information towards the teaching of the use of ICT in Primary teachers' college. This interview will take approximately 30 minutes or less.*

(i)   Background information on ICT teaching

1. What do you understand by the concept of ICT?

2. Explain about the prior ICT knowledge prospective teachers have before joining the primary teachers' college.

3. Which methods do you think are used while prospective teachers are being taught how to use ICTs as pedagogical tools during teaching after their preservice teacher education?

4. Name the ICT content that you think is taught to prospective teachers during their teacher education.

(ii)   Early career teachers' perceptions about learning ICT

5. What is your view towards the inclusion of ICT for learners with visual impairment into the preservice teacher education curriculum so that they can be taught how to use it while teaching?

6. How do you think prospective teachers can be helped to develop competencies in ICT for learners with visual impairment during their teacher education?

7. What do you think are the hindrances towards teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teaching as they underwent their teacher education?

(iii) Teacher educators' engagement in ICT for learners with visual impairment teaching and competencies development

8. What do you think are the teacher educators' views towards teaching the use of ICT for learners with visual impairment to prospective teachers?

9. Why do you think that it is important to teach a prospective teacher how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teaching as they undergo their preservice teacher education?

10. How do you think teacher educators can help prospective teachers to combine the ordinary ICT knowledge and practice and ICT knowledge and practice for learners with visual impairment as they (prospective teachers) are undergoing their teacher education?

11. What do you think are the positive effects for prospective teachers to be taught ICT for learners with visual impairment?

12. What could be the challenges to successfully teach prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teaching as prospective teachers undergo their teacher education?

13. What interventions do you suggest should be put in place to make the teaching of prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment during teaching successful?

(v) **Institutional collaboration in teaching prospective teachers how to use ICTs as pedagogical tools towards facilitating conducive learning environments for learners with visual impairment.**

How are the following institutions collaborating to see to it that ICT for learners with visual impairment is taught to prospective teachers?

14. Ministry of Education and Sports (MoES) with Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind, and Primary Teachers' Colleges?

15. Ministry of Information and Communication Technology (ICT) with the Ministry of Education and Sports (MoES), Uganda National Association of the Blind, and Primary Teachers' Colleges?

16. Uganda National Association of the Blind (UNAB) with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES), and Primary Teachers' Colleges (PTCs)?

17. Primary Teachers' colleges with Ministry of Information and Communication Technology (ICT), Ministry of Education and Sports (MoES), and Uganda National Association of the Blind (UNAB)?

Thank you for participating in this interview.

Appendix V: Pilot study interview guide for the Deputy Principal (Academics)

1. Comment on the provision of ICT for persons with visual impairment in the teacher education curriculum.

2. How often do students access ICTs for persons with visual impairment even when they are not in the lecture?

3. Why, do you think, was ICT education for persons with visual impairment included in the primary teachers' college curriculum?

4. Which ICT software for persons with visual impairment is in the primary teachers' college curriculum?

5. Comment on the teaching of the above software to students?

6. How does the ICT tutor help student teachers achieve their full potential of teaching and learning ICT skills for persons with visual impairment?

7. What are your views towards the teaching and learning of ICT for persons with visual impairment to student-teacher during their teacher education while at college?

8. What do you think are the contributions of ICT for persons with visual impairment to student teachers after completing their teacher education?

9. What are your experiences from student teachers about the teaching and learning ICT for persons with visual impairment in your college?

10. Explain the availability of the above resource in your college:
    (a)   Power supply and its stability
    (b)   Computers and their applications
    (c)   Availability of technicians and other support personnel at college

11. What were your expectations as an administrator when this subject was introduced in the primary teachers' curriculum?

12. What barriers do you think the ICT tutor encounters in the teaching of ICT for persons with visual impairment to the student teachers in your college?

13. How does the tutor overcome the above barriers?

14. What are your suggestions to curriculum developers as regards the teaching and learning of ICT for persons with visual impairment in primary teachers' colleges?

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Appendix VI: Pilot study interview guide for the Teacher

1. Comment on the provision of ICT for persons with visual impairment in the teacher education curriculum.

2. How often were you accessing ICT for persons with visual impairment even when you were not in the lecture?

3. Why, do you think, is ICT education for persons with visual impairment included in the primary teachers' college curriculum?

4. Which ICT software for persons with visual impairment is in the primary teachers' college curriculum?

5. Comment on how you were taught (teaching techniques) the above software.

6. How were you helped to achieve their full potential of learning ICT skills for persons with visual impairment?

7. What are your views towards the teaching and learning of ICT for persons with visual impairment while you were at the primary teachers' college?

8. What do you think are the contributions of ICT for persons with visual impairment to student teachers in the primary teachers' colleges in Uganda?

9. What are your experiences while learning ICT for persons with visual impairment during your teacher education?

10. Explain the availability of the above resource in your college:
    (d)   Power supply and its stability
    (e)   Computers and their applications
    (f)   Availability of technicians and other support personnel at college

11. What were your expectations as an ICT student-teacher when this subject was introduced the first time during your teacher education?

12. What barriers do you encounter during the teaching and learning of ICT skills for persons with visual impairment during your lessons?

13. How did you overcome the above barriers?

14. What are your suggestions to curriculum developers as regards the teaching of ICT for persons with visual impairment in primary teachers' colleges?

Appendix VII: Pilot study interview guide for the Tutors

1. Comment on the provision of ICT for persons with visual impairment in the teacher education curriculum.

2. How often do students access ICTs for persons with visual impairment even when they are not in the lecture?

3. Why, do you think, was ICT education for persons with visual impairment included in the primary teachers' college curriculum?

4. Which ICT software for persons with visual impairment is in the primary teachers' college curriculum?

5. Comment on how you teach the above software to your students?

6. How do you help your student teachers achieve their full potential of teaching and learning ICT skills for persons with visual impairment?

7. What are your views towards the teaching and learning of ICT for persons with visual impairment during your teaching in primary teachers' colleges?

8. What do you think is the contribution of ICT for persons with visual impairment to student teachers during their education in the primary teachers' college?

9. What do you learn from students' experiences about learning ICT for persons with visual impairment?

10. Explain the availability of the above resource in your college:
    (g)   Power supply and its stability
    (h)   Computers and their applications
    (i)   Availability of technicians and other support personnel at college

11. What were your expectations as an ICT tutor when this subject was introduced in the primary teachers' curriculum?

12. What barriers do you encounter when learning ICT skills for persons with visual impairment to your student teachers?

13. How did you overcome the above challenges?

14. What are your suggestions to curriculum developers as regards the teaching and learning of ICT for persons with visual impairment in primary teachers' colleges?

Appendix VIII: Introductory Letter for research from UiO

UiO : **Department of Education**
University of Oslo

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To whom it may concern

Date: 28.11.2016
Your ref.:
Our ref.:

Confirmation

This is to certify that Mr. Joseph Odeke-Nato, born 17.04.1964, is a PhD candidate at the Department of Education, Faculty of Educational Sciences, University of Oslo, Norway. He is expected to finish his PhD degree within 01.08.2018.

As part of his PhD research project, Joseph Odeke-Nato is planning to conduct research fieldwork in Uganda starting December 2016.

We would greatly appreciate any assistance which may be given to Mr. Joseph Odeke-Nato in relation to his upcoming fieldwork.

Sincerely yours,

Olga Mukhina
Senior Executive Officer
Department of Education
University of Oslo

2285 42 86, olga.mukhina@iped.uio.no

Appendix IX: Self-introductory letter

UNIVERSITY OF OSLO
FACULTY OF EDUCATIONAL SCIENCES
Department of Education

Boks 1074 Blindern
0316 Oslo, Norway

01st June 2016

Supervisors

Assoc. Prof. Heidi Biseth
University College of Southeast Norway,
Faculty of Humanities, Sports and Education,
Department of Human Rights, Religion and Social Sciences
Phone: +4731008772/+4795995313
E-mail: Heidi.Biseth@hbv.no

Prof. Eevi Elisabeth Beck
University of Oslo
Department of Education
Post Box 1092 Blindern 0317 OSLO
Phone: +47-22854259
E-mail: e.e.beck@iped.uio.no

The Principal
Canon Apollo Primary Teachers College, Kabarole
P. O. Box
Fort Portal

Dear Principal,

Re: Identification of your College for Main Study

As part of my Doctor of Philosophy in education, I am undertaking a research project titled "**Teaching and Learning of Information and Communication Technology (ICT) in Primary Teachers' Colleges (PTCs) in Uganda".** …. Primary Teachers College, in … district, and …. primary teachers, college in …. the district has been identified as the colleges to participate in the study. The study targets early career teachers who completed from the above college between 2013 to 2018, the teacher educators from the above colleges, an official from the organization of the blind and the curriculum developers.

Your college, being the curriculum implementer and assessor is beheld as one of the primary respondents of the study. I will provide the college with a copy of the summary of the Data. However, data will be aggregated such that participants and participating colleges cannot be identified. If you would like to get a summary of the final results, they will be available in the final

report after August 2018 which will be delivered into the libraries of the two primary teachers' colleges.

I will provide the district with a copy of the summary of the Data; however, data will be aggregated such that individuals cannot be identified. If you would like a summary of the final results, they will be available in the final report after August 2018.

Thank you for considering your college to participating in this study. If you have any questions about my study, please contact me or my supervisors at the above address.

Your participation is highly appreciated.

………………………………………
Odeke-Nato Joseph
Ph.D. candidate, University of Oslo, Norway

Off: +47 228 40 716 (Norway)
Mob.: +47 465 73 664 (Norway)
      +47 467 20 843 (Norway)
      +256 772 902 425 (Uganda)
      +256 704 647 432 (Uganda)
      +256 704 066 812 (Uganda)
E-Mail: jodekenato@yahoo.com
      j.n.odeke@iped.uio.no
      jodeke-nato@kyu.ac.ug

UNIVERSITY OF OSLO
FACULTY OF EDUCATIONAL SCIENCES
Department of Education
Boks 1092Blindern

0316 Oslo, Norway

18 April 2016

Supervisors

Assoc. Prof. Heidi Biseth
University College of Southeast Norway,
Faculty of Humanities, Sports and Education,
Department of Human Rights, Religion and Social Sciences
Phone: +4731008772/+4795995313
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Prof. Eevi Elisabeth Beck
University of Oslo
Department of Education
Post Box 1092Blindern
0317 OSLO
Phone : +47-22854259
E-mail: e.e.beck@iped.uio.no

Dear Participant,

Re: Consent Form for Participants

As part of my Doctor of Philosophy in education, I am undertaking a research project titled "**Information and Communication Technology (ICT) in Teacher Education: An Analysis of the Teaching and Learning of ICT for Learners with Visual Impairment in Ugandan Primary Teachers' Colleges".** The project examines the digital competencies teacher educators find among student teachers and the kind of support teacher educators give to these students in primary teachers' colleges, among others. You were purposely sampled to participate in the study because it is presumed that you will give valuable information towards the teaching of the use of ICT in Primary teachers' college. This interview will take approximately 90 minutes or less.

Your participation is completely voluntary and there will be no negative consequences as to you not participating. The information you are giving will be audio-recorded. These recordings are only a support for me in working with the material and I will be the only one accessing these recordings. They will be deleted at the end of the project.

During the interview, you will have the opportunity to supplement and clarify the information. At any time you can end the interview and withdraw from the project without providing any reason and without any consequences for you.

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I will provide the college with a copy of the final report; however, data will be aggregated such that individuals cannot be identified. If you would like a summary of results, they will be available in the final report after August 2018.

Before I begin the interview, I kindly request you to sign the consent form.

Thank you for considering participating in this study. For further inquiries about my study, please contact me or my supervisors using the above address. Your participation is highly appreciated.

………………………………………
Odeke-Nato Joseph
(Ph.D. Candidate)

Participant's Consent

I have read and understood the above. I agree to participate in this study.

[ ] Yes, I/we permit the interview data and audio-visual material (picture and video) collected to be applied in the research project. The data is anonymized to project completion (01.08.2018).

…………………………………….
Signature of respondent

Date: _____ / _____ / _____

Appendix XI: Letter of appreciation to the college Principal

UNIVERSITY OF OSLO
FACULTY OF EDUCATIONAL SCIENCES
Department of Education

Boks 1092 Blindern
0316 Oslo, Norway

8 August 2016

The Principal
Canon Apolo PTC, Kabarole
P. O. Box
Fort Portal

Appreciation for Allowing Me to Carry Out Data Collection in Your College
This is, to most sincerely, state that I thank you for accepting me to carry out data collection in your institution for the last two months.
I would like to assure you that the findings of the study which your institution actively participated in through the interview will be used twofold: first for purposes of the study. Secondly, to plan, implement, promote, and enhance the teaching of ICT for persons with visual impairment not only in participating college but in all primary teachers' colleges in Uganda.
May I further reassure you, as I had done before and after the interview that all the information that was given is and will be kept confidential. No records, whatsoever, will be kept with the names or that of the district.
Thank you, once more for your co-operation.
Yours sincerely

Odeke-Nato Joseph
Ph.D. Candidate
University of Oslo
Norway.

Appendix XII: **Letter of appreciation to the District Education Officer**

UNIVERSITY OF OSLO
FACULTY OF EDUCATIONAL SCIENCES
Department of Education

Boks 1092 Blindern
0316 Oslo, Norway

8 August 2016

District Education Officer
Kabarole District
P. O. Box
Fort Portal

Appreciation for Allowing Me to Collect Data in Your District
This is, to most sincerely, state that I thank you for accepting me to carry out data collection in institutions in your district for the last two months.
I would like to assure you that the findings of the study which your district actively participated in through the interview will be used twofold: first for purposes of the study. Secondly, to plan, implement, promote, and enhance the teaching of ICT for persons with visual impairment not only in participating college in your district but to all primary teachers' colleges in Uganda.
May I further reassure you, as I had done before and after the interview that all the information that was given is and will be kept confidential. No records, whatsoever, will be kept with the names or that of the district.
Thank you, once more for your co-operation.
Yours sincerely

Odeke-Nato Joseph
Ph.D. Candidate
University of Oslo
Norway.

Appendix XIII: Letter of appreciation to the participants

UNIVERSITY OF OSLO
FACULTY OF EDUCATIONAL SCIENCES
Department of Education

Boks 1092 Blindern
0316 Oslo, Norway

8 August 2016

Mr./Mrs/Ms/Prof./Dr. _____
_____
_____

Appreciation for your Participation
This is, to most sincerely, state that I thank you for accepting to take part in the study which I conducted in your district/college/university for the last two months.
I would like to assure you that the findings of the study which you actively participated in through the interview will be used twofold: first for purposes of the study. Secondly, to plan, implement, promote, and enhance the teaching of ICT for persons with visual impairment not only in participating college but in all primary teachers' colleges in Uganda.
May I further reassure you, as I had done before and after the interview that all the information you gave is and will be kept confidential. No records, whatsoever, will be kept with your name or that of the district/school/college/University.
Thank you, once more for your co-operation.
Yours sincerely

Odeke-Nato Joseph
Ph.D. Candidate
University of Oslo
**Norway.**

Appendix XIV: Canon Apollo PTC General Time Table 2017

CANON APOLO CORE PRIMARY TEACHERS' COLLEGE
GENERAL TIME TABLE 2017

DAYS	CLASS	8:00 9:00	9:00 10:00	10:00 11:00	11:00 11:15	11:15 12:15	12:15 1:15	1:15 2:15	2:15 3:15	3:15 4:15	4:15 5:15	5:15 6:15
MONDAY	1A	ENG 17	MTC 06	SST 08	B	L.L 07	I.SCI 19	L	MUS 03	KISW 26	RE 04	GAMES AND SPORTS
	1B	R.E 04	ENG17	MUS 03		1.SCI 19	L.L 07		MTC 06	AGR 28	IPS 09	
	1C	MUS 03	SST 08	MTC 06		ENG 17	1PS 09		AGR 28	L.L 07	I.SC 19	
	2A	MTC 05	ICT 27	IPS09/AG28		PES 25	KISW 26		I.SCI 19	ENG 23	KISW 26	
	2B	I.SCI 19	MTC 05	ICT 27		KISW 26	PES 25		ENG 23	R.E 04	AGR 28	
	2C	SST 08	KISW 26	I.SCI 19		MTC 05	ENG 23		PES 25	ICT 27	ECD 10	
TUESDAY	1A	ASSEMBLY	I.SCI 18	ENG 21	R	PES 02	ECD 21	U	IPS 09	MTC 06	R.E 04	GAMES AND SPORTS
	1B		MTC06	PES 02		ECD 21	SST 22		L.L 07	IPS 09	I.SCI 18	
	1C		ENG 21	MTC 06		I.SCI 18	PES 02		ECD 21	SST 22	IPS 09	
	2A		PRINCIPAL'S LECTURE			SST 22	R.E 04		PES 25	I.SCI 18	ICT 27	
	2B					PES 25	I.SCI 18		KISW 26	PES 02	AGR28/IPS	
	2C					PES 02	PES 25		I.SCI 18	ECD 21	SST 22	
WEDNESDAY	1A	IPS 09	SST 22	PES 25	E	KIS 26	ECD 10	N	ENG 17	L.L 07	1.SCI 19	Community Service.
	1B	R.E 04	PES 25	ECD 10		ENG 21	SST 08		MUS 23	1.SCI 19	KISW 26	
	1C	P.E 12	ECD 10	MUS 23		I.SCI 19	PES 25		KISW 26	R.E 04	AGR 28	
	2A	PES 20	I.SCI 19	KISW 30		PES 02	MTC 05		P.E/MUS23	SST 08	ENG 21	
	2B	I.SCI 19	PES 20	AGRIC 28		MTC 05	KISW 30		ENG 21	AGR 28	SST 22	
	2C	ENG 21	KISW 30	MTC 05		SST 08	I.SCI 19		ECD 10	PES 20	R.E 04	
THURSDAY	1A	IPS 13	I.SCI 18	AGRIC 28	A	ICT 15	ICT 15	O	PES 20	MTC 05	P.E 12	GAMES AND SPORTS
	1B	ENG 17	PES 20	I.SCI 18		P.E 12	IPS 13		MTC 05	SST 22	AGR 28	
	1C	SST 22	IPS 13	PES 20		I.SCI 18	R.E 04		ICT 15	ICT 15	MTC 05	
	2A	IPS11/AG	KIS 26	ICT 27		SST 08	P.E/MSE29		MTC06	ENG 17	AGR 28	
	2B	ENG 17	ICT 27	SST 08		KISW 26	SST 08		P.E/L.L	MTC06	ICT 27	
	2C	I.SCI 18	MTC06	KISW 26		L.L/P.E12	ICT 27		ICT 27	KISW 26	ENG 17	
FRIDAY	1A	ENG 23	PES 14	SST 22	K	AGR 28	ECD 10	H	MTC 05	MUS 23	P.E 12	GAMES AND SPORTS
	1B	MTC 05	ENG 23	ECD 10		PES 14	P.E 12		ICT 15	ICT 15	KISW 26	
	1C	PES 14	MTC 05	P.E 12		ECD 10	ENG 17		ENG 23	KISW 26	L.L 07	
	2A	I.SCI 18	KIS 30	MTC06		ENG 17	R.E 04		ENG 07	PES 20	AGR28/IPS	
	2B	KISW 30	PES 20	ENG 17		I.SCI 18	MTC 06		P.E 12	ENG 07	R.E 04	
	2C	ENG 17	MTC06	KISW 30		R.E 04	PES 20		ECD 10	PE 12/LL	ENG 07	

Source: Canon Apollo PTC Library

Appendix XV: A map of Uganda showing the location of the first special school and units (annexes) for children with visual impairment
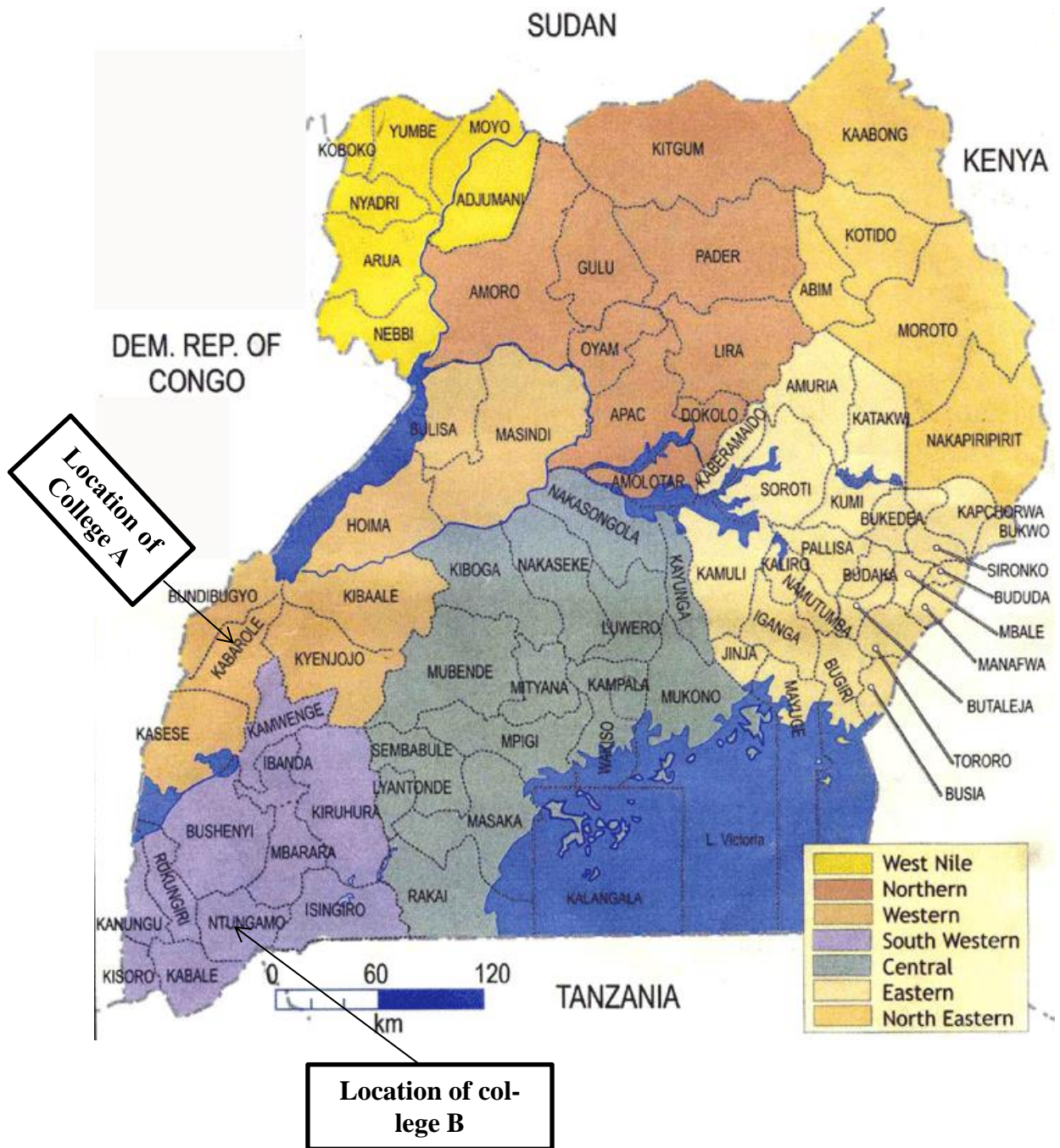
Source: online.

Errata list

Name of candidate: Odeke-Nato Joseph

Title of thesis: **Information and Communication Technology (ICT) in Teacher Education**

Towards facilitating conducive learning environments for learners with visual impairment

Abbreviations for different types of corrections:

Cor – correction of language

Cpltf – change of page layout or text format

Page	Original text	Type of correction	Is corrected to read
IV	to reforms …………	Cor.	… to the reforms that are taking place ….
IV	n order to find out how…..	Cor.	with the intention of finding out how …..
IV	…Actor-Network Theory (ANT) because it (ANT) is ….	Cor.	… Actor-Network Theory (ANT) because ANT guided studies are interested in …
IV	experience findings that ICT is being to prospective teachers ….	Cor.	… findings that showed that ICT is being to prospective teachers …..
IV	… the Ministry of Education and Sports (MoES), the Ministry of Information and Communications Technology (MoICT), the Uganda National Association of the Blind (UNAB), and the primary teachers' colleges …	Cor.	…. Ministry of Education and Sports (MoES), Ministry of Information and Communications Technology (MoICT), Uganda National Association of the Blind (UNAB), and primary teachers' colleges ….
1.	…. their teacher education …….	Cor.	… their preservice teacher education …
2.	…. the increased importance of ICT….	Cor.	… increasing importance of ICT ….
2.	… helping professionalism ….	Cor.	… professional …
3.	.. spending by governments…	Cor.	and spending by government …

4	therefore, though more indirectly, …	Cor.	and, though more indirectly, ….
5.	ICT teaching involves giving strategies ….	Cor.	Notwithstanding, ICT teaching in teacher education should involve teaching prospective teachers strategies……
5.	This is not different from the Ugandan context in that ICT teaching in teacher education involves …….	Cor.	This should not be different in the Ugandan context whereby, if possible, ICT teaching in teacher education could involve …..
6.	Felder and Brent say whereas ….	Cor.	Felder and Brent further say that whereas …
6.	… towards facilitating ……	Cor.	…. facilitate ….
7.	… showing great interest in and motivation to learn about computer education which in most cases ICT….	Cor	… showing great interest in and are motivated to learn about computer education which in most cases is ICT ….
7.	… on modern ….	Cor.	…. in modern …
8.	Ahmed et al., 2019Sharnma, 2003;	Cor.	Ahmed et al., 2019; Sharnma, 2003;
7	… in this section 1.4 of this study	Cpltf	Below
12	noted	Cor.	Note
12	This study aimed to investigate …	Cor	The aim of this study was investigate ………
12.	… is gained or promoted….	Cor.	… are gained or promoted
13	… an emphasis….	Cpltf	…. a focus …..
19.	…. the research design,		on the research approach and design
40.	teacher's …	Cor.	teachers' ….
40.	… make …..		…. made …
63.	… (Johannesson et al., 2012) …	Cor,	… Johannesson et al.,(2012) …
67.	Revolved	Cor.	Gyrate
67.	… in a place ….	Cor.	in place …..
73.	…. brought …..	Cor.	…. be brought …
76.	…. whereby all of them …..		….. each of them ….
86.	This study is a qualitative research approach, ……..	Cpltf	Although this study was using a qualitative research approach (as described in 5.3 below)…..
86.	Presented	Cor.	Described
86.	qualitative approach	Cor.	qualitative research

			approach
92.	Out of the 16 …	Cor.	Out of these 16 ……
92.	In the table below,	Cor.	In table 2 below,
93.	learned ICT or not learned it, were not ….	Cor	learned ICT or not, they were not …..
94.	….. ICTs that is appropriate and could be taught to prospective …..	Cor.	…. ICTs that are appropriate towards the teaching and learning of persons with visual impairment and could be taught to prospective…
94.	… involved ….	Cor.	…… is, sometimes, involved ….
96.	…… were selected ……	Cor.	….. were considered t ….
145	…participants' views are …..	Cor.	… participants' views were …
145	come to colleges	Cor.	came to colleges
148	we are living in a changing world in that there are rapid technological changes taking place	Cor.	It is important to note that we are living in a changing world where there are rapid technological changes taking place
150	I agree with the above statement that during the pilot study …..	Cpltf	I approve the above findings because during the pilot study …….
152	Develop	Cor.	acquire.
153	… if they make the teaching of ICT compulsory at every level, its teaching would be prioritized	Cpltf	… if ICT teaching is made compulsory in all institutions of learning,, its teaching may be prioritized in the primary teachers colleges.
155.	…. test learners' …..	Cor.	… test prospective teachers' …..
155.	Learners	Cor.	This word was deleted