INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN NATIONAL TEACHERS' COLLEGES IN UGANDA

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Doctor of Philosophy in Education (Curriculum and Teaching)

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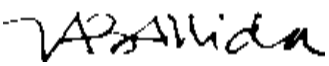
Approval Sheet

This dissertation entitled Integrating Information and Communication Technology in Teaching and Learning in National Teachers' Colleges in Uganda, written and submitted by Nyakito Charles, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education (Curriculum and Teaching) is hereby accepted and approved.



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Abstract

The purpose of this study, which was underpinned on the theories of Technology Acceptance Model (TAM) and theory of self-efficacy, was to investigate the level of ICT integration and the factors that influence its integration in the instructional practices of the teacher educators in the National Teachers' Colleges in Uganda. Using a concurrent triangulation mixed-method research design and purposive sampling strategy, the researcher collected and triangulated data from multiple sources: questionnaires with 253 teacher educators, focus groups with 40 teacher educators, interview with 4 Principals and observation of 4 lessons. Spearman's coefficient of correlation, multiple regression, Mann Whitney U and Kruskal Wallis were computed to analyze data. The results revealed: a) a low level of ICT integration in teaching and learning, b) a significant positive relationship between the level of ICT integration and the teacher educators' attitudes (r=0.12), self-efficacy (r=0.75), college ICT vision (r=0.28), administrative support (r=0.21), technical support (r=1.00) and college ICT policy issues (r=1.00), and c) significant differences in the level of ICT integration attributed to gender, age, teaching experience and ICT training. The researcher crafted a LEISURE model of ICT integration and recommended continuous professional development opportunities, peer coaching and mentorship, review of teacher education curriculum, regular support supervision, benchmarking between colleges, and development of college ICT vision and policy.

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I am deeply indebted to the following: First and foremost, to my Lord and my God Almighty for being with me and particularly carrying me and directing me in each step of this journey. Each time I consulted Him, doors were opened so wide that I had no doubt He was in-charge. To God be all the glory and praises for this achievement.

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Dedication

To my wife, Joyce, my partner in marriage for 36 years now, for her love, patience, and dedication to me; and to our children and grandchildren, to whom I now hand over the baton to complete the educational race to the finishing point - professorship.

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List of Abbreviations

ASTC:	Association of Science-Technology Centers.
BECTA:	British Educational Communications and Technology Agency.
CK:	Content Knowledge.
GoU:	Government of Uganda.
ICT:	Information and Communication Technology.
IT:	Information Technology.
MoES:	Ministry of Education and Sports.
NTC:	National Teachers' College.
OTA	Office of Technology Assessment.
PCK:	Pedagogic Content Knowledge.
PK:	Pedagogic Knowledge.
SAITIS:	South African Information Technology Industry Strategy.
TCK:	Technological Content Knowledge.
TK:	Technological Knowledge.
TPACK:	Technology Pedagogic and Content Knowledge.
TPK:	Technology Pedagogic Knowledge.
TVET	Technical and Vocational Education and Training.
UNESCO:	United Nations Educational, Scientific and Cultural Organization.
UNESCO CFIT:	United Nations Educational, Scientific and Cultural Organization/China Funds In Trust

CHAPTER ONE

INTRODUCTION

Background of the Study

In this 21st century it has become increasingly important that school teachers are able to proficiently integrate ICT in their teaching and learning practices (Robinson & Aronica, 2015; Spector, 2010). Teacher training institutions, therefore, are expected to train teachers who are capable of integrating ICT in their instructional practices. The emphasis on ICT-mediated learning has been made based on the assumption that ICT-rich learning environments provide opportunities for students to acquire 21st century skills and competencies such as problem solving, collaboration, digital literacy, critical thinking, creativity and media literacy. As a result, teacher education institutions are now faced with the challenge to restructure their curriculum to be able to train teachers who can successfully integrate ICT into teaching and learning practices (Sang et al, 2010; Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010; Tomte, Enochsson, Buskqvist & Kavstein, 2015).

According to Lawrence & Tar (2018), the embracement and infusion of technologies into the instructional process provides more benefits for educational practitioners, including teachers and students to thrive in a worldwide digital era and to access

knowledge and keep up with modern developments. Through the adoption and integration of technologies, which enable higher-order abilities such as resolving challenging real-world problems and the advancement of other 21st century talents, new educational methodologies to classroom instruction are feasible. (Knezek & Christensen, 2016). Internet resources such as information superhighways are available where educationists can gain access to and share research and course content in real time (Suárez, Almerich, Orellana & Díaz, 2018).

Lee (2017) observed that Information and communication technology (ICT) has become a more ubiquitous element in our society and educational settings are undergoing transformation where educators and students are expected to teach and learn using this new technology irrespective of the subject area. Pelgrum (2011) stated that using computers could revolutionize an outmoded educational system, better prepare students for the information age and accelerate national development efforts. Cuban (2001) considered computers a vehicle for reforming educational practices, to be used as an instructional tool by teachers at all levels of education. McAllister & Mitchell (2018) added that using computers will make the learning process exciting for both students and teachers.

The electronic era pervades all spheres of human endeavour (Ga`ová, Mi`ík & 'Tofková, 2018). Ocaña, Valenzuela & Garro (2019), assert that contemporary trends require information literacy from employees, including better access for consumers and business to online goods and services, and rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and

smart automation. If people can understand the practical utility of digital technologies and even be able to utilize them in practical situations, will determine the employment potential of the technologies (Area, 2018; Mavrou & Loizou, 2017). Colchester, Hagras, Alghazzawi and Aldabbagh, (2017) claim that the procurement, recharging and deepening of advanced digital skills is one of the requirements for a person to thrive in the network society and knowledge based economy.

Inspite of efforts to digitalize learning in educational institutions, a number of international and local studies have reported that school teachers lack the necessary skills to use ICT as a pedagogical tool in the teaching and learning process (Ndibalema, 2014; D'Aprile, 2017). Students are still taught how they were taught in the 1950s, many decades earlier, because of the inadequate use of ICT as a pedagogical tool (Eyyam & Yaratan, 2014). Although the influence and development of ICT within society is dramatic, many classrooms, staff rooms, schools and colleges appeared to work in an incredibly similar way to those of 20 years ago (Ndibalema, 2014). Actually latest scholars and researchers such as Ocaña, Valenzuela and Morillo, (2020) agree that the reality about the inadequate access to customized knowledge, skills and support for the utilization and integration of technology is a challenge that many third world countries are grappling with.

Although there is no single factor in isolation that plays a role in influencing the teacher educators' integration of ICT in teaching and learning in their classes, there are few studies examining the factors from a holistic perspective (Kombo, 2013; Norton, McRobbie, & Cooper, 2000). Thus, there is a need for further studies to delve into the

components that impact the teacher educators' integration of technology in their instructional practices from a holistic perspective.

A Condie and Livingston (2017) study found that whereas some teachers are still hesitant to experiment with new technologies, others are wary of trying new methods that they consider may have a negative effect on the results of the exams. Using technology to facilitate learning and teaching and using more socio-constructivist techniques tends to be viewed by a few teachers as risky methods and that they would rather adopt tried and tested methods that they consider allow them to more easily predict and influence performance.

The Malaysian education system is designed, in line with globalization and the information highway, to educate students to become potential technology-savvy, creative and knowledgeable workers with technological know-how (Ghavifekr & Sufean, 2010). This is intended to encourage the state to be more innovative and successful in today's globalization (Abas, 2009). Therefore, one of the core elements of strategic planning for ICT integration into the Malaysian education system is the need for an effective ICT-based curriculum. This will ensure that technology investment decisions are tailored and strategically prepared within the system (Suhaimi et al., 2007).

A study by Almadhour (2010) on the incorporation of ICT into pedagogy by school teachers in teaching in New Zealand, recognized tools as pedagogical tools like the Internet, digital cameras, film, video cameras and video players. The cameras were only used to produce photos and videos of the events examined. Similar findings were revealed by Afamasaga-Wright (2008) study on teacher perceptions of ICT in schools in

Samoa that the net was mostly used by teachers to search for teaching knowledge. The analysis showed that there were also videos used.

Teo (2006) conducted a study in Singapore on the observations of ICT-mediated lessons that found many obstacles to teacher ICT-integration within the classroom. These obstacles included inadequate appointment of competent support personnel, insufficient appointment and training of ICT student assistants, insufficient time for teachers to plan ICT-mediated lessons, insufficient teamwork between teachers in the planning of ICT-mediated lessons, lack of support given by school leaders in resolving teachers' ICT issues, and insufficient training. The research, however, failed to illustrate the reality of the attitudes of teachers towards the use of ICT as a pedagogical instrument.

A research by Dirckinck-Holmfeld, Hodgson, Jones, de Laat, McConnell, & Ryberg (2010) in Cyprus found that curriculum and faculty manuals did not provide ICT integration; each learning unit lacked support materials. Therefore, teachers had to expend an enormous amount of time finding, analyzing, updating and modifying learning materials, activities and resources to fit their students' requirements as well as the curriculum. Peeraer and Van Petegem (2011) believed that the computer skills and faith in ICT use of teacher educators were major barriers to the use of ICT in teaching and learning. However, lack of exposure to lessons completely planned with ICT resources, lack of opportunities to venture with ICT, the need to practice in a technology laboratory, lack of teachers of educational technology, an examination-driven education system and learning to be informed just what was to be examined were part of the underlying reasons for the negative impression of the potential teachers' negative perceptions of ICT use

within the teaching and learning process (Hismanoglu, 2012).

Numerous reports, including Malapile and Keengwe (2014), have indicated that third world countries have fundamental problems such as poor country and community status and unemployment, and thus members of the general population are unable to afford costly technology and thus the government is unable to provide adequate funding for ICT infrastructure and teacher education on the way to using ICT. Ramorola (2013) emphasizes that the lack of consistent ICT policies, inadequate technology services in the classroom, the lack of trained ICT teachers, the lack of maintenance of available technology resources and lack of continuous teacher support are great obstacles affecting the incorporation of technology at the educational level. Bhuasiri et al. (2012) contend that the limited expertise and skills of teachers in digital technology are early obstacles to digital technology adoption in educational programs. Olutola and Olatoye (2015) stress that teachers' and students' access to digital technologies within and without the classroom influences the application of technology in pedagogy.

Instead of investing in the ideas of advanced countries, Khan et al. (2012) propose that third world countries should develop their ICT education policy, strategy and agenda on the basis of their context and carefully execute the policy to achieve their desired ICT objectives. As an example, a study by Nyarusy (2016) in Tanzania directing attention to the integration of ICT in teaching and learning in non-public secondary schools found that the foremost problem facing most of those schools was the inadequacy of economic resources. The problem was found to have caused a variety of other school issues, such as insufficient IT services, lack of IT staff, lack of internet access, and inadequate pay for

teachers. It was further discovered that the problems that hindered IT productivity in schools were power fluctuations, uncompleted syllabi and a few schools using old syllabi.

In Kenyan schools, ICT integration in teaching and learning has never been any better. Kombo, (2013) revealed that performance on ICT font had fallen below aspirations despite the Kenya government's effort and determination to pursue ICT as an instructional instrument. The report added that the slow incorporation of ICT into operations and programmes within the Ministry of Education's strategic plan for 2008-2012 was described as an area of major weakness within the ministry.

With the national ICT policy development process initiated in 1998 by the Uganda National Council of Science and Technology (UNCST), the development and growth of technology integration in education in Uganda begun (Torach, Okello & Amuriach, 2006). Five years later, in 2002, the UNCST sent to the cabinet a draft national ICT policy structure that was approved the following year. Therefore, a national ICT policy structure was adopted in 2003. Strategic Goal number 2 of this strategy emphasized the need to enhance literacy and develop capacity for human capital. The incorporation of ICT into mainstream education curricula, in addition to other literacy programmes, and ensuring equal access for pupils and/or students at all levels of education were among the strategies for achieving this goal (Uganda Ministry of Works, 2003).

On this basis, an ICT policy on the education sector was developed in 2005 to rationalize and harmonize uncoordinated and fragmented ICT-related activities/programmes within the education sector (Uganda, MoES Draft ICT Policy,

2006). The policy framework document acknowledged that Uganda would like to adopt the goal of lifelong education for all (Farrell, 2007). In addition, it was noted that the introduction of ICT into the teaching and learning process demanded modifications to more learner-centered and interactive teaching approaches, thereby redefining the teacher's task as a facilitator. It is however, almost two decades since the implementation of ICT policy; but it seems that what was specified simply remained on paper and has not been accomplished since many scholars have criticized the degree of competence of teachers in the employment of ICT as a pedagogical instrument in teaching and learning (Isaacs, 2007; Balanskat, Blamire, & Kefala, 2006) In this respect, it makes sense to point out that in Uganda, the use of ICT as a pedagogical method is not a standard practice in educational institutions such as the National Teachers' Colleges.

Statement of the Problem

The Government of Uganda (GoU) chose to adopt ICT with the partial objective of enabling the country to enhance and sustain growth, thereby reducing poverty (Uganda Ministry of works, 2003). The national ICT agenda, in pursuit of this goal, supports, among other things, the introduction of ICT into mainstream education. The Ministry of Education and Sports (MoES) therefore established an ICT strategy for education in order to help direct the introduction of ICT into education. Uganda's ICT education policy acknowledged the vital role of teachers in enforcing any initiative to reform education and pointed out that the main emphasis was to be on the teachers/trainers/lecturers and the curriculum they were required to adopt in ensuring that ICT was best used (Luwangula, 2011).

Despite the colossal expenditure on ICT infrastructural development, resources and professional development to improve the quality of teaching and learning in Uganda, Luwangula (2011) and Wells & Wells (2011) have observed that the enormous investment in education has provided little evidence of ICT acceptance and use in teacher training, especially in National Teacher's Colleges that provide training for would be secondary schools teachers.

Several demographic, attitudinal, infrastructural, and technical obstacles tend to be interconnected to impede the introduction of ICT into instructional pedagogy. These variables need to be considered and thoroughly explored in totality for the efficient integration of ICT. Previous researches have looked at these factors in isolation; making it difficult to see how some of the aforementioned factors would combine to either impede or enhance the integration process (Luhombo, 2015; Kolawole, Sunday & Ibatayo, 2015). In addition, there has not been any study conducted to establish the extent of ICT integration in teaching and learning in the National Teachers' Colleges (NTCs) neither has there been any study that explored the approaches that could be used to enhance ICT integration in the colleges. Therefore, the aim of this study was to examine, from a holistic perspective, the extent of ICT integration and the factors that hinder integration into the teaching and learning process at the National Teachers' College in Uganda, taking into account demographic, attitudinal, efficacy, infrastructural, technical, administrative, as well as policy issues and crafting a model that would enhance the integration process.

Research Questions

The purpose of this study was to explore the extent of ICT integration and the factors that affect the integration of ICT in teaching and learning practices in the National Teachers' Colleges in Uganda from a holistic perspective and craft a model that can help improve the practice. Six research questions have helped direct the research to that purpose:

1. What are the demographic characteristics of the teacher educators in the National Teachers' colleges in Uganda?

2. What are the levels of ICT Integration in teaching and learning among the Teacher Educators in the National Teachers' Colleges in Uganda?
3. Is there a statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and:
   (a) Their attitudes
   (b) Self-efficacy
   (c) College ICT vision
   (d) Administrative support
   (e) Technical support
   (f) Accessibility to ICT infrastructure
   (g) College ICT policy issues?
4. Are there statistically significant differences in the teacher educators' levels of ICT integration in teaching and learning attributed to the following demographic factors:

a) Gender

b) Age

c) Teaching experience

d) Qualifications

e) ICT training?

5. To what degree do the ICT-related factors predict the extent of ICT integration of teacher educators in the teaching and learning practices?
6. What are the perceived barriers to the effective integration of ICT in teaching and learning in the National Teachers' Colleges?

Hypotheses

The following null hypotheses were tested in the study:

H_{O1} There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and:

(a) Their attitudes

(b) Self-efficacy

(c) College ICT vision

(d) Administrative support

(e) Technical support

(f) Accessibility to ICT infrastructure

(g) College ICT policy issues

H_{O2} There are no statistically significant differences in the teacher educators' levels of ICT integration in teaching and learning attributed to the following demographic factors:

(a) Gender

(b) Age

(c) Teaching experience

(d) Qualifications

(e) ICT training?

Significance of the Study

The study was intended to be of considerable interest to educational policymakers, leaderships, practitioners, curriculum designers, and scholars.

1. The study will provide a standard model for ICT integration in teaching and learning for education policy makers that could be adopted for teacher education during pre-service and in-service teacher education programmes in Uganda.

2. This study will encourage local education leaders to be able to embrace ICT incorporation efforts by teacher educators in teaching and learning.

3. At the micro level, the proposed model for systemic and coordinated incorporation of ICT in teaching and learning will support individual practitioners, many of whom may have been innovating in their own classrooms and experimenting with the evolutionary approach through the haphazard integration of ICT into their own practice.

4. In line with the proposed model for ICT integration in teaching and learning, this study will help curriculum designers plan, create and generate relevant digital content for use in schools.

5. The results of this study will stimulate interest among other scholars who may undertake more studies in a similar field and articulately communicate the implications of the findings for both government as well as professionals.

6. This study will have a ripple effect from the teacher educators in the teachers' colleges to their products that become secondary school teachers and thus strengthen the instructional practices of secondary school teachers using ICT.

Justification of the Study

Governments the world over, have introduced global investment in ICT to improve teaching - learning process in schools. In the United Kingdom, for example, government spending on ICT education in the UK in 2015-2016 was £ 2.5 billion (Nut, 2010), in the United States, spending on K-12 schools and higher education institutions was $ 6 billion and $ 4.7 billion in 2016 (Nut, 2017) respectively, and in New Zealand, the government spends more than $ 410 million annually on ICT infrastructure in schools (Johnson, Calvert & Raggert 2009). In Uganda, the government allocated Shs149 billion to the ICT sector for the 2018/19 Financial Year (Asingwire, 2018). Gulbahar (2017) reported that despite all these investments on ICT infrastructure development, resources and teacher training to improve education in many countries, the enormous investment in education has not yielded a proportionate evidence of the adoption and use of ICT in teaching and learning, especially in developing countries.

Research indicates that a large part of the public purse has been and is being invested on the incorporation of ICT in education (Asingwire, 2018), but the implementation of ICT in the education sector has not gained a foothold as anticipated (Smarkola, 2016). A number of studies were conducted to analyze the variables associated with the integration of ICT in teaching and learning processes by teachers (Baek, Jung & Kim, 2018; Norton, McRobbie, & Cooper, 2000). In Uganda, however, hardly any research has been carried out to examine the factors that preclude the permeation of ICT integration into the education system. To justify the continued heavy government expenditure on ICT in education, such a study is necessary, considering that ICT is the vehicle for socioeconomic, educational as well as cultural transformation.

This study, therefore, was intended to explore the level of ICT integration and the factors affecting the integration in teaching and learning in Uganda's National Teachers' Colleges with the vision of creating a model that will be able to enhance the practice.

Theoretical Framework

Two theories from social psychological studies are considered to be extremely important in research where the personality characteristics of practitioners are centered on. One of these is the Technology Acceptance Model (TAM) Framework and the other is the self-efficacy theory.

Technology Acceptance Model (TAM) Framework

The Technology Acceptance Model (TAM) was initially conceived at the Massachusetts Institute of Technology as a PhD thesis by Fred Davis in 1985. Existing literature seems to indicate that TAM is a widely cited paradigm. Chuttur (2009) claims

that TAM's large acceptance is predicated upon the assumption that a sound theoretical premise and functional effectiveness are included in the framework. The framework was modified from the time it was proposed in 1985 to integrate factors and experiences from the Fishbein and Ajzen Theory of Reasoned Action (TRA) of 1975 (Priyanka & Kumar, 2013)

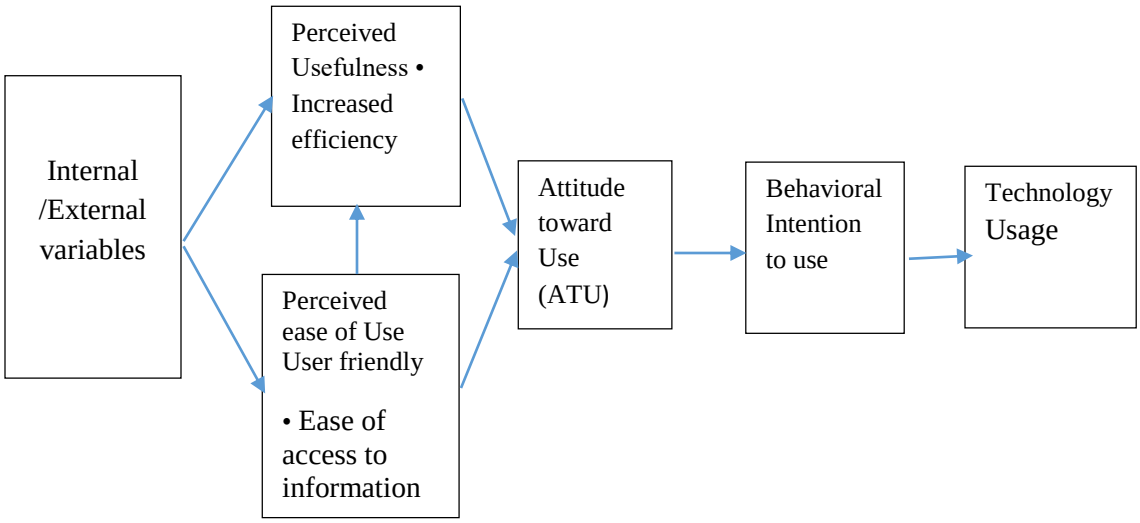

Figure 1: The Technology Acceptance Model

Source: Davis (1989) p.133

The model was proposed to demonstrate how a technology can be assented to and used by consumers. The conceptual underpinning is based on the assumption that three major determinants influence the decision on how and just when to use a new technology when consumers are confronted with it. Its perceived utility (PU) is the primary determinant, while the second is the perceived ease of use (PEOU), and the third is consumer attitude towards use (ATU).

Perceived utility (PU), according to Davis, (1989) and, Shroff, Deen, & Mee, (2011), is the extent to which a consumer assumes that utilizing a specific system will increase his or her employee productivity

Similarly, the perceived ease-of-use (PEOU) is the extent to which a consumer feels that it will be effortless to employ a given technology. In other phrases, the extent to which customers consider a technology to be superior to its equivalents (Park, 2009). Making comments on the model, Chen & Chang, (2015); Chen, Li & Li (2011); Park, (2009), expanded the claim that attitudes towards usage (ATU) of a technology are positively influenced by perceived utility (PU) and perceived ease of use (PEOU). The model in Fig. 1 will explain the relation between the determinants, as Davis suggested.

Moreover, certain essential variables affect both perceived ease of use and perceived usefulness. On the variables that dictate the utility and ease of use of a technology, numerous scholars have provided their recommendations. Asiri, Mohamud, Abu-Bakar & Ayub, as cited in Alharbi & Drew (2014), suggested two types of such variables: internal variables and external variables, when examining the adoption of Learning Management Systems at the University of Saudi Arabia. Internal variables accommodate variables like the user's mindset, their methodological values, and competency level. The researchers recognized that it is more probable that a positive attitude towards ICT motivates a person to use the technology. In addition, attitudes about e-learning have been found to be significant in influencing the utilization of a technology, in tandem with other researches. The researchers noted that the utilization of technology could be determined by the degree of competency, which means that its use would be influenced by possessing the expertise and experience to use a device. External variables, on the opposite side, include the external obstacles encountered by consumers during utilization like organizational, technological, and social barriers. Similarly, to predict technological use, demographic variables such as gender, ICT self-efficacy, and

levels of coaching (competency) are also employed.

The researcher has obtained an appropriate opinion from TAM's study that ICT could progressively gain entrance in teaching and learning and within the schooling institutions. Research results back up the claim that the technology not only tends to be beneficial, but also simple to use. There are difficulties in attitude, however, and scholars must struggle to cope with attitudinal challenges emerging from learners, staff, leadership, and decision makers. Hence, before ICT devices can be incorporated in any educational process, a scientific investigation must be carried out, driven by a suitable model of technology acceptance (TAM) in order to identify the factors that may impede the continued acceptance of innovations into the education system (s). This suggestion is in line with the Chen, Li, & Li (2011) studies, which clarify that determinants of ICT impressions need to be examined as an initial phase in the implementation of ICT at any educational level. These determinants are currently under investigation in the Ugandan educational system, especially at university level.

The Technology Acceptance Model (TAM), was considered particularly applicable in this study because it postulates that when users perceive that a type of technology is useful and also easy to use, they will be willing to use it. Consequently, the more teachers recognize that ICT will make their tasks easier to perform; the higher is the probability that they will use it and accept the new technology as being useful (Alharbi & Drew, 2014)

Theory of Self-efficacy

Many psychologists have addressed the notion of self-efficacy in respect to the performance of people at given tasks. Among these psychologists are Albert Bandura, Anita Woolfolk Hoy and Gibson & Dembo. The fore-coming content will try to describe the theories of Albert Bandura and Anita Woolfolk Hoy, as representative samples.

The theory of self-efficacy is of particular significance in this study because research has shown that a greater sense of computer self-efficacy influences the preference of teachers about computer use and adoption in education, not only how much ICT will be used in instructional practices but also how they are used (Surej, 2018; Chang & Tung, 2018; Papastergiou, 2010).

Bandura's Theory of Self-efficacy

Perceptions of self-efficacy are a vital component of human motivation and behavior and often influence the behaviors that will affect one's life. With regard to self-efficacy, Bandura (1995) notes that it "refers to beliefs in one's capabilities to organise and implement the courses of action required to manage eventual situations" (p. 2). More literally, self-efficacy is what an individual feels he or she would be able to do under certain conditions using his or her abilities (Frank, 2011). It was believed that self-efficacy was a task-specific variant of self-esteem (Lunenburg, 2011). The underlying concept behind the theory of self-efficacy is that people are more likely to participate in activities for which they are extremely self-efficient and are hesitant to participate in those for which they are not (Van der Bijl & Shortridge-Baggett, 2002).

People act in the manner that their initial convictions are implemented, as such, self-efficacy acts as a prophecy of self-fulfillment. Employee A, for instance, has a high capacity to design diagrams and a strong background, but does not have faith that he/she can design a leading diagram for a crucial meeting. Employee B has only the mediocre ability to design diagrams and only a limited level of experience, but he/she has great faith that he/she will be able to push for the aforementioned meeting to design a leading diagram. Because of the low self-efficacy of Employee, A for designing diagrams, he/she loses the motivation to design one for the meeting and informs his/her supervisor that he/she cannot compete for the assignment. Employee B is very driven thanks to her high self-efficacy, struggles tirelessly to learn how to design a diagram of prime quality, presents it at the meeting, and is rewarded with a promotion. Self-efficacy affects the willingness of people to explore, their enthusiasm and their accomplishment, because individuals frequently want to learn and perform only certain tasks they think will succeed (Lunenburg, 2011)

Self-efficacy assessments are typically defined on three fundamental scales: magnitude, strength, and generality. The magnitude of self-efficacy tests the level of complexity (e.g., simple, moderate, and complicated) an individual feel is appropriate to perform a specific task (Van der Bijl & Shortridge-Baggett, 2002). How challenging is the task? The strength of self-efficacy refers to the magnitude of confidence a person has to perform successfully at different levels of complexity (Van der Bijl & Shortridge-Baggett, 2002). For instance, how confident am I that I'm going to progress along the success ladder? The self-efficacy generality refers to the “degree to which the expectation

is generalized across situations" (Lunenburg, 2011, p.87). How certain am I that my new tasks will be covered by the capacity I have learned?

The underlying principle behind the theory of self-efficacy is that success and motivation are partly dictated by how effective individuals think they will be (Bandura, as quoted in Williams & Williams (2010). The principle is demonstrated clearly by Mahatma Gandhi's following quote:

"If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning" – Mahatma Gandhi

Computer self-efficacy does not apply to component abilities, such as the use of a specific software function or the start-up of a computer, but to the versatility of using one's capabilities while using technology for wider functions (Compeau & Higgins, as cited by Surej, 2018)

Anita Woolfolk Hoy Theory of self-efficacy

Albert Bandura pioneered the notion of self-efficacy more than twenty years ago, or "beliefs in one's capacity to rearrange and execute the courses of action required to come up with given attainments" (Bandura, 1997, p. 3). From that time, research has shown the intensity of efficacy perceptions in human learning, accomplishments, and motivation in many arenas. The sense of efficacy of teachers may be a reflection of the power to impact student involvement and learning, particularly among those students who are likely to be problematic or unmotivated (Hoy, 2004). Teachers with a powerful sense of efficacy tend to show higher levels of forethought, preparation, and excitement

and spend longer hours teaching in places where their sense of effectiveness is higher, whereas teachers tend to avoid subjects and topics when efficacy is lower. They seem to be more receptive to new ideas, freer to innovate with new approaches to satisfy their students' requirements, and more dedicated to teaching. And though things may not go perfectly, they endure and are more resilient in times of failures. They appear to be much less negative of learners who make errors and to assist more a learner who is tussling (Ashton & Webb, 1986; Coladarchi, 1992; Gibson & Dembo, 1984; Tschannen-Moran & Woolfolk Hoy, 2001).

In pre-college environments, Ross (1994), analyzed 88 teacher efficacy studies and established possible connections between the sense of efficacy of teachers and their behaviors. Ross indicated that the teachers with higher levels of efficacy are far more likely to (1) acquire and use new teaching approaches and strategies, (2) use leadership processes that maximize learner involvement, (3) offer special support to learners with low achievement, (4) develop learners' consciousness of their academic abilities, (5) set realistic goals, and (6) persevere even amidst learner disappointment.

Four sources of efficacy expectations were established by Bandura (1997): mastery experiences - the belief that teaching has been effective (mastery) increases hopes that teaching will be successful in the foreseeable future, unless the achievement needs such massive work that the person feels unable to maintain this degree of effort. The impression that one's teaching has been a failure decreases belief in efficacy, leading to the presumption that future performances will also be ineffective, unless the failure is seen as offering hints about methods that may be more effective. The feeling of superiority or inability may be enhanced by perceptions of emotions and physiological

arousal. Tension stimuli, for example, may also be viewed as fear and anxiety that failure is inevitable or as enthusiasm (i.e., being "psyched" for a decent class).

Vicarious experiences are those within which a competence is modelled by some other person. The closer the observer is to the model, the greater the effect on efficacy (Bandura, 1977). The effectiveness of the observer is increased when a credible model teaches well. If the model underperforms, the observer's aspirations decrease. Social or verbal encouragement can include "pep talk" or a boss, peer, or student providing feedback. Often, student assessment of instructions is a sort of verbal persuasion, for better or worse. While limited in its effect, social persuasion can provide a "boost" to offset periodic failures; the effectiveness of persuasion depends on the persuader's reputation, integrity, and competence (Bandura, 1986). The efficacy of teachers is extremely context-specific, too. For instance, a teacher who feels extremely efficacious in teaching his/her biology class may feel less efficacious in teaching sophomore grammar or the other way round. So, it is essential to evaluate one's positives and negatives on the basis of the necessities of the assignment at stake in drawing an efficacy decision.

One of the factors that makes teachers' efficacy decisions so effective is because of the cyclical nature of the procedure. Greater efficacy leads to greater commitment and determination, resulting in increased output (a new mastery experience), which results in greater efficacy successively. In contrast, the opposite is also true. Reduced efficacy induces less commitment and quick surrender, resulting in poor instructional results, thus producing reduced efficacy.

In conclusion, therefore, the concept of efficacy is definitely an important result of early educational experience that should be nurtured by specialized training that

enhances the pedagogical knowledge required, a diverse range of suggestions, and social support that perpetuates the consistent concerns of beginner teachers.

Conceptual Framework

The study identified a number of variables that could influence the integration of ICT in teaching and learning at the National Teachers' Colleges in Uganda. The conceptual framework (Figure 2) shows how the dependent variable is influenced by the independent variables. The independent variables were classified as internal and external factors.

The internal variables were broken down to include teacher educators' demographic characteristics (gender, age, teaching experience, qualifications), teacher educators' attitudes toward ICT integration, and self-efficacy. External variables were mainly environmental, such as ICT infrastructure accessibility, administrative and technical support, national ICT policy issues, and the college ICT Vision. The level of ICT integration in teaching and learning in the National Teachers' Colleges in Uganda is the dependent variable. A detailed discussion of the independent and dependent variables is contained in the review of related literature.

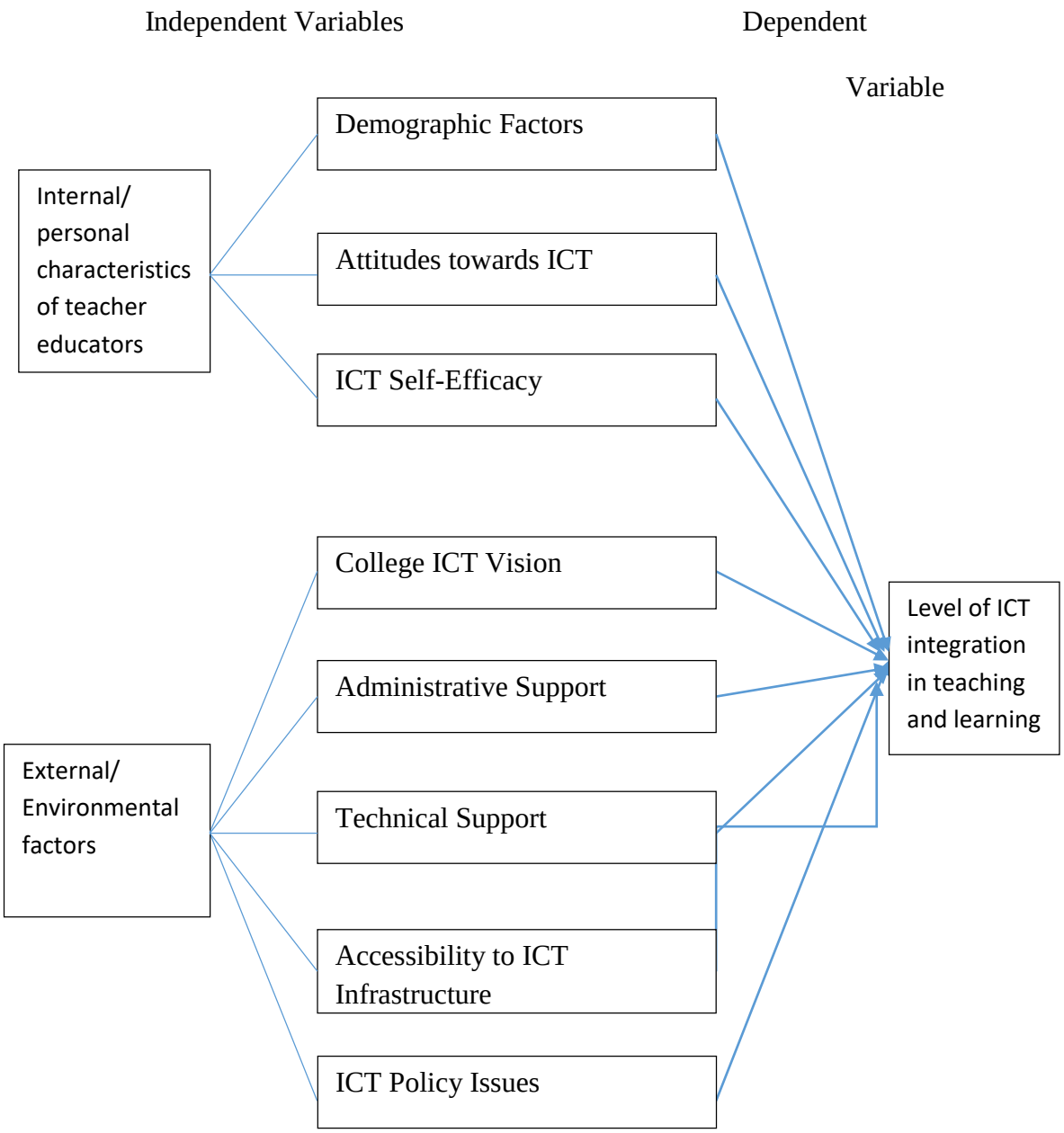

Figure 2: Conceptual Framework. Source: Conceptualized by the researcher (2019)

Scope of the Study

The research was conducted in four of Uganda's five National Teachers' Colleges. The investigator used questionnaires, focus group discussions, interviews and observation

as the data collection methods. Data was collected on the personal characteristics of teacher educators, including demographic details, attitudes towards ICT integration in teaching and learning, and the self-efficacy of ICT teacher educators. Data on school-related factors such as college ICT vision, administrative and technical support, ICT infrastructure accessibility, ICT policy issues and the level of ICT incorporation in teaching and learning were also collected. The data was collected in the months of February-April 2020.

Definition of Terms

The terms defined in this section of the dissertation are operationally defined as implied in the research context.

External Variables: Environmental variables or factors which could be school or technology related, and are external to the personal characteristics of the teacher educators such as access to the technology, Internet access, bandwidth, technology related training.

ICT Integrating: The act of infusing the different technological devices in the process of teaching and learning.

Information and communications technology (ICT): Refers to technologies that provide access to information through telecommunications; similar to Information Technology (IT), but focuses primarily on communication technologies, including the Internet, wireless networks, cell phones, computers, tablets, and other communication mediums.

Internal Variables: These variables or factors are embedded within the personal characteristics of the teacher educators such as their demographic characteristics.

LEISURE model: A seven components' approach to ICT integration involving ICT Literacy, Enriched ICT Environment, provision of Incentives, Support services, students and lecturers enhancing use of ICT in teaching and learning.

National Teachers' College: A Teacher training college in Uganda that trains teachers for lower secondary schools awarded Diploma in Education of Kyambogo University.

Teacher educators: Tutors or lecturers who teach teacher trainees in the National Teachers' Colleges

CHAPTER TWO

REVIEW OF RELATED LITERATURE AND STUDIES

By reviewing the literature from the fields relevant to the research topic, which includes the variables that have been found to affect ICT integration in teaching and learning, chapter two provides the framework for this review. In this regard, the literature review covered the following content areas: importance of ICT in education, influence of demographic factors, self-efficacy, school ICT vision, administrative support, technical support, accessibility to ICT infrastructure, ICT po!icy issues and popular models of ICT integration in teachings and learning. An attempt was made to search from multiple resources, including journals, dissertations, books, internet**,** and unpublished theses.

Importance of ICT in Education

Information and communication technologies (ICT) are becoming increasingly essential in people's day to day lives and in the global educational systems, as Lawrence and Tar (2018) point out. On the other hand, educational institutions are increasingly demanding that ICT be used to educate learners the skills and information they will need in the 21st century digital age (Knezek and Christensen, 2016). ICTs have a major influence on society and impacts every sphere of human effort. According to Kauffman and Kauffman (2017), in educational literature, the embracement and utilization of technologies in education continues to gain traction. The proliferation of the use of

computers in education is because a positive association has been realized between ICT integration and increased student learning (D'Aprile, 2017; Eyyam & Yaratan, 2014; Montgomery, 2017). Equally, when ICT was integrated in the teaching and learning engagements with learners, Higgins, Juscroft-D'Amgelo & Crawford (2019) found a significant positive influence on learning in the examination of 24 studies.

ICTs are potentially powerful tools for educational change and reform. When used appropriately, diverse ICTs are believed to help increase educational access, enhance the applicability of education to expand the digital workforce, and improve the quality of education by assisting in the transformation of teaching and learning into an interactive and active process connected to real life (Pedro, 2019). ICTs do not themselves enhance students' learning capabilities but teachers who use ICTs thoughtfully do. It's the teaching and learning requirement that need to stimulate ICT intervention, rather than the ICTs themselves (Baylor & Ritchie, 2012).

ICTs play a vital role in enhancing a person's skill of collaboration, information retrieval, social interaction and civic participation (Zhong, 2011). In the context of twenty-first century technological changes, the use of ICT is one of the competences for lifelong learning, which people need for personal fulfilment, active citizenship, social cohesion, and employability in a knowledge society (Grek, 2018). Use of ICT enhances students' knowledge and skills, fosters a collaborative learning environment (Wilson-Strydom, Thomson, & Hodgkinson-Williams, 2005) and motivates9 students towards the knowledge creation learning instead of memorization of facts and figures only (Naicker, 2020).

The integration of ICTs in education affects the educational process while dealing with key challenges of management, access, equity, pedagogy, quality and innovation. The growing trend of using ICT in teaching practice by teachers is likely to change the strategies employed by policy makers, educators and teachers in teaching and learning process (Snehi, 2017; Mbodila, Jones, & Muhandji, 2013). ICTs have the potential to enhance teachers' and learners' motivation, transforming teaching and learning process from being highly teacher-dominated to student-centered, and that this transformation results in increased learning gains for students; creating and allowing of opportunities for learners to develop their creativity, problem-solving activities, informational reasoning skills, communication skills and abstract thinking skills. Since students' performance is mainly explained by students' characteristics, educational environment and teachers' characteristics, ICTs may have a positive impact on these determinants and consequently the outcome of education (Charles & Issifu, 2019).

ICT has the great potential to bring about the educational reform, enhancing teachers' teaching practice, with ICT mediated lessons, redefining the roles of teachers and students in the teaching and learning process while creating a collaborative learning environment in classrooms (Khan, Hasan, & Clement, 2018).

ICTs have the capacity to invent, expedite, broaden, and deepen learners' skills, to inspire and engage learners, and to improve learners' academic performance and create economic viability for future workforce. This in turn would better prepare the learners for lifelong learning as well as to improve the quality of teaching and learning. ICTs can be

used to prepare the workforce for the information society and to meet the challenges of global economy.

Unfortunately, Hao and Lee (2015) reported that although ICT has the potential to positively influence teaching and learning in the classroom, it is currently underutilized in schools. Many teachers are still resistant to integrate ICT in their instructional practices even though infrastructural challenges have been addressed (Hao & Lee, 2015; Tondeur, et al, 2017; Zehra & Bilwani, 2016). Information search robots, search engines, interactive tools, platforms, and social networks are only a few examples of integrating technology, according to Nazir, Abdul, and Fozia, (2016). Meanwhile, Aguiar, Velázquez, and Aguiar (2019) discussed features of ICT integration such as competence, proactive incorporation, and motivation, emphasizing that these are critical factors that enable advanced learners to achieve educational quality in the new style of learning using ICTs. Melo (2018) defined ICT integration as knowing how to convey and integrate new technology trends, as well as how to get learners to obtain relevant information using ICT in the classroom, based on skills; it is built on a comprehensive, constructivist, integrative, scientific, and systemic posture.

The process of ICT integration in teaching and learning where the instructional manager plays a pivotal role is such a complex phenomenon (Suárez et al., 2018). Relatedly, Yu, Lin, and Liao (2017) have argued that many research studies have reported that both the personal and organizational factors like the way teachers perceive the usefulness of a given technology may influence the teachers' integration of technology in teaching and learning..Almerich, Orellana, Suárez, and Díaz (2016)

contend with the other researchers that the process of ICT integration in teaching and learning practices is indeed complex and challenging because the integration is often influenced by a multiplicity of factors.

Factors Associated with ICT Use

Several researchers have investigated factors that have a significant impact on the use of ICT in classroom instruction (Flanagan, & Jacobsen, 2003; Lim & Chai, 2008; Vanderlinde, & van Braak, 2010; Yuen, Law & Wong, 2003). Based on the literature, the factors that influence the holistic integration of ICT in the curriculum focus mainly on the characteristics of teachers, including gender (Tezci, 2011), teachers' attitudes towards ICT (Drent & Meelissen, 2008), teachers' pedagogical beliefs (Tondeur et al., 2016) and ICT training (Tondeur et al., 2017). However, other researchers have highlighted factors that influence the use of ICT and come from the wider environment of a school community (Flanagan & Jacobsen, 2003; Yuen, Law & Wong, 2003). They mention the school culture (Tezci, 2011), ICT educational policy (Tondeur et al., 2017; Vanderlinde, van Braak & Dexter 2012), ICT infrastructure (Tondeur et al., 2017) and institutional and technological factors (Buabeng-Andoh, 2012)

Demographic Variables as Determinants of ICT Integration in Teaching and Learning

Demographic characteristics refer to attributes that describe the status of people or a person such as age, gender, ethnicity, or income (Ghaleb, Abdoulaye, & Shorouq, 2021). This study used gender, age, teaching experience, qualifications and previous ICT training as the demographic characteristics. Prior studies have suggested that demographic characteristics such as these can have an impact on the teacher ICT performance (Christmann, 2017; Amparo et al., 2018). For example, gender (Islahi 2019; Tondeur et al. 2016), previous experience with technology (Ritzhaupt et al. 2012; Ifinedo et al.2020), and teaching experience (Inan and Lowther 2010) are among some of the factors demonstrated effective in technology use. For instance, female teachers' use of technology was reported lower compared to their male counterparts (Scherer and Siddiq 2015). Experience with technology is another important correlate of technology use in the classroom. Teachers having more frequent use of technology in the classroom have more experience with technology (Tondeur et al. 2016).

Teaching experience is also of utmost importance in the context of technology use. Most of the time, researchers provided evidence of non-significant direct effect of teaching experience on technology integration (e.g., Ritzhaupt et al. 2012). Russell et al. (2003), however, demonstrated how technology use for different purposes differed across years of experience in teaching: as teachers with 15+ years of experience used technology less compared to those who have 6–15 years of experience. Moreover, Inan and Lowther (2010) reported a significant indirect effect of years of teaching on technology

integration. Because these demographic variables were shown as factors in explaining teachers' use of technology, they were added to the conceptual framework.

Attitude as a Precursor of ICT Integration in Teaching and Learning

Attitude is regarded as a predisposition to respond to an item, individual, or event favorably or unfavorably (Ajzen, as cited in Guma, Haolader & Khushi, 2013). It would greatly rely on the attitudes of teachers in order to effectively introduce and enforce ICT in the school curriculum. The attitudes and values of teachers about technology are one of the influences impacting the effective introduction of ICT into teaching and learning (Hew & Brush, 2007; Keengwe & Onchwari, 2008). If the attitudes of teachers about the use of instructional technologies are supportive, then they can effectively offer valuable perspective into the implementation and application of ICT into teaching and learning processes. Many studies have emphasized the close association between technology-related beliefs and technology usage in school (Sang, Valcke, Braak & Tondeur, 2010; Tondeur, et al 2016). Technology beliefs impact the acknowledgement of the utility of technology by teachers and often determine whether teachers incorporate ICT into their classroom (Guma, Haolader & Khushi 2013).

The teacher's favorable or unfavorable attitude toward the use of ICTs influences their use; if the teacher shows a negative attitude toward them even though he or she is provided with excellent facilities; he or she will not use them in his or her session (Eger, Klement, Pisoňová and Petrová, 2018). Factors imbedded within the teacher like the teacher's age, gender, educational experience, knowledge of ICTs, and attitude toward ICT to a large extent govern the teacher's adoption and infusion of ICT in teaching and

learning (Lawrence & Tar, 2018). Eger et al. (2018) contend that a skilled and knowledgeable teacher is better placed to determine the value of ICT integration in the teaching and learning practices. Similarly, Pittman and Gaines (2015) asserted that the facilitation of classrooms with ICT resources will motivate teachers to use them thereby yielding a positive impact. Therefore, it is not just the mere existence of ICT infrastructure in the classrooms that will motivate the teachers to adopt and use them but the capacity and knowledge of the teacher to judge the practical utility of the ICT in the teaching and learning situation. (Picón, de Caballero & Paredes, 2020; Ocaña, Valenzuela & Morillo, 2020; Mavrou & Loizou, 2017).

According to Aslan and Zhu (2016), the instructional activities are represented by ICT factors (Prendes, Gutiérrez & Martínez, 2018 & Suárez, Almerich, Orellana & Díaz, 2018). Teachers are likely to adopt and integrate ICT into teaching and learning practices if they can realize that the integration of technology offers relative benefits over other pedagogies such as improving the quality of teaching and learning (Suárez, Flores & Peláez, 2019; Pereira & Castro, 2017; Alemu, 2015). According to Eynon and Geniets (2016), integrating ICTs into classroom instruction is incredibly challenging; these challenges dissuade teachers from embracing and incorporating them. Several scholars (Badia, Meneses, & Sigales, 2013, Bertram & Waldrip, 2013; Chen, 2010) have suggested that the attitudinal influences of teachers have a substantial effect on school adoption of technology. For instance, (Paraskeva, Bouta, & Papaginna, 2008) stated that factors related to the character of the personality of the teacher are considered important for the adoption and application of technology in education.

Technology attitudes are supposed to predict one's usage of technology (Bai & Ertmer, 2009; Eickelmann, 2011). Additionally, one of the best researched factors is the attitude or mindset towards ICT or technology. It was shown to be a major indicator of the use of technology by teachers in educational settings. Studies have explicitly demonstrated that the likelihood of teachers integrating technology and its successful use and application is closely linked to the attitudes of consumers towards the PC or technology (Erdogan, 2011; Ertmer, Ottenbreit-Leftwich, 2010). Some studies (Fathema, Shannon & Ross, 2015; Fraillon, Ainley, Schulz, Friedman & Gebhardt, 2014) have noted that teachers who possessed positive attitudes towards technology were often more likely to use computers in their teaching. That is, assumptions about the value of technology have significantly strengthened the expectations of teachers about the effectiveness of teaching and learning using technology. Studies have shown that the attitudes of teachers towards technology impact their appreciation of technology's utility and its incorporation into teaching (Eickelmann, 2011).

The computer experience of teachers positively impacts their attitudes towards computer. The more teachers have experience with computers, the more they will have positive attitudes towards technology integration (Fullan, 2012). It is anticipated that positive attitudes towards computers will promote computer incorporation within the classroom (Hammond, Reynolds & Ingram, 2011). Consumers must cultivate favourable attitude toward the innovation in order to effectively change educational practice (Ertmer & Ottenbreit-Leftwich, 2010).

In conclusion, Ertmer et al. (2013) revealed that teacher beliefs and attitudes towards technology, in addition to their current levels of knowledge and skills remain barriers for the use of technology in education. Furthermore, Aydin, Gürol and Vanderlinde (2016) report as a result of their literature review that "there is a link between teachers' use of ICT in their classes and their ICT training and ICT competencies" (p. 3). In this regard, the variables incorporating teacher characteristics, institutional and training related variables in the proposed research model of this study is assumed to shed light on the teacher groups' influencing factors in relation to their use of technology for educational purposes.

Self-efficacy as Predictors of ICT Integration in Teaching and Learning

Bandura's (1997, p. 3) concept of "self-efficacy refers to a belief in one's capabilities to organize and execute the courses of action required to produce given attainments." For the teaching profession, "a teacher's efficacy belief is a judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Hoy, 2001, p. 783). In other words, teacher self-efficacy is about "teachers' beliefs that they are capable of carrying out good teaching in the classroom" (Christophersen , Elstad, Turmo & Solhaug, 2016, p. 241).

Previous research has shown that the self-efficacy of teachers has an effect on their work satisfaction and professional dedication (Friedman, & Kass, 2005; O'Bannon & Judge, 2013; Skaalvik & Skaalvik, 2007; Ware & Kitsantas, 2007), turnover from the teaching profession (Klassen & Chiu, 2011; Hong, 2012; Rehmat & Bailey, 2014; Farah 2011) and is a significant predictor of the engagement of learners (Caprara , Barbaranelli

, Steca , Malone , 2006; Guo , Connor , Yang , Roehrig , Morrison, 2012).Hence, it is an important topic to investigate to identify variables that can affect the self-efficacy of teachers in using ICT in their teaching practice. Social cognitive theory refers to a possible positive impact on continuous development and a feeling of superiority in the same field and related fields of interest on the perception of individuals of their own skills and abilities in a particular area of interest (i.e. self-efficacy). Bandura (1997) claimed that such beliefs are greater than one's individual abilities; therefore, beliefs of self-efficacy may become prophecies of self-fulfillment. Bandura claimed that self-efficacy in a particular area influences the thinking processes of individuals, levels of resilience, degrees of determination and affective states about tasks within the same area, thereby affecting the output of individuals.

According to Badura (1997), improving the self-efficacy beliefs of individuals in a particular set of tasks increases their success on those tasks; however, in tasks that exceed their perceived coping capabilities, the same people can fail. Latest research on self-efficacy and the application of ICT in teaching backs up the assertions of Bandura and reaffirms the belief that higher levels of ICT self-efficacy will lead to higher levels of conviction in becoming an effective ICT teacher (Fanni, Rega, & Cantoni, 2013; Yamamoto, & Yamaguchi, 2016; Kellenberger & Hendricks, 2011). Hammond, Reynolds & Ingram (2011) investigated the motives why ICT is used by educators and found a correlation between lower levels of self-efficacy in ICT and the less regular use of ICT. In addition, recent studies indicate a positive correlation between self-efficacy in the application of digital technologies and the use of ICT for teaching purposes (Teo, 2014; Hatlevik, 2017; Clark, 2015; Wang, Ertmer, & Newby, 2014). Furthermore, there

is a positive correlation between the use of computers by teacher trainees and their ICT self-efficacy (So, Choi, Lim & Xiong 2012; Brown, Holcomb & Lima 2010; Bunkure, 2015; Enochs, Riggs, & Ellis, 2013).

In this study, the researcher focused on teacher educators' ICT self-efficacy for instructional purposes, which describes the self-confidence teacher educators have when it comes to using ICT in their own teaching and instruction (Krumsvik, 2011; Guma, Haolader & Khushi 2013). Krumsvik (2011) distinguishes between the confidence to use ICT on one's own and the pedagogical use of ICT. Scherer & Siddiq (2015) also documented that technology self-efficacy is strongly correlated but different constructs in intermediate and advanced operational and interpersonal ICT skills and self-efficacy in the use of technology for educational purpose. One way to view this positive correlation is that the general perception of teachers of their own ICT skills (general self-efficacy of ICT) is a necessary determinant for self-efficacy in the use of ICT for educational purposes, but not a sufficient one. This interpretation makes sense, since in order to be able to apply it while instructing others, one needs to be knowledgeable in a skill oneself. A logical conclusion to draw from Bandura's (1997) theory of self-efficacy and the results of the different studies listed here are that the self-efficacy of ICT teachers for educational purposes positively correlates to their overall self-efficacy in ICT and their use of ICT in teaching practice.

Bandura (1997) believed that there are four significant considerations on beliefs of self-efficacy: vicarious perceptions, verbal persuasion, physiological arousal, and experiences of mastery. In this study the researcher focused on how general ICT self-

efficacy and contextual variables such as collegial cooperation on the use of ICT in teaching, and the lack of enablement for the use of ICT in teaching by educational institutions correlate with ICT self-efficacy for educational purposes, It can be argued that in particular, collegial cooperation implies the chance for both vicarious experiences and verbal support and persuasion. In addition, the absence of management facilitation may be viewed as an obstacle to the development of ICT self-efficacy for educational purposes (Kellenberger & Hendricks, 2011; Riggs & Enochs, 2016; Brown, Holcomb & Lima, 2010).

Reflections of self-efficacy beliefs may be experienced during in-class applications by teachers. Teachers with strong self-efficacy beliefs may choose to use different teaching techniques, adopting a student-centered teaching approach; contrary to this, teachers with low self-efficacy beliefs were stated to have a more teacher-centered lesson tendency during in-class teaching (Henson, 2001; Milner & Woolfolk-Hoy, 2002; Perkmen & Pamuk, 2011). Thus, it is possible to say that technology integration self-efficacy beliefs may be a factor for a teacher diversifying in-class applications. In this context, to ensure the planned improvement by including technology within the education process, it is important that teachers have necessary competency about benefitting from these technologies (Coklar, Kilicer & Odabasi, 2007).

As discussed earlier, sources of self-efficacy may be personal and reside within people or may result from their social and physical environments (Bandura, 1994). For example, self-efficacy beliefs influence teachers' persistence, enthusiasm, commitment and instructional behavior when things do not go smoothly as well as impacting their

resilience in the face of challenges and setbacks (Tschannen-Moran & Woolfolk Hoy, 2001). The utility of the self-efficacy concept lies in its operative qualities and deeper understandings of how efficacy can be addressed by the four main sources of influence defined in Bandura's self-efficacy theory, and a clear focus on performance task and context specificity (Bandura, 1994). As such, teachers, who are enthusiastic about the promise of digital technology, should see Web-based technology not as a product or a binary choice but instead as part of the process (AECT, 2016; Cuban, 2001), one that is capable of supporting deeper learning when paired with relevant instructional and learning strategies, critical thinking, and real-world curriculum relevancy (HMH, 2018; Sprague & Katradis, 2015).

Possession of a College ICT Vision as a Stimulant to ICT Integration in Teaching and Learning.

School management must have a vision on ICT use, taking into account the new developments in ICT, and must formulate a strategy to achieve the ICT vision. Shaping the vision means finding an answer on the question: "What kind of school do we want to be? And how does ICT fit into our vision?" ICT supports both 'formal' and 'informal' learning, so that all can share not only in the learning experience but also increasingly personalised learning. Realising the vision means the integration of the vision into the School Improvement/ Development Plan and to consider how the needed investment will be secured. ICT is a major investment for the school and requires long-term planning and regular monitoring and review. A school's vision for ICT should be driven by the potential to improve teaching, learning and achievement rather than by the technology

itself (Whitaker & Grey Coste 2012): The question to ask is not ‘What resources do we have?’ but ‘How do we use our resources effectively to enhance the education of our pupils?

The institutionalization and communication of a specific achievable vision is an essential component of the effective and efficient incorporation of ICT in teaching and learning because the vision provides direction and intent for future progress (Clarke, 2013). The process of defining the vision of the school requires the compilation of a mission statement that shows the methods to be followed in order to achieve pre-established goals.

It is necessary to establish a mission statement because it provides an opportunity to determine the ideals and values that will drive the school's growth, intent and key characteristics. The mission creation process encourages and supports different actions required to strengthen and maintain successful teaching and learning (Anderson & Dexter, 2015; Arnold, Perry, Watson, Minatra & Schwartz, 2012; Foskett & Lumby, 2011; Kearsley & Lynch, 2012; Tomlinson, 2014).The vision will stimulate and empower teachers to work towards achieving objectives and goals, pave the way for career growth for teachers, set a level of excellence, allow progress to take place by using the skills, capabilities and resources available, and ensure that management practices and actions are constructive and realistic (Arnold et al., 2012; Bennett, 2012).

Principals engaging teachers in the vision-making process can help create a common vision, allow teachers to make contributions and bring their expertise, skills and positive attitudes, resulting in ownership and the constructive use of such a vision

(Arnold et al., 2012; Becta ICT Research, 2005; Becta ICT Research, 2006; Bush, 2010; Clarke, 2013; Davies & Davies, 2015; DoE, 2008; Drago-Severson, 2009; Leithwood, 2012; Means & Olson, 2012; Prinsloo & Van Schalkwyk, 2011). Therefore, in partnership with teachers, principals must create and express a clear vision of how teacher professional development can be implemented in order to bring about educational improvements in teachers teaching and learning for ICT incorporation in order to be sustainable (Ho, 2006). Bush (2010) states that while governments have the constitutional mandate to enforce their will, without the commitment of those who have to execute the will, no innovation will be implemented successfully.

The next task is to formulate a technology integration plan once the vision has been successfully developed and adopted, detailing how teachers are supposed to incorporate technology into their classrooms (Strudler & Wetzel, 2009). Actually, an ICT master plan designed in accordance with the vision of a school and its socio-cultural context ensures the successful incorporation of ICT (Bangkok, 2014). A research was performed by Gulbahar (2017) to demonstrate how the technology planning process was implemented in a private K-12 school in Turkey. Data from 105 teachers, 25 administrative staff and 376 students were obtained. The results of the study suggested that schools and universities need to establish a technology strategy to allow effective and productive use of technology for teaching, learning and administrative purposes. In addition, other concerns that ought to be addressed include the enhancement of staff and students in ICT-related skills, curriculum and evaluation, ICT infrastructure and equipment, and support personnel (technical, administrative and pedagogical). An ICT integration plan therefore offers a comprehensive roadmap of the models and procedures

required to transform the vision of school ICT into practice. It is undoubtedly a complicated and time-consuming process to create ICT integration plans, but they are typically well worth the effort and time taken to put them together.

Administrative Support to Inspire ICT Integration in Teaching and Learning

Administrative support involves the use of role models like school heads to inspire the integration of ICT (Baylor & Ritchie, 2012). To be able to give technology leadership in administrative, teaching and learning roles, the school heads ought to be proficient in the use of ICT (Afshari, Bakar, Luan, Samah, & Fooi, 2009). Support by the school heads inspires teachers to incorporate ICT into their own teaching practices (Ali, Nor, Hamzah, & Alwi, 2009). Administrative support is, therefore, a key factor in inspiring teachers to utilize laptops as a tool to present their lessons (Mosesa, Kamariah, Rosnaini & Wong, 2011).

Support from the school administrators plays a key role in inspiring the teachers to integrate the ICT in their day-to-day teaching practices (Baylor & Ritchie, 2012). Apparently, the school administrators who promote the integration of technology in teaching not just in words but also in practice, results into the acceptance of technology as a practice. On this basis, Baylor and Ritchie argued that if school managers were to foster a culture of technology use, then instead of sitting aside, they would need to figuratively "roll up their sleeves and join in." As such, the effectiveness of incorporating ICT into teaching and learning activities depends heavily on the support provided by the school administrator (Samuel & Bakar, 2016).

Other factors being imperative, school administrative support is a powerful determinant of teacher educators' utilization of ICT in the instructional process (Anderson & Dexter, 2015). Yee (2000) contends that a school administrator who enforces ICT plans and also shares a similar aspiration with the subordinates motivates them to use ICT in their instructional practices. For the optimum utilization of ICT by faculty members, there is the need for a good governance to boost a well-designed ICT roadmap in the classroom (Lai & Pratt, 2004). The Becta report on the impact of technology on the instructional process in basic schools in United Kingdom also emphasized the role of administrative support (Lai & Pratt, 2004). Moreover, Becta, identified five factors including ICT leadership, ICT teaching, ICT resources, general school leadership and general teaching that were regarded essential for successful utilization of ICT in schools (Becta, 2004).

A study that was conducted on the transformational integration of technology in Hong Kong and Singapore exposed the result that effective technology transformation is influenced by leadership support for collaboration and teacher's commitment to learner centered instruction (Wong and Li, 2008). On his part, Ng (2008) found that transformational leadership with essential qualities of identifying and articulating a common vision, promoting team work, offering support to individuals, providing a model figure to the subordinates, sets high performance targets and strengthens school ICT culture, is prone to influencing ICT integration. Likewise, the results of a study conducted by Afshari et al. (2009) revealed a positive relationship between the leadership level of ICT competence and transformational leadership and therefore, they concluded that for successful integration of ICT in the teaching and learning practices,

transformational leadership is an essential requirement.

Moreover, in a study conducted by Yuen, Law & Wong (2003), the results showed that the school leadership was the key change agent in modeling ICT integration while providing visionary leadership and staff development opportunities. Other studies such as the one conducted by Anderson & Dexter (2015), have further reported that different levels and categories of school leadership like the Principal and technology leadership, can impact effective integration of ICT in schools. Thus, educational institutions that are characterized by the leadership active involvement in ICT integration, strengthened by a robust ICT plan, will effectively and successfully adopt the integration of ICT in the school curriculum.

Administrative support can, therefore, influence the effectiveness of incorporating ICT into the teaching-learning practice among schoolteachers on the basis of the literature review (Ali et al., 2009; Baylor & Ritchie, 2012; Samuel & Bakar, 2016). Therefore, in the application of ICT in a classroom context, administrative support is critical.

Technical Support as Key Element in Successful ICT Integration in Teaching and Learning

As cited in Mosesa, et al (2011), Resta describes technical support as professional staff capable of supporting and assisting teachers in the application of instructional technology. Whilst the technical support was described by Dexter, Anderson, & Ronnkvist (2009) as accessing, operating and troubleshooting microcomputer systems and network resources. Technical support includes vendor Electronic resources and

internal help desk support given within the ministry of education, according to Frost & Sullivan (2016).

Support for technology has an enabling influence on the use of ICT by educators (Khan, Hossain, Hasan, & Clement, 2012) and their incorporation of ICT into teaching-learning processes (Dexter, Seashore, & Anderson, 2013). For this purpose, guidance, support and resources as components of technology applications need to be provided (Haslaman, Mumcu, & Usluel, 2008). Technical support for the use of technology in the curriculum is necessary in the implementation of ICT, since the lack of it can create issues and lead to decreased enthusiasm for the curriculum (Mosesa, et al, 2011). Similarly, Resta (2002) also proposed that more technical support be provided to address the obstacles found.

The relevance of technical support for teachers is undeniable. Studies have indeed demonstrated that technical support has an influence on improving teacher application of ICT (Dexter, et al, 2013; Kipsoi, Chang'ach, & Sang, 2012). Jones (2004) stated that when a computer breaks down, it causes disruptions, and if there is an absence of technical staff, it is likely that the computer will not be repaired on a regular basis, leading to teachers never using computers in the classroom. Consequently, teachers would be hesitant to utilize computers for fear of equipment breakdown, as no one would provide them with technical assistance if a problem arose. Where there is the absence of technical support accessible at a school, it is unlikely that technical maintenance will be carried out on a regular basis, leading to a greater risk of technical malfunctions according to Becta (2004). The National Council for Technology in Education's 2005

census report on ICT infrastructure in Ireland (as cited in the ICT strategy group report, 2008-2013) reported that 85.3 percent of schools rated technical support and maintenance as a 'high' or 'very high' priority, and it ought to be a key component of the school ICT environment, with proper technical support made available to maintain ICT infrastructure. In examining the technology integration procedures in the Turkish education system, Yilmaz (2011) stated that in addition to supplying schools with ICT infrastructure, it is also imperative to give technical assistance for maintenance and repair in order for ICT to be used in schools.

As a result, if teachers do not receive technical support, they feel disgusted and reluctant to integrate ICT in their teaching (Tong & Trinidad, 2005). Despite the fact that the absence of technical support may discourage teachers from adopting and integrating technology in the classroom, a study conducted by Korte & Husing (2017) found that schools in the United Kingdom and the Netherlands recognize the importance of technical support in assisting teachers in integrating technology into their classrooms. They claimed that school-based ICT support encourages instructors to use ICT in the classroom instead of time loss debugging hardware and software issues.

Level of Accessibility to ICT Infrastructure Enhancing ICT Integration in Teaching and Learning

Information technology infrastructure measures the distinguished availability and appropriateness of ICT resources, like hardware, software and peripheral devices installed in the school, (Vanderlinde & van Braak, 2010). ICT infrastructure refers to the availability of facilities, software, Internet connectivity and other related supplies in the

school (Pelgrum, 2001). In addition, school infrastructure and resources are planned and allowed to facilitate the continuous transformation and advancement of different learning strategies (Anderson & van Weert, 2012).

Access is among the most fundamental requirements for teachers in schools to effectively use ICTs, and it is crucial for ICT integration into the classroom instructional process (Moreno, Cavazotte, & Alves, 2017; Careaga & Avendao, 2016). According to Pérez (2017), one of the most successful methods to employ ICTs in education is to have access to technology resources. In this respect, Fernandez, Fernandez, and Cebreiro (2018) stated that the biggest barrier to ICT implementation in schools is access to ICT resources; thus, access to ICT infrastructure and resources in schools is a fundamental prerequisite for ICT integration in education (Al-Shwabkah, Hamad, Taha & Al-Fadel, 2016). The ease of access to ICT resources such as software and hardware is critical for ICT adoption and integration. According to Moreno et al., (2017), if teachers do not have any access to technology resources, they will be unable to exploit them and learners will equally have little or no exposure to them.

Krysa conducted a study in 2013 to establish and investigate frequently occurring factors influencing the application of technology among school teachers. To determine the causes, a qualitative research was conducted on four school teachers. Based on the results, one of the teachers stated that obsolete technology restricts the use of computers in teaching (Krysa, 2013). Because of the old and obsolete technology, the teacher was not able to incorporate technology into teaching. On the other hand, one of the informants

claimed that restricted software is one of the precedents that prohibits computers from being used as an educational tool (Krysa, 2013).

According to Shiue (2017), when teachers have the appropriate computing resources, they can have better control over the use of technology for educational purposes. Cowie & Jones (2005) indicated that teachers could access school computers, the Web and desktop accessories (printer, digital camera, data projector, large TV screen, scanner and video camera) with the ICT infrastructure provided. When ICT facilities are provided in a good way, teachers have more chances to use instructional technology. Past studies have consistently shown that ICT infrastructure is one of the factors affecting the use of technology among teachers (Cowie & Jones, 2005; Krysa, 2013; Shiue, 2017).

As a result, accessibility to ICT infrastructure and resources in schools is a prerequisite for ICT integration in curriculum (Plomp, Anderson, Law, & Quale, 2009). The ease of access to ICT resources, such as hardware and software, is critical for the effective adoption and integration of ICT into classroom instruction. Teachers will obviously not use ICT resources if they cannot access them. As a result, having access to ICT resources, as well as updated software and hardware, is critical to successful technology adoption and integration. Yildrim (2007) discovered that providing teachers with access to technological resources is one of the most effective strategies to improve their pedagogical use of ICT in the classroom. Furthermore, Usluel, Askar & Bas, (2008) conducted a survey of 814 higher education faculty members in Turkey and reported that the vast majority of respondents said they had access to computers and the internet. 82.5 percent and 81.2 percent of faculty members, correspondingly, had access to computers

and the internet. Meanwhile, in Albirini (2016) quantitative study to gather information from high school English instructors' perspectives on computer attributes, cultural perceptions, computer proficiency, computer access, and personal characteristics, the findings of the study revealed that 57 percent of respondents had access to computers at home, while only 33.4 percent had access to computers at school. This was an apparent sign of instructors' inadequate computer access. Furthermore, according to the National Center for Education Statistics report, more than half of the respondents used computers in their schools for research and preparing lessons (Afshari, Bakar, Luan, Samah, & Fooi 2009). Approximately 78 percent of those polled said they did not have enough access to computers in the classroom. Although insufficient computers were not cited as a major obstacle to ICT use in their classrooms by 38 percent of respondents, greater availability and fairness of access to digital resources by educators, learners, and administrative personnel is critical.

It is not only vital to have access to hardware and software, but it is also important to employ the right tools and programs to enhance teaching and learning (Tondeur, et al. 2016). When incorporating technology into a lesson, the affordances and limitations of the tool must be thoroughly evaluated (Chen, 2010). It is also crucial to distinguish between access to ICT resources for teachers and for pupils. For example, Dexter, Seashore, and Anderson (2013) found that 37.4 percent of teachers and 14.4 percent of pupils had access to computers in a study of preservice teachers, implying that computers were more accessible to teachers than to pupils. To foster pupil-centered digital learning, learners must obviously have access to high-quality technological resources.

ICT Policy Issues as Guidelines for ICT Integration in Teaching and Learning

Policy and planning are critical in defining the goals of the use of ICT in education and in identifying priorities for resource allocation (Omwenga, Waema, & Eisendrath, 2002). They also point out that the school administrators and the centres they are responsible for have main tasks to enable, enforce and track the use of ICT for teaching and learning purposes.

Pernia (2008) notes that ICT policies that merely acknowledge the strategic role of Technology for progress and expansion have ranked countries low on ICT appreciation. She further states that although access to computers is minimal, internet costs are high and the computer-to-population ratio is inadequate; she cites Sri Lanka and the Pacific Islands as examples. ICT policies in nations ranked high in ICT recognition go beyond interventions that promote ICT programs, such as Australia, Malaysia and Japan. These nations have high income levels and even provide their citizens with ample ICT resources.

School ICT policy should be formulated with the learners' interest in mind. Formulating such a policy should involve school administrators, teachers, students and stakeholders (MOE, 2012). UNESCO, (2011) ICT policy becomes acceptable if its formulation involves stakeholders. Essentials of an ideal school ICT policy must be acceptable for effective implementation of Computer Studies Curriculum.

A key factor hindering the successful integration of ICT in schools is the absence of a well-defined educational policy and planning especially depicting ICT integration in the instructional practices of the teachers. Systematic implementation of ICT depends upon the educational policy makers' perception and vision, towards the use of ICT in school culture (Pelgrum, 2001). Inadequate ICT planning and strategies may hinder teachers' efforts to implement ICT into their teaching practices in classrooms (Woozney, Velkatesh & Abrani, 2016). Similarly, educational policies should include mechanism for incentivizing and rewarding the teachers' use of ICT in classes and it should be the part of professional development of teachers. ICT policies and strategies need to be developed to facilitate its utilization in education (Balenskat, Blamire & Kerala, 2006). Tondeur et al. (2016) put emphasis on the schools' shared vision for ICT implementation, stable strategies and teachers' consideration of school policies for ICT implementation. ICT policy helps in the establishment of school culture for the effective implementation of ICT (Hew & Brush, 2007). A strategic policy and planning is required to introduce ICT based curricula for the use of ICT in education (Hew & Brush, 2007). In a study about four schools, Lim & Khine (2016) highlighted the importance of shared vision and ICT policy for schools' heads and teachers in providing guideline and a clear goal for the successful integration of ICT. In developing countries, like Uganda, absence of concrete policy for the implementation of ICT in schools is a major barrier in taking initiative for the provision of technical resources in schools (Parvin, 2013).

ICT has become an important part of education reform that many governments around the world have made strategic plans to allocate more funds for education for the provision of ICT resources in schools. However, the fact is that educational reforms of

many countries regarding the adoption of ICT lack a solid rationale. Instead of focusing on the efforts of teachers to use ICT in their teaching practice, teachers lack the idea of using ICT effectively in the classrooms (Condie & Munro, 2017). More often, integration of ICT is taken as vague conceptions about the desired learning enhanced by technologies. There is a lack of shared vision among policy makers and educationalists about the use of ICT in education (Twining, 2012). Consequently, there seems no point in providing ICT infrastructure in schools unless proper rationale is set (Newhouse, 2012). There is an urgent need of a shared vision for the use of ICT in teaching and learning (Hughes & Zachariah, 2001; Otto & Albion, 2002). Teachers engaged in developing ICT planning have a constructive role in the application of ICT in a novel way (Kozma, 2003). An assessment and an evaluation approach is needed to find out the ambiguities in the use of ICT and make necessary changes for its successful integration (Kennewell, Parkinson & Tanner, 2000). Setting of goals and the provision of means for achieving the goals are crucial when making ICT policy and planning for schools (Bryderup & Kowalski, 2012).

Extent of ICT Integration in Innovative Pedagogy

To assess the level of ICT incorporation in teaching and learning, several researches have been conducted worldwide (Paryono & Quito, 2010; Sukri, 2010; Mahmud & Ismail, 2010; Ngah & Masood, 2006; Wahab & Kaur, 2006; Mustapha, 2008; Bakar & Mohamad, 2010).. The level of ICT integration is generally low or moderate, these studies report. Inasmuch as several educators are conscious that ICT incorporation

will enhance student learning, most of them are still reluctant to incorporate ICT into teaching and learning (Hew & Brush, 2007).

Several researchers have studied the ICT use rate of educators and related factors in classrooms (Kuskaya-Mumcu & Kocak-Uslue, 2010; Jawarney, El-hersh, & Khazaleh, 2011; Buntat, Saud, Dahar, Arifin & Zaid, 2010). A research by Jawarney et al, (2011) examined the ICT skill levels of teachers and the degree of ICT incorporation in classroom teaching in training schools and vocational education. This study found the basic ICT skills of vocational educators to be sufficient. In order to analyze the attitudes of primary school educators regarding the use of computer technology in the classroom, Simonson (2014) used a quantitative approach from which the findings showed that the values and perceptions of teachers impacted their use of ICT in the classroom. Moses (2016) analyzed instructional practices in another study involving 390 teachers and found that few teachers employed ICT in the classroom, notwithstanding most of them being appropriately ICT proficient; some even used higher level of digital skills in their private lives.

A survey of educators in 11 schools was conducted by Rakes, Fields & Cox, (2016) and found that less than a quarter of educators regularly incorporated ICT into the classroom. Drent & Meelissen (2008) explored variables that promoted teachers' creative use of ICT in which their research showed that the teacher's learner-oriented pedagogical approach, technology experience, favorable attitude towards technology, and personal entrepreneurship had a positive effect on the educator's innovative use of ICT. The use of educational technology among Turkish VET school educators was explored by Kuskaya-Mumcu & Kocak-Uslue (2010). They observed that ICT was used most frequently by

educators for administrative purposes than for real academic purposes. The degree of ICT adoption among Malaysian secondary school teachers was examined by Lau & Sim (2008). They noticed that older teachers would routinely use educational technology in classroom teaching more than new teachers. Older teachers could easily incorporate educational technology into their teaching practice due to the benefit of both teaching experience and basic competency in ICT. Lawless & Pellegrino (2007) argued that if teacher-training programs concentrated on ICT abilities and creative strategies for classroom tasks, educators could also embrace and incorporate ICT into their classroom. The duration of the training period should be adequate to ensure that trainee teachers have ample experience to strengthen their confidence in the use of ICT in the classroom.

While several previous researchers have concentrated on the barriers and constraints that discourage or inhibit teachers from incorporating ICT into their teaching effectively (Borthwick & Pierson, 2012), there seems to be little or no research involving teachers' insights on how to improve the willingness of teachers to incorporate ICT into teaching practice.

In conclusion, information and communication technology (ICT) is regarded as a crucial instrument for enhancing the quality of teaching and learning (Blackwell, Lauricella, & Wartella, 2014). Ultimately, one of the most debated issues in the current education policy development process is the implementation and successful use of ICT in the curriculum (Baturay, Gökçearslan & Ke, 2017). As a matter of fact, reports from latest research indicate that ICT has the potential to facilitate instruction as well as provide opportunities for authentic collaboration across the curriculum between students and teachers in ways that were not possible before (Tondeur, et al, 2016)

In recent studies in the field, the vital role of teacher educators in the successful adoption of technology in teaching has been given top priority (Comi, Argentin, Gui, Origo & Pagani, 2017; Englund, Olofsson & Price, 2017; Nikolopoulou & Gialamas, 2016). More precisely, recent researches have centered on the variables that affect the adoption of ICT in the teaching - learning practices, considering teacher educators as the key perpetrators of ICT usage in curriculum (Kale & Goh, 2014; Kreijns, Vermeulen, Kirschner, Buuren & Acker, 2013). Apparently, getting a clear understanding of the determinants of the acceptance of ICT in education helps us to establish suitable strategies to improve the teaching and learning practices (Macharia & Pelser, 2014).

While factors such as perceived utility and perceived ease-of-use from the Technology Acceptance Model (TAM) (Davies 1989) and ICT adoption in education have already been widely researched (Cassim & Obono, 2011; Terzis & Economides, 2011), most of the variance in technology acceptance remains unresolved and there is still a dearth of researches examining the incremental impact of specific determinants such as ICT literacy of educators and the school climate and support, especially in the Ugandan context ((Papanastasiou & Angeli, 2008; Baturay, et al, 2017).Taking into account recent developments in existing literature, this study tested several factors that are believed to influence ICT adoption in education, such as teachers' perceptions of ICT integration, demographic factors, technical and administrative support, ease of access to ICT infrastructure, and others. In addition, the research focused on data that was gathered in the Ugandan context, which, given the emphasis of the Ugandan government on ICT adoption in education, is considered to be of major relevance. The study also provided a

clearer understanding of the factors that influence and predict ICT adoption in general, and has made practical recommendations for the National Teachers' Colleges in Uganda.

Review of Existing Models of ICT Integration in Teaching and Learning

This section elaborates on some of the existing models of ICT integration in education which substantiated the reasons for presenting the proposed LEISURE model.

The Activity Theory Model

Based on “Activity Theory”, Nyvang (2006) suggested a theoretical framework using a Danish university as a case study, to incorporate ICT in higher education. The framework suggests that incorporation is an activity system in itself. The Nyvang (2006) incorporation activity consists of three processes: ICT selection; ICT adaptation; and ICT change of practice.

The TPACK Model

An ICT model for teachers to incorporate technology through pedagogical content into knowledge classroom instruction was posited by Mishra & Koehler (2006). The proposed ICT model known as TPACK in Mishra and Koehler (2006) is informed on Shulman's (1987) pedagogical content knowledge (PCK) constructs to include knowledge of technology. For successful technology integration in the classroom, the development of TPACK by educators is crucial. The essence of technologies and the significance of their incorporation in the proposed ICT model were discussed by Mishra and Koehler (2006). The TPACK ICT model successfully enabled the incorporation of and the use of technology in teaching through the above-used constructs.

The Generic Model

A generic ICT model involving three main components: technology, social interaction, and pedagogy, was developed by Wang (2008). Wang clarified that the development of these components could enable teachers to effectively integrate ICT into the curriculum. The design of interactivity, constructivist theories of learning and the concept of usefulness provide the theoretical basis for the development of the proposed ICT model. In the construction of learning environments, support of internet discussions and correlation of ICT resources, the recommended generic model can be used (Wang, 2008).

ICT-enhanced Teacher Development Model (ICTeTD)

The ICT-enhanced teacher development model (ICTeTD), which uses technology in classroom instruction, was posited by Engida (2011). In the context that it does provide a visual image of the concepts / knowledge bases from which educators draw during their classroom instruction, the ICTeTD model is conceptual.

Teaching is comprehended to be wider in the ICTeTD model and includes all of a teacher's activities related to a particular discipline, such as lesson preparation, classroom instruction, assessment/evaluation, review and development of the curriculum.

The Systematic Model

A systematic model for developing ICT-integration plans was suggested by Wang & Woo (2007). Their suggested model of ICT integration is regarded systematic since it maintains a logical progression and has components arranged in a quite linear way. In their ICT model, the creation of each component depends very much on the completion

of the previous components. In addition, their ICT model basically offers a framework that is simple to follow, where designers switch to the next component only after the current component has been completed. The main components of their ICT model include: problem statement, setting goals of learning, necessary technology, justification, methods, appraisal and reflection.

Criticism of the Existing Models

A literature review reveals that almost all the educational ICT integration models cited above are more teacher-oriented, i.e., they concentrate more on the integration of ICT into pedagogical practices without taking into account enhanced student active roles in the teaching and learning process. As teachers learn to integrate ICT in pedagogy, students need to understand and acquire the skills necessary to use ICT in their own disciplines of study. In this study, the proposed LEISURE model offers the possibility for students to express concerns and give feedbacks on whether they are comfortable and familiar with the ICT equipment and facilities available that are essential for their education.

As a result of the researcher's exhaustive literature review, it can be inferred that ICT's potential to revolutionize education by enhancing teaching and learning is undeniable. ICT should be used by teachers to assist students in becoming innovative, problem-solving, and dynamic learners. Learners can communicate, learn, search for, and retrieve information more effectively with the use of ICT. The teacher's responsibility as a learning facilitator is crucial in all of these stages. Uganda recognizes that information and communication technology (ICT) is a critical engine for revolutionizing education

and delivering solutions to issues such as access, quality, relevance, and equity. It is also recognized that instructors' Technology Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) are essential for ICT integration in classroom instructional process.

Summary of Literature Review

The literature review has examined the perceived importance of ICT integration in education and highlighted the increasing demand by governments worldwide to promote the integration of ICT in all aspects of human endeavour, including education. The literature further explored the factors which are usually associated with enhanced integration of ICT in the teaching and learning practices of the teachers. However, in spite of the perceived importance of ICT in the field of education, studies have shown that even when ICT infrastructure is prevalent, incorporation in classroom instruction is still constrained, necessitating a holistic investigation into the factors involved that obstruct integration in teaching and learning practices, with a special focus on teacher educators in the National Teachers' College in Uganda.

CHAPTER THREE

METHODOLOGY

A discussion of the research protocol that was followed in the study is provided in this chapter. It is organized into six sections. The research design implemented in the study is provided in the first section. The second section explains the population, the sample size and the methods of sampling, while the third section contains the data gathering instruments that were used. The fourth section describes the procedures for data collection, followed by the fifth section, which explains the procedure for data analysis, and finally the sixth section describes the ethical issues considered during the study.

Research Design

A concurrent triangulation mixed methods design was used in the study (Creswell, Plano Clark, Gutmann & Hanson, 2014). A QUANT + QUAL approach was used to indicate that although the study focused quantitatively on exploring the extent of ICT integration and the relationships and differences that existed between the independent and dependent variables, both quantitative and qualitative methods were used and data from both sources were collected at the same time (Tashakkori, & Teddlie, 2016). Data was analyzed separately, as shown in Figure 3, and then integrated during interpretation (Creswell et al., 2014).

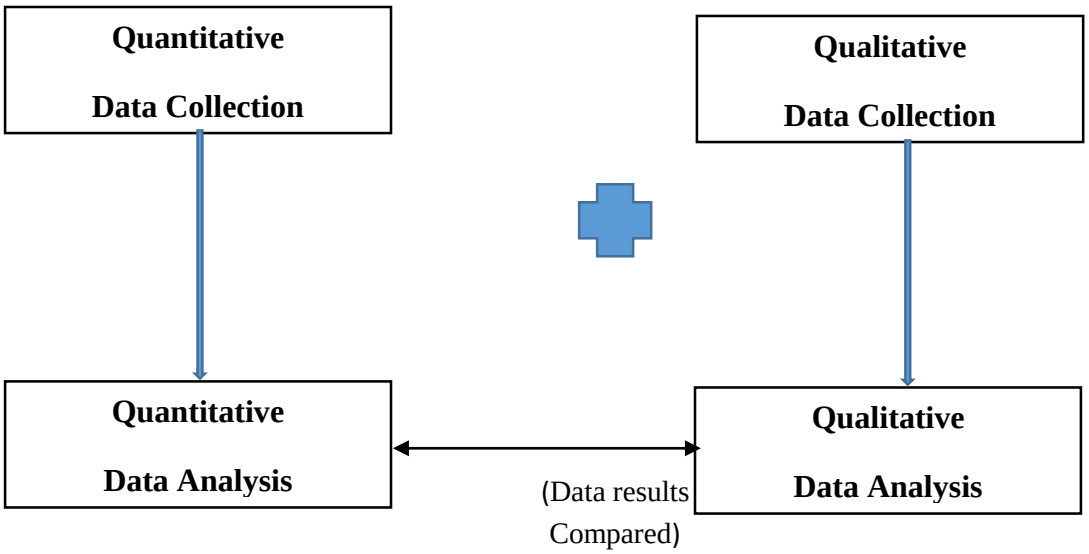

Fig. 3: Concurrent triangulation mixed methods design (adapted from Creswell et al., 2014, p. 181)

Using the concurrent triangulation mixed methods research design in this study, quantitative data was collected from 253 teacher educators using questionnaires while qualitative data was concurrently collected from 40 teacher educators using focus group discussion and interviews with 4 Principals from four National Teachers' Colleges. The findings of the quantitative and qualitative parts of the study were then mixed at the interpretation level. Both descriptive and inferential statistics involving Spearman's coefficient of correlation and multiple regression analyses were done for relationships and prediction questions respectively, while inductive applied thematic analysis was done for qualitative data. An analysis of: (i) the demographic characteristics of teacher educators in the NTCs and (ii) the levels of ICT integration in teaching and learning in the NTCs was included in the descriptive aspect of the research. Meanwhile the

inferential component of the data analysis included (i) a correlational analysis of the integration of ICT into teaching and learning as the dependent variable with external and internal factors as independent variables; and (ii) a hierarchical regression analysis of the degree to which ICT-related variables predicted ICT integration.

Population, Sample Size and Sampling Techniques

The target population of the study constituted the teacher educators and Principals in four out of the five National Teachers' Colleges in Uganda (N = 253). The fifth National Teachers' College, where the researcher was teaching, was used for the pilot study to check the validity and reliability of the research instruments.

The investigator used the total population sampling strategy for the first quantitative part of the study. This was a form of purposive sampling technique in which the researcher preferred to explore the entire population (i.e., the total population) that had a specific set of attributes, such as a particular background, expertise, abilities, event exposure, etc (Kothari, 2017). In this particular instance, since the size of the population that had the desired collection of features that the researcher was interested in was limited, the whole population was chosen. Thus, if a small number of units (teacher educators) were not included in the survey, a large portion of the data could be deemed to be missing. This approach enabled the researcher to obtain, without exception, data from all the teacher educators (n = 253).

A sample size of 10 participants per college was selected according to age ranges in the category; 30-39 (5) and 45+ (5), for the second, qualitative part of the study; using

a snowball purposeful sampling strategy for each focus discussion group as shown in Table 1 below. These age ranges were selected because these teacher educators were presumed to have varying expertise and experiences in teaching and learning with ICT.

Table 1: Summary of research population and samples for the quantitative and qualitative data collection.

College	**Population of teacher educators + Principal**	**Qualitative Study (Focus Group Discussion)**
W	63	5 Age range, 30-39 5 Age range, 45+
X	56	5 Age range, 30-39 5 Age range, 45+
Y	60	5 Age range, 30-39 5 Age range, 45+
Z	74	5 Age range, 30-39 5 Age range, 45+
TOTAL	**253**	**40**

Research Instruments

To obtain the desired data, the researcher used four different sources of data: questionnaire, focus group discussion guide, interview guide and observation checklist.

Questionnaire

The primary method for quantitative data collection was through a self-developed teacher educator questionnaire. Alharbi (2014 p. 77), citing Kumar, describes the questionnaire as a "written list of questions to which the respondents record their answers." Respondents read the questions in the questionnaires, interpret what is required and then write down the answers. For a multitude of purposes, the questionnaire was deemed suitable for this study. The questionnaire provided a high response rate since it was hand delivered to respondents to complete and personally collected by the researcher. It also took less time and energy for the questionnaire to be administered and completed. Not only did the questionnaire provide the possibility of anonymity, since the names of the respondents were not needed, but it also offered less room for prejudice, since it was consistently presented. There were mostly closed items in the questionnaire that made it simpler to analyze using SPSS.

Questionnaire Design

The questionnaire instrument (see appendix 1) contained 9 sections, each measuring a different variable as follows: Demographic characteristics (5 items), Attitudes towards ICT integration (8 items), Level of self-efficacy (8 items), College ICT vision (8 items), Administrative support (8 items), Technical support (8 items),

Accessibility to ICT infrastructure (8 items), ICT policy issues (8 items), Extent of ICT integration (8 items)

The questionnaire instrument was pilot tested using 40 teacher educators from one non-participating National Teachers' College. The purpose of the pilot study was to validate the instrument as well as assess its reliability.

Focus Group Discussion

A self-developed focus group discussion guide (See Focus Group Discussion Guide: Appendix 2) was developed to collect qualitative data from the teacher educators. A Focus Group Discussion (FGD) is a qualitative research methodology consisting of a structured discussion that was used by the researcher to collect in-depth knowledge (qualitative data) under the themes: level of ICT integration in teaching and learning, attitudes to ICT integration, ICT infrastructure and accessibility, ICT technological support, ICT-related preparation and barriers to effective integration of ICT in teaching and learning. The intent of the discourse was to use the group's social dynamics to encourage participants to chat more openly about the topic without fear of being judged by others and disclose important details about their thoughts, values, attitudes and perceptions, under the guidance of the researcher who served as the moderator (Nyumba, 2018; Zander, Stolz, & Hamm, 2013).

Interview

The investigator used a self-developed interview guide to collect data from the Principals. An 'interview' is basically a face-to-face interaction between a researcher and a respondent involving the transmission of data to the interviewer (Creswell, 2012). The

interview was semi-structured with open-ended questions to allow both the researcher more freedom to ask additional questions and the participant more information to share (Alharbi, 2014). The researcher asked the principals to discuss general views on the integration of ICT in teaching and learning. The interview questions were constructed based on the research questions (See Interview guide: Appendix 3)

Observation

Finally, in the actual classroom situation, the researcher used a self-developed observation instrument to gather data on the integration of ICT in teaching and learning (See Observation checklist: Appendix 4). The lesson observation which lasted the entire length of the lesson, sought to identify evidence of the use of ICT resources in the lesson and the level of engagement with the ICT resources by the students, teacher and ICT technical personnel. Observational research is defined as the method of watching and documenting participants' actions and behaviors (Bernard, & Bernard, 2012).

Validity and Reliability of the Research Instruments Validity

Validity is sometimes defined as the degree to which an instrument measures what it purports to measure (Blumberg et al., as cited in Kumar, 2017). Thus, validity means that the research instrument (questionnaire) measures the concepts in the study accurately (Pallant, 2011; Robson, 2011; Thatcher, 2010)

In this research, the researcher measured two types of validity: face and content validity. Face validity refers to the extent to which a test seems to assess what it sets out to measure (Leedy & Ormrod, as cited in Kumar 2017). It is the easiest and least precise

form of validity determination, which relies solely on the assessor's experience and knowledge of the subject matter (Nwana, 2007). It establishes that the measure seems to test the intended construct under investigation. It is commonly used without scientific proof to define the appearance of validity (Divaharan & Lim, 2010). Therefore, face validity is usually taken to be the poorest of all forms of validity (Hashim, Murphy & O'Connor, 2007)

The face validity of the instrument to measure ICT integration in teaching and learning in the National Teachers' Colleges in Uganda was established by the expert reviewers (research supervisors) from the University of Eastern Africa Baraton and other reviewers from Gulu University in Uganda who assessed whether or not the questionnaire items were considered relevant with respect to the various variables being measured.

Content Validity is the extent to which all possible questions about the content or skill can be asked about the questions on the tool and the scores from these questions (Creswell, as cited in Kumar 2017). It guarantees that the questionnaire comprises an adequate collection of items that fit into the concept. The greater the scale items reflect the concept domain being measured, the greater the validity of the content (Shekaran & Bougie, 2010). Content validity, therefore, includes the evaluation of each test item for its relevance to the targeted construct, i.e. whether the items are precisely and accurately worded, whether the scoring and scaling are sufficient to ensure that the items of the instrument are representative samples of the universe of content and/or domain behavior being examined (Yassir, McIntyre, & Bearnm, 2016; Krikorian, 2016). It is possible to

modify the ambiguous and vague questions, and the counterproductive and non-functioning questions to be removed from the expert reviewers' advice.

Instrument Validation

To ensure instrument validity, the researcher took the following measures: 1) Extensively reviewed related literature of past studies and analysed instruments used in similar studies, 2) sought guidance from the supervisors from the University of Eastern Africa, Baraton and Gulu university in Uganda who ensured relevancy, representativeness, comprehensiveness, and clarity of the items and, 3) Conducted a pilot study with 40 teacher educators from a non-participating college and used the results to modify the ambiguous and vague questions.

Reliability

Reliability is a measure that produces consistent outcomes with equivalent values (Blumberg et al., as cited in Kumar, 2017). It tests consistency, accuracy, reproducibility, and integrity of the data collection instrument (Chakrabartty, 2013). It demonstrates the degree to which the instrument is without prejudice (error free) and thus ensures consistent assessment across time and over the different items in the tools. The word 'dependability' is used by some qualitative researchers rather than reliability. It is the degree to which stable (free from errors) and reliable results are provided by an evaluation method. This means that a measure's observed score represents the measure's true score (Feldt & Brennan, in Kumar 2017). Reliability is, therefore, a notion that demonstrates how well the various items in a single dimension merge to assess the same

thing. In this study, a minimum alpha value of 0.60 was considered acceptable (Griethuijsen et al, 2014)

Measurement of the Instrument Reliability

To measure the reliability of the questionnaire, the researcher conducted a pilot study with 40 teacher educators from a nonparticipating college and used the results to compute Cronbach alpha coefficient of correlation for the various dimensions of the questionnaire (See appendix 13).

Table 2: Cronbach Alpha internal consistency estimates for the components of each questionnaire dimension

Questionnaire Dimension	Coefficient Alpha	Number of Items
Attitudes	.833	8
Self-efficacy	.941	8
ICT Vision	.844	8
Administrative support	.638	8
Technical support	.818	8
Accessibility to ICT Infrastructure	.784	8
ICT Policy issues	.836	8
Extent of ICT integration	.878	8

The internal consistency estimates for every component of each dimension are reported in Table 2. A value of 0.70 or above for coefficient alpha were considered good, while values between 0.60 and 0.70 were considered acceptable and adequate (Griethuijsen et al, 2014). The results in Table 3.3 indicate that the Cronbach alpha levels of all dimensions exceeded the value of 0.60 suggested as acceptable.

Data Collection Procedures

After finalizing the tools for data collection, the researcher visited the colleges under the study personally for getting permission from the Principals to collect the necessary data. Subsequently, the researcher discussed in detail with the Principals of the respective colleges the nature and purpose of the study and sought permission from them

to collect the necessary data from the teacher educators. The researcher also assured the Principals of confidentiality of the information that would be obtained from their colleges and anonymity of the name of the college.

Quantitative Data Collection

In the quantitative phase of data collection, having secured permission from the Uganda National Council for Science and Technology and Principals of the colleges, the researcher met the teacher educators in each participating college all together and introduced the purpose of visiting the institution and requested them to participate in the research study. In order for the teacher educators to give responses freely and frankly, honestly and sincerely, the researcher guaranteed them confidentiality of the information they would provide, anonymity of their identities, and freedom to choose to withdraw from the study at any stage. Before distributing the questionnaires, the researcher requested the participants to sign the Informed Consent Forms (See Appendix 9) The researcher then explained the instructions clearly on how to fill the questionnaires before distributing the questionnaires to each of them. The researcher told the participants to feel free to find a suitable place to fill the questionnaire for the next 30 – 45 minutes after which the questionnaires were collected by the researcher. The researcher thanked all the participants including the Principal for their cooperation. The same procedure was followed in all the colleges.

Qualitative Data Collection

In the qualitative phase of data collection, the researcher held focus group discussions with carefully and purposefully selected 10 participants of whom five were in the age range 30-39, and the other five 45+ years. The participants in each college chose an appropriate venue for the focus group discussion. To make the focus group discussions effective and unbiased, the researcher conducted the focus group sessions after a thorough rehearsal using the pilot study. Each focus group discussion lasted 30-45 minutes.

A "single moderator focus group approach" was used where the moderator/researcher ensured the session progressed smoothly and in an unbiased manner. The researcher was confident in initiating discussions and used the experiences which were gained during the pilot study. The researcher had the group dynamics skills and ability to ensure the group stayed focused on the questions and maintained the flow of discussions. The researcher as a moderator played the three roles: formal direction, steering the topic and steering the dynamics (Punch, 2015).

In all the four focus group discussions of this research, group dynamics were clear as all participants contributed well and expressed their candid opinions. Group dynamics provided more thinking about the subject in some focus groups, which led to in-depth discussions. The objective of the researcher was to generate the maximum number of different ideas in the allocated time from the participants of the focus group and ensured that the entire group was not dominated by one or two members.

In the third phase of data collection, the researcher observed a 60-minutes lesson conducted by a volunteer teacher educator in which ICT was integrated in the teaching and learning process. The researcher used a self-developed observation tool to record the relevant ICT aspects integrated in the lesson.

Finally, the researcher conducted a guided interview with each Principal of the respective colleges to obtain as much information as possible about ICT integration in teaching and learning: the opportunities, challenges, roles of stakeholders and possible recommendations for improvement were explored. The interviews took place in the respective Principals' offices and lasted 30-40 minutes.

Statistical Treatment of Data

It was earlier mentioned that the research design used in this study was a mixed methods design. This means that both quantitative and qualitative analysis methods were used.

Quantitative Data Analysis

The quantitative data (in this case, questionnaire responses) were gathered from the respondents together and analyzed using Statistical Package for the Social Sciences (SPSS) version 23. Research question one was about the demographic characteristics of the participants which were analyzed and presented as frequency and percentage. Research question two was about the extent of ICT integration in teaching and learning in the teachers' colleges. The data collected was analyzed using descriptive statistics by computing the means and standard deviations of the levels of integration. Research question three was about the relationship between the dependent variable (level of ICT

integration) and the independent variables. Spearman's coefficient of correlation (r) statistics was used to analyze the data at 0.05 level of significance. Spearman's coefficient of correlation was chosen as the appropriate statistic to use because the data was ordinal in character and derived from Likert-type scale. Research question four was about whether there were significant differences in the integration of ICT in teaching and learning attributed to the demographic characteristics of the participants. Data was analyzed using the Mann Whitney U statistics for variables with two independent groups and Kruskal Wallis for variables with more than two independent groups. Research question five was a prediction question. It sought to establish the extent to which the ICT-related variables predicted the level of ICT integration in teaching and learning. Multiple regression statistics was used to analyze the data. Research question six was qualitative. It sought to explore the perceived barriers to the effective integration of ICT in teaching and learning. Data analysis followed the process of transcribing, identification of themes, coding and conceptualizing.

Hypothesis Testing in Quantitative Data Analysis

The level of statistical significance **(***p*-value) was established at .05. After conducting the statistical analysis using the SPSS software, where the *p* value was less than .05, the null hypothesis was rejected and a conclusion was drawn that there was a relationship or a difference between the variables in the study. Conversely, where the *p* value was greater than .05, the null hypothesis was retained or accepted and a conclusion was drawn that there was not enough evidence to say there was a relationship or a difference between the variables.

Qualitative Data Analysis

In the second, qualitative phase of the study, the raw data in the form of words from the interview and focus group sessions were not meaningful in themselves. Figure 4 shows the four main steps involved in the qualitative data analysis process: a) translating and transcribing (Punch, 2015); b) identification of themes (Neuman, 2011); c) coding data (Neuman, 2011; Punch, 2015) and d) conceptualization of themes (Neuman, 2011).

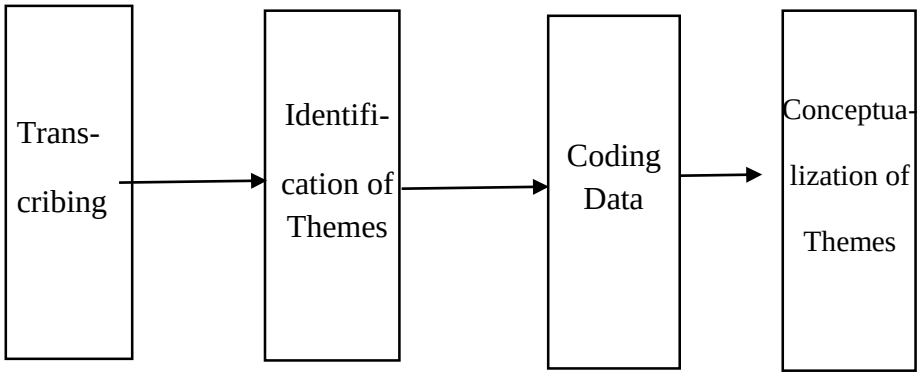

Figure 4: Qualitative data analysis process (adapted from Punch, 2015) p.87

Transcribing

By playing the recorded version through a multimedia player, the digital sound versions of the interviews and focus group sessions were displayed, which the researcher had the power to start and stop by pausing. The recordings of the interview were transcribed verbatim. There were a total of four interviews and four focus group sessions to transcribe. All the four focus group sessions and interview sessions were conducted in English Language. After transcribing all the interviews and focus groups sessions, the transcripts were checked against the recordings for a second time.

Identification of themes

The coded data was sorted into arrays according to the major categories, giving special attention to the research questions. All the chunks of data that had the same labels or closely related labels were categorized.

Coding the data

Qualitative analysis begins with coding, a main feature (Creswell & Clark, 2007; Neuman, 2011) that is essential for efficient qualitative study (Voss et al., 2012). Segmenting the text into small units and grouping and assigning tags to each one (Creswell & Clark, 2007; Neuman, 2011).The information gathered from the interviews and focus group sessions was used to derive these tags. Codes are labels or tags for the assignment of units of meaning (Neuman, 2011). Codes are particularly useful instruments for the purposes of data reduction (Neuman, 2011).

Conceptualization of themes

The conceptualization of themes tied the data together and paved the way in answering the research questions. The basic ideas for conceptualization were to document the general idea inferred from specific instances of the data collected

To validate the findings, i. e., determine the credibility of the information and whether it matched reality, three primary forms were used in the second, qualitative, phase of the study: (1) triangulation – converging different sources of information (focus group discussion, interview, observation, artifacts); (2) member checking – getting the feedback from the participants on the accuracy of the identified categories and themes; (3) providing rich, detailed description to convey the findings.

Ethical Considerations

Ethics applies to well-based principles of right and wrong that define what people ought to do, typically in terms of rights, duties, social benefits, justice, or particular virtues (Saunders, Lewis, & Thornhill, 2012). Ethics is described by Magwa & Magwa (2015) as the rules of conduct of researchers involved in research.

This study was therefore, conducted with highest regard to ethical issues. The researcher sought permission to conduct the research at various levels. The first level was to seek permission from the Research Ethics Committee (REC) of the University of Eastern Africa Baraton, Kenya (See Appendix 5). The next level was to seek permission from Gulu University Research Ethics Committee (See Appendix 6), for a recommendation to Uganda National Council for Science and Technology (UNCST), and then, from Uganda National Council for Science and Technology (See Appendix 8). After obtaining permission from UNCST, the researcher sought permission from the Principals of the respective colleges to collect data from the colleges (See Appendices 10-12).

The researcher adhered to strict codes of confidentiality and anonymity, along with the right to terminate and the protection of data storage. In addition, the Informed Consent Forms (See Appendix 9) were freely completed by all participants and those who were interviewed and engaged in the focus group discussions were asked to consent to the use of a tape recorder in the interview and focus group discussions. The teacher educators whose lessons were observed were also asked for permission to allow the camera to be used to record the lesson.

Using codes (W, X, Y, Z), the names of the colleges were obscured while the names of the participants were converted to false names (pseudonyms) at the early stage of information processing. The transcripts and audio tapes of each participant with their names shall be kept safely in a cabinet until the researcher graduates, after which they shall be deleted and destroyed.

CHAPTER FOUR

PRESENTATION OF FINDINGS, ANALYSIS AND INTERPRETATIONS

Introduction

The purpose of this study was to investigate the extent of ICT integration and the factors influencing the integration in teaching and learning in the National Teachers' Colleges in Uganda with the view to developing a model that could improve the process. Specifically, the study analyzed the demographic characteristics, attitudes, computer self-efficacy, college ICT vision, administrative and technical support, accessibility to ICT infrastructure, ICT policy issues, and examined the manner in which these factors relate to ICT integration as a pedagogical tool in teaching and learning. The chapter closed with a proposed ICT integration model.

Demographic Characteristics of the Teacher Educators

This section, which was guided by research question 1, focused on the demographic characteristics of the teacher educators' that comprised: gender, age, teaching experience, qualifications and ICT related training. The results were tabulated by frequency and percentage in some cases. In other instances, they were presented in graphic format.

Research Question 1:

What are the demographic characteristics of the teacher educators in the National Teachers' Colleges?

Gender of the Teacher Educators

Table 3: Gender of teacher educators

		Frequency	Percent	Valid Percent
Valid	Male	167	66.0	66.0
	Female	86	34.0	34.0
	Total	253	100.0	100.0

Presented in Table 3 is the gender of teacher educators who were involved in the study. A total of 253 teacher educators filled in the questionnaires, out of these, 167 were male, representing 66%, while 86 were female, representing 34%. These results show that there are more male teacher educators than their female counterparts in the National Teachers' Colleges in Uganda. Gender was considered an important demographic variable in this study because there are interesting myths surrounding gender and ICT usage. The role of gender in ICT literacy and in other synonymous concepts defining the potential to achieve with digital technology have been explored in recent research studies.

Male teachers appeared to record higher levels of ICT literacy than female peers when questioning teachers about their ICT literacy (Vekiri, 2010). But when it came to the actual output of teachers on computer-based tasks, the findings were less consistent.

Some studies have shown that male teachers perform better in ICT-related tasks than females (Calvani et al., 2012; Gui & Argentin, 2011; Van Deursen, 2012). Meanwhile, the findings of the international ICILS analysis (Fraillon et al., 2014) and the results of national research in Australia (Ainley, Fraillon, & Freeman, 2007), Chile (Claro et al., 2012), Korea (Kim, Kil, & Shin, 2014; Kim & Lee, 2013; Yang, 2012) and Norway (Hatlevik et al., 2015) showed that female teachers performed better than their male counterparts on ICT-related tasks. Nevertheless, there have not been identified gender gaps in ICT literacy in various other research studies (Hatlevik & Christophersen, 2013; Van Deursen, Van Dijk & Peters, 2011).

Age of Teacher Educators

Table 4: Age of teacher educators

		Frequency	Percent
Valid	<30	25	10
	30-34	72	28
	35-39	15	6
	40-44	15	6
	45-49	13	5
	50+	113	45
	Total	253	100

The ages ranged from less than 30 to 50 years and more with a mean of 36.6. The findings revealed that the teacher educators who were less than 30 years old were about 10%, those who were in age bracket 30-34 were about 28%, 35-39 were about 6%, 40-44 were about 6%, 45-49 were 5% and those who were 50 years plus were about 45%. This

means that majority (44.7%) of the teacher educators are those in the 50 and more age bracket while the least category of teachers (5.1%) are those in the 45-49 age bracket.

From the table, it is discernible to note that more than half of the teachers who participated in the study (61.6%) were within the age brackets, 35-39, 40-44, 45-49 and 50+. These age brackets comprise a group that is defined as post youth by the UNESCO, African Youth Charter (Hatlevik et al., 2015).

There has been an existing myth that there is a generational difference in ICT usage so that, in comparison to their elders who are said to be 'digital immigrants,' the rising generations are said to be 'digital natives' (Prensky, 2011). In this view, generational change is the solution to the issue, such that young teacher educators are expected to be stronger adopters and consumers of emerging technology and, thus, to be the resources to bridge the digital divide between populations. It was considered important in this study to determine the age differences among teacher educators and to see if age in any way accounted for the use and integration of ICT in teacher education programmes.

According to UNESCO, people who fall within the ages of 18-35 are youth. It is therefore possible to argue that most teacher educators who currently teach in National Teachers' Colleges in Uganda are in their post youth age hence the need to see their active role in bridging the generational digital gap that might be existing in the colleges. Previous studies have pointed out that there is a negative correlation between the age and teachers' use of ICT in the classroom and that young teachers are more inclined to use

ICT than older teachers (Bee & Chia, 2018; Sahin-Kizil, 2011; Sadik, 2016; Isleem, 2013)

Teaching Experience of the Teacher Educators

In terms of teaching experience, according to Figure 5, approximately 12% had taught for between 1 to 4 years, while 16% had taught for 5 to 9 years, 27% had taught for 10 to 14 years, 2% had taught for 15 to 19 years, another 2% had taught for 20 to 24 years, 7% had taught for 25 to 29 years and over 34% had taught for 30 years and over. This analysis shows that majority of the teacher educators (34%) were very experienced, with a teaching experience of over 30 years.

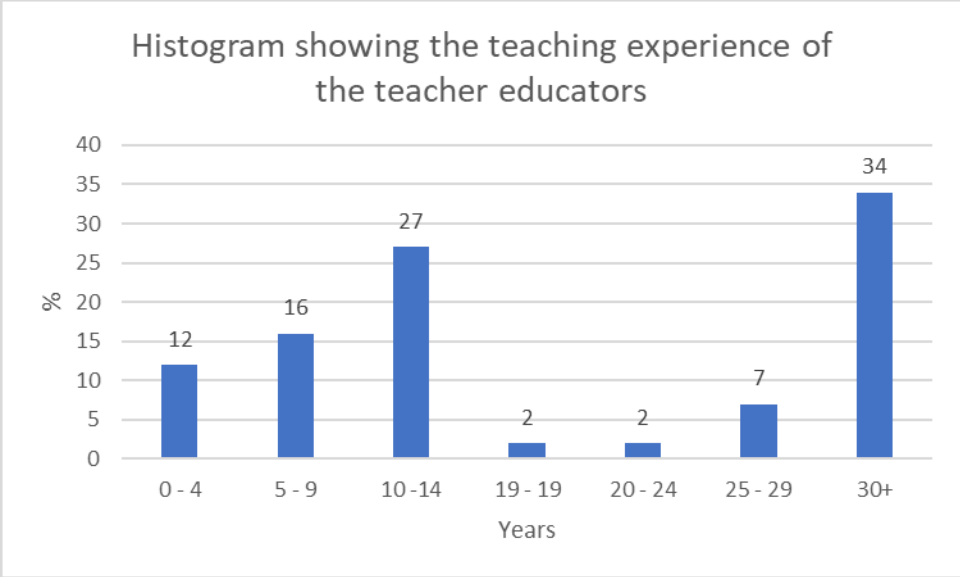

Figure 5: Histogram showing the teaching experience of the teacher educators

Teaching experience is a variable of the years of teaching service. Generally speaking, age is correlated with experience in teaching. That is, older teacher educators have more teaching experience than young teacher educators have. Age is negatively correlated with computer use, as analyzed above. It is arguable that senior educators are

less likely in the classroom to use computer technology. Sadik's (2016) research found that teachers with less teaching experience had a more positive attitude to ICT.

Huang, cited in Albirini (2016), found that senior teachers had less positive attitudes towards computers and were less willing to use them in their class than the less experienced fresh teachers did. The researcher noted that this was a highly experienced sample, which could be situated – on the basis of the Life Cycles theory (Huberman, as cited by Yang, 2012) – in a phase of consolidation and professional maturity that can evolve towards two different and opposite trends: to be conservative or innovative.

Qualifications of the Teacher Educators

Figure 6 illustrates the academic qualifications of the teacher educators in the National Teachers' Colleges.

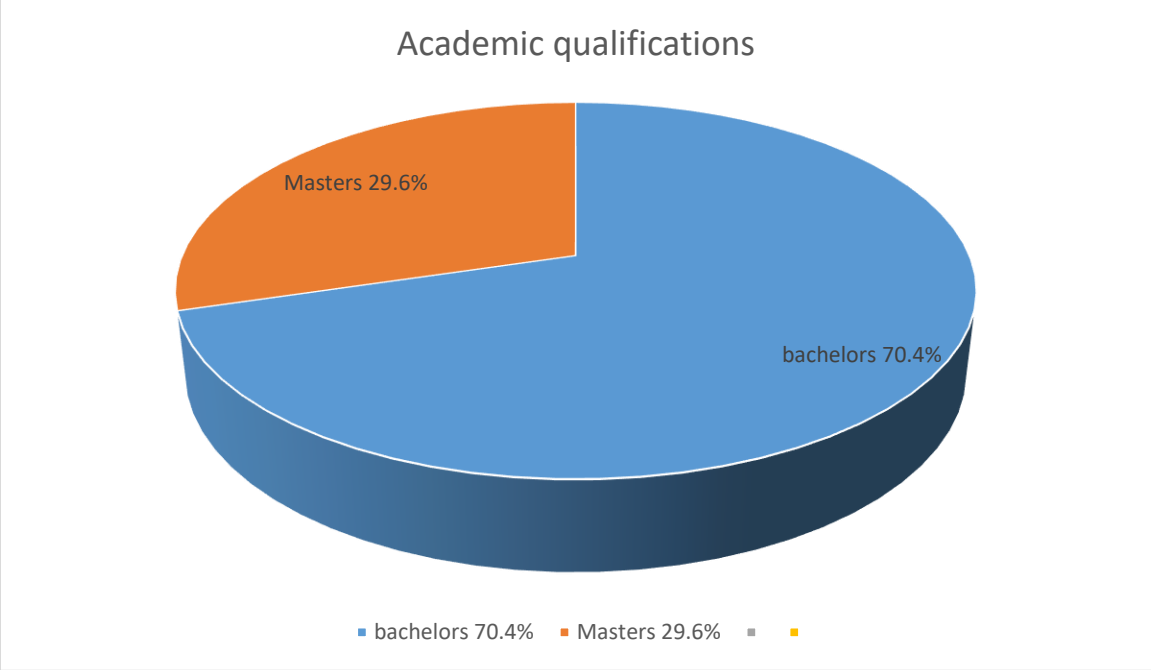

Figure 6: Pie chart showing academic qualifications of the participants

As presented in the figure, the teacher educators with Bachelors' degree numbered 178 (70.4%), while 75 (29.6%) had Masters' degree. It is clearly discernible from the data that majority of the teacher educators (70.4%) in the National Teachers' Colleges in Uganda have Bachelors' degrees. Although the minimum requirement for teacher educators in the NTCs is a Bachelor of Education Degree, it was interesting to note that a significant number (29.6%) of the teacher educators already possessed Masters Degrees. As a requirement, most universities that offer postgraduate degrees in Uganda require students at that level to use ICTs for various functions including research work, academic writing and for presentations. The Pan African Research Agenda on the Pedagogical Integration of ICTs. (2011), observes that people who have tertiary qualifications are more likely to be better ICT users than their counterparts with lesser qualifications. It was therefore assumed that the more teachers pursue higher opportunities of learning at postgraduate level, their enhanced ICT skills would be transferred innovatively into instructional practices.

ICT Training

Figure 4.3 is a visual representation of the ICT-related training of the teacher educators. It is clear from the figure that the greatest bulk of the participants (78.7%) received some basic training in ICT while only 2% received post graduate training. It is also worthwhile to note that at least13.4% of the teacher educators reported not having had any ICT training at all and only 6% reported having had training on ICT integration in teaching and learning.

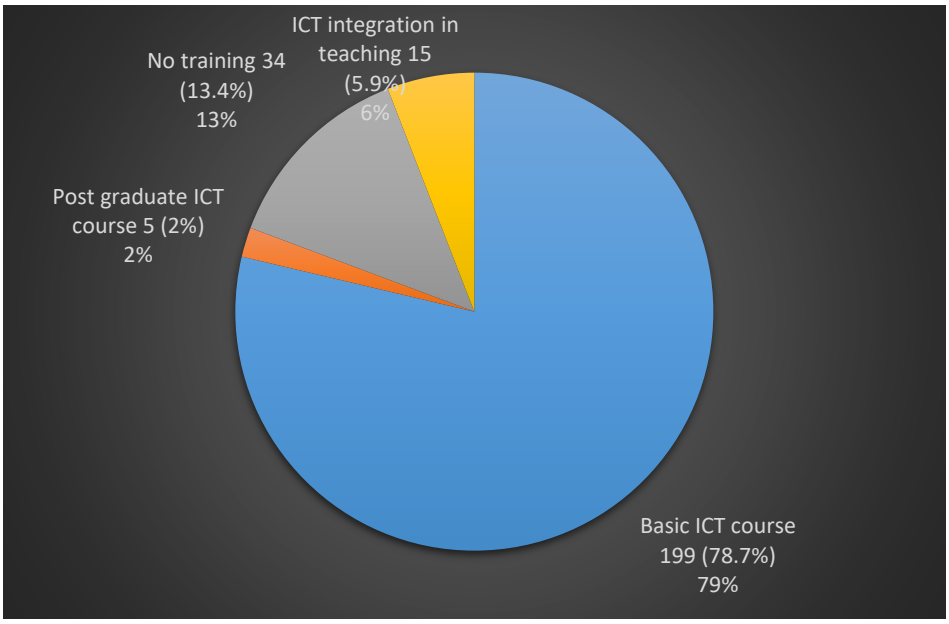

Figure 7: Pie chart showing ICT related training of the teacher educators

In this study, ICT-related training was considered an important variable since there is no question that computer training will help enhance the computer competence of teachers. It is not infrequent, however, to see that some teachers who are skilled at operating a computer still do not know how to incorporate ICT into authentic teaching in the classroom. Training should, therefore, not only emphasize basic computer skills, but also the introduction into classroom activities of relevant pedagogical applications. Many studies have shown that training is an essential component in enhancing the integration of ICT into education. Warschauer (2012 p. 76) pointed out in his study that an Egyptian university lecturer told him that "we have the hardware, we have the software, but we lack the human ware"- meaning that there was lack of human resource capable of proficiently manipulating the computer resources. The study by Sadik (2016) indicated that the correlation between training and teachers' use of ICT was positive, i.e. more training would lead to more integration of ICT in teaching. Sadik (2016) further indicated

that trained teachers expressed statistically more positive attitudes toward ICT integration in teaching and learning than non-trained teachers did. Lewis et al (2019) pointed out that it was necessary to enhance the capacity of teachers to teach effectively, including incorporating technology into the subject taught, through a professional development program based on training on a particular curriculum and subject field.

Since training is necessary for the incorporation of ICT into education, more training should be provided to teachers, especially older generation teachers, including in-service and pre-service training through seminars, intensive courses, video, face-to-face or web-based case studies, etc., after the implementation of computer software and hardware into the curriculum (Sadik, 2016). Once teachers know how to implement ICT into the classroom in order to produce better teaching results, their attitude towards ICT in education will change (Lewis et al., 2019). It is important to prepare and engage in the training of all school teachers because otherwise only teachers who are already familiar with ICT can volunteer for the training, whereas teachers who require the most training would typically opt out of the program.

The Level of ICT Integration in Teaching and Learning among the Teacher Educators

The questionnaire items in section ix sought to measure the extent to which the teacher educators integrated ICT in teaching and learning. The teacher educators were asked to rate their levels of agreement or disagreement with statements describing their levels of ICT integration in teaching and learning as follows: Strongly disagree (1), Disagree (2) Agree (3) and Strongly agree (4). Statistical Package for Social Sciences

(SPSS) was used to obtain the means, overall mean and standard deviation of the responses. The section was guided by the research question 2.

Research Question 2:

What are the levels of ICT integration in teaching and learning among the teacher educators in the National Teachers' Colleges in Uganda?

Table 5: Means and Standard Deviation of extent of ICT integration

	N	Mean	Std. Deviation
I create visual presentations, graphics, charts, and drawings for students	253	1.52	.843
I download teaching materials regarding my subject	253	3.11	1.038
I use computer to develop schemes and lesson plan	253	1.63	.818
I use email to ask and send assignments to my students	253	1.64	.888
I have created and use chart rooms with my students	253	1.59	.834
I use ASSURE lesson plan format to prepare my lessons	253	1.39	.643
I encourage pupils in class to search for information on internet	253	3.41	.716
I use computer as a tool for demonstration working with presentations	253	1.75	.953
Overall Mean		2.00	.526

The scale of interpretation of the findings in table 5 is as follows: Means of 1.0-2.0, the level of integration is considered Low; Means of 2.1-3.0, the level of integration

is considered Moderate and a Mean of 3.1-4.0, the level of integration is considered High. It is notable from the table that the level of teacher educators' integration of ICT is low, with an overall arithmetic mean of 2.00 and a standard deviation of 0.53. Since the standard deviation is relatively low, that is, less than one, it indicates convergence among the study sample, meaning that the majority of the study sample had a mean of approximately 2.00 (disagreeing with the statements). The results also show that the highest integration in the teacher educators' responses was "encouraging pupils in class to search for information on internet," where the arithmetic mean was 3.41 and the standard deviation 0.72. "Downloading teaching materials regarding subject areas" was second with arithmetic mean of 3.11 and a standard deviation of 1.04 – implying a wide disparity among the teacher educators at the level of downloading teaching materials regarding subject areas.

The lowest level of integration among the teacher educators was "using the ASSURE lesson plan format to prepare lessons" with an arithmetic mean of 1.39 and a standard deviation of 0.64 – implying a convergence at this level, meaning that many teacher educators strongly disagreed with using the ASSURE lesson plan format to prepare lessons.

The quantitative data analysis results in regard to extent of ICT integration in teaching and learning corroborated with the results of the qualitative analysis. The researcher used focus group discussion with the teacher educators, interviews with Principals and observation of selected sample lessons under the theme and sub-themes as in figure 8.

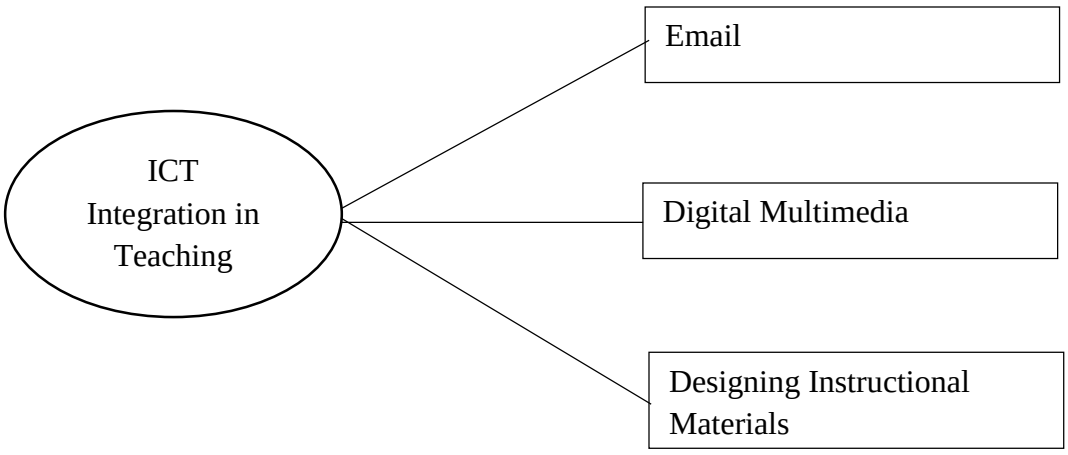

Fig. 8: The themes and sub-themes for ICT integration in teaching and learning

Both the interview and focus group discussion findings revealed that the teacher educators had hardly used email to send or receive assignments. This meant that the extent of integration of ICT in teaching and learning was low as some teacher educators even intimated that for them they thought that integration of ICT in teaching was only possible in ICT subject.

One history teacher educator in college X, responding to how often he used email to send and receive assignments said:

> *"You don't expect someone teaching history subject to ask students to send their assignment through the email, that task is for teachers who are teaching ICT subject. To be honest as a history teacher, I have never asked my students to do so".*

Another teacher educator of religious education in the same college said:

"..... I even long forgot my email address let alone the password; I last opened and used an email address when we had ICT training in the year 2017 at the college. So how will I ask my students to send their assignment through emails? I even doubt whether all the students have email addresses anyway. This is impossible in my class due to the big number of students attending my subject. In my religious education class I teach over one hundred students which is impossible to prepare digital materials for all of them".

It was interesting to note that most teacher educators interpreted the use of digital multimedia in their classroom presentations to mean the use of Micro Soft Power Point only. The findings from the interviews and focus group discussions revealed that most of them thought that the use of ICT in teaching has something to do with the use of MS Power Point only. One relatively young looking biology teacher in college Z said:

".... for us in the science department we are only two teachers who have personal laptops and often use projectors in the college for power point presentations. Other teachers are old and ICT illiterate and they are not conversant with power point presentations. I think with power point presentations; we are the only ones using ICT in presenting the subject matter".

The belief that the integration of ICT in teaching and learning means the use of power point in presentation was corroborated by the lesson observation the researcher carried out for a lesson conducted supported by ICT integration where the teacher used

only power point presentation. See figures 9(a) and 9(b) below representing ICT integration in teaching and learning.

Figure 9(a): A vignette of a Teacher educator at the front of the classroom conducting a power point lesson using projector with support of ICT technician.

Figure 9(b): A vignette of a Teacher educator "integrating" ICT in teaching and learning using projector, but learners are taking notes the traditional way.

During the focus group discussions with the teacher educators, it became clear that they hardly used ICT for designing instructional materials. When asked how laptops were used to share information and design instructional materials, one College W teacher educator responded:

> *"I really don't know much about designing instructional materials with laptop. What I know is just preparing notes in power point and sometimes present them to my class. In fact, last year I attended a one-day workshop organized by the Ministry and facilitated by UNESCO at the college on instructional media design*

but I did not understand much due to limited time. But I was even better off than other teachers because I am at least ICT literate. Other teachers who were ICT illiterate had to learn first how to use computers and by the time they started on instructional materials design, the workshop was ended."

Another relatively old looking teacher educator from college Y responded saying:

"… for me when talking about the use of computers in my teaching, I can say that yes we have the computer lab with many computers, but when students get in the lab to use the internet, it becomes very frustratingly slow. So I simply use the lab computers for typing students' exams when needed for submission to the academic registrar. I also sometimes use the computers to read and send my personal email. Remember I am too old; beginning to deal with computer at this age is time wastage. After all, I was not trained to use computers during my teacher education; even the selection of participants for ICT workshops is discriminative. I have ever attended only a one-day workshop where I learnt how to use email to send and receive messages. Where do I get the skills to enable me integrate ICT in pedagogy?"

The result that there is low level of ICT integration in teaching and learning by the teacher educators is not surprising. A number of studies by different scholars have reported similar low levels of ICT integration by teachers (Paryono & Quito, 2010; Sukri, 2010; Mahmud & Ismail, 2010; Ngah & Masood, 2006; Wahab & Kaur, 2009; Mustapha, 2008; Bakar & Mohamad, 2010). These studies generally reported a low to moderate level of ICT integration in teaching, although many teachers were aware that integration

of ICT in teaching could help enhance student learning. The degree of ICT adoption among Malaysian secondary school teachers was investigated by Lau & Sim (2008). They observed that older teachers would more regularly use educational technology in classroom instruction, than new teachers. Older teachers could easily integrate educational technology into their teaching practice with their benefit of both teaching experience and basic competency in ICT. Lawless and Pellegrino (2007) argued that if teacher-training programmes also concentrated on ICT skills and innovative approaches for classroom tasks, educators could also accept and integrate ICT into their classrooms. The duration of the training period should be adequate to ensure that trainee teachers have sufficient practice to reinforce their confidence in the use of ICT in the classroom.

The Relationship between the Teacher Educators' Levels of ICT Integration and Selected ICT-Related Variables

The researcher sought to determine the relationships that existed between the teacher educators' levels of ICT integration in teaching and learning as a dependent variable and each of the independent variables which included the teacher educators' attitudes, self-efficacy, college ICT vision, administrative and technical support, accessibility to ICT infrastructure and college ICT policy issues. Spearman's coefficient of correlation (r) statistic was used to determine the relationships at 0.05 level of significance in each case. Spearman's coefficient of correlation was chosen as the appropriate statistic to use because the data was ordinal in character and derived from Likert-type scale. This section of the study was guided by research question 3 and null hypothesis 1.

Research question 3:

Is there a statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and:

(a) Their attitudes

(b) Self-efficacy

(c) College ICT vision

(d) Administrative support

(e) Technical support

(f) Accessibility to ICT infrastructure

(g) College ICT policy issues?

Null Hypothesis (H_O) 1: There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and:

(a) Their attitudes

(b) Self-efficacy

(c) College ICT vision

(d) Administrative support

(e) Technical support

(f) Accessibility to ICT infrastructure

(g) College ICT policy issues

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and their attitudes.

Ho 1(a): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and their attitudes**.**

Table 6: Relationship between the teacher educators' level of ICT integration and attitudes.

Correlations

			Extent of ICT Use	Attitude
Spearman's rho	Extent of ICT Use	Correlation Coefficient	1.000	.119
		Sig. (2-tailed)	.	.042
		N	253	253
				.

Level of significance (p) = 0.05

Table 6 shows a positive correlation coefficient, r = 0.12 between teacher educators' level of ICT integration and their attitudes. The sig. (2-tailed) is at 0.06 which is greater than 0.05, and therefore, the null hypothesis was accepted, thus; the researcher did not find a significant relationship between the teacher educators' level of ICT integration and their attitudes.

The teacher educators' attitude towards ICT integration in teaching and learning was also qualitatively assessed under the theme and sub-themes as in figure 10.

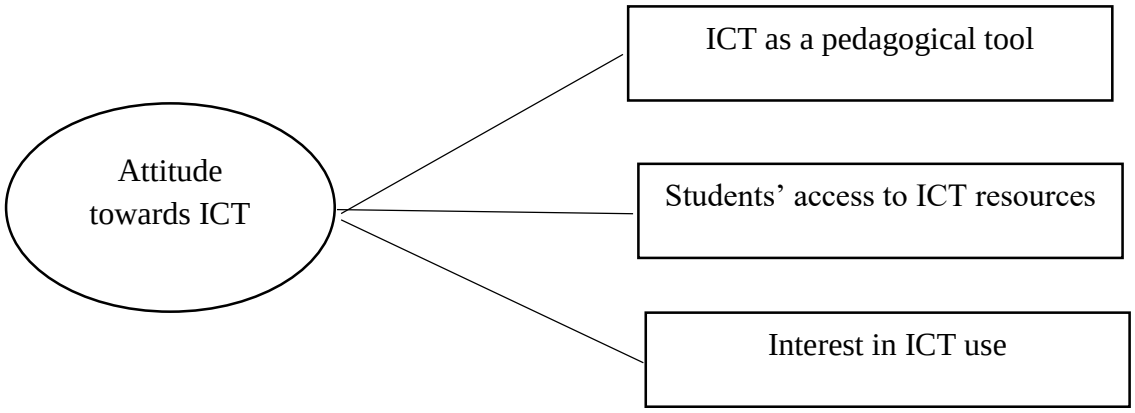

Figure 10: The theme and sub-themes for Attitudes towards the use of ICT as a pedagogical Tool

According to the discussions of the teacher educators during the focus group interactions and interview responses of the Principals, there was evidence that both categories of staff in the National Teachers' Colleges had a positive attitude towards ICT integration in teaching and learning, although they expressed some reservations. During a focus group discussion, when asked what they felt about the use of ICT as a pedagogical tool in the classroom, one teacher educator from college Z responded:

"In my opinion, ICT can be used as a pedagogical tool to enhance learning in the classroom but it is not used at our college. We have enough computers, LCD projectors and smart board but most of us don't use them since we don't have sufficient training about them. Last year

there was some training at the college in which most of us participated but it focused on equipping basic ICT skills instead of pedagogical competence. Some of us are even afraid to use projectors in the classroom because we are not able to prepare digital presentations and for fear of failure and being embarrassed before the students who are more technologically savvy than us".

During an interview with one of the Principals of college X, he said:

"I always encourage my lecturers to embrace the use of ICT in their teaching because the traditional teacher-centric styles of teaching can no longer find a place in this twenty first century. But the Ministry of Education and Sports needs to help us particularly with the old lecturers who demonstrate phobia for ICT tools"

Regarding the attitudes of the teacher educators towards students' access to ICT resources, many of them expressed rather negative attitudes. Some of the concerns that came up were that some of the resources might be abused by the students for cyber bullying, or spreading malicious rumors. The focus group discussion on whether students should be allowed to possess personal ICT tools such as cell phones, tablets, laptops etc., at school was hot. One female teacher educator from college W retorted:

"*Personal ICT tools like cell phones should not be allowed in schools because if the students get bored, they might use them to play games or do other activities that distract their attention from learning. Let schools*

provide the resources to the students which they can regulate when and how they are to be used".

At a focus group discussion in college Z, the teacher educators were even of the view that students should not be allowed to access the ICT laboratory in their colleges without the presence of a teacher or ICT personnel to avoid misuse of the resources. For example, one of the teacher educators in college Z commented:

"*When we allow our students to get into the computer room to search for materials that are relevant to their subjects, they become excited. But you will find some of them watching pornographic pictures and others chatting with their friends in face book instead. Funny enough, many students are using the internet at the college to spread rumors and even discuss issues related to politics and love affairs. Much needs to be done to assist our students to understand the importance of ICT in learning"*

From both the interviews with the Principals and focus group discussions with the teacher educators, it emerged that teachers were interested in incorporating ICT as part of pedagogy, but lacked high-quality tools and well-designed ICT infrastructures, which led to difficulties in using ICT as a pedagogical instrument successfully. For instance, one college X teacher educator said in explaining the reasons for the ineffective use of ICT as a pedagogical tool:

"Many of us enjoy using computers and other digital tools in our teaching, but the available digital tools are not enough to accommodate our needs. At our college, we have one computer room which is open to both students and teachers; you often find teachers competing with students in the computer lab to get

computers when there is internet connectivity; these days with the little computer training many of us have received, even to secure a projector for a lesson has become a scramble, even worse, some lecturers secure the projectors well in advance of their lessons and keep until when the lesson is due, disadvantaging their colleagues whose lessons come before".

During a focus group discussion, another teacher educator from college Y said:

"Yes I enjoy using technology in my teaching and my students also do, but sometimes I ask my students to send their assignments to my email address; some of them manage to do so but the majority fail due to poor internet connectivity at the college and there is no any initiative brought forward by the Principal to improve that situation. I am ready to use ICT even in sharing my lecture notes with students and promoting a culture of independent research among the students but the infrastructures are not ready to support the usage".

The results of this study corroborated with the results of many other studies that have indicated that teachers' attitude plays a significant role in the successful integration of ICT into education (Albirini, 2016; Xiaojun, & Dostál, 2017; Kim et al, 2013). According to Xiaojun, & Dostál, (2017), teachers' attitude towards ICT is the main factor affecting the infusion of ICT into instructional practice since, first of all, the teacher is the direct implementer of ICT who must play an important role in combining ICT and education. If teachers' attitude towards ICT is negative, or if teachers refused to use ICT in classroom teaching, the integration of ICT in classroom teaching would break down. Schiller (2013) argues that the use of technology is not guaranteed by the mere existence

of computers in a school. The teacher's attitude towards the use of ICT is considered to be a good predictor of whether or not ICTs would be used by teachers.

Schoolnet (2010) discovered in a related study that there is a connection between the attitudes of the teacher towards technology and their chances of incorporating it into classroom instruction. The teachers who are more likely to successfully integrate ICTs are those who are more experienced, confident and positive in their ability to use them effectively (Peralta & Costata, 2017). However, while the investigator found a positive correlation in this study between the level of integration of ICT and the attitudes of teacher educators, the analysis did not find a statistically significant relationship between the level of integration of ICT and attitudes. This meant that other factors other than their attitudes could have been responsible for the non-integration of ICT into teaching and learning.

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and their Self-Efficacy.

Ho 1(b): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and their self-efficacy.

Table 7: Relationship between the teacher educators' level of ICT integration and self-efficacy.

Correlations

	Extent of ICT Use	Self-Efficacy

Spearman's rho	Extent of ICT Use	Correlation Coefficient	1.000	.754**
		Sig. (2-tailed)	.	.000
		N	253	253
				.

Level of significance (p) = 0.05

Table 7 shows a positive correlation coefficient, r = 0.75 between teacher educators' level of ICT integration and their self-efficacy. The sig. (2-tailed) is at 0.000 which is less than 0.05, and therefore, the null hypothesis was rejected, thus; the researcher did find a significant relationship between the teacher educators' level of ICT integration and their self-efficacy. This means that the teacher educators who are efficacious (confident with use of ICT tools) are more likely to integrate ICT in their teaching and learning practices.

Previous studies on self-efficacy and the use of ICT in teaching confirm the findings of this study and highlights the notion that higher levels of computer self-efficacy can lead to higher levels of confidence in becoming an effective ICT teacher (Fanni et al., 2013). Hammond et al. (2011) studied the reasons why ICT is used by teachers and found a link between lower levels of self-efficacy in ICT and less regular use of ICT. In addition, recent research indicates a positive correlation between self-efficacy in the use of digital technologies and the use of ICT for teaching purposes (Teo, 2014; Hatlevik, 2017).

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and the College ICT Vision.

Ho 1(c): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and the college ICT vision.

Table 8: Relationship between the teacher educators' level of ICT integration and college ICT vision

Correlations

			Extent of ICT Use	ICT Vision
Spearman's rho	Extent of ICT Use	Correlation Coefficient	1.000	.277
		Sig. (2-tailed)	.	.000
		N	253	253

Level of significance (p) = 0.05

Table 8 shows a positive correlation coefficient, r = 0.28 between teacher educators' level of ICT integration and the college ICT vision. The sig. (2-tailed) is at 0.000 which is less than 0.05, and therefore, the null hypothesis was rejected, thus; the researcher did find a significant relationship between the teacher educators' level of ICT integration and the college ICT vision. The implication here is that colleges with robust ICT visions are the ones where ICT integration takes place.

The outcome of this study is backed by the opinions of many researchers who affirmed that the existence of an ICT vision can stimulate and encourage teachers to work towards achieving targets and goals, act as a catalyst for professional development of teachers, set a standard of excellence, enable change to take place by using the skills,

talents and resources available, and ensuring that the practices and actions of management are purposeful and practical (Arnold et al., 2012; Bennett, 2012; Bush, 2010; Ertmer, Addison, Lane, Ross & Woods, 2013; Spurr, Rosanowiski, & Williams, 2008; Tomlinson, 2014; Wallace & Poulson, 2013; Young, Sheets, & Knight, 2015). It is therefore, most probable that the teacher educators who were integrating ICT in their teaching were influenced by the ICT visions in their colleges.

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and Administrative Support.

H_O 1(d): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and administrative support.

Table 9: Relationship between the teacher educators' level of ICT integration and administrative support

Correlations

			Extent of ICT Use	Administrative Support
Spearman's rho	Extent of ICT Use	Correlation Coefficient	1.000	.213
		Sig. (2-tailed)	.	.001
		N	253	253

Table 9 shows a positive correlation coefficient, r = 0.21 between teacher educators' level of ICT integration and the administrative support. The sig. (2-tailed) is at 0.001 which is less than 0.05, and therefore, the null hypothesis was rejected, thus; the researcher did find a significant relationship between the teacher educators' level of ICT integration and the administrative support. This means that in colleges where the administrators support the teacher educators' integration efforts, there is more likely to be observed heightened levels of ICT integration in teaching and learning.

Various researchers have indeed found positive relationships between administrative support and ICT integration in teaching and learning. For instance, based on the literature review, administrative support was found to significantly influence the success of integrating ICT into the teaching-learning process among the school teachers (Ali et al., 2009; Baylor & Ritchie, 2012; Samuel & Bakar, 2016). In order to provide technology leadership in managerial, educational and learning roles, Principals ought to be proficient in the use of ICT (Afshari, Bakar, Luan, Samah, & Fooi, 2009). The provision of support by the principals enables teachers to integrate ICT into their own teaching (Ali, Nor, Hamzah, & Alwi, 2009). The existence of administrative support is, therefore, key in encouraging teachers to use laptops as a tool for classroom instruction. (Mosesa, Kamariah, Rosnaini & Wong, 2011).

Support from administrators plays a role in impacting teachers to use the technology, according to Baylor & Ritchie (2012). It seemed that administrators who support the use of technology not only in words but also in action, lead to the acceptance

of the utilization of technology as a culture. On this basis, Baylor and Ritchie asserted that if administrators were to cultivate a culture of technology use, instead of sitting aside, they have to figuratively "roll up their sleeves and join in." As such, the success of integrating ICT into teaching and learning practices depends largely on the support provided by the school Principal (Samuel & Bakar, 2016). Therefore, for the successful infusion of ICT in a school setting, administrative support is paramount.

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and Technical Support.

Ho 1(e): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and technical support.

Table 10 shows a positive correlation coefficient, r = 0.03 between teacher educators' level of ICT integration and the technical support. The sig. (2-tailed) is at 0.037 which is less than 0.05, and therefore, the null hypothesis was rejected, thus; the researcher did find a significant relationship between the teacher educators' level of ICT integration and the technical support. This means that there was a positive relationship between technical support and level of ICT integration, and the relationship was strong enough to influence ICT integration in the teachers' colleges.

Table 10: Relationship between the teacher educators' level of ICT integration and technical support

Correlations

			Extent of ICT Use	Technical Support
	Technical Support	Correlation Coefficient	.031	1.000
		Sig. (2-tailed)	.037	.
		N	253	253

Level of significance (p) = 0.05

In regard to technical support, qualitative data was collected using focus group discussion and interview with Principals under the theme and sub-themes as in figure 11.

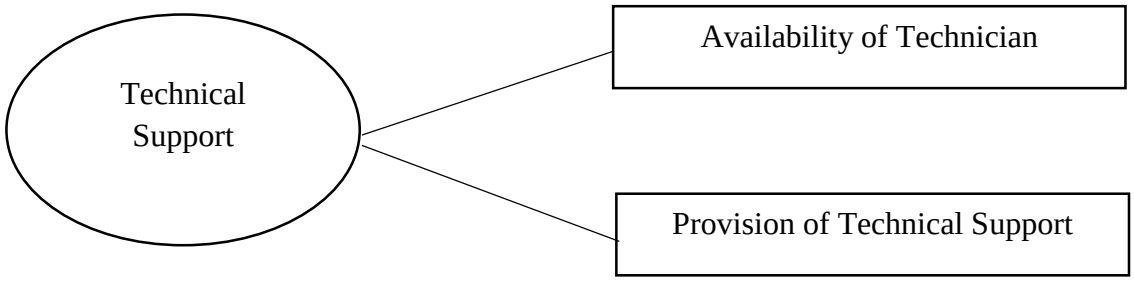

Fig. 11: The theme and sub-themes for Technical Support

The teacher educators were asked in a focus group discussion whether there were ICT lab technicians or specialists who provided support to the users and how supportive they were to the teacher educators. In all the colleges, the teacher educators intimated that they had at least one technical personnel in each of the colleges. However, they complained that the number was inadequate and as a result, they provided insufficient support. To illustrate their claim, one respondent from college X said:

> *"There is only one ICT technician who always looks overwhelmed by the number of students who flock the ICT lab. He is always busy with students and when you are a teacher and you try to consult him for help, he sometimes embarrasses you before the students saying that as a teacher you ought to know what to do. But even then, the lab technician only provides technical services to students like trouble shooting, how to open email accounts and help with forgotten email passwords, fixing internet*

connectivity; he has little knowledge and skill of how to integrate the ICT in teaching and learning."

The results of many academics whose research studies have reported that technical support has an influence in promoting the use of ICT among teachers are corroborated by this result (Dexter, et al, 2013; Kipsoi, Chang'ach, & Sang, 2012). Technical support is essential in schools to make it easier for educators to use ICT effectively in their teaching practices, according to Mosesa, et al (2011). Teachers are least expected to overcome the obstacles impeding them from using ICT without good technical support in both the classroom and whole-school resources (Lewis, 2013). Pelgrum (2001) found that a lack of technical support was one of the significant obstacles to the integration of ICT in education.

In the study by Sicilia (2005), technical challenges were identified as one of the major obstacles for teachers. These technical challenges included having to wait for websites to open, failing to access the internet, printers failing to work, computers that were malfunctioning, and teachers working on old computers. "Technical barriers impeded the smooth delivery of the lesson or the natural flow of the classroom activity" (Sicilia, 2005, p. 43).

Korte and Hüsing (2017) claimed that in schools, ICT technical support services help teachers incorporate ICT in classroom instruction without wasting time by having to address issues with software and hardware. "If there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns" Becta, 2004, p. 16). Majority

of Becta (2004) survey respondents reported that technical challenges discouraged them from incorporating technology in their teaching due to the fear of breaking down of equipment during a lesson. It is therefore, imperative that if the teacher educators are to be able to integrate ICT in their teaching and learning practices, there must be ready and always available technical support whenever required.

Relationship between the Teacher Educators' Level of ICT Integration in teaching and learning and accessibility to ICT infrastructure.

Ho 1(f): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and accessibility to ICT infrastructure.

Table 11: Relationship between the teacher educators' level of ICT integration and accessibility to ICT infrastructure.

Correlations

			Extent of ICT Use	Accessibility
	Accessibility	Correlation Coefficient	.023	1.000
		Sig. (2-tailed)	.713	.
		N	253	253

Level of significance (p) = 0.05

Table 11 shows a positive correlation coefficient, r = 0.02 between teacher educators' level of ICT integration and the accessibility to ICT infrastructure. The sig. (2-

tailed) is at 0.71 which is greater than 0.05, and therefore, the null hypothesis was accepted, thus; the researcher did not find a significant relationship between the teacher educators' level of ICT integration and the accessibility to the ICT infrastructure.

Qualitative data on ICT infrastructure and accessibility was also collected on the theme and sub-themes as in figure 12.

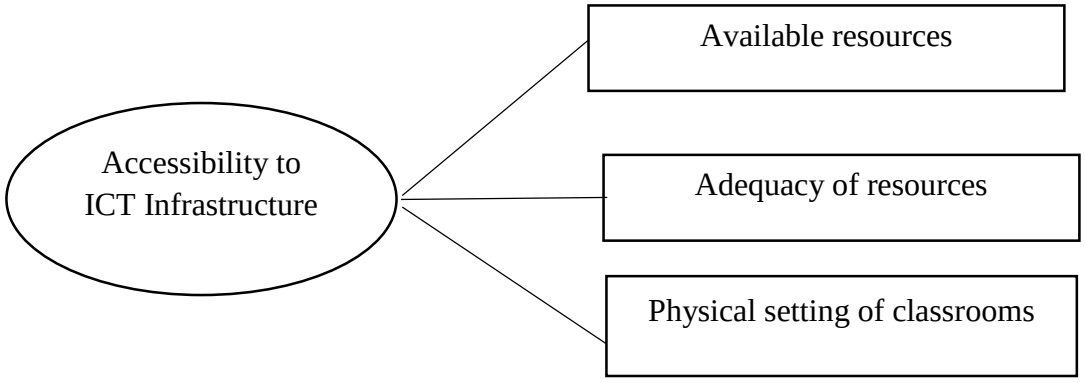

Fig. 12: The theme and sub-themes for Accessibility to ICT Infrastructure.

The sub-theme "available resources" dealt with the actual available ICT resources such as "software" and "hardware", internet, ICT lab or resource center, and others to which the teacher educators had access in the colleges. It was understood from their responses that the colleges had the minimum software and hardware to integrate ICT in their teaching practices. During the interviews with the Principals, all the four Principals reported having a computer lab, computers, laptops, a few tablets, projectors, smart boards, and a ICT resource center with computers installed with e-learning resources. One of the Principals of college W had this to say:

"….. *My college was lucky to have been supported by a number of Development Partners in the area of ICT. We received a consortium of desktop computers from the Uganda Communications Commission (UCC) and one-year internet connection subscription. Then the Belgian Technical Corporation (Enabel) also supported us with many desktop computers and personal laptops for the lecturers. Some of the lecturers who were later appointed as mentor teachers were also given personal tablets. Enabel went a step further to train the lecturers in different applications of ICT in teaching and learning. So in terms of availability of ICT resources, I can say that my college is up to date."*

Although it was evident in the focus group discussions with the teacher educators and interview meetings with the Principals that all the colleges had some substantial quantities of ICT software and hardware, through further probing it became apparent that the resources were not adequate compared to the users. For example, some teacher educators reported the high competition for the few available projectors to the extent that some of them secured them earlier than their lectures and kept them until their lessons were due. In this regard, one teacher educator from college Z said:

> *"I think the desktop computers are enough because I see the ICT lab full of computers and I am told there are at least one hundred stations. With my class of about sixty students, those computers would be adequate. But I see only one smart board and one digital camera. If we were all able to use these equipments, how would we*

share them? Even projectors, there are only two against over fifty of us who would need to use them."

The teacher educators were asked during the focus group discussions whether their classroom settings were appropriate for ICT integration in their lessons. The responses indicated that the classrooms were overcrowded and originally not constructed with the foresight of the designs that would be required to facilitate ICT integration. To illustrate her point, one history teacher from college W said: "*I teach history and my class has over 200 students. The classroom is overcrowded, there is even no space for the teacher …. Where can I put a screen and the laptop?"* Another teacher educator from college Y, who teaches Educational Psychology, a general subject offered by all teacher trainees said: "*For me I teach Educational Psychology, my class has got over 500 students. When I try to use power point in my lecture, the students standing at the back complain that they cannot clearly see and read what is on the screen".* One of the Principals of college Z in an interview concurred with the teacher educators and suggested: "*Classrooms ought to be conveniently reorganized to accommodate ICT use. They ought to be spacious to allow easy movement of the teacher and the lighting systems ought to be sufficient."*

Many previous research studies have clearly shown that ICT infrastructure can be one of the factors influencing the use of technology among teachers, as discussed in the literature review (Cowie & Jones, 2005; Krysa, 2013; Shiue, 2017). For example,

Newhouse, (2012) pointed out that some of the essential factors for the successful incorporation of ICT in schools, among others, include the provision of hardware and software infrastructure. Numerous research studies have also shown that the inaccessibility to ICT resources, including domestic access, is a complicated barrier that discourages teachers from incorporating emerging technology into their teaching and learning practices, as demonstrated in the following discussion.

Several explanations for the lack of access to ICT resources have been established in different research studies. Teachers complained in the study by Sicilia (2005, p.50) over how hard it was to always gain access to computers. The author gave reasons like "computers had to be booked in advance and the teachers would forget to do so, or they could not book them for several periods in a row when they wanted to use them with the students". In other words, since most of the ICT resources were shared among the different teachers, it was difficult for a teacher to gain access to them. The lack of access to ICT resources may not necessarily be due to merely the inexistence of the resources or other ICT materials in the institution. This may be due to one of a variety of reasons, like poor resource organization, sub-standard hardware, unsuitable software, or personal inaccessibility by the teachers (Becta, 2004).

The constraints to accessibility for teachers to emerging technology are prevalent and vary from state to state. Empirica's (2016) European study reported that inaccess is the greatest obstacle and that educators have encountered numerous obstacles to the application of ICT in teaching, such as inaccess to computers and a lack of sufficient information. Likewise, Korte and Hüsing (2017) reported that certain technology

obstacles, such as internet connectivity, are not yet accessible in European schools. They estimated that there was still no high Speed internet connectivity for one third of European schools. Pelgrum (2001) examined the views of practitioners from 26 countries on what they considered were the key barriers to school adoption of ICT. He found that the accessibility to ICT resources was linked to four of the top ten obstacles. These obstacles were insufficient computer numbers, limited peripheral devices, inadequate copies of software and limited simultaneous connectivity to the Internet.

Basically, the issues raised about accessibility to ICT infrastructure in this study are quite similar to those discussed in the literature review. Issues such as inadequate computers, lack of or slow internet connectivity, sharing of resources, and the like, were cited in this study as well as in past studies.

Relationship between the Teacher Educators' Level of ICT Integration in Teaching and Learning and College ICT Policy Issues.

Ho 1(g): There is no statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and college ICT policy issues.

Table 12 shows a positive correlation coefficient, r = 0.53 between teacher educators' level of ICT integration and college ICT policy issues. The sig. (2-tailed) is at 0.00 which is less than 0.05, and therefore, the null hypothesis was rejected, thus; the researcher did find a significant relationship between the teacher educators' level of ICT integration and the college ICT policy issues.

Table 12: Relationship between the teacher educators' level of ICT integration and college ICT policy issues.

Correlations

			Extent of ICT Use	ICT Policy
	ICT Policy	Correlation Coefficient	.527	1.000
		Sig. (2-tailed)	.000	.
		N	253	253

Level of significance (p) = 0.05

This result corroborates with a number of research studies that presented evidence that an increase in classroom use of ICT was linked to a favorable ICT policy environment. (Barron et al., 2013; Tearle, 2013). Other scholars have argued that a supportive school-level policy makes it attractive to establish a consistent and responsive community of practice linked to the efficient, routine and consistent use of ICT (Dawes 2001; Hennessy, Ruthven & Brindley, 2005). It should be noted that there is a need for a clear vision of both the government and the colleges outlining a proper strategy, programmes, implementation and monitoring for the successful incorporation of ICT in colleges, which is apparently lacking in many colleges.

Ertmer (2009, p. 54) stated, "A vision provides us with a place to start, a goal to reach, and a guidepost along the way". Numerous scholars have suggested that the ICT policy of a school is critical for successful ICT integration (Anderson & Dexter, 2015).A study by Tondeur, et al., (2012), for example, pointed out that there were many higher education institutions in big cities in Bangladesh that had ICT resources but could not effectively incorporate ICT into teaching and learning because of the unavailability of a proper vision, plan and policy. ICT integration is, therefore, explicitly linked to school-level initiatives, such as the creation of an ICT vision, strategy, and policy (Tondeur, et al., 2012).

Differences in Teacher Educators' Levels of ICT Integration in Teaching and Learning as Attributed to their Demographic Profiles

This section was guided by the research question 4 and null hypothesis (H_O) 2. The researcher deemed it useful to compare whether there were significant differences in the teacher educators' levels of ICT integration in teaching and learning (Dependent variable) attributed to the demographic profiles (independent variables) under investigation in this study. To do this, the researcher compared the overall means of the levels of ICT integration in teaching and learning with the means of the different dimensions of the demographic factors using Mann Whitney U statistics for those with two independent groups and Kruskal Wallis for those with more than two independent groups.

Research Question 4:

Are there statistically significant differences in the teacher educators' levels of ICT integration in teaching and learning attributed to the following demographic factors:

(a) Gender

(b) Age

(c) Teaching experience

(d) Qualifications

(e) ICT training?

Null Hypothesis (H_o) 2: There are no statistically significant differences in the teacher educators' levels of ICT integration in teaching and learning attributed to the following demographic factors:

(a) Gender

(b) Age

(c) Teaching experience

(d) Qualifications

(e) ICT training

Differences in the Levels of ICT Integration Attributed to Gender

H_O-2(a): There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to gender.

Tables 13(a) and 13(b) show the outputs of the Mean ranks and the significance level of difference respectively for the Mann Whitney U statistics between teacher educators' level of ICT integration and gender.

Table 13(a): The Mean ranks of the Mann Whitney U statistics between teacher educators' level of ICT integration and gender.

Ranks

	Gender of respondent	N	Mean Rank	Sum of Ranks
Extent of ICT	Male	167	143.07	23893.00
Use	Female	86	95.79	8238.00
	Total	253		

The Mean rank for male is approximately 143 while for female is 96, suggesting a difference between male and female in terms of integration of ICT in teaching and learning.

Table 13(b): Significance level of the Mann Whitney U statistics between teacher educators' level of ICT integration and gender.

	Extent of ICT Use
Mann-Whitney U	4497.000
Wilcoxon W	8238.000
Z	-5.054
Asymp. Sig. (2-tailed)	.000

Grouping Variable: Gender of respondent. Level of significance: p = 0.05

The Asymptotic sig. (2-tailed) is 0.000 which is much less than 0.05, meaning that the hypothesis that "There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to gender." is rejected.

Rejecting the hypothesis implies that the result of the Mann Whitney U statistics shows that there is a statistically significant difference in the teacher educators' levels of ICT integration attributed to gender differences.

A substantial body of research in the 1990s and early 2000s showed a disadvantage for girls in ICT literacy (e.g., Hakkarainen et al., 2000; Janssen Reinen & Plomp, 1993; Kuhlemeier & Hemker, 2007; Volman et al., 2005). In contrast, more recent studies revealed a less consistent pattern (Punter et al., 2017). For example, in two international comparison studies including 21 countries (Eickelmann et al., 2019; Fraillon et al., 2018), most samples found that females outperformed males in ICT literacy. Similar results were observed among Flemish sixth-graders (Aesaert & van Braak, 2019), Korean students in grades 4 to 6 (Kim et al., 2018), and also eighth graders from the United States (Hohlfeld et al., 2018). However, despite some evidence that gender

differences in ICT literacy may have reversed in recent years, the available findings are rather inconsistent. For example, no differences in computer skills were found among secondary school students in Norway (Hatlevik & Christophersen, 2013), the Netherlands (van Deursen & van Diepen, 2017), and Germany (Hohfeld, et al 2018). Summarizing the available body of research, a recent meta-analysis including 46 effect sizes estimated a small gender difference in ICT literacy of Hedges' g = 0.13 in favor of girls (Siddiq & Scherer, 2019). However, the respective analyses also uncovered pronounced heterogeneity in the observed effects resulting in a rather large credibility interval of 95% CrI [-0.08, 0.35]. Together, these findings raise doubts whether universal gender differences in ICT literacy still exist that induce women (or men) to systematically underperform on ICT-related tasks.

Similarly, as quoted in Mahmood and Bokhari (2018), Withers believes that gender and ICT connect in a complicated manner, but on the whole, women are far less inclined to partake ICT courses, professions and leadership. It is therefore, worth noting that since ICT is eventually superseding the traditional teacher-centered teaching and learning environment in education in recent times, and focus has switched from teacher to learner, it is pertinent that both female and male teachers at all levels of education take advantage of ICT to facilitate learning.

Differences in the Levels of ICT Integration Attributed to Age

Ho-2(b): There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their age.

A Kruskal Wallis test statistic was run to test the null hypothesis. Tables 14(a) and 14(b) show the outputs of the Mean ranks and the significance level of difference between teacher educators' level of ICT integration and age groups respectively.

Table 14(a): The Mean ranks of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and age.

Ranks

	Age of respondent	N	Mean Rank
Extent of ICT Use	<30	25	194.40
	30-34	72	109.46
	35-39	15	190.10
	40-44	15	140.10
	45-49	13	162.92
	50+	113	109.02
	Total	253	

The highest Mean rank (194) for ICT integration is in the age group below 30 years of age. The lowest Mean rank (109) is in the age group 50 years and above. The other age groups also yielded different Mean ranks, for instance, 30-34 (109.5), 35-39 (190), 40-44 (140) and 45-49 (163). This definitely shows a remarkable difference in the levels of ICT integration attributed to age.

Table 14(b): Significance level of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and age.

	Extent of ICT Use
Chi-Square	50.595
Df	5
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: Age of respondents

c. Level of significance: p = 0.05

The Asymptotic sig. (2-tailed) is 0.000 which is much less than 0.05, meaning that the null hypothesis that "There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their age." is rejected. The research hypothesis that "There is statistically significant difference in the teacher educators' levels of ICT integration attributed to their age," therefore, holds. There has been an existing myth about there being a generational gap related to ICT use such that the rising generations are said to be 'digital natives' in contrast to their elders who are said to be 'digital immigrants' (Prensky, 2011)

Nowadays the number and variety of computer technology is higher than ever. At many schools and universities many students are now required to take a computer course. Consequently, the younger generation has been exposed to more computer technology than the older generation, which helps them to gain more computer literacy. It is

presumed that the more computer literacy and skills a person possesses, the more likely he or she will use a computer. A study by Sahin-Kizil (2011), for instance, indicated a negative correlation between age and the attitudes of teachers towards ICT. Kim, et al (2013) reported that young teachers are much more willing than older teachers to use ICT. These results are in line with a study by Isleem (2013) that indicated a negative predictive value in age.

Differences in the Levels of ICT Integration Attributed to Teaching Experience

H_O-2(c): There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their teaching experience.

A Kruskal Wallis test statistics was run to test the null hypothesis. Tables 15(a) and 15(b) show the outputs of the Mean ranks and the significance level of difference between teacher educators' level of ICT integration and the teaching experience respectively.

Table 15(a): The Mean ranks of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and teaching experience.

Ranks

	Teaching experience of respondents	N	Mean Rank
Extent of ICT Use	<5	30	194.22
	5-9	76	108.76
	10-14	14	182.82
	15-19	6	180.58
	20-24	19	147.74
	25-29	82	86.47
	30+	26	173.02
	Total	253	

The highest Mean rank (194) for ICT integration is in the teaching experience group below 5 years of age. The lowest Mean rank (86) is in the teaching experience group 25-29 years. The other age groups also showed variations in the Mean ranks, for instance, 5-9 (109), 10-14 (183), 15-19 (181) 20-24 (148) and 30+ (173). This definitely shows a remarkable difference in the levels of ICT integration attributed to teaching experience.

Table 15 (b): Significance level of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and teaching experience.

	Extent of ICT Use
Chi-Square	84.470
df	6
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: Teaching experience of respondent

c. Level of significance: p = 0.05

The Asymptotic sig. (2-tailed) is 0.000 which is much less than 0.05, meaning that the null hypothesis that "There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their teaching experiences." is rejected. The research hypothesis that "There is statistically significant difference in the teacher educators' levels of ICT integration attributed to their teaching experiences," therefore, holds. Generally speaking, age correlates with experience in teaching. In other words, older educators have more classroom experience than younger educators. In the preceding discussion above, it was pointed out that age negatively correlates with computer use. Therefore, it is possible to argue that experienced people, who are presumably the older teachers, are less likely in the classroom to use computer technology. The research by Sadik (2016) pointed out that there was a more supportive attitude towards ICT use for educators with little classroom experience. Huang, quoted in

Albirini (2016), found that senior educators had less positive attitude towards computers and were less eager than the less experienced new teachers to use them in their class.

Differences in the Levels of ICT Integration Attributed to Qualifications

Ho-2(d): There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their qualifications.

A Mann Whitney U test statistics was run to test the null hypothesis since the independent variable, qualifications, had only two groups: bachelors and Masters. Tables 16(a) and 16(b) below show the outputs of the Mean ranks and the significance level of difference between teacher educators' level of ICT integration and their qualifications respectively.

Table 16(a) The Mean ranks of the Mann Whitney U statistics test between teacher educators' level of ICT integration and qualification

Ranks

	Qualification of respondent	N	Mean Rank	Sum of Ranks
Extent of ICT Use	Bachelors	178	125.33	22309.00
	Masters	75	130.96	9822.00
	Total	253		

The Mean rank for Bachelor's degree was approximately 125 while for Masters was 131, showing a slight difference between Bachelors and Masters in terms of integration of ICT in teaching and learning.

Table 16(b): Significance level of the Mann Whitney U statistics test between teacher educators' level of ICT integration and qualifications.

	Extent of ICT Use
Mann-Whitney U	6278.500
Wilcoxon W	22209.500
Z	-.435
Asymp. Sig. (2-tailed)	.562

a. Grouping Variable: Qualification of respondent

a. Level of significance: p = 0.0

The Asymptotic sig. (2-tailed) is 0.56 which is much greater than 0.05, meaning that the null hypothesis that "There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their qualifications," is accepted. From the analysis of the demographic data, it was interesting to note that a significant number (29.6%) of the teacher educators teaching in the NTCs already possessed Masters Degrees. As a requirement, most universities that offer postgraduate degrees in Uganda require students at that level to use ICTs for various functions including research work, academic writing and for presentations. The Pan African Research Agenda on the Pedagogical Integration of ICTs (2011), observes that people who have tertiary qualifications are more likely to be better ICT users than their counterparts with lesser qualifications. It would therefore, be assumed that the more teachers pursued higher

opportunities of learning at postgraduate level, their enhanced ICT skills would be transferred innovatively into instructional practices.

Differences in the Levels of ICT Integration Attributed to ICT-related Training

Ho-2(e): There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to the ICT training received.

A Kruskal Wallis test statistics was run to test the null hypothesis since the independent variable had 4 groups. Tables 17(a) and 17(b) below show the outputs of the Mean ranks and the significance level of difference between teacher educators' level of ICT integration and the ICT-related training respectively.

Table 17(a): The Mean ranks of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and ICT-related training.

Ranks	ICT Training	N	Mean Rank
Extent of ICT Use	Basic ICT course	199	113.45
	Post graduate in ICT	5	198.20
	No training at all	34	178.32
	ICT integration in teaching	15	166.70
	Total	253	

The highest Mean rank (198) for ICT integration is in the post graduate ICT training while the lowest Mean rank (113) is for those who have had basic ICT course.

Those who had had no ICT training at all and those who had had ICT integration course in teaching had Mean ranks of 178 and 167 respectively. This definitely shows a remarkable difference in the levels of ICT integration attributed to ICT-related training.

Table 17(b): Significance level of the Kruskal Wallis statistics test between teacher educators' level of ICT integration and ICT-related training.

	Extent of ICT Use
Chi-Square	35.245
df	3
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: ICT Training

C. Level of significance: p = 0.05

The Asymptotic sig. is 0.00 which is much less than 0.05, meaning that the null hypothesis that "There is no statistically significant difference in the teacher educators' levels of ICT integration attributed to their ICT training," was rejected. Conversely, the research hypothesis that "There is a statistically significant difference in the teacher educators' levels of ICT integration attributed to their ICT training," is therefore, true.

Qualitative data was obtained from the teacher educators through focus group discussions and Principals through interviews relating to ICT-related training under the theme and sub-themes as in figure 13.

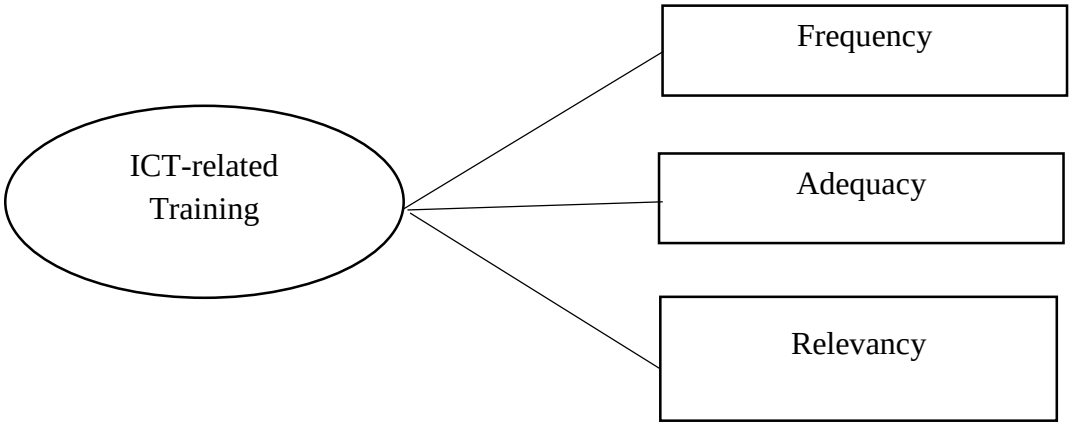

Fig. 13: The theme and sub-themes for ICT-related Training.

The interviews with the Principals and focus group discussions with the teacher educators both revealed that most of the older teacher educators hardly received any ICT training during their own initial teacher training. Some had received some ICT training through in-service training like workshops and short courses but they felt these were not adequate to raise their confidence levels. They demanded that the ICT-related courses should be more regular to enable them gain confidence. In this regard, one teacher educator from college W, at a focus group discussion said:

"You cannot expect us to do what we have never been trained to do. During our teacher education course, there was nothing like ICT pedagogy, now from nowhere we are asked to integrate ICT in teaching and learning. Where do we begin when we have never learnt anything about ICT?"

During an interview with one of the Principals of college Y, he made the following remark:

"We thank the Ministry of Education and Sports and our Development Partners for the training our lecturers have benefitted from so far. However, the lecturers require extensive, on-going exposure to ICTs to be able to evaluate and select the most appropriate resources. 'One-off training' is not sufficient, the Ministry needs to invest in and implement long term ongoing training and continuous professional development in order for the lecturers to keep up with rapidly evolving digital technologies".

The analysis of data in regard to ICT training concurs with a number of studies which have shown that training is a crucial way to foster the integration of ICT into education. Warschauer (2012) pointed out in his study that an Egyptian university lecturer told him that "we have the hardware, we have the software, but we lack the humanware, that is, persons who can proficiently use computer systems to produce desired results." Sadik's (2016) research found that the association between training and the use of ICT by teachers was positive, i.e. further training would translate into more teaching incorporation of ICT. Sadik (2016) further suggested that in classroom instructional practice, trained teachers demonstrated statistically more optimistic attitudes towards ICT integration than non-trained teachers did. Lewis et al (2019) pointed out that it was necessary to enhance the capacity of teachers to teach effectively, including the introduction of technology into the grade or subject taught, through a professional development program based on training on a particular curriculum and subject field.

As training is essential to the incorporation of ICT into education, after the implementation of computer software and hardware into the curriculum, further training should be provided to teaching staff, especially the older generation teachers, including

in-service and pre-service training through workshops, coaching, intensive courses, mentoring, video-based, face-to-face-based or web-based case studies, etc. It can be argued here that their attitude towards ICT in education will definitely improve when teachers are informed about how to incorporate ICT into the classroom to improve teaching and learning performance.

Prediction of the Teacher Educators' Levels of ICT Integration in Teaching and Learning

The prediction of the teacher educator' levels of ICT integration in teaching and learning was based on research question 5. Hierarchical multiple regression was run to test to what degree the independent variables predicted the teacher educators' level of ICT integration in teaching and learning. The independent variables were examined in terms of Model X, Y and Z. In Model X, the variables which were internal to the teacher educators such as gender, age, teaching experience, qualifications, ICT training, attitudes and self-efficacy were tested to examine whether they had a significant impact on their integration of ICT in teaching and learning. In Model Y, the external variables which included the college ICT vision, administrative support, technical support, accessibility to ICT infrastructure, and ICT policy issues were run together to test to what extent they predicted the dependent variable. The variables in Model X and Model Y were collected in Model Z and run together to test to what extent they predicted the integration of ICT into teaching practices. The results are displayed in Table 4.16.

Research Question 5: To what degree do the ICT-related variables predict the teacher educators' levels of ICT integration in teaching and learning practices?

The table presented below showed that the variables in Model X did not significantly predict the dependent variable (R^2 = .02 or only 2%) and gender is negatively associated with the integration of ICT (β = -.06, *t* = -.69; *p* = .26).

Table 18: Results of Ordinal Regression Analysis of the prediction of the independent variables with regard to integration of ICT in teaching practices.

	Model X			Model Y			Model Z		
	β	*t*	*p*	*β*	*t*	*P*	*β*	*t*	*p*
Internal Variables									
Gender	-.06	-.69	.26	-	-	-	-.54	-.73	.41
Age	.04	.51	.44	-	-	-	.033	.41	.65
Teaching experience	.05	.42	.61	-	-	-	.086	1.16	.22
Qualifications	.04	.52	.43	-	-	-	.16	1.55	.13
ICT training	-.11	-1.08	.25	-	-	-	-.04	-.67	.41
Attitudes	.10	1.02	.31	-	-	-	.08	.75	.43
Self-efficacy	-.05	-.67	.46	-	-	-	-.09	-.95	.31
External Variables									
College ICT vision	-	-	-	.16	1.54	.13	.82	1.11	.21
Administrative support	-	-	-	.42	4.65	**.001**	.44	4.81	**.001**

Technical support	-	-	-	.10	1.03	.31	.07	.90	.32
Access to ICT infrastructure	-	-	-	.085	1.04	**.001**	.29	3.06	**.001**
ICT policy issues	-	-	-	.29	3.11	.26	.04	.48	.61
R^2 Level of ICT integration		.02			.53			.55	

Level of significance: p = .05

Unlike Model X, the variables in Model Y appeared to account for 53% (R^2 = .53) of the integration of ICT into education. Besides, "Administrative support" (β = .42, *t* = 4.65, *p* = .001) and "Accessibility to ICT infrastructure" (β = .085, *t* =1.04, *p* = .001) variables significantly predicted the integration of ICT into teaching practices. The results indicated that the variables in Model Z explained 55% (R^2 = .55) of the dependent variable. Model Z also confirmed that the internal variables, that is gender, age, teaching experience, qualifications, ICT training, attitudes, and self-efficacy variables did not have a major impact on teachers' integration of ICT into their lessons. It was seen that just administrative support (β = .44, *t* = 4.81, *p* = .001) and accessibility to ICT infrastructure (β = .29, *t* = 3.06, *p* = .001) had a predictive value for the dependent variable.

The Perceived Barriers to the Effective Integration of ICT in Teaching and Learning

This section was guided by the research question 6 which was qualitative and contained in the questionnaires and also raised at both the interviews with Principals and focus group discussion with the teacher educators.

Research Question 6: What are the perceived barriers to the effective integration of ICT in teaching and learning in the National Teachers' Colleges?

The qualitative data revealed that teacher educators faced several obstacles to the incorporation of ICT in teaching and learning ranging from lack of experience and skills in usage of ICT, to inadequate resources and intensive teaching programmes due to examination pressures and competitions for better grades between schools. Other barriers cited included overcrowded classrooms, slow internet connectivity, intermittent electricity supply, and attitudinal barriers from the relatively older teacher educators who have technophobia. For instance, one female teacher educator from college Z during a focus group discussion had this to say: *"I cannot find time due to heavy workload and intensive teaching programme in the college"* Many of the teacher educators also emphasized that the competitive examinations at the end of the academic year prevents them from integrating technology in their teaching effectively. To illustrate his point a young looking teacher educator from college W said: *"There is an exam at the end of the year that students need to be ready for. Much as I could integrate technology in my teaching, I must complete the curriculum in readiness for the exams".* Another male Biology teacher educator from college X indicated that: *"For me my teaching focuses more on revising past examination questions because of competitions among the colleges rather than teaching the subject in detail".*

It is discernible to note that the perceived obstacles to ICT incorporation in teaching and learning highlighted by the teacher educators in this study corroborate so

much with results of studies conducted elsewhere. Several other studies have suggested that the limited capacity to incorporate ICT into pedagogy is one challenge that forbids teachers from using ICT in their teaching (Becta, 2005). Newhouse (2012) found in an Australian study that many teachers were wanting in their expertise and skills to use computers and were not passionate enough about the improvements and incorporation of additional learning related to the incorporation of computers into their teaching practices. Recent studies have shown that this barrier's degree varies by region. In third world countries, research has shown that the limited level of technological expertise of educators is a major obstacle to their adoption and acceptance of ICT (Pelgrum, 2001; Al-Oteawi, 2012). In Syria, for instance, the limited level of technological expertise of educators has been identified as the major obstacle (Albirini, 2016). Similarly, the lack of ICT skills in Saudi Arabia is a significant barrier to incorporating technology into teaching and learning (Al-Alwani, 2015; Almohaissin, 2016). Empirica (2016) conducted a survey involving teachers and head teachers in 27 European countries and the findings showed that teachers who did not use computers in classrooms claimed that "lack of skills" were a constraining factor preventing them from using ICT for teaching. It is therefore, not surprising to note that the teacher educators in this study reported lack of sufficient knowledge and skills being a barrier to their integration of ICT in teaching and learning.

Much research into the challenges to the introduction of ICT into education also noted that the attitudes of educators and an intrinsic aversion to innovation were a major obstacle (Cox et al., 2009; Watson, 2009; Earle, 2012; Becta, 2005; Gomes, 2005; Schoepp, 2015). For instance, Gomes (2005) reported that the unwillingness of educators

to change involving the use of emerging technologies is an obstacle to ICT incorporation in instructional practice. Becta (2005) claimed at a macro level that fear of change or inflexibility is a serious obstacle to the integration of new technology by teachers in education. Watson (2009), an Australian academic, observed that it involves change to incorporate emerging technology into educational environments and that various educators will cope with this change differently. According to him, understanding the attitudes of various educators to change is essential because the views of educators affect what they will do in classrooms. Becta (2005) suggests that the understanding of how these technologies can support their teaching and the learning of their students is one crucial area of educators' attitudes towards the use of the emerging technologies. In his research, Schoepp (2015) reported that while educators believed that there was more than enough available technology, they did not feel that they were being assisted, directed, or rewarded in incorporating technology into their teaching. Teachers who do not use modern technologies such as computers in the classroom still believe that the use of such technologies has no advantages or uncertain advantages, according to Empirica (2016). No wonder that the issue of the teacher educators' attitudes came out very prominently during the focus group discussions as a barrier hindering their integration of technology into teaching.

A lack of appropriate training is yet another challenge most often alluded to in the literary works (Albirini, 2016; Balanskat et al., 2006; Beggs, 2010; Özden, 2007; Schoepp, 2015; Sicilia, 2005; Toprakci, 2016). One revelation from Pelgrum's (2011) research, for example, was that there were not sufficient training programmes for educators in the integration of ICTs in instructional discourse. Similarly, Beggs (2010)

urgued that the lack of training was one of the top three obstacles to educators' use of ICT in teaching students. Latest studies in Turkey reported that the greatest challenge with the introduction of emerging technologies in teaching was the absence of in-service teacher training programs (Özden, 2007), and Toprakci (2016) concluded that inadequate teacher training in ICT integration in Turkish schools is a significant barrier.

Lack of time is another impediment to the successful inclusion of ICT in classroom instruction that has been widely documented. Several recent studies have shown that many educators possess the competence and confidence to infuse technology in classroom instruction, but since they lack enough time, they also make little use of the technology. A large number of scholars have described time constraints and the challenge of planning adequate time for computer integration in classroom instruction as an obstacle to the use of ICT by educators in their teaching. (Al- Alwani, 2015; Becta, 2005; Beggs, 2010; Schoepp, 2015; Sicilia, 2005).

The most prevalent difficulty identified by all teachers, according to Sicilia (2005), was the inadequate time they had for planning technology lessons, explore the various websites, or examine the different forms of instructional software. Similarly, the teacher educators in this study raised concerns that integrating technology in teaching requires a lot of time for planning, consumes time for content coverage and consumes time for preparing students for examinations.

The Proposed LEISURE Model of ICT Integration

Based on the comprehensive literature review of previous studies and the results of this present analysis, this proposed **LEISURE** model is crafted. It is a model of ICT

integration that seeks to promote the incorporation of ICT in education through key players comprising of students and teachers. As shown in Figure 14, the model is composed of seven (7) key components that interrelate to facilitate ICT incorporation in classroom instructional practice. The acronym LEISURE stands for: **L**iteracy (1), **E**nvironment (2), **I**ncentives (3), **S**upport services (4) st**U**dents (5), lectu**R**ers (6) and **E**nhanced ICT integration (7). The numbering was done solely to designate the order of the letters that form the acronym LEISURE.

Literacy (1)

ICT literacy is the ability to morally and lawfully identify, access, maintain, integrate, analyze, construct and communicate information using digital technologies, communication platforms and/or networks in order to operate in a globalized world (Prensky 2011). ICT literacy training should include training in essential ICT skills and ICT integration in pedagogy for both students and lecturers. Once both students and lecturers are made aware of the benefits and use of ICT in their diverse fields of study, teaching and research, the model then moves to the next level, providing a rich ICT environment.

ICT-enriched Learning Environment (2)

This is a learning environment that facilitates innovative teaching and learning practices powered by technology. Such a learning environment provides abundant opportunities for the personal contribution of students to the learning mission using the technology and/or internet access (Pelgrum, 2001). The development of ICT-enriched learner-centered environments requires a holistic approach, according to Özden, (2007),

which calls for improvements at three levels: teacher, classroom climate and learning activities. Fundamentally, however, it is teachers who can maximize the advantages of ICT-enriched environments with help from parents, administrators and policy makers to make learner-centered learning a reality. Such an environment will be enriched with Desktop and Laptop computers, Projector, Digital cameras, Printer, Photocopier, tablets, Ipads, Smartphones, Scanners, Microphones, interactive white board, DVDs and CDs, Flash discs, Video Games, Internet connectivity and educational software. The inclusion of ICT-enriched learning environment in the LEISURE model is informed by the finding in this study and other related studies that accessibility to ICT infrastructure enhances ICT integration in classroom instructional practices of teachers (Kimanzi, Bwire & Miima, 2018; Ozer & Yilmaz, 2011)

Incentives (3)

These are factors that will motivate both the students and lecturers to integrate ICT in their teaching and learning practices. According to Chigona & Chigona (2014), there may be extrinsic or intrinsic motivation. The latter happens when people are internally driven to do something because it either gives them gratification, or they think it's necessary. In that category, accomplishment, appreciation, work, accountability, success and potential for development are included. Extrinsic motivation happens when, because of exogenous factors to him or her, an educator is driven to do something or behave in a certain way. Examples of extrinsic influences include policies and management, technical assistance, conditions of employment and position. Three extrinsic motivational factors have been examined in the context of this study: a stimulating ICT infrastructure, an empowering ICT policy, and presence of an ICT

vision. These three factors together feed into the provision of appropriate incentives for both educators and learners to infuse ICT in their teaching and learning practices.

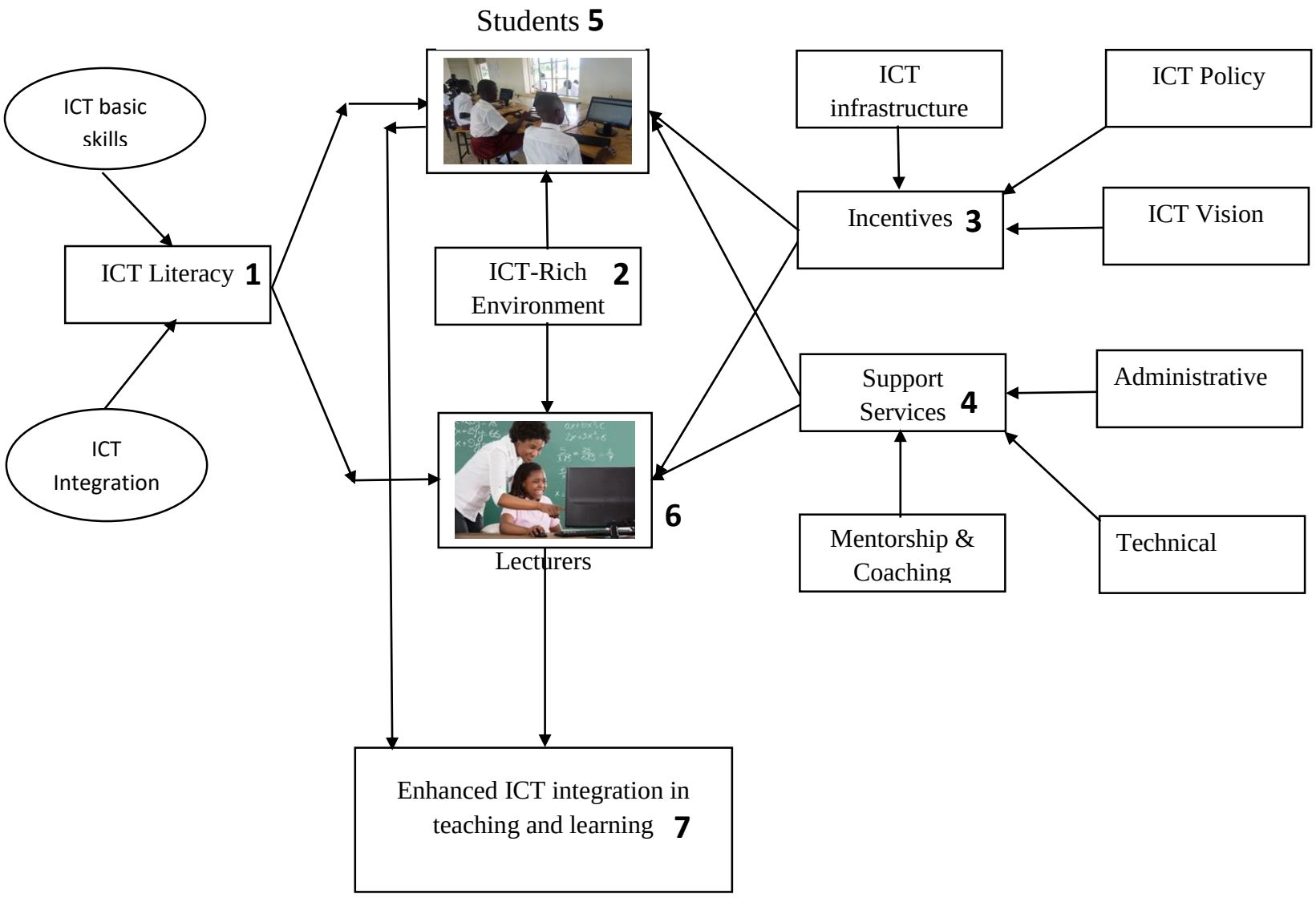

Figure 14: The proposed LEISURE model of ICT integration

ICT infrastructure examines the perceived availability and appropriateness of ICT resources, such as hardware, software and auxiliary devices installed in the educational institution, according to Vanderlinde and van Braak (2010). Past research studies have clearly shown that ICT infrastructure can provide sufficient incentives to enable teachers and students to use technology (Cowie & Jones, 2005; Krysa, 2013; Shiue, 2017).

Similarly, in the context of the introduction of ICT into classroom teaching, school ICT policy is fundamental to the management and decision-making of schools (Adelman & Taylor, 2011; Galabawa, & Agu, 2010). School ICT policies are designed to clearly chart and sequence prospects throughout the curriculum for the implementation and development of ICT in schools and to ensure the incorporation of ICT in a manner consistent with the national ICT policy. The main objective of the ICT policy approach is to express concrete teaching strategies that can encourage and relate the use of ICT to improve the ICT skills of teachers and students for use during teaching and learning experiences (Evoh, 2017). The development of appropriate ICT policy in the school, therefore, provides appropriate incentives for both teachers and learners to incorporate ICT in their teaching and learning practices.

Finally, school management must craft a vision for the use of ICT, taking into consideration recent innovations in ICT, and devise a plan for achieving the vision (Schreurs, 2017). While the government can strongly support innovations in ICT in schools by mobilizing funding and policy guidance, it is, however, up to individual schools to create an ICT vision that is appropriate for them and that will fulfill their expected needs and expectations. Shaping the vision implies finding a response to the

question**: "**What kind of school do we want to be? And how does ICT fit into our vision?" A comprehensive ICT vision formulated together with all the stakeholders in a school will provide appropriate incentives for the implementation of ICT initiatives by both students and teachers.

Support Services (4)

Support services are provided to help or assist both students and lecturers in incorporating ICT into their respective fields of study or teaching and learning. The services could be in the form of technical support, administrative support, or mentorship and coaching programmes. It could also involve nominating the lecturers for continuous professional development training in ICT related courses to enhance their capacities and supporting them with the training requirements such as tuition and other allowances.

Resta (2002) describes technical support as professional staff capable of helping and assisting educators in the implementation of instructional technology. In the meantime, technical support was described by Dexter, Anderson, and Ronnkvist (2009) as accessing, running and troubleshooting hardware, software and web resources. Technical support has a positive effect on the use of ICT by teachers (Mosesa et al., 2011) as well as their incorporation into teaching-learning activities (Dexter, Seashore, & Anderson, 2013). For this purpose, the provision of technical support services as part of the implementation of technology is important (Haslaman, Mumcu, & Usluel, 2008)..

Administrative support is defined as the creation of an environment that promotes the use of ICT by role models like the Principal (Baylor & Ritchie, 2012). In order to model technology leadership in managerial, teaching, and learning activities, the

principals themselves ought to be proficient in the use of ICT (Afshari, Bakar, Luan, Samah, & Fooi, 2009). The presence of the Principal's support helps teachers to incorporate ICT into their teaching (Ali, Nor, Hamzah, & Alwi, 2009). The support by administrators plays a role in motivating teachers to use the technology, according to Baylor and Ritchie (2012). It is apparent that not just in words but also in practice, the administrators who endorse the use of technology contribute to its acceptance and use as a culture. On the basis of this argument, Baylor and Ritchie argued that if administrators were to foster a culture of technology use, then instead of sitting aside, they would need to figuratively "roll up their sleeves and join in" (p. 412).

Mentorship and coaching are two related support services, like administrative and technical support, that can be very instrumental in supporting the technology integration efforts of teachers. According to Anderson & Dexter (2015).), to effectively incorporate technology into his or her classroom, every instructor, whether inexperienced or experienced, needs time, encouragement and reflection. Too often, the ICT department or a single ICT Technician/Specialist is responsible for that support. Whatever the case, none of these can possibly help an entire school of unassisted teachers. Therefore, it is important that teachers collaborate and help each other through the mentorship process. There are teachers who are early adopters of technology in every school, or others who are a little less leery of taking risks in the classroom. As mentors, these teachers are a great resource to their colleagues— someone to run to when you need ideas and resources (Alampay, 2010). Teachers, however, need the guidance of a coach for deeper reflection and encouragement, someone who is also not burdened by the everyday duties of teaching a class.

Students (5) and Lecturers (6)

The students and lecturers are at the centre of the LEISURE ICT integration model. Once the appropriate ICT literacy intervention is achieved, and appropriate ICT-enriched learning environment is provided, with appropriate incentives and support services, the students will interact with the ICT-enriched environment to integrate technology in their teaching and learning endeavours.

Enhanced ICT Integration (7)

Enhanced ICT integration in teaching and learning is the outcome of the LEISURE model. The lectures are seen to regularly incorporate ICT in their pedagogical engagements with students while the students are as well seen to use ICT for collaboration, research and in their other learning encounters Consistent with Teo (2014), enhanced ICT integration refers to the frequently used descriptors of the implementation of ICT in the classroom as "learning (a) about, (b) with, or (c) from technology". The oldest of these is "learning about" which implies learning computer science or courses focused on practical skills. The descriptor "learning with" arose along with the ICT trend to be cross-curricular rather than separate. This means strengthening student learning with the aid of technology to increase comprehension and performance. However, what this practically means is that ICT is used as a tool for presentation. The third descriptor, "learning from," arose from the utilization of the web (as a source of information) and from the growing use of automated courses online.

Inter-relationships of the Elements in the Model

The model illustrates the beginning point of enhancing ICT integration in teaching and learning to be the development of ICT literacy (1) for both students (5) and lecturers (6) through sensitizing them on the importance of ICT in education and training them on some basic ICT skills.

Sensitization and training of the students and lecturers are an ongoing process and require ICT enriched college environment (2). For the success of the sensitization and training, there is need for appropriate incentives (3) to motivate the students and the lecturers to integrate the technology in their teaching and learning practices. These incentives will come from formulating an enabling ICT policy, a comprehensive college-based ICT vision and setting up a consortium of ICT infrastructure composed of ICT tools connected to the internet.

Support services (4), consisting of technical, administrative and mentorship and coaching support will have to be provided to both students (5) and lecturers (6) to enhance their competences to handle any difficulties that might arise during their engagement with the ICT tools.

Incentives (3) and support services (4) are needed for both students (5) and lecturers (6), using the ICT enriched college environment (2) to enhance ICT integration in their teaching and learning practices (7).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Study

The focus of this study was to investigate the extent of ICT integration and the factors that impede the integration in the teaching and learning process in the National Teachers' Colleges in Uganda from a holistic perspective, with the view to recommending an innovative model that is more effective and efficient. The theoretical framework upon which the study was based was underpinned on the two social psychological research theories of self-efficacy and attitude-behaviour relations. The other theory was the technology acceptance model framework. The study adopted the concurrent triangulation mixed methods design, utilizing both quantitative and qualitative approaches. Data was collected from 253 teacher educators using questionnaire, 40 teacher educators through focus group discussions, 4 Principals of the colleges using individual interviews and observations of sample lessons where ICT was integrated in the teaching and learning process. The quantitative questionnaire data was analyzed using SPSS version 23 software while the qualitative data from focus group discussions, interviews and observations was transcribed, themed, coded and conceptualized.

Summary of the Findings

Six research questions were identified at the beginning of this research study. The summary of research findings follows the order of the research questions.

Research question 1: What are the demographic characteristics of the teacher educators in the National Teachers' Colleges in Uganda?

The findings were as follows:

1. There were more male teacher educators (66%) as compared to their female counterparts (34%).

2. Majority of the teacher educators (56%) were in their post youth age bracket, that is, 40-50+ years. 44% were in the youth age bracket, (30-39) years.

3. The majority of the teacher educators had a vast teaching experience of 15-30+ years (53%), while 47% had a teaching experience of less than 15 years.

4. Regarding the qualifications of the teacher educators, an overwhelming majority (70%) had a Bachelor's degree while 30% had Master's degree.

5. In regard to ICT training, a hefty 79% had had basic ICT training course and 13% had had no ICT training at all. 8% had had either a post graduate ICT training or training on ICT integration in teaching and learning.

Research question 2: "What are the levels of ICT Integration in teaching and learning among the Teacher Educators in the National Teachers' Colleges in Uganda?

The findings about research question 2 were as follows:

1. The level of ICT integration in teaching practices was found to be generally low (overall Mean was 2, meaning that the respondents disagreed with most of the statements describing integration of ICT in teaching and learning).

2. It was found that the highest practice of integrating ICT in teaching and learning centred on just encouraging students in class to search information in the internet (Mean = 3.41), while using the ASSURE lesson plan format had the least practice (Mean = 1.39) .

3. The teacher educators erroneously believed that substituting the chalkboard in the classroom with a projector during a lesson means integrating ICT in teaching and learning.

Research question 3: Is there a statistically significant relationship between the teacher educators' level of ICT integration in teaching and learning and their attitudes, self-efficacy, college ICT vision, administrative support, technical support, accessibility to ICT infrastructure, and college ICT policy issues?

The findings to the research question 3 were as follows:

1. The researcher did find significant positive relationships existing between the variables; self-efficacy, college ICT vision, administrative support and ICT policy issues with ICT integration in teaching and learning.

2. However, the researcher did not find significant relationship between the variables: the teacher educators' attitudes, technical support and accessibility to ICT infrastructure with their ICT integration in teaching and learning.

3. The colleges visited had employed at least one technical personnel who carried the dual role of trouble shooting the computers and teaching basic computer skills to both the staff and students.

Research question 4: Are there statistically significant differences in the teacher educators' levels of ICT integration in teaching and learning attributed to the following demographic factors: gender, age, teaching experience, qualifications, and ICT training?
The findings to the research question 4 are as summarized below:

1. The researcher did find significant differences in the ICT integration in teaching and learning attributed to gender, age, teaching experience and ICT-related training of the teacher educators.

2. However, there was no significant difference in ICT integration in teaching and learning attributed to the qualifications of the teacher educators.

Research question 5: To what degree do the ICT-related variables predict the teacher educators' level of ICT integration into teaching and learning practices?
The findings to research question 5 are summarized herein below:

1. The external variables (college ICT vision, administrative support, technical support, access to ICT infrastructure and ICT policy issues) accounted for 53% prediction of ICT integration in teaching and learning.

2. The internal variables (gender, age, teaching experience and qualifications) accounted for negligible percentage of prediction (2% prediction) of ICT integration in teaching and learning.

3. Administrative support and accessibility to ICT infrastructure significantly predicted ICT integration in teaching and learning by 53% and 55% respectively at (p = .001) for each of them.

Research question 6: What are the perceived barriers to the effective integration of ICT in teaching and learning in the National Teachers' Colleges?

The following barriers were cited by the teacher educators:

1. Lack of experience and skills in usage of ICT.
2. Inadequate resources.
3. Intensive teaching programmes due to examination pressures.
4. Competitions for better grades between schools.
5. Overcrowded classrooms,
6. Lack of time.
7. Heavy workload.
8. Slow internet connectivity.
9. Intermittent electricity supply and,
10. Attitudinal barriers from the relatively older teacher educators who have technophobia.

Conclusions

In light of the research questions addressed in this study, the researcher draws the following conclusions; the serial numbers of the conclusions correspond to the serial numbers of the research questions:

1. The teacher educators were of varied demographic characteristics and basing on literature review, the demographic characteristics always influence the teachers' decision and ability to integrate ICT in teaching and learning.

2. It was apparent in the study that the teacher educators' integration of ICT in teaching and learning was low. This meant that in spite of there being some conducive environment for integration, the teacher educators hardly integrated ICT in their teaching and learning.

3. Both the personal characteristics of the teacher educators and external (college based) variables bore positive relationships with ICT integration in teaching and learning. It is therefore, prudent to modify both categories of variables in order to enhance ICT integration.

4. Differences exist in levels of ICT integration attributed to gender, age, teaching experience and ICT training. The results of the analysis of data showed that male teacher educators integrated ICT in their teaching more than their female counterparts, while the relatively younger teacher educators also integrated more ICT in their teaching and learning practices than their older counterparts. The results further showed that the teacher educators with fewer

years of teaching experience integrated more ICT in their teaching than those with more years, while the teacher educators who had some training in ICT integration also integrated more ICT in their teaching and learning practices. Colleges will therefore, have to forge ways of reducing these differences and create equity.

5. The external variables such as college ICT vision, access to ICT infrastructure, administrative and technical support and ICT policy issues have high predictive powers of ICT integration in teaching and learning.

6. The teacher educators in the National Teachers' Colleges are challenged by a number of barriers that hinder their integration of ICT in teaching and learning. These barriers are real and pose a great threat to the successful integration of ICT in teaching.

Finally, if technology is to be effectively incorporated into curriculum at all levels of education, and result into desired improved learning, teachers, the primary agents of educational reform, must be properly trained to use the technology in their instructional processes. Pre-service and in-service teacher training programmes should therefore, not focus only on the acquisition of basic technology skills, but also on how technology can be used to augment the instructional process. Finding the most effective and innovative ways to train teachers who can incorporate technology into the process of teaching and learning is a challenge that all colleges of education must boldly face and address. In light of the review of related literature, data analysis and the findings in this study, the researcher, thus, proposed the LEISURE model that could be most effective in increasing

the integration of ICT in teaching and learning through engaging the major classroom stakeholders, lecturers and students.

Recommendations

The study recommendations are classified into four categories, the first of which addresses recommendations directed to the government, the second of which are pertinent to curriculum developers, the third to the school level and, lastly recommendations for further research.

Recommendations to the Government

1. The Ministry of Education and Sports must find lasting solution to obstacles to the use of ICT by teachers, especially those related to education policy, such as lack of time, lack of access to technology, recruitment of ICT technical personnel, continuous professional development (CPD) opportunities for the teacher educators and development of a relevant ICT curriculum for the teachers' colleges.

2. It is also recommended that adequate, sufficient and up-to-date technology should be made available to schools. To support the technology tools supplied to colleges by the government, government also needs to enact appropriate policy that will encourage students to bring their own devices (BYOD policy).

3. It is recommended that the technical and the pedagogical skills of using technology in teaching and learning should always be combined in any continuous professional development training packages so that the teacher

educators are not just introduced to the basics of technology skills, but they should be able to integrate it in their day to day teaching practices.

4. The Ministry of Education and Sports, through its officers in the Inspectorate Division, should provide regular support supervision and training opportunities aimed at upskilling and raising the competence levels with special emphasis to the female teacher educators and the relatively older ones who have technophobia.

At Curriculum Development Level

5. The curriculum developers for the teacher education institutions should pay more attention to preparing student teachers for the technology age. There should be a deliberate effort to design a stand-alone ICT curriculum for the teachers' colleges and also infusion of ICT in the content of all other disciplines taught in the teachers' colleges.

At College Level

6. The use and incorporation of ICT in teaching and learning should be encouraged by college ICT policy. College-level policy makes it attractive to create a cohesive and supportive community of practice aligned to the effective, routine and consistent use of ICT (Dawes, 2001). ICT policy makers need to understand that teachers should not be excluded from the planning and development of college policy. Colleges should therefore, follow a participatory approach involving all stakeholders such as students, lecturers, college administrators, and where possible, the parents when planning and developing college-based ICT policy.

7. The teacher educators at the college levels should adopt the LEISURE model of ICT integration in their instructional practices. The LEISURE model is important because it puts both the teacher and the learners in the forefront in the process of ICT integration in teaching and learning.

Recommendation for further Research

8. There are three levels of teacher training in Uganda; Primary Teachers' Colleges (PTCs), training teachers for Primary schools; National Teachers' Colleges (NTCs), training teachers for lower secondary education and universities, training teachers for higher secondary education. This study has been conducted in NTCs to examine the extent of ICT integration in teacher preparation and the factors that influence the integration. Since both universities and NTCs train teachers for secondary level of education, it is now recommended that a similar study be conducted in universities in Uganda that train teachers to compare the situation in universities and NTCs.

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APPENDICES

Appendix 1: Questionnaire for Teacher Educators in NTCs in Uganda

Dear Respondent,

This Questionnaire is meant to collect data on ICT integration in teaching and learning in National Teachers Colleges in Uganda.

You are kindly requested to fill in the spaces provided following the instructions as provided. Please try to be as sincere and accurate as possible in your responses to uphold the reliability and validity of the responses.

Please note that this research is purely for academic purpose only. Any information given will be treated with utmost confidentiality and will not be shared with any other person outside the research bracket. Kindly do not write your names anywhere on this questionnaire so as to remain anonymous.

Thank you for your cooperation and assistance. God bless.

Nyakito Charles
Researcher

Instructions

1. For section I, please tick as appropriate.
2. For sections II, III, IV, V, VI, VIII and IX, please rate your level of agreement or disagreement with each of the given statements using the scale: Strongly Disagree **(SD**) (1), Disagree (**D)** (2), Agree (**A**) (3), Strongly Agree (**SA**) (4)

3. For section VII, Please rate your level of accessibility to ICT resources on a scale of 1 – 4, where: 1 = Extremely not sufficient (**ENS**), 2 = Not Sufficient (**NS**), 3 = Sufficient (**S**), 4 = Extremely Sufficient (**ES)**

Section I: Demographic Information

1. Gender of Respondent M ☐ F ☐

2. Age of Respondent < 30 ☐ 30-34 ☐ 35-39 ☐ 40-44 ☐

45-49 ☐ 50+ ☐ (in years)

3. Teaching experience < 5 ☐ 5-9 ☐ 10-14 ☐ 15-19 ☐

20-24 ☐ 25-29 ☐ 30+ ☐ (in years)

4. Qualification Bachelors ☐ Masters ☐

5. ICT Training Basic ICT course ☐

Post graduate in ICT ☐

No training at all ☐

ICT integration in teaching ☐

Section II: Attitudes towards the Use of ICT as a Pedagogical Tool

(Please tick only one appropriate response for each descriptor)

	Descriptors	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	The use of ICT in teaching and learning leads to greater student learning.				
2	The use of ICT in teaching and learning leads to faster syllabus coverage				
3	I enjoy using ICT in teaching.				
4	I know that ICT can help me to teach more effectively				
5	I believe that ICT makes the subject more interesting and more systematic.				
6	I believe that ICT can really improve my teaching practice.				
7	I perceive ICT integration as an important factor in maintaining the school's competitive advantage				
8	I am concerned about ICT integration in teaching and learning and I pledge to support significant others to use it				

Please add any relevant additional information you wish to include in the space provided.

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Section III: Teacher educators' level of ICT Self-efficacy

(Please tick only one appropriate response for each descriptor)

	Self-efficacy descriptors	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	I feel more competent with the use of ICT than most other tutors at college.				
2	I know enough about ICT to get my teaching activities well done.				
3	I can use ICT competently for instructional purposes in class rooms				
4	I know what to do for using ICTs in instructional environments.				
5	I am confident I can answer any question my students ask about ICTs. `				
6	I am sure that I am computer-literate to use ICTs in my classes				
7	I am sure my ability to use ICTs in class activities grows day by day.				
8	I can handle different learning preferences of my students having different learning styles by using ICTs.				

Please add any relevant additional information you wish to include in the space provided.

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Section IV: College ICT Vision

(Please tick only one appropriate response for each descriptor)

	Descriptors	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	The college has a clear ICT vision				
2	The college ICT vision was collaboratively formulated by all members of the college				
3	The college ICT vision focuses on ICT use in teaching and learning				
4	The college strategies set out priorities for realizing the vision				
5	The college management has a vision on future development of ICT				
6	The ICT vision is open for innovations and new challenges				
7	The college management shares the ICT vision with all the stakeholders such as students and staff				
8	The college vision of ICT integration motivates teachers to use ICT integration effectively in their teaching				

Please add any other relevant additional competences you wish to include in the space provided (Be specific).

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Section V: Administrative Support

(Please tick only one appropriate response for each descriptor)

	Type of support	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	The college administrator encourages peer coaching among teachers to share knowledge gained and support one another for the benefit of the learner.				
2	The college administrators reward the teachers who integrate technology in teaching				
3	The college administrators encourage those teachers who do not integrate technology in teaching				
4	The college administrators model the use of technology in teaching and performing other administrative roles				
5	The college administrators provide opportunities for staff development in ICT				
6	The college administrators provide funds for regularly maintaining and updating ICT equipment				
7	The college administrator always invites an expert, a trainer, to come and train the teachers on how to use the ICTs.				
8	The school leadership requires those teachers who attend training to share the new knowledge and skills acquired with the rest of the staff.				

Please add any other relevant additional type of support you wish to include in the space provided (Be specific).

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Section VI: Technical Support

(Please tick only one appropriate response for each descriptor)

	Type of support	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	There is a technical personnel who provides real time support whenever required				
2	The technical personnel is always present to help troubleshooting whenever required				
3	The technical personnel helps teach students computer basics when required				
4	The technical personnel possesses adequate skills and knowledge in computer applications				
5	Gives skills' related training to the staff				
6	Provides a helpdesk during teaching /learning process				
7	Helps manage college network and website				
8	Provides both technical and pedagogical support to the staff				

Please add any other relevant additional technical support provided by the technical personnel in your college (Be specific).

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Section VII: Accessibility to ICT Infrastructure

(Please tick only one appropriate response for each descriptor)

	ICT Resources	**1 (ENS)**	**2 (NS)**	**3 (S)**	**4 (ES)**
1	Desktop computers				
2	Laptop computers				
3	Projector				
4	Scanner, printer, Televisions (TVs)				
5	Smart board/ Interactive Whiteboard				
6	Broadband internet connectivity				
7	WI-FI internet connectivity				
8	Educational software eg tutorial software, drill and practice software, educational games, simulations				

Please add any other relevant additional ICT resources you normally use to conduct your lessons.

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Section VIII ICT Policy Issues

(Please tick only one appropriate response for each descriptor)

	Statements relating to ICT Policy	**1 (SD)**	**2 (D)**	**3 (A)**	**4 (SA)**
1	The college has an elaborate ICT policy document				
2	The ICT policy was formulated by all the stakeholders in the college				
3	The ICT Policy has been extensively disseminated to all the stakeholders				
4	The ICT policy guides both the student and staff users				
5	The ICT policy promotes ICT integration in teaching and learning				
6	All stakeholders in the college adhere to the ICT policy requirements.				
7	ICT policy is disseminated and clearly understood by all stakeholders				
8	The ICT policy guidelines encourage students to use their own mobile devices during lessons				

Please add any other relevant additional policy issues you wish to include in the space provided (Be specific).

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Section IX: Extent of the Use of ICT as a Pedagogical Tool

(Please tick only one appropriate response for each descriptor)

	Descriptors	**1** **SD**	**2** **D**	**3** **A**	**4** **SA**
1	I create visual presentation, graphics, charts, drawings and type assignments for students by using ICT.				
2	I download teaching materials regarding my subject.				
3	I use computer-based programs in developing the scheme of work and lesson plan.				
4	I use email to ask and send assignments to my students if possible.				
5	I have created and use chat rooms with my students eg whatsapp, facebook, instagram etc				
6	I use ASSURE lesson plan format to prepare my technology-based lessons.				
7	I encourage pupils in class to search for relevant information on the Internet				
8	I use computer as a tool for demonstration working with presentations I have made myself (e.g., PowerPoint)				

Please add any other relevant additional information you wish to include in the space provided.

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Appendix 2: Focus Group Discussion Guide

This focus group discussion guide formed part of the instruments used to gather data on ICT integration in teaching and learning in National Teachers' Colleges in Uganda. The guide was based on 6 specific themes: the extent of the teacher educators' integration of ICT in teaching and learning, the teacher educators' attitudes towards the integration of ICT in teaching and learning, the teacher educators' satisfaction levels with ICT infrastructure and accessibility, satisfaction with the technical support, ICT-related training and the barriers to effective ICT integration in teaching and learning. The questions and discussions were centred on the themes as outlined below.

Section I: ICT Integration in Teaching and Learning

- Use of email in teaching and learning
- Use of digital multimedia
- Electronic designing of instructional materials

Section II Attitudes towards the use of ICT as a pedagogical tool

- Use of ICT as a pedagogical tool.
- Students' access to ICT resources.
- Interest in classroom use of ICT

Section III: ICT Infrastructure and Accessibility

- Availability of ICT resources
- Adequacy of the resources for effective use
- Physical setting of the classrooms

Section IV: ICT Technical Support

- Availability of ICT technical personnel

- Satisfaction with the technical support

Section V: ICT-related training

- Frequency of training
- Adequacy of the training
- Relevancy of the training

Section VI: Barriers to Effective Integration of ICT in Teaching and Learning.

- Institutional-related
- Infrastructure-related
- Personal characteristics

Appendix 3: Interview Guide for Principals

The researcher held separate interviews with the Principals of the participating colleges. The interviews followed the structure of the focus group discussion guide with similar themes. The interviews lasted 30-40 minutes

Section I: ICT Integration in Teaching and Learning

- Use of email in teaching and learning
- Use of digital multimedia
- Electronic designing of instructional materials

Section II Attitudes towards the use of ICT as a pedagogical tool

- Use of ICT as a pedagogical tool.
- Students' access to ICT resources.
- Interest in classroom use of ICT

Section III: ICT Infrastructure and Accessibility

- Availability of ICT resources
- Adequacy of the resources for effective use
- Physical setting of the classrooms

Section IV: ICT Technical Support

- Availability of ICT technical personnel
- Satisfaction with the technical support

Section V: ICT-related training

- Frequency of training
- Adequacy of the training
- Relevancy of the training

Section VI: Barriers to Effective Integration of ICT in Teaching and Learning.

- Institutional related
- Infrastructure related
- Personal characteristics

Appendix 4: Lesson Observation Checklist

(i) The researcher sought for evidence of the use of any of the following ICT resources in the lesson:

S/N	ICT Resource	Used	Not Used
1	Internet resources		
2	Desktop computers		
3	Laptop computers		
4	Projector		
5	Interactive white board		
6	Ipads		
7	Smart phones		
8	Digital camera		
9	Printers/Scanners		
10	ASSURE lesson plan format		

(ii) Level of engagement with ICT resources

	Least engaged	Moderately engaged	engaged	Highly engaged
Students				
Teacher educator				
Technical person				

Appendix 5: University of Eastern Africa Baraton, Ethical Approval.

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2500-30100, Eldoret, Kenya, East Africa

B0415052020 May 15, 2020

TO: Charles Nyakito
School of Education, Humanities and Social Sciences
University of Eastern Africa, Baraton

Dear Charles,

RE: A Model for Integrating Information and Communication Technology in Teaching and Learning in National Teachers' Colleges in Uganda

This is to inform you that the Research Ethics Committee (REC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/REC/04/05/2020. The approval period is 15th May, 2020 – 14th May, 2021.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Research Ethics Committee (REC) of the University of Eastern Africa Baraton.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Research Ethics Committee (REC) of the University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Research Ethics Committee (REC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Research Ethics Committee (REC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely yours,

Jackie K. Obey

Prof. Jackie K. Obey, PhD
Chairperson, Research Ethics Committee

University of Eastern Africa, Baraton
15 MAY 2020
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

GULU UNIVERSITY

P.O. Box 166 Gulu Uganda
Website: www.gu.ac
Email: guluuniversity.rec@gmail.com

Tel: +256-4714-32096
Fax: +256-4714-32913
Mob:+256772305621/776812147

RESEARCH ETHICS COMMITTEE

February 3, 2020

APPROVAL NOTICE

Mr. Charles Nyakito,
University of Eastern Africa, Baraton.

Re: **Application No. GUREC-011-20**

Type of review:
[X] Initial review
[ ] Amendment
[ ] Continuing review
[ ] Termination of study
[ ] SAEs
[ ] Other, Specify:_____

Title of Proposal: **"A Model for Integrating Information and Communication Technology In Teaching And Learning In National Teachers' Colleges In Uganda"**

I am pleased to inform you that at the 59th convened meeting on 21st November 2019, the Gulu University Research Ethics Committee (**GUREC**) voted to approve the above referenced application.

Approval of the research is for the period of **21st November 2019 to 20th November 2020**

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the **GUREC** for re-review and approval prior to the activation of the changes. The **GUREC** application number assigned to the research should be cited in any correspondence.

GULU UNIVERSITY
INSTITUTIONAL REVIEW COMMITTEE
APPROVED
★ 03 FEB 2020 ★
FACULTY OF MEDICINE
P. O. Box 166, Gulu

3. Any unanticipated problems involving risks to participants must be promptly reported to the **GUREC**. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for the **GUREC** review.

4. Only approved and stamped consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The **GUREC** may conduct audits of all study records, and consent documentation may be part of such audits.

5. Regulations require review of an approved study not less than once per 12-month period. Therefore, a continuing review application must be submitted to the **GUREC** eight (**8**) weeks prior to the above expiration **date of 20th November 2020** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely manner may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

6. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following documents have been approved in this application by the **GUREC:**

	Document	Language	Version	Version Date
1	Protocol	English	Version 3.0	2nd February 2020
2	Data Collection Tools	English	Version 3.0	2nd February 2020
3	Informed consent Document	English	Version 3.0	2nd February 2020

Signed,

GULU UNIVERSITY
INSTITUTIONAL REVIEW COMMITTEE
APPROVED
★ 03 FEB 2020 ★
FACULTY OF MEDICINE
P. O. Box 166, Gulu

Dr. Gerald Obai
Chairperson
Gulu University Research Ethics Committee

Appendix 7: UNCST Notice of Approval

Notice of Approval (SS 5224): A Model for Integrating Information and Communication Technology in Teaching and Learning in National Teachers' Colleges in Uganda

Inbox x

Isaac Makhuwa <i.makhuwa@uncst.go.ug> Mar 10, 2020, 3:41 PM

to me, guluuniversity.rec, mkiduma, lekobai, researchreview

Dear Mr. Charles Nyakito,

This is to notify you that the Uganda National Council for Science and Technology (UNCST) approved the above – named protocol on 6th March 2020.

The approval is subject to the following condition:

1. Payment of the research administration and clearance fee of 50 US Dollars. Payment is made to Standard Chartered Bank Speke Road Branch (or any other branch); the account title is UNCST and the US Dollar account number is 8705611811400. If, however you wish to pay in Uganda shillings, the account number is 0105610632101. If you intend to wire the research fees, the swift code is SCBLUGKA. Note that bank charges will entirely be the researcher's responsibility.

After payments, please bring the bank pay slip or transaction sheet to UNCST accounts office upon which a receipt will be issued to you. Please quote your name and the above reference number on your pay slip. The approval letter will be issued within 10 working days after receiving the UNCST receipt.

2. Obtaining of clearance to the study districts from the Research Secretariat, Office of the President; the process of obtaining clearance from the Research Secretariat, Office of the President is handled by UNCST on behalf of the researcher. Once approval has been secured, you will be notified. Meanwhile, you are encouraged to make arrangements to begin administering your tools in order to meet the requirements of your time schedule.

Yours sincerely,

Isaac Makhuwa

For: Executive Secretary

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Appendix 8: UNCST Approval Letter

Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: SS 5224 **16th June 2020**

Mr. Charles Nyakito
Principal Investigator
Gulu University
Gulu

Dear Mr. Nyakito,

Re: Research Approval: **A Model for Integrating Information and Communication Technology in Teaching and Learning in National Teachers' Colleges in Uganda**

I am pleased to inform you that on **06/03/2020**, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of **06/03/2020** to **06/03/2021.**

Your research registration number with the UNCST is **SS 5224.** Please, cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. Keeping all co-investigators informed of the status of the research.
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval **prior** to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST.
4. Unanticipated problems involving risks to research participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC.

LOCATION/CORRESPONDENCE

Plot 6 Kimera Road, Ntinda
P.O.Box 6884
KAMPALA, UGANDA

COMMUNICATION

TEL: (256) 414 705500
FAX: (256) 414-234579
EMAIL: info@uncst.go.ug
WEBSITE: http://www.uncst.go.ug

5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. An annual progress report and approval letter of continuation from the REC must be submitted electronically to UNCST. Failure to do so may result in termination of the research project.

Please note that this approval includes all study related tools submitted as part of the application as shown below:

No.	Document Title	Language	Version Number	Version Date
1.	Research proposal	English	3.0	February 2020
2.	Informed consent forms	English	3.0	February 2020
3.	Questionnaire for teacher educators in NTCs in Uganda	English	3.0	February 2020
4.	Focus group discussion guide	English	3.0	February 2020
5.	Interview guide for principals	English	3.0	February 2020
6.	Observation checklist	English	3.0	February 2020

Isaac Makhuwa
For: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Copied: Chair, Gulu University, Research Ethics Committee

Appendix 9: Informed Consent Form

Title of the study: Integrating Information and Communication Technology (ICT) in Teaching and Learning in National Teachers' Colleges in Uganda.

Investigator: **Nyakito Charles**

Institution(s) University of Eastern Africa Baraton, Kenya.

Introduction

The researcher is called Nyakito Charles. He is currently a PhD student of the University of Eastern Africa. Nyakito Charles is conducting a research study as in the title above, in partial fulfilment for the award of the Degree of Doctor of Philosophy (PhD) in Curriculum and Teaching.

This informed consent explains the study to you. After the study has been explained, any questions you may have are answered, and you have decided to participate in the study, you will be asked to sign a consent, which you will be given a copy to keep.

Sponsors of the research project

The research project is self-sponsored.

Purpose:

The study seeks to develop a model that can be used to integrate ICT in teaching and learning in the National Teachers' Colleges in Uganda. The findings of this study will help to promote the integration of ICT in teaching and learning in the training of Secondary School teacher trainees and ultimately improve the quality of secondary education in Uganda.

Procedures:

Your participation in this study will involve filling a questionnaire and/or participating in a focus group discussion, or interview with the researcher, or being observed while presenting a lesson, as the case may apply.

Who will participate in the study?

The participants of the study shall include:

- Teacher educators (Lecturers) in National Teachers Colleges.
- Principals of the National Teachers Colleges.

You have been chosen to participate in this study because you are a teacher educator/Principal of a teachers' college. Filling the questionnaire will last for approximately 30 minutes, focus group discussion 30-40 minutes and the interview about 30 minutes. The number of participants who will take part in the study is 257 (253 teacher educators and 4 principals).

Risks/discomforts:

There is no foreseeable risk of harm or discomfort that will arise from your participation in this study. The only risk or discomfort will be the inconvenience in terms of the time you will spend filling the questionnaire or participating in the focus group discussion/interview.

Benefits:

It is anticipated that your participation in this research study will help provide useful data that will be used to promote the integration of ICT in teaching and learning and thus improve access to and the quality of education in Uganda.

Confidentiality:

Your identity will not be revealed to any one as the researcher shall only use codes to identify colleges and participants. Information obtained will only be accessible by the research team. Soft copies of the data will be protected by password and hard copy files will be kept under lock and key. Confidential information will only be accessed by the investigator.

Alternatives:

You do not have to participate in this study if you are not interested. You will not lose any benefit in case of no participation.

Cost:

There will not be any additional cost incurred by you as a result of participating in this study.

Questions:

If you have any questions related to the study as a research participant, you can contact the investigator, Nyakito Charles, on telephone number 0772373419 or via email on nyakito60@gmail.com

Statement of voluntariness:

Participation in the research study is voluntary and you may join on your own free will. You have a right to withdraw from the study at any time without penalty.

If you have any issues pertaining to your rights and participation in the study, please contact the Chairperson, Research Ethics Committee, University of Eastern Africa

Baraton Tel: No., +254; email: ; or the Uganda National Council for Science and Technology, on plot 6 Kimera road, Ntinda, Kampala on Tel 0414705500.

Statement of consent

The researcher has described to me what is going to be done, the risks, the benefits involved and my rights as a participant in this study. I understand that my decision to participate in this study will not affect me in any way. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name ……

Signature of the participant……..Date …….

Name: Nyakito Charles

Signature of interviewer……..Date: ……

Appendix 10: Letter of Permission from NTC Mubende

NATIONAL TEACHERS' COLLEGE MUBENDE

P.O. Box 158
MUBENDE
Tel.0464660270/
0772638892

Our ref: NTC/MUB/EC/03/20
Your ref: .....

Date: 05/03/2020.

Mr. Nyakito Charles
Principal NTC Unyama
GULU

For the Attention:
Executive Secretary,
Uganda National Council for Science and Technology

Dear Charles

Re: REQUEST TO CONDUCT PhD RESEARCH FROM NTC MUBENDE

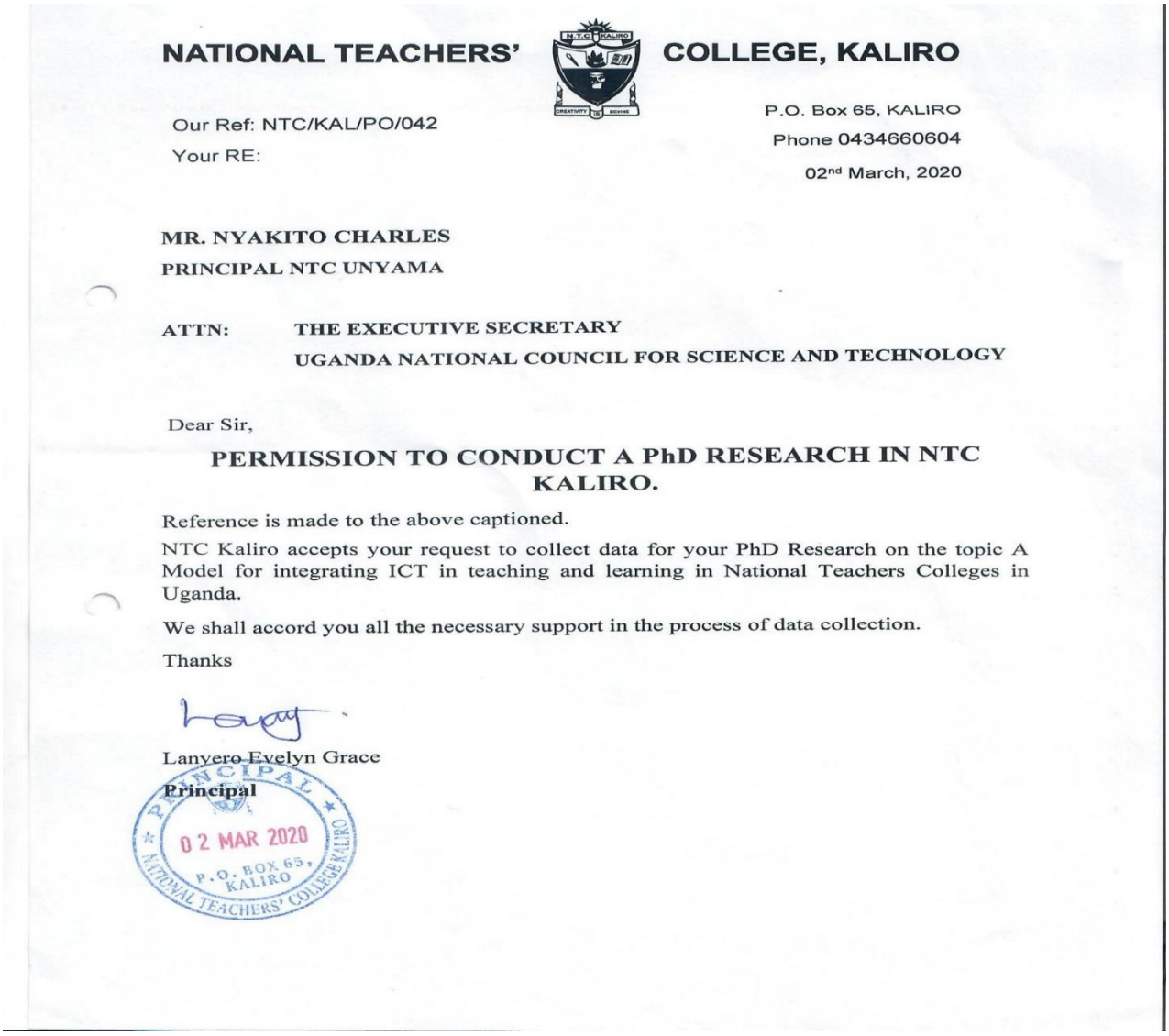
With reference to your letter dated 29/02/2020, I am writing to inform you that there is no objection to your request to conduct the above mentioned kind of research from our college. The college management, staff and students are ready to provide the possible assistance that you may require during the period of data collection.

Kind regards

PRINCIPAL
N T C MUBENDE
DATE.....

Kateregga Francis
PRINCIPAL

Appendix 11: Letter of Permission from NTC Kaliro



NATIONAL TEACHERS' COLLEGE, KALIRO

P.O. Box 65, KALIRO
Phone 0434660604

Our Ref: NTC/KAL/PO/042
Your RE:

02nd March, 2020

MR. NYAKITO CHARLES
PRINCIPAL NTC UNYAMA

ATTN: THE EXECUTIVE SECRETARY
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Dear Sir,

PERMISSION TO CONDUCT A PhD RESEARCH IN NTC KALIRO.

Reference is made to the above captioned.

NTC Kaliro accepts your request to collect data for your PhD Research on the topic A Model for integrating ICT in teaching and learning in National Teachers Colleges in Uganda.

We shall accord you all the necessary support in the process of data collection.

Thanks

Lanyero Evelyn Grace
Principal

PRINCIPAL
02 MAR 2020
P.O. BOX 65, KALIRO
NATIONAL TEACHERS' COLLEGE KALIRO

Appendix 12: Letter of Permission from NTC Muni

NATIONAL TEACHERS' COLLEGE MUNI

Email:
daisyaliwaru@gmail.com
ntcmuni1985@gmail.com

P.O Box 9,
Arua-Uganda
Telephone: +256782 831155

OFFICE OF THE PRINCIPAL

3rd March, 2020

Mr. Nyakito Charles
Principal
NTC Unyama
P. O Box 541, GULU

Attn: The Executive Secretary
Uganda National Council for Science and Technology
Plot 6 Kimera Rd
P. O. Box 6884
KAMPALA (U).

Dear Sir,

PERMISSION TO CONDUCT PhD RESEARCH AT NATIONAL TEACHERS' COLLEGE MUNI

I write in response to your request dated 29th February 2020 as per the above captioned subject.

This communication therefore serves to inform you that National Teachers' College Muni has granted you permission to carry out your research within the stipulated time in your request letter.

Wishing you success in your studies.

Yours sincerely,

National Teachers' College Muni
03 MAR 2020
PRINCIPAL
P.O. BOX 9, ARUA

Daisy Aliwaru
PRINCIPAL

Appendix 13: Questionnaire Reliability Test Outputs

Output 1: Reliability statistics for Attitudes of teacher educators

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.838	8

Inter-Item Correlation Matrix

	ICT use leads to greater learning	Use of ICT leads to faster syllabus coverage	I enjoy using ICT	ICT can help me to teach more effectively	ICT makes the subject more interesting	ICT can improve my teaching practice	ICT integration improves school's competitive advantage	Iam concerned about ICT integration in teaching
ICT use leads to greater learning	1.000	.287	.474	.652	.540	.584	.234	.366
Use of ICT leads to faster syllabus coverage	.287	1.000	-.003	.349	.232	.129	.272	.094
I enjoy using ICT	.474	-.003	1.000	.532	.391	.719	.288	.450
ICT can help me to teach more effectively	.652	.349	.532	1.000	.626	.695	.312	.479

ICT makes the subject more interesting	.540	.232	.391	.626	1.000	.631	.253	.308
ICT can improve my teaching practice	.584	.129	.719	.695	.631	1.000	.341	.402
ICT integration improves school's competitive advantage	.234	.272	.288	.312	.253	.341	1.000	.337
Iam concerned about ICT integration in teaching	.366	.094	.450	.479	.308	.402	.337	1.000

Output 2: Reliability statistics for Self-efficacy.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.941	.940	8

Inter-Item Correlation Matrix

	i feel more competent	I know enough about ICT	I can use ICT competent	I know what to do for using ICT	Iam confident, I can	Iam sure that Iam computer	My ability to use ICT grows day	I can handle different
i feel more competent than most tutors	1.000	.481	.530	.497	.542	.478	.473	.408
I know enough about ICT	.481	1.000	.834	.752	.651	.790	.569	.623
I can use ICT competently for instructional purposes	.530	.834	1.000	.856	.732	.831	.730	.721
I know what to do for using ICT	.497	.752	.856	1.000	.728	.805	.626	.798
Iam confident, I can answer any question	.542	.651	.732	.728	1.000	.786	.610	.638
Iam sure that Iam computer literate	.478	.790	.831	.805	.786	1.000	.644	.687

My ability to use ICT grows day by day	.473	.569	.730	.626	.610	.644	1.000	.700
I can handle different learning preferances of my students	.408	.623	.721	.798	.638	.687	.700	1.000

Output 3: Reliability statistics for ICT Vision

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.844	.844	8

Inter-Item Correlation Matrix

	College has a clear ICT	College ICT vision	ICT vision focuses	College strategies set out	College managem ent has a	ICT vision is open for	Managem ent shares the ICT	College vision motivates
College has a clear ICT vision	1.000	.256	.671	.267	.338	.356	.401	.353

College ICT vision was collaboratively formulated by all members	.256	1.000	.225	.387	.264	.039	.428	.377
ICT vision focuses on ICT use in teaching and learning	.671	.225	1.000	.193	.513	.421	.485	.427
College strategies set out priorities for realizing the vision	.267	.387	.193	1.000	.488	.308	.366	.513
College management has a vision for future development of ICT	.338	.264	.513	.488	1.000	.464	.513	.759
ICT vision is open for innovations and new challenges	.356	.039	.421	.308	.464	1.000	.663	.247
Management shares the ICT vision with all stakeholders	.401	.428	.485	.366	.513	.663	1.000	.566
College vision motivates teachers to use ICT in their teaching	.353	.377	.427	.513	.759	.247	.566	1.000

Output 4: Reliability Statistics for Administrative support

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.638	.630	8

Inter-Item Correlation Matrix

	College administrator allows peer coaching	College administrator rewards teachers for ICT integration	College administrator encourages teachers who do not integrate ICT	Administrators model the use of technology in teaching	Administrators provide opportunity for staff development in ICT	Administrators provide funds for maintaining ICT equipment	Administrators always invites experts to train teachers on ICT use	Teachers who attend trainings share the acquired knowledge
College administrator allows peer coaching	1.000	.178	.287	-.012	.107	.432	-.067	.220
College administrator rewards teachers for ICT integration	.178	1.000	.296	.087	.191	.460	.100	.159
College administrator encourages teachers who do not integrate ICT	.287	.296	1.000	.086	.170	.264	.257	-.110

Administrators model the use of technology in teaching	-.012	.087	.086	1.000	.454	.195	.576	-.165
Administrators provide opportunity for staff development in ICT	.107	.191	.170	.454	1.000	.133	.561	-.010
Administrators provide funds for maintaining ICT equipments	.432	.460	.264	.195	.133	1.000	-.031	.229
Administrators always invites experts to train teachers on ICT use	-.067	.100	.257	.576	.561	-.031	1.000	-.130
Teachers who attend trainings share the acquired knowledge	.220	.159	-.110	-.165	-.010	.229	-.130	1.000

Output 5: Reliability Statistics for Technical Support

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.818	.814	8

Inter-Item Correlation Matrix

	There is a technical personnel to provide support	Technical personnel is always present to help troubleshooting	The technical support helps to teach students computer basics	The technical support posseses adequate skills	The technical support gives skills' related training to staff	provides a help desk during teaching/ learning process	Helps manage college network and website	provides both technical and pedagogical support to staff
There is a technical personnel to provide support	1.000	.667	.531	.390	.281	.305	.210	.337
Technical personnel is always present to help troubleshooting	.667	1.000	.289	.301	.428	.393	.000	.467
The technical support helps to teach students computer basics	.531	.289	1.000	.401	.156	.273	.077	.221
The technical support posseses adequate skills	.390	.301	.401	1.000	.485	.407	.343	.453
The technical support gives skills' related training to staff	.281	.428	.156	.485	1.000	.665	.153	.698
provides a help desk during teaching/ learning process	.305	.393	.273	.407	.665	1.000	.158	.633
Helps manage college network and website	.210	.000	.077	.343	.153	.158	1.000	.160
provides both technical and pedagogical support to staff	.337	.467	.221	.453	.698	.633	.160	1.000

Output 6: Reliability Statistics for Accessibility to ICT resources

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.784	.788	8

Inter-Item Correlation Matrix

	Desktop computers	Laptop computers	Projectors	Scanner, printer, Televisions	Smartboard/ Interactive boards	Broadband internet connectivity	Wi-Fi internet connectivity	Educational software
Desktop computers	1.000	.435	.339	.183	-.233	-.127	-.080	.072
Laptop computers	.435	1.000	.579	.346	.396	.108	.163	.497
Projectors	.339	.579	1.000	.582	.370	.138	.234	.168
Scanner, printer, Televisions	.183	.346	.582	1.000	.438	.281	.497	.218
Smartboard/ Interactive boards	-.233	.396	.370	.438	1.000	.601	.541	.387
Broadband internet connectivity	-.127	.108	.138	.281	.601	1.000	.660	.531
Wi-Fi internet connectivity	-.080	.163	.234	.497	.541	.660	1.000	.558
Educational software	.072	.497	.168	.218	.387	.531	.558	1.000

Output 7: Reliability Statistics for ICT Policy Issues

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.836	.843	8

Inter-Item Correlation Matrix

	College has an elaborate ICT policy document	The policy was formulated by all stakeholders	The policy has been extensively disseminated	The policy guides both students and staff users	The ICT policy promotes ICT integration in teaching and learning	Policy requirements are adhered to by all stakeholders in college	Policy is clearly understood by all stakeholders	Policy guidelines encourage students to use their own Mobile devices during lessons
College has an elaborate ICT policy document	1.000	.486	.274	.230	.077	.344	.322	.135
The policy was formulated by all stakeholders	.486	1.000	.378	.327	.347	.690	.609	.200
The policy has been extensively disseminated	.274	.378	1.000	.386	.232	.438	.447	.389
The policy guides both students and staff users	.230	.327	.386	1.000	.678	.466	.299	.568

The ICT policy promotes ICT integration in teaching and learning	.077	.347	.232	.678	1.000	.477	.408	.608
Policy requirements are adhered to by all stakeholders in college	.344	.690	.438	.466	.477	1.000	.818	.381
Policy is clearly understood by all stakeholders	.322	.609	.447	.299	.408	.818	1.000	.225
Policy guidelines encourage students to use their own Mobile devices during lessons	.135	.200	.389	.568	.608	.381	.225	1.000

Output 8: Reliability Statistics for Extent of ICT use

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.878	.876	8

Inter-Item Correlation Matrix

	I create visual presentations, graphics, charts, drawings for students	I download teaching materials regarding my subject	I use computer to develop schemes and lesson plan	I use email to ask and send assignments to my students	I have created and use chart rooms with my students	I use ASSURE lesson plan format to prepare my lessons	I encourage pupils in class to search for information on internet	I use computer as a tool for demonstration working with presentations
I create visual presentations, graphics, charts, drawings for students	1.000	.684	.693	.428	.135	.399	.426	.730
I download teaching materials regarding my subject	.684	1.000	.572	.515	.299	.365	.515	.777
I use computer to develop schemes and lesson plan	.693	.572	1.000	.664	.261	.642	.290	.575
I use email to ask and send assignments to my students	.428	.515	.664	1.000	.506	.720	.320	.436
I have created and use chart rooms with my students	.135	.299	.261	.506	1.000	.595	.094	.504

I use ASSURE lesson plan format to prepare my lessons	.399	.365	.642	.720	.595	1.000	.107	.405
I encourage pupils in class to search for information on internet	.426	.515	.290	.320	.094	.107	1.000	.468
I use computer as a tool for demonstration working with presentations	.730	.777	.575	.436	.504	.405	.468	1.000

Appendix 14: Curriculum Vitae

1. Bio-data

Surname	Nyakito
Other Names	Charles
Sex	Male
Date of Birth	1st April 1960
Place of Birth	Senda Village
District of Birth	Tororo
Tribe	Jap'Adhola
Nationality	Ugandan
Marital Status	Married
Current Employment Status	Retired Teacher Educator – currently on one year contract with Enabel as Education National Expert
Languages Spoken	• Dhop'Adhola • English • Kiswahili

2. Person Profile

- Self-motivated, organized, and capable of working under pressure without supervision.
- Readily adapts to new situations and a strong sense of responsibility.

- A strong ability to initiate, plan and organize team work.
- Wide experience in both primary and secondary school teacher training.
- Reliable, trustworthy, hardworking and eager to learn.
- Always sets targets to complete any assignment within the deadline.
- Strong respect for authority and avoids all forms of intrigue.
- Proficient in Microsoft word, Microsoft Excel, power point and SPSS.
- Strong leadership and organizational skills.

3. Education

S\N	INSTITUTIONS ATTENDED	YEARS	AWARD
1	University of Eastern Africa Baraton, Kenya	2016 – 2022	PhD (Cand). To graduate July, 2022
2	University of Pune, India	1995 - 1996	M. Ed
3	Institute of Teacher Education Kyambogo	1988 - 1990	B. Ed
4	National Institute of Education Makerere University	1984 - 1986	Dip. Tr. Ed
5	Bishop Willis Primary Teacher' College, Iganga	1978 – 1980	Cert. in Educ
6	Masaba Secondary School	1974 - 1977	EACE
7	Kirewa Primary School	1967 - 1973	PLE

4. Work Experience

S/N	INSTITUTION	PERIOD	DESIGNATION
1	National Teachers' College Unyama, Gulu	2018 - 2020	Principal
2	National Teachers' College Unyama, Gulu	Feb. 2017 – Oct. 2018	Deputy Principal
2	National Teachers' College Kaliro	2014-2016	Principal Lecturer
		2010 - 2014	Senior Lecturer
		1994 - 2010	Lecturer
		1990 - 1994	Graduate Teacher
3	Mulanda Primary Teachers' College	1986 - 1990	Grade V Teacher
4	Masese Primary School	1980 - 1985	Grade III Teacher

5. Responsibilities/Assignments

S/N	RESPONSIBILITY/ASSIGNMENT	PERIOD	INSTITUTION
1	College Administrative Secretary	2006 - 2016	NTC Kaliro
2	Head of PDU	2010 - 2016	NTC Kaliro
3	Head of Department (Professional)	2005 - 2016	NTC Kaliro
4	Head of School Practice	1998 – 2004	NTC Kaliro

5	Ag. Assistant Registrar	2004 – 2006	NTC Kaliro
6	Warden	2000 – 2004	NTC Kaliro
7	Head of Science Department	1986 – 1990	Mulanda PTC

6. Short Courses Attended

S/N	COURSE	INSTITUTION	YEAR	AWARD
1	Certificate in ICT Integration in Teaching	Commonwealth of Learning	2015 - 2016	Certificate in ICT Integration in Teaching
2	Active Teaching and Learning	MoES	Aug2014 – Jan2016	Cert. of Proficiency
3	Teacher Education Proficiency Course	MoES	May2013 – May2014	Cert. of Teacher Education Proficiency
4	Active Teaching and Learning – Units 1 and 2	MoES	Sep 01 – 06 2014	Cert. of Participation
5	Advancing Policy and Planning for e-Learning in Ugandan Teacher Training	University of Sunshine Coast, Australia	Jul – Aug 2012	Cert of Completion
6	Team Building and Leadership Training	Corporate Training Oz	Jul 07 – 10, 2012	Cert. of Attendance

7	Secondary Headteacher Training Project	Makerere Univ. & Univ. of Minnesota	2005 - 2008	Cert. of Participation
8	Pilot Training Workshop for Secondary Headteachers and Deputy Headteachers	Makerere Univ. & Univ. of Minnesota	Jul 30 – Aug 02, 2007	Cert. of Accomplishment
9	Materials Development and Training Facilitation Workshop	Makerere Univ. & Univ. of Minnesota	Jan 08 – 13, 2007	Cert. of Participation
10	Secondary Headteacher Training Materials Workshop	Makerere Univ. & Univ. of Minnesota	Aug 10 – 16, 2006	Cert. of Participation
11	Data Interpretation and Blue Print Development for Training Materials Workshop on Secondary Headteachers' Professional Efficacy	Makerere Univ. & Univ. of Minnesota	May 16 – 19, 2006	Cert. of Participation
12	HIV/AIDS Technical Training	Peace Corps	Mar 10 – 13, 2014	Cert of Completion
13	Intermediate Procurement Course	Centre for Procurement Management	Nov. 28 – 30 2006	Cert of Completion
14	Risk Management and Fraud Prevention Course	Centre for Procurement Management	Nov. 14 – 16, 2006	Cert of Completion

15	Guidance and Counseling	MOESTS	May 27 – 31, 2002	Cert. of Attendance
16	Education as Introduction to Total Reality	AVSI	Oct. 06 – 08 2008	Cert. of Participation
17	Learning Disabilities	Rotary Club of Khadki	Jan. 22 – 23, 1996	Cert. of Attendance

7. Publications

Nyakito, C., Allida, V. B., & Amimo, C. (2021) Integration of Information and Communication Technology in Teaching and Learning among National Teachers' Colleges in Uganda. *East African Journal of Education and Social Sciences,* 2(3) 1-8

Nyakito, C., Amimo C., & Allida, V. B. (2021) Challenges of Integrating Information and Communication Technology in Teaching among National Teachers' Colleges in Uganda. *East African Journal of Education and Social Sciences*, 2(3) 157-171

Nyakito, C., & Allida, D. (2018). "Spare the Rod and Spoil the Child." Is Corporal Punishment Morally and Legally Justified in Ugandan Secondary Schools? A Case of Gulu District. *Baraton Interdisciplinary Research Journal (2018)*

Nyakito, C., & Role, E. (2018) Teacher Educators' Experiences of Integrating Information and Communication Technology in Teaching and Learning in Selected National Teachers' Colleges in Uganda. *Baraton Interdisciplinary Research Journal (2018)*

Nyakito, C., & Allida, V. (2018). Twenty-First Century Education: Is Kenya Heading towards the Right Direction of Improving Teaching and Learning as Prescribed by

Educational Transformation Programme?) *Baraton Interdisciplinary Research Journal (2018).*

Nyakito, C., & Allida, D. (2017). Parental Participation in Improving Learning Outcomes in Universal Primary Schools in Kaliro District, Uganda. *Baraton Interdisciplinary Research Journal (2017), 7(Special Issue)*, pp 1-11

Samson, B., Nyakito, C., Koskey, J., Kiwanuka, J.W., Mbuti, E., Magaleta, J., & Allida, V. (2017). The Quest for 3H: Towards a Holistic Secondary Education in Kenya. *Baraton Interdisciplinary Research Journal (2017), 7(Special Issue)*, pp 1-7

8. Paper presented

Presented a paper at the Northern Caribbean University entitled: "Integrating ICT in teaching and learning in National Teachers' Colleges in Uganda" on 16th February 2022, during the College of Education and Leadership Research Day.

9. Other Accomplishments

- STIR Innovator: Wrote one of the best 50 awards winning national innovations.
- STiR Innovator: Implementer
- STiR Innovator: Changemaker
- UNEB Examiner for over 10 years marking O level exams.
- Research supervisor for Makerere University School of Education for 5 years.

- Setter for Grade III Teachers' Examinations since 2004 - 2017.

- Chairman BOG Muna Sec School, Bulumba, 2004 - 2010

Signed:  Date: 31st May, 2022

Charles Nyakito

0772373419

nyakito60@gmail.com