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Primary Teacher Trainees' ICT Competencies, Tutors' mode of Instruction, ICT Infrastructure and Pedagogical Practices in Uganda

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Abstract : Teacher Trainees' ICT competencies influence the future application of educational technologies in teaching and learning. ICT has a significant impact on the changing scenario of education. It is a necessity for student teachers. The purpose of this study was to establish Primary Teacher Trainees' information and communications technology (ICT) competencies for pedagogical practices in Uganda. The objectives of this study were: To establish the level of ICT competencies amongst Primary Teacher Trainees in Uganda; To evaluate the Quality of ICT Infrastructures and assess tutor's mode of Instruction in Primary Teachers' Colleges in Uganda. This study followed the pragmatism research paradigm and was guided by a non-experimental, concurrent embedded mixed methods design. For colleges, a disproportionate stratified sampling technique was used. The study took place in Primary Teacher Training Colleges, sampled from Central, Southwestern, Western, Eastern and Northern regions of Uganda. For students per selected college, convenient sampling was opted for. The study used a questionnaire to collect quantitative data and an observation schedule to collect qualitative data. Collected data on self-administered questionnaires were edited, categorized or coded and entered into the computer using the IBM SPSS version 23.0 for the generation of descriptive statistics. Results have shown that Primary teacher trainees' ICT competencies have been reported as low, slightly below average in terms of skills, but slightly above average in terms of ICT knowledge. Recommendations have been made to all stakeholders in teacher education.

IndexTerms - **ICT, Competencies, Pedagogical Practices, Mode of Instruction, ICT Infrastructure**

I. INTRODUCTION

ICT competencies aid the teacher trainees' pedagogical practices in terms of; planning instruction, resource development, and assessment (Higgins & Packard, 2004). ICT provides several powerful tools that can help transform the currently divided, teacher-oriented and text-based classes into technology-enhanced, student-centred and collaborative (Rastogi & Malhotra, 2013). However, for teacher trainees to acquire ICT competencies for pedagogical practices other variables such as ICT infrastructure and tutors' teaching strategies should also be taken into consideration. For teachers to embrace technology effectively into their classrooms, they need to receive sufficient training before starting the actual teaching (Brun & Hinostroza, 2014; Tondeur, Van Braak, Siddiq & Scherer, 2016; Usun, 2009). UNESCO has documented 194 country-wide school closures, constituting a near-global shutdown because of COVID-19 prevention measures (UNESCO, 2020). Many countries have resorted to the development of radio and TV content and e-learning

and supplying distance learning materials, resources, and platforms. In Uganda and Zambia for example, UNESCO's Capacity Development for Education (CapED) has been carrying out teacher assessments to determine the ICT competency levels of teachers (UNESCO, 2020). In the short term, this will determine the type of ICT-related interventions that will be developed for teachers as part of the current educational response to COVID-19. Over time, evaluation recommendations will form the basis for the development of teacher training materials using ICT as a teaching tool in the COVID-19 era and beyond (UNESCO, 2020). So this current study was in line with the global ICT agenda and is noteworthy.

However, according to recent research, the education sector in Uganda has not fully utilized technology during the tough season when schools were closed; they either lack ICT competencies or education institutions have no or limited ICT infrastructure (Nelson et al., 2020). Researchers (Higgins & Packard, 2004; Fox, Waters, Fletcher & Lewin, 2012; CISCO, 2013) posit that a school's broadband bandwidth increasingly determines online content, functionality and application. When teacher trainees are digitally literate and trained to use ICT, these approaches can lead to higher-order thinking skills, provide creative and individualised options for teacher trainees to express their understanding, and leave them better prepared to deal with ongoing technological change in society and the workplace in future. Experts of ICT in Education such as; Higgins & Packard (2004) suggested that a teacher trainee should be confident to use different software, which is designed to manage and manipulate text (such as Microsoft's Word in the Office suite). These experts further emphasize that; teacher trainees should be able to undertake tasks for themselves (such as writing assignments) and to prepare materials for their actual teaching. Teacher trainees need to be aware of the potential of ICT for supporting their work in the preparation of teaching materials. It's believed that the ICT competencies among teacher trainees would equip them with knowledge and skills for their future pedagogical practices which includes, learning resources development, lesson planning and assessment of learning activities in schools. This is because Information and communication technology (ICT) is gaining importance in education since students have emerged as the most active ICT users of computers and cell phones with internet access (Hakoama & Hakoyama, 2011; Wentworth & Middleton, 2014). UNESCO (2009) argues that ICT can help to enhance the quality of education with advanced teaching methods, improve learning outcomes enable reform of the education system hence achieving the United Nation's sustainable development goal number 4 (SDG4). Worldwide, the utilization of ICT in education has been regarded as an essential factor for economic growth, although the educational practices and structures and the economic growth have a posh and reciprocal relationship, as Kozma (2005) describes them comparing Finland, Hong Kong and Egypt regarding their solutions to applying technology in education. According to new research by Huawei (2017), support and investment in ICT directly affect an individual country's performance, against the United Nation's sustainable development goals (SDGs), through education, skill development and new service creation.

Computers like mindtools (Jonassen, Peck & Wilson, 1999) allow students to perform a variety of critical thinking activities. The acquisition of ICT competencies by teacher trainees is therefore important to both teachers, learners and the economic development of any nation. These ICT Competencies in education are a set of technology standards that define proficiency in using computer technology in the classroom (Lawrence & Veena, 2013). According to Uerz, Volman, and Kral (2018) teachers got to be provided with the

newest technologies because they bear responsibility for preparing technologically literate citizens during a 21st-century society where technological developments are constantly in flux. As a result, understanding and developing pre-service teachers' competency in technology use is that the cornerstone in integrating technology into teaching. Knowledge and skills containing computer-related skills are grouped into four common areas: (1) Basic Technology Operation, (2) Personal and Professional Use of Technology Tools, (3) Social, Ethical, and Human Issues, and (4) Application of Teaching Technology (Lawrence & Veena, 2013). UNESCO defines these competencies as; the skills, knowledge, and understanding needed to do something successfully. Teachers' Information and Communication Technology (ICT) knowledge and skills are important variables that integrate the learning process resources.

Teachers need to incorporate ICT into their daily teaching and change their traditional methods with modern tools and resources. They are expected to always be ready and well equipped in terms of ICT knowledge and skills, tools and a positive attitude to provide ICT-based learning opportunities for students to improve their learning quality. These students from lower secondary are the ones enrolling in teacher training colleges, which would give rise to 'digital native' teachers when the basics of ICT meets professionalism during teacher training.

However, some researchers have noted that some teachers are not comfortable with even the very basic applications of computers. Luwangula (2012) noted that teachers still yearn to learn packages like Microsoft (MS) Word, Excel, Powerpoint and internet surfing. Luwangula projected that the Ugandan teachers don't have any idea of how even the basic ICT skills they seek to learn can be used to enhance the teaching-learning process.

For this current study, teacher trainees' ICT competencies are conceptualized as a combination of professional behaviour, skills and knowledge of ICT that a teacher trainee possesses for pedagogical practices. Pedagogical Practices here refers to teacher trainees' activities which they do during their training to become professional teachers, for example; learning how to develop different learning aids, lesson planning for different subjects by searching own notes and how to assess learners. Primary teacher trainees' ICT competencies and pedagogical practices are moderated by accessibility and availability of ICT infrastructure and tutors' modes of instruction.

II. Purpose of the Study

The purpose of this mixed-methods study was to; establish Primary Teacher Trainees' information and communications technology (ICT) competencies for Pedagogical Practices in Uganda.

III. Objectives of the Study

The specific objectives of this study were;

1. To establish the level of ICT competencies amongst Primary Teacher Trainees in Uganda
2. To evaluate the Quality of ICT Infrastructures in Primary Teachers' Colleges in Uganda
3. To establish tutors' mode of instruction at Primary Teacher's Colleges in Uganda

IV. Research Questions

1) What is the level of ICT Competencies among primary teacher trainees in Uganda?
2) What are the availability and quality of ICT Infrastructures in primary teachers' colleges in Uganda?

3) What is the tutor's mode of instruction at primary teacher's colleges in Uganda?

V. LITERATURE REVIEW

Teacher trainees ICT Competencies

A competency is defined as a combination of skills, abilities, and knowledge needed to perform a specific task (Jones, Voorhees & Paulson, 2001). These attributes include high levels of data, values, skill, personal dispositions, sensitivities and capabilities, and therefore the ability to place those combinations into practice in an appropriate way (Commonwealth Department of Education, Science, and Training, 2002). The term competency is frequently used when we talk about any profession or work that expresses one's quality of being competent, processing adequate professional skills, knowledge, and capacity (Dave, 1998). UNESCO (2011) defines competency as; the skills, knowledge, and understanding needed to do something successfully. Competencies often serve as the basis for skills standards that specify the level of knowledge, skills, and abilities required for success in the workplace as well as potential measurement criteria for assessing competency attainment. Competencies are the talents and knowledge that enable an educator to achieve success.

Teacher competency refers to the excellence capability including knowledge, skills, attitude, and experience to complete a definite task at a particular level to high excellence by a teacher (Pranab, 2019). Teacher competence is the capability, ability, and skills of the teachers to make the teaching-learning environment effective (Sekar, 2016). Perera (2003) defines teacher competencies as, "a combination of professional behaviour, values, and attitudes, skills and knowledge that a teacher possesses to demonstrate quality teaching concerning their context of teaching.

Teacher Trainees' ICT Competencies are defined as a set of technology standards that define proficiency in using computer technology in the classroom. The competencies contain computer-related skills grouped into four general domains: (1) Basic Technology Operation, (2) Personal and Professional Use of Technology Tools, (3) Social, Ethical, and Human Issues, and (4) Application of Technology in Instruction (Lawrence, & Veena, 2013). UNESCO (2011) looks at ICT competencies basing on three approaches; Technology Literacy, Knowledge Deepening, and Knowledge Creation. Most of the schools and educational systems started providing extensive computer networks for their students and these are increasingly becoming main components of the teaching and learning environment (Fraillon et al. 2014). Technology has become an increasingly important part of students' lives beyond school, and even within the classroom. It can also help to deepen their understanding of complex concepts or to encourage peer learners collaboration. Because of these benefits, current educational practice suggests that teachers implement some sort of technology in their classrooms – but many teachers face difficulties in doing so.

For example, teachers lack knowledge on how technology can best be utilized to benefit students across diverse subject matter. Lack of adequate training and experience is one of the main factors why teachers do not use technology in their teaching (Danner & Pessu, 2013). This also results in teachers' negative attitudes toward computers and technology. Also, low self-esteem leads to a refusal to use computers by teachers (Kumar & Kumar, 2003). To enhance student learning, teachers must be proficient in a variety of knowledge and skills in a highly complex environment where critical daily decisions are needed

(Jackson, 1990). Few jobs require a mixture of professional judgment and proficient use of evidence-based competencies as does the teaching.

ICT Knowledge

Numerous studies have highlighted the importance of ICT Knowledge as a critical factor among teacher's ICT competency. The use of ICT in teacher education has been extensively studied and documented especially the positive impact of ICT in teacher education (Kay, 2006; Murray, Nuttall & Mitchell, 2008), the use of ICT as an instructional tool (Murray et al., 2008; Ryan & Scott, 2008). The ICT knowledge teacher trainees acquire from colleges has an impact on their future use of pedagogical ICTs when they enter job markets as qualified teachers.

ICT Knowledge components:

1. Understanding of the hardware and software of computer systems and how these can be used to meet entertainment, personal and business needs.
2. Knowledge of a variety of software packages and programs, and how to choose the most appropriate program for a specific task.
3. Work with information data to meet specified business needs; this covers data structures, storage and how you can transfer data between different mediums.
4. Understand how ICT is used to support business working practices, such as how employees can communicate with each other remotely; diary management; and working collaboratively on documents.
5. Understand the risks of ICT and how to prevent these risks, by following sensible E-Safety guidance.

ICT Skills

Information and communications technology (ICT) skills refer to a person's ability to communicate with people through various technologies. Similar to information technology (IT), ICT refers to the use of technology to perform normal tasks: send an email, make a video call, search the internet, using a tablet or mobile phone, and more.

Surprisingly, ICT skills can also include the ability to use old communication technologies such as telephones, radios, and televisions. Often, ICT professionals are asked to integrate old communication technology with the new technologies. Almost every job requires some ICT skills, and many require hybrid skills, a set of skills mixed with technical and non-technical skills.

The success of educational plans in each country depends on the teachers armed with scientific competencies and professional skills (Maryam & Maryam, 2011). Oliver (2002) argues that the use of ICT in higher education promotes student-centred learning. Lee (1997) found that a great number of students in teacher preparation programs were not equipped with basic computer operational skills.

Teacher development is required to prepare teachers with ICT skills to equip students with the kinds of critical skills needed if they, as members of the society, are to contribute meaningfully to the country's future development. All teachers need to be familiar with ICT applications and competent in the use of ICT

applications (Danner & Pessu, 2013). White (2003) suggests that teachers need to experience online learning as part of their professional development. Lee (1997) found that a great number of students in teacher preparation programs were not equipped with basic computer operational skills. Ozoemelem's (2010) study has shown that there is a low level of expertise in the use of ICT among Nigerian university students. Similarly, Yusuf (2005) reported that teachers in Nigerian secondary schools lack proficiency in basic computer operations and the use of generic software. If teachers are expected to integrate ICT into the school curriculum, training must be done at the pre-service teacher education level.

Teacher training programs should focus on the need for student-teachers to have ICT skills for their use, in the preparation of materials for teaching and learning activities; they need to facilitate the direct use of ICT in student learning activities within the classroom environment; and the need for teachers to develop in their students a critical awareness of ICT applications and the social impacts (Robbins, 1998).

Types of ICT Skills

According to Siddiquah and Salim (2017), teachers should be experts in simple skills such as MS Word, MS PowerPoint, searching and browsing at Internet, social networking, Email, File attachment, and computer games.

Email Management and Setting

Being able to communicate effectively and efficiently via email is essential for any job. You will need to send emails to colleagues, employers, clients, and so on. Companies expect their employees to write effective and well-written emails and respond quickly to messages received in their inboxes.

Depending on the level of professionalism required by your employer, you may also need to be able to manage settings or set up email accounts on various work devices.

Online research

Almost every job requires at least some online research. Whether you are looking for new ideas in the article or looking for the latest news from your company's competition, you need to be able to filter out all the online information to find what you need. This includes basic online data management skills, including; Search Engine Optimization, Test Sources, Credit Sources, FAQs and Online Forums

Social Media Management

Some jobs require you to use social media. For example, many people who work in advertising tend to manage or update the company's social media presence. While this is not a critical part of your job, employers are increasingly looking for employees with basic communication skills. The more you know about the benefits and limitations of social media, the more you can begin to use that media in important ways at work. These sources of communication include; Facebook, LinkedIn, Pinterest, Instagram, YouTube, Twitter, Reddit and social media groups.

Internet Collaboration

Online collaboration is a broad section that focuses on anyway to share information with your colleagues (or managers, or clients) online. These include meeting in a shared online calendar, providing documentary feedback with a web-based application, and hosting an online video conference with partners. Other online

tools include; Software Conferencing Software, Skype, GoToMeeting, Instant Messaging, Google Docs, File Sharing, DropBox Pro, Slack and Google Hangouts.

Data Management and Inquiries

From researchers to administrative assistants to primary school teachers, almost everyone needs to be able to develop and manage data using spreadsheets. In addition, they should be able to analyze that data and identify styles and patterns. Fluency in programs such as Microsoft Excel is essential for today's job market. Data Management and Inquiries include; MS Excel, Filters, MySQL and measurement analysis.

Desktop Publishing

Desktop publishing includes the production of materials that require printing and distribution. This could include feathers, brochures, newsletters, and more. Because you can create a lot using desktop publishing software, many tasks require you to have basic skills in this field. While people have a creative eye, this art is very good at desktop publishing, anyone can be better off with practice. Desktop publishing with; MS Publisher, MS PowerPoint, MS Word, print settings, Adobe Creative Suite and QuarkXPress

Smartphones and tablets

Many employers require their employees to use smartphones and tablets; they may issue certain calls to employees or state that employees should be available via email from time to time. For these reasons, it is important to know how to use a smartphone. Examples are; iPhone, Samsung Smartphones, Blackberry Devices, iPad, Samsung Tablets, CAT S41 and Panasonic Tough Pad.

Processing the Word

In this day and age, job seekers are expected to learn how to use word processing technology. Applicants must be able to produce written documents (including business letters, minutes of meetings, and more) using a computer processor such as Microsoft Word. Word processing can be done with; Microsoft Word, Libre Office Writer, Transcription, Typing and Note Taking.

Teacher Trainees Pedagogical Practices

Teacher pedagogical practices are operationally defined as teacher trainees‘ activities which they do during their training to become professional teachers, for example; learning how to develop different learning aids, lesson planning for different subjects by searching own notes, and how to assess learners. UNESCO ICT Framework (2008a, 2008b, 2011) encapsulates key aspects of a learning system, which include pedagogy, teacher practice and professional learning, curriculum and assessment.

Given that the relationship between teaching, learning, and assessment through the use of ICTs is very complex, one would not expect the inclusion of ICT in the learning environment could bring about a change in the pedagogical practice itself. Rather, we would expect the use of ICTs in education to be inextricably linked with teacher understandings of teaching and learning (Becker, 2000; Becker and Riel, 1999; Bransford, Brown & Cocking, 2000; Cuban, 1993, Jones & Mercer, 1993). Pedagogies associated with the effective use of ICT include those that emphasise high levels of understanding of key concepts within subject areas and the ability to use these concepts to solve complex real problems (Bransford, Brown & Cocking, 2000). Most recently, curriculum development initiatives have emphasised: “21st-century skills” (often referred to as “Key Skills” or “Key Competencies”), (ETA, 2010; OECD, 2005; NCCA, 2008a,

2008b, 2009), qualities that prepare students to live and work in a digital society. These include skills such as critical thinking and problem solving, communication, collaboration, self-regulation and information management (Binkley et al., 2012, Partnership for the 21st Century, 2003, 2005).

However, both internationally (ESSIE, 2013) and nationally (e.g., Conway & Brennan, 2009), it has been found that teachers first and foremost use ICT to prepare their teaching and for teacher presentation during lessons to explain information and concepts and consolidate learning. Few teachers use ICT to work with students during lessons and, when they do, student use of ICT is for beginners/basic. The majority of students use ICT to find information on the Internet, practice routine skills or take tests. In this sense, ICT has been used to reinforce or automate traditional methods of teaching and learning (e.g., Campuzano, Dynarski, Agodine & Rall, 2009; Plomp, Anderson, Law & Quale, 2009). This may reflect the fact that teachers' pedagogical orientations as well as the prevailing school, regional and national cultures, together with government current policy priorities, influence the shape and form of how digital tools are used in schools and classrooms.

However, research suggests that, with careful planning, relevant teacher training, and buy-in from school leadership, teachers, students and parents can contribute to improving student outcomes through the use of ICT (Stansbury, 2010). Similar to teaching, it is envisaged that assessment using technology will, over time, move beyond replicating traditional summative assessments in electronic format, towards assessing such skills as complex problem solving, communication, teamwork, creativity and innovation. In this scenario, assessments will include modelling, video data, data processing, simulation and utilisation (Binkley et al., 2012).

Tutors' Mode of Instruction

Teacher education institution tries to restructure their education programmes and classroom facilities to husband the potentials of ICT in improving the content of teacher education (Mohit, Daudhar, Moga & Manpreet, 2015). Tutors are expected to teach their subject(s) and help their trainees develop effective teaching approaches founded on recognized and explicit educational theory, well-researched practice, current initiatives, and recent inspection evidence.

A variety of teaching methods are used: lectures, demonstrations, presentations, seminars, discussions, distance learning materials, tutorials, practical workshops. You are expected to model good practice. Trainees are tested on their knowledge, skills, subject comprehension, teaching ability, and expertise. With all these approaches and methods if modelled with ICT, trainees will develop expertise in ICT application for their teaching practice and future job. Mahmud & Ismail (2010) indicate that teachers lacking ICT skills are due to a lack of pre-service and in-service training. Abu-obaidah (2012) found out that teachers who did not attend any ICT course had lower ICT skill scores than those who attended ICT courses.

Students' achievement can be improved if the students are often exposed to attractive and interesting Teaching &Learning methods (Tee et al., 2016). Student willingness and motivation should also be improved (Dalilah et al., 2014) because they lack practical mastery is due to the perfunctory attitude, lack of interest and lack of guidance from instructors (Tee et al., 2016). The lack of interest and guidance will affect

the students' learning outcomes (Azubuike, 2011; Abdull Sukor, Nurahimah, Izam, Rafisah & Nur Fatirah, 2014).

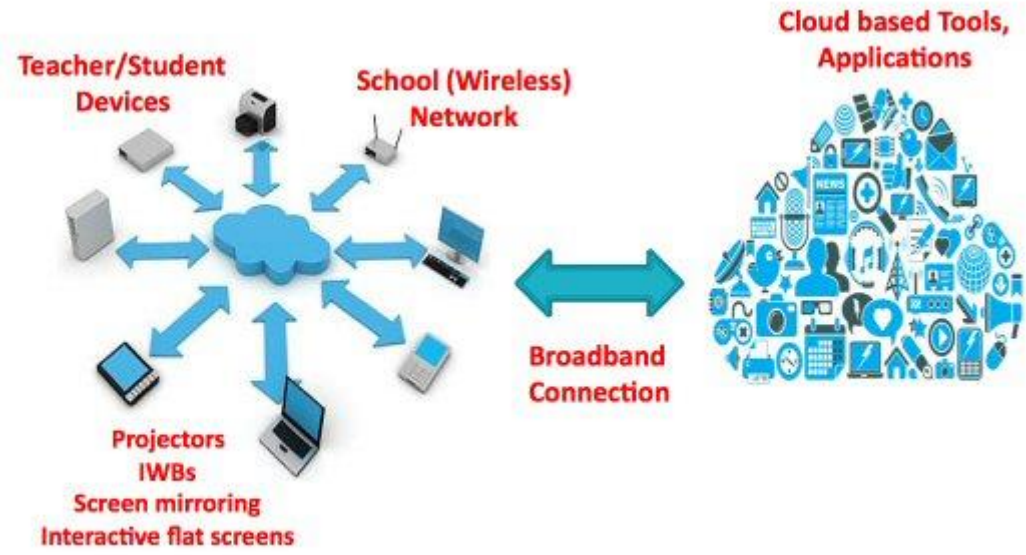
ICT Infrastructure

In some developing and underdeveloped countries, lack of infrastructure is a major problem for teachers' ICT use (Agyei & Voogt, 2011; Demmans Epp et al., 2017). However, ICT infrastructure is well suited to support teaching, learning, assessment and school management. ICT infrastructure includes digital television, global satellite calls, the Internet, websites, mobile phones, short messaging services, and multimedia equipment, such as video, audio, projectors and podcasts. Also, it includes digital media and communications, which are helped by the transmission hardware and software, information sharing and distribution, especially in teacher education.

A Nigerian study has shown that the lack of ICT resources and poor infrastructure hinders the full implementation of ICT in education (Adeosun, 2010). Improved types of ICT supported instruction including computers and Internet-assisted teaching require appropriate infrastructure including computers and Internet resources. Computers available for educational institutions must have computers for teaching and administration purposes. The development of a strong infrastructure that provides teacher trainees with the resources they need, when and where they are needed is a key factor in developing their ICT skills.

Figure 1

ICT infrastructures



Overview of ICT infrastructure areas for schools

This image highlights some of the key areas of ICT in schools, including wireless school networks which connect teachers' and student mobile devices through broadband to cloud-based tools and applications. Although each school differs in size, location and location on the use of ICT, there are some common changes and trends in the way schools use ICT. These include:

1) Increased use of cloud-based tools and applications by schools
2) The importance of fast/reliable broadband connectivity to cloud-based applications

3) Use of mobile computing devices by teachers and students, including areas for special educational needs
4) The importance of appropriate Wi-Fi networks in schools to support mobile learning
5) Changes in how screens are displayed and alternatives to projectors in classrooms

In many countries, digital learning is being developed through the introduction of information and communication technology (ICT) in schools. Other common ICT education programs include:

One laptop per child: Cheap laptops are designed for 1: 1 use in school with features such as low power consumption, a low-cost operating system, and special reprogramming functions and mesh network functions (Zuker & Light, 2009). Despite cost-cutting efforts, however, providing one laptop per child can be costly in some developing countries (Warschauer & Ames, 2010).

Tablets: Tablets are small personal computers with a touch screen, allowing input without a keyboard or mouse. Inexpensive software ("apps") can be downloaded to tablets, making it a versatile learning tool (Bryant et al., 2015; Nirvi, 2011). The most effective applications develop a high level of thinking skills and provide creative and tailored options for students to express their understanding (Goodwin, 2012).

Interactive White Boards or Smart Boards: White interactive boards allow customized computer graphics to be displayed, intelligently made, dragged, clicked, or copied (BBC.n.d). At the same time, handwritten notes can be taken from the board and saved for later use. Interactive whiteboards are associated with classroom instruction rather than student-centred activities (Turel & Johnson, 2012). Student involvement often peaks when ICT is available for use by students throughout the classroom (Beilefeldt, 2012).

E-readers: These are electronic devices that can digitally hold hundreds of books, and are widely used in the delivery of reading materials (Jung et al., 2011). Students - both skilled students and hesitant students - have positive responses to the use of e-readers in independent reading (Miranda, Williams-Rossi, Johnson & McKenzie, 2011). These e-readers have features that motivate learners to use them for example; they are portable and have a long life battery, text response, and the ability to define unfamiliar words (Miranda, Williams-Rossi, Johnson & McKenzie, 2011).

Flipped Classrooms: A flipped classroom model, which includes lecture and home practice with computer-guided instructions and interactive learning activities in the classroom, may allow for an extended curriculum. There is little research into student learning outcomes of flipped classes (Bishop & Verleger, 2013). Perceptions of students in the flipped classes are mixed, but positive, because they prefer cooperative learning activities in the classroom rather than the lecture (Bishop & Verleger, 2013; Strayer, 2012).

ICT and Teacher Professional Development: Teachers need specialized opportunities for professional development to increase their ability to use ICT in constructive learning, individualized teaching, access to online resources, and to facilitate students' interaction and collaboration (Dunleavy, Dextert & Heinecke, 2007). Such training in ICT should have a positive impact on teachers' general attitudes towards ICT in the classroom, but should also provide direct guidance on ICT teaching and learning within each discipline. Without this support, teachers often use ICT in skills-based applications, limiting students' thinking (Smeets, 2005). Supporting teachers as they transform their teaching is also important

for education managers, administrators, teacher trainers, and decision-makers to be trained in the use of ICT (Chapman, & Mählck, 2004).

Ensuring the benefits of ICT investment: To ensure that investments made in ICT for students are beneficial, additional conditions must be met. School policies need to provide schools with an acceptable ICT infrastructure, including stable and affordable internet connectivity and security measures such as filters and site blockers. Teacher policies need to identify the basic skills of ICT learning, the use of ICT in teaching environments, and discipline-specific uses (Kopcha, 2012). The effective use of ICT requires the integration of ICT into the curriculum. Finally, digital content needs to be produced in local languages and reflect local culture (Voogt et al., 2013). Continued technical, human and organizational support for all these issues is needed to ensure the effective access and use of ICT (Kopcha, 2012).

Contexts constrained by resources: The total cost of ICT ownership is important: teacher and management training, connectivity, technical support, and software, among others (Zuker & Light, 2009). When establishing ICT classrooms, policies should use an incremental pathway, establishing infrastructure and delivering sustainable and easily renewable ICT (Enyedy, 2014). Schools in some countries have begun allowing students to bring their mobile technologies (such as a laptop, tablet, or smartphone) to the classroom instead of providing such tools to all students – an initiative called Bring Your Own Device (Alberta Education, 2012; Project Tomorrow, 2012; Song, 2014). However, not all families can afford the devices or service plans for their children (Sangani, 2013). Schools must ensure that all learners have equal access to learning ICT devices.

The availability of ICT affects the teacher's ICT skills significantly (Oqunkola, 2008; Kumar et al., 2008; Wozney et al; 2006). Teacher trainees can increase their ICT knowledge and skills through the ICT resources available at their teacher's colleges.

VI. METHODOLOGY

Geographically, the study took place in Primary Teacher Training Colleges, sampled from Central, Southwestern, Western, Eastern and Northern regions of Uganda using disproportionate stratified sampling. By content, it dealt with ICT infrastructures, Tutors' mode of Instruction, ICT Competencies and Teacher Trainees' Pedagogical practices, to establish Primary Teacher Trainees' information and communications technology (ICT) competencies and their Pedagogical Practices in Uganda. Only Teacher trainees (finalists) were involved in the study with a sample size of 627 using convenient sampling, whereas colleges were selected using a stratified sampling technique. A pragmatism paradigm and concurrent embedded mixed methods design was followed. This allowed the collection of quantitative data using a questionnaire and observational data using an observation schedule, all done at once.

Data were analyzed using descriptive statistics (mean, frequency and percentages and inferential statistics (correlations and regression analysis) and thematic analysis for qualitative data collected on quality and accessibility of ICT infrastructures in colleges.

VII. Results and Discussions

Demographics of Respondents

The demographic information presented in this section includes; sex, age of respondents and location of colleges where research data were collected.

Sex of the Respondents

The sample of the study comprised 627 male and female primary teacher trainees from five (5) Primary Teacher Training Colleges considering all regions of Uganda. Results are presented in Table 1.

Table 1

Sex of Respondents

Sex	Frequency	Percent
Male	219	34.9
Female	408	65.1
Total	627	100.0

Field data, 2020

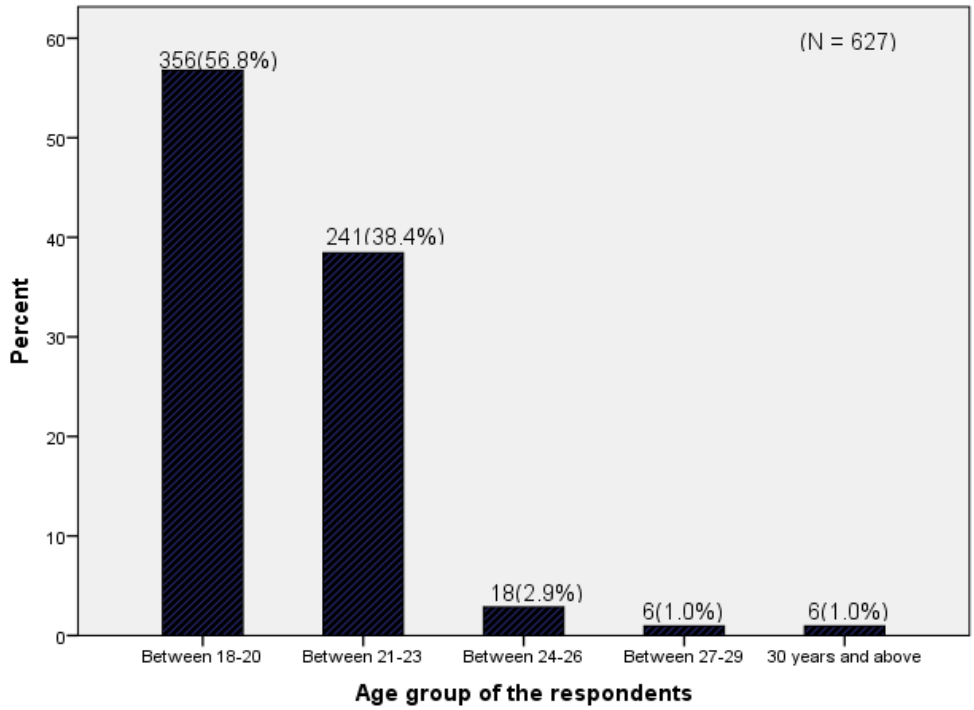
Results in Table 1 indicate that majority of the respondents 408 (65.1%) were females. This is because one of the sampled colleges was coincidently a single-sex college, whereas other colleges were mixed (both males and females). Males were 219 representing 34.9%.

Age of the Respondents

Primary Teacher Trainees were asked to indicate their age range. Results are presented using a bar graph as shown in Figure 2.

Figure 2

The age range of the Respondents



Results in Figure 2 indicate that majority of the respondents 356(56.8%) were between the ages 18-20, followed by 241(38.4%) who were between the ages 21-23 years. 18(2.9%) of the respondents were between ages 27-29 years, whereas 6(1.0%) were between the ages 27-29 years similarly 6(1.0%) were 30 years old and above.

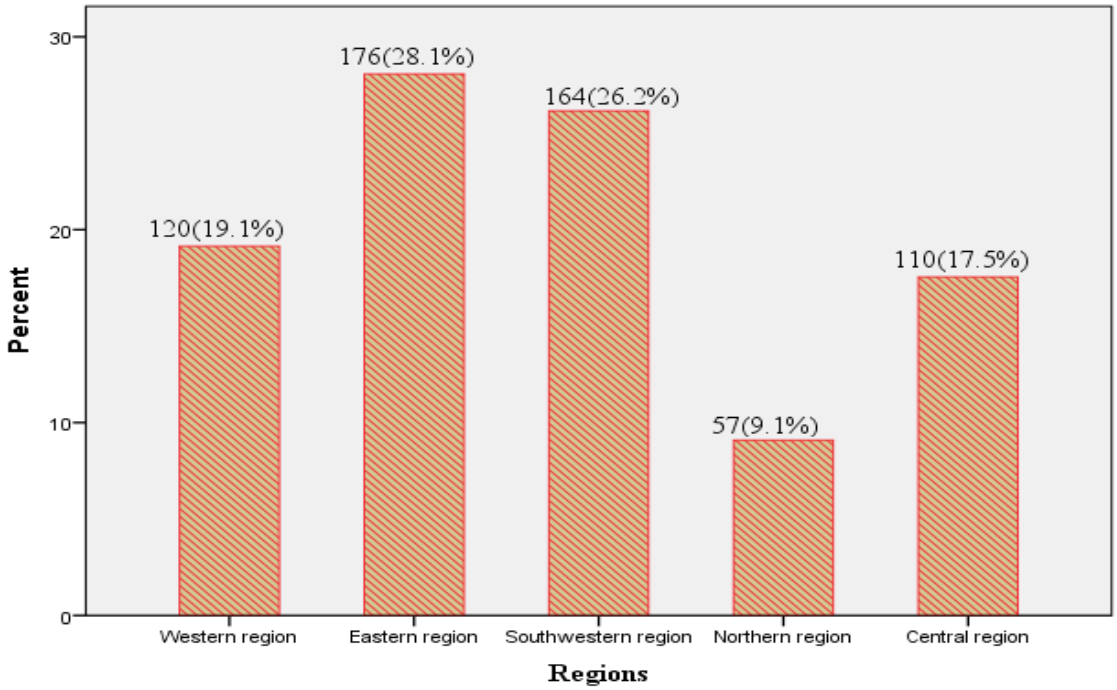
Elli and Ricafort (2020) argue that young teachers may be better at computers and technology and more eager to learn more about teaching. Accordingly, the young age of these primary teacher trainees in Uganda would be a good stage to explore ICTs if infrastructure allows and also their tutors demonstrate for them.

Location of Colleges

To ensure representation of all Primary Teacher Training Colleges, all the five (5) regions of Uganda were considered since their geographical factors differ. The results were presented on a bar graph using frequencies and percentages as shown in Figure 3.

Figure 3

Location of the Colleges



Results from Figure 3 indicate that majority of the respondents 176(28.1%) were from the Eastern region followed by 164(26.2%) from the Southwestern region and 120(19.1%) from the Western region, then 110(17.5%) from the Central region and finally 57(9.1%) from Northern region. All respondents were found in their classrooms and they all participated equally. Their differences in frequencies and percentage are attributed to core primary teachers colleges and non-core teachers colleges. Core primary teachers colleges have a large enrollment capacity of a minimum of 450 students, unlike non-core teachers colleges whose enrolment is at 150 students (Daily Monitor, 2019).

Primary Teacher Trainees ICT Competencies

Teacher Trainees ICT Competencies were scored based on basic ICT tools, Complex ICT tools, professional learning, curriculum and assessment and ICT knowledge. Items on the questionnaire were

scored on a Likert scale of 1-5. Results were interpreted using the scoring guide adapted from Mailizar and Fan (2019) as shown in Table 2.

Table 2

Scoring guide

Means (*M*)	Percent (%)	Interpretation
1.0 ≤ x < 1.5	10 – 20	Very low
1.5 ≤ x < 2.0	21-30	Low
2.0 ≤ x < 2.5	31-40	Moderately low
2.5 ≤ x < 3.0	41-50	Slightly below average
3.0	51-60	Average
3.0 < x ≤ 3.5	61-70	Slightly above average
3.5 < x ≤ 4.0	71-80	Moderately high
4.0 < x ≤ 4.5	81-90	High
4.5 < x ≤ 5.0	91-100	Very high

Source*: Adapted from Mailizar and Fan (2019).*

Descriptive Statistics for Skills on ICT Basic Tools

Primary Teacher Trainees were asked to indicate the extent to which they can use; a word processor, presentation software, a web browser, email address, search engine, courseware, open educational resources, record and maintain pupil's grades and attendance using the computer. Results are presented in Table 3 using mean (M) and standard deviation (SD).

Table 3

Descriptive Statistics for Skills on ICT Basic Tools

Items	N	Mean	SD
To what extent can you use a word processor?	627	2.28	1.03
To what extent can you use presentation software?	627	2.16	1.04
To what extent can you use a web browser?	627	2.14	1.09
To what extent can you use an email address?	627	2.37	1.15
To what extent can you use a search engine?	627	1.94	1.08
To what extent can you use courseware?	627	1.91	1.02
To what extent can you use open educational resources?	627	2.45	1.11
To what extent can you use the computer to record grades, maintain pupil's records, or take pupil's attendance?	627	2.53	1.14
Grand Mean		2.22	

Field data, 2020

Results in Table 3 indicate that the grand mean for ICT basic tools scored by teacher trainees is 2.22. According to the scoring scale provided in Table 7, this puts teacher trainees' basic ICT skills at an averagely low. The majority of the respondents reported that they can use a word processor a little (*M*=2.28, *SD* =1.03). Word processing is an important skill in modern society. As more technology is developed, teacher trainees are expected to understand the basics of typing and using word processing

programs. As future teachers, they will use the word processing program to prepare worksheets and activities for their students for example typing notes, inserting pictures and links and creating forms. Almost everything becomes digital, in the future students need to print application letters or all departments will be digital. At that point, you can't imagine that applications are received as handwritten letter on physical paper. Teacher trainees need more time to practice computer basic typing skill.

Also, the majority of the respondents reported that they can use presentation software a little (*M*=2.16, *SD* = 1.04) and the majority can use a web browser a little (*M*=2.14, *SD* =1.09). Teacher trainees need to have the basics of presentation software because presentation software makes the ability to communicate messages to a group of people much easier than other delivery methods. Seeing a presentation while listening to it helps visual and audio learners absorb information. In today's education presentation software goes beyond the mere provision of facts to the facilitating of the higher-order skills of creativity, problem-solving, analysis and evaluation. Teacher trainees should be able to utilize web browsers. A web browser (commonly alluded to as a browser) may be a program application for getting to data on the World Wide Web. Cases include google chrome, firefox, opera, torch and numerous others. When a client demands a web page from a specific site, the internet browser retrieves the necessary content from a web server and then displays the page on the user's gadget. Web browsers are utilized on a range of gadgets, including desktops, laptops, tablets, and smartphones. We use a web browser to get information resources from the internet on our gadgets. Therefore, teacher trainees should have fundamental skills for web browsers that are great for downloading, uploading information for teaching and learning.

Furthermore, the email address can be used a little by respondents (*M*=2.37, *SD* = 1.15). Teacher trainees should be able to create and make good use of an email address. Email is used for many different purposes, including networking with friends, contacting experts and administrators, requesting information, and applying for jobs, apprenticeships and bursaries. Depending on your goals, the messages you send will vary according to their style, the intended audience, and the results you want. All of these basic skills should be passed on to these teacher trainees during their teacher training.

Results in Table 3 further indicate that majority of the respondents can use a search engine a little (M= 1.94, SD= 1.08) and a little courseware (M=1.91, SD = 1.02). Primary teacher trainees should be equipped with the skills to search for peer-reviewed papers, theses, books, abstracts and articles from academic publishers, professional societies, preprint repositories, universities and other scholarly organizations. They should be able to explore various search engines, such as Google Scholar, Microsoft Academic, Educational Resources Information Center (ERIC), ResearchGate, Connecting Repositories (CORE), Semantic Scholar, Seek, Science.gov, infotopia, Google Books and more. Also, teacher trainees should be introduced to educational coursewares and be able to use them. Courseware combines the words 'course' and 'software'. Originally it was used to describe additional educational materials intended such as teacher or trainer's kits or student tutorials, which are often integrated into computer use. The meaning of the term and its use are expanded and may refer to the whole lesson and additional material concerning an online or 'computer-formatted classroom reference'. Examples are some of the coursewares are Acrobatiq, Lumen learning, OpenStax, CogBooks, Cerego (House et al., 2018).

Respondents reported that they can use a few open educational resources (*M* = 2.45, *SD*=1.11) and they can use the computer a little (*M*= 2.53, *SD*=1.14) to record grades, maintain pupil's records or take pupil's attendance.

Though the current findings have shown primary teacher trainees in Uganda reported that they can use a few open educational resources, Chiappe and Adame (2018) argue that open educational practices have become a growing form of established education based on ICT. UNESCO (2019) also states that the intelligent use of open educational resources, combined with appropriate teaching methods, and well-designed learning materials, and diversity of learning activities, can provide a wide range of innovative educational options to engage teachers and students to become active participants in education processes and content creators as members of diverse and inclusive informed communities. For example, open educational resources can facilitate the learning and teaching processes during the educational disruption due to the COVID-19 outbreak (Huang et al., 2020). According to a research project conducted by Feldstein et al (2012) Students who chose these courses, which were based on open educational resources, had better grades and lower failures, more often than their counterparts who did not take courses based on open educational resources. In addition, students acknowledged that open digital educational resources are more knowledgeable than standard textbooks and that they will always choose to study using digital technology or digital content. In terms of the level of functionality offered by the open educational resources website, there are three main categories of open educational resources:

(1) Directories – These provide a list of OER and links to resources that are available elsewhere on the Web. (2) Platforms – Specific digital tools designed to "do" something with the open educational resources, for example, social networks (Flickr, YouTube, Twitter, and Facebook). (3) Repositories – Databases or collection of OER, usually ones developed by a particular institution.

(2) Many international organizations, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), Arab League for Education, Culture and Scientific Society (ALECSO) and The Commonwealth of Learning (COL) have shared quality open educational resources and their tools on web pages for teachers and students to use during the learning process at home. Open educational resources are learning, teaching, and research materials in any format and medium that reside in the public domain or are under the copyright that has been released under an open license that permits no-cost access, reuse, repurpose, adaptation, retention and redistribution by others (Stracke et al., 2019; UNESCO, 2019). It is therefore more important than ever that the global community, Uganda inclusive, come together now to promote universal access to information and knowledge utilizing open educational resources.

Primary teacher trainees reported that they can use the computer a little to record grades, maintain pupil's records or take pupil's attendance. Teacher trainees need computer skills to record marks, keep student records or take student's attendance. If you are a first-time teacher, you will have many different aspects of teaching management. In addition to designing lesson plans and teaching students, teachers need to come up with an effective classroom management system. Record keeping and ordering can be a time-consuming process for classroom management. Teachers need to set up systems that will help them keep track of all the different records they need to keep for each student. Once they have done this, they can focus on other aspects of their work. In addition to marks, they need to record the times they send notes home, when you

have to report a student in the office, or when you have to contact a parent directly. One of the grades-keeping software has a place where you can easily enter this information and your existing records. Having a single system for managing your documents will help you stay efficient and organized. Another very important aspect is to keep up with grading papers and making sure you're entering them correctly into the computer. This will help you avoid problems down the road when it's time to submit grades. All of these skills need to be developed from college before they can join the teaching profession itself.

Descriptive Statistics for ICT Skills on Complex Tools

Primary Teacher Trainees were asked to indicate the extent to which they can use different ICT complex tools such as authoring environments, platforms, social networks, open educational resources and ICTs to collaborate with other schools. Using a scale of 1-4 from not at all to a large extent, the results are shown in Table 4.

Table 4

Descriptive Statistics for ICT Skills on Complex Tools

Items	N	Mean	SD
To what extent can you use authoring environments to produce learning materials for your pupils?	627	2.79	1.15
To what extent can you use authoring environments to produce online materials for your pupils?	627	2.16	1.00
Can you use a platform to manage, monitor, or assess the progress of your pupils?	627	2.31	1.07
Can you use social networks to interact with your pupils and/or colleagues?	627	2.81	1.13
To what extent can you use open educational resources?	627	2.50	1.09
Can you use ICTs to collaborate with other schools?	627	2.50	1.12
Grand mean		2.51	

Field data, 2020

Results from Table 4 indicate that the grand mean for all items for ICT skills on complex tools is 2.51. This implies that it's slightly below average. Teacher trainees not only need to have basic ICT skills such as word processing, PowerPoint, and Internet access, but they also need to develop logical pedagogical skills to successfully integrate ICT into their school curriculum into future teaching activities. The use of ICT in the classroom enables teachers to challenge students and develop higher thinking skills (BECTA, 2003) However, to become confident ICT users in the classroom, teacher trainers need to participate in ongoing training. Teacher trainers should understand the benefits of digital learning. ICT training needs to be seen as important in teaching such skills, and as empowering alternative teaching and learning methods. The digital skills needed by future teachers go beyond word processing and spreadsheets. The digital skills that 21st Century teachers should have include cloud storage and sharing solutions, social media, web editing, image editing, presentation software, and general multimedia.

The majority of the respondents reported that they can moderately (M = 2.79, SD = 1.15) use authoring environments to produce learning materials for pupils and also they can a little (M = 2.16, SD =

1.15) use authoring environments to produce online materials for their pupils. Advanced Distributed Learning (ADL) (2011), defines authoring tools as software applications used to create e-learning products. Authoring tools enable the production of interactive lessons or learning materials that can be in the form of hypermedia or multimedia by combining and embellishing objects such as text, image, animation and video (Dağ, Durdu and Gerdan, 2014). Users with a basic level of computer literacy are expected to use any educational authoring tool. The authoring tool has a graphical interface that enables the design of the e-learning material interface and content design.

Results in Table 4 further indicate that majority of the respondents reported that they can use a platform a little (M = 2.31, SD = 1.07) to manage, monitor, or assess the progress of their pupils and they can use social networks a little (M = 2.81, SD = 1.13) to interact with their pupils and/or colleagues. Teacher trainers should emphasize tools such as Animoto, Padlet, Answer Pad, AnwerGarden, ClassKick, Coggle, FreeOnlineSurvey, Gimkit, Kahoot!, Plickers, Peergrade, PlayPost, ProProfs, Quick Key, Quizalize, Quizizz, Spark, Vocaroo, Zoho Survey, Yacapaca, SurveyMonkey, Triventry, Survey Hero and many others. These technology tools can be used for rapid assessment in a variety of ways, such as tracking students' progress over time, helping constructive assessment, helping to increase engagement, identifying knowledge gaps and supporting in-depth learning (Kathy, 2019). Teacher trainees should be equipped with the skills to use social bookmarks to share resources within and between students. They should also have the skills to use blogs and wikis to build online platforms for students.

Also, results indicate that respondents agreed that they can use open educational resources a little (M = 2.50, SD = 1.09) and they can also a little (M = 2.50, SD = 1.12) use ICTs to collaborate with other schools. Teacher trainers and ICT instructors should emphasize open educational resource exploration and utilization by teacher trainees. Open educational resources can provide access to high-quality resources while eliminating the cost of traditional textbooks. Also, teacher trainees should know how a teacher with a limited science lab can use open online videos to create demonstrations of classic experiments and also experiments in other subjects. Teacher trainees should also be able to demonstrate how teachers may use an open lesson plan online to add an enrichment activity for students or to provide additional practice for students struggling with a concept. Digital technology provides new learning opportunities in an interconnected society, where learning to work with others and interact has become a very important skill (García-Valcárcel, Basilotta and López-García, 2014). Teacher trainees should be equipped with adequate ICT skills for collaborating with other schools. Teachers, who do not have ICT skills to interact with other schools in the area, especially those in a different category, may put their schools at risk of poor performance. If some schools do more wonderful and innovations than yours, it will not make a good name for you. You need to share information and teaching strategies and activities to keep up with the performance of other schools in the area. ICT's ability to host social networks like Twitter, WhatsApp and blogs are great for improving collaboration. It is even possible for students from schools that are miles (or even continents) away to work together using digital collaboration tools (Gallagher, & Magid, 2017).

Descriptive Statistics for ICT Skills on Teacher Professional Learning

To ascertain the level of Teacher Trainees ICT competencies for pedagogical practices, respondents were asked to indicate whether they can use ICTs to share digital resources, collaborate with experts, be

members of the virtual community and also use the internet for their professional learning. Results are presented in Table 5.

Table 5

Descriptive Statistics for ICT skills on Teacher Professional learning

Items	N	Mean	SD
Can you share digital resources with your colleagues?	627	2.49	1.16
Can you collaborate with outside experts?	627	2.45	1.11
Are you a member of a teacher's virtual community of practice?	627	2.31	1.20
To what extent do you use the internet for your professional learning?	627	2.70	1.12
Grand mean		2.49	

Field data, 2020

Results in Table 5 indicate that the grand mean is 2.49 which imply that the respondents ICT skills for professional learning are moderately low. Yet, knowing how to use information and communication technology (ICT) is a very important set of skills for students, both during their time in College and beyond. Results indicate that majority of the respondents can share digital resources a little (*M* = 2.49, *SD* = 1.16) with their colleagues and they can collaborate a little (*M* = 2.45, *SD* = 1.11) with outside experts.

Digital communication tools allow students to share their creations - whether it's articles, videos, podcasts, or info-graphics - with people without their teachers (Gallagher, & Magid, 2017). If teacher trainees know that their final product will be viewed by a wider audience, they will strive hard to produce high-quality work. Students feel a sense of purpose when they do something that may affect other people positively. Technology allows students to build and engage in this way and get valuable feedback from other students, professionals, and others who may be interested in their work. Therefore, teacher trainees should familiarize themselves with this experience to acquire all the relevant skills while continuing the training.

The majority of respondents further reported that they are a little (M = 2.31, SD = 1.20) members of the teacher's virtual community of practice. A virtual community of practice (VCoP), also known as an online community of Practice (OCoP), is a community that is formed and maintained through the Internet. Virtual Communities of practice are informal networks, which exist outside any particular organization, that support professionals to develop shared ideas and participate in building knowledge among their members by providing opportunities to build relationships and connections through Internet-based ICT as alternatives (Zarb, 2006). Qualifying to be an Online Community of Practice, aspects of the Community of Practice (CoP) as defined by Lave and Wenger must be met (Wenger, 1998). To date, the Online Community of Practice must include active members of physicians, or "specialists," on a specific profit base (Wenger, 2011). Members must participate in the process of shared learning within their domain. The online community enables participants to read, post and receive advice and feedback from the community in the way they wish. Those who choose to participate in a well-received (i.e. read-only) way can still gain knowledge and skills from community resources, which is especially important for first-time professionals. The online community enables participants to read, post and receive advice and feedback from the community in the way they wish. Those who choose to participate in a well-received (i.e. read-only) way

can still gain knowledge and skills from community resources, which is especially important for first-time professionals. Online Community of Practices give beginners, who may not feel comfortable sharing their knowledge, the opportunity to learn from their experienced colleagues beyond their own space by observing and absorbing information and dialogue. Veterans borrow a certain level of legitimacy from the community, as well as the experience of new members. The result is a state of counselling for the novice. As new physicians gain understanding and expertise, they are more comfortable sharing their backgrounds and ideas with the Online Community of Practices by further expanding the knowledge base (Gunawardena, et al., 2009). The asynchronous nature of many forums (e.g. blogs, wikis) allows participants to participate voluntarily. Forums maintain a record of ideas, speeches and resources, creating an expert archive in the field of practice that can be accessed at almost any time (Gray, 2005).

Respondents further reported that they can use the internet a little (M = 2.70, SD = 1.12) for professional learning. According to UNESCO ICT CFT (2018), teachers should be able to use technology to interact with professional networks to support their professional development. The Internet has changed the way professional development for teachers can be delivered. Internet technology allows professional development to be disseminated anywhere and anytime, as long as one has a working computer and an internet connection. Professional learning holds teachers at the highest level and encourages them to pursue their independence while acquiring knowledge and skills. It also allows teachers to exchange expertise to improve their learning community.

Descriptive Statistics for ICT Skills on Curriculum and Assessment

Respondents were asked to indicate the level to which they can use ICTs for curriculum and learning assessment. The results are shown in Table 6.

Table 6

Descriptive Statistics for ICT Skills on Curriculum and Assessment

Items	N	Mean	SD
Can you intentionally use ICTs to improve pupils' communication skills?	627	2.45	1.08
Can you intentionally use ICTs to help pupils find ideas and information?	627	2.61	1.08
Can you intentionally use ICTs to help pupils to collaborate?	627	2.38	1.07
Can you intentionally use ICTs to help pupils share knowledge?	627	2.58	1.10
Can you help pupils acquire information problem-solving skills?	627	2.62	1.11
Do you use web2.0 to assess higher-order skills (creativity, problem-solving, etc)?	627	2.05	1.08
Grand mean		2.45	

Field data, 2020

Results in Table 6 indicate that the grand mean for all items is 2.45. This implies that respondents ICT skills for curriculum and assessment are moderately low. These results are in agreement with UNESCO (2011) which found out that many teacher training institutions in developing countries cannot design and

provide ICT training courses in education. Therefore the formal development of the ICT-Teacher Framework under these circumstances remains a challenge. However, the inclusion of ICT in education seems to reinforce that level of teaching, making those technologies more relevant to 21st-century profile teaching (Larrosa, 2010). Also, the UNESCO ICT Competency Framework for Teachers recommends that teachers should have a good knowledge of curriculum standards in their subject, as well as knowledge of general assessment strategies. In addition, teachers need to be able to integrate the use of technology into the curriculum (UNESCO, 2011).

The majority of the respondents agreed that they can a little (M = 2.45, SD = 1.08) intentionally use ICTs to improve pupils' communication skills and also a little (M = 2.61, SD = 1.08) use ICTs to help pupils find ideas and information. The majority of the respondents further agreed that they can a little (M = 2.38, SD = 1.07) intentionally use ICTs to help pupils to collaborate and they can a little (M = 2.58, SD = 1.10) intentionally use ICTs to help pupils share knowledge. Though the findings in this study have shown that teacher trainees can a little intentionally use ICT to help pupils collaborate, Cox et al., (2004) argue that students working in pairs or groups using ICT-based resources can challenge each other's understanding and learn from these interactions. Therefore, more support for further professional development is needed for teacher trainees to integrate the use of ICT and improve pupils' communication skills using ICT. Also, the majority of the respondents agreed that they can a little help pupils (M = 2.62, SD = 1.11) to acquire information problem-solving skills and they also agreed that they can a little (M = 2.05, SD = 1.08) use web2.0 to assess higher-order skills (creativity, problem-solving etc).

Unfortunately, the findings from this current study have shown that the primary teacher trainees in Uganda are lacking these interesting skills, they are moderately low. ICT instructors in primary teacher training colleges in Uganda should model and emphasize ICT skills that will facilitate teacher trainees to help their future learners to communicate, find information and improve their communication skills. During a lockdown when children were away from their teachers it was the time for learners to use different ICT gadgets to access information and ideas themselves, to share with their teachers through different media such as social media and telephones. This can happen when teachers have ICT skills that are imparted to learners. All these skills are acquired at the college since there is no programme yet to train teachers who are already in service.

Danner and Pessu (2013) suggest that, if teachers are expected to integrate ICT into the school curriculum, preparations must be made at the pre-service teacher education level. Likewise in Uganda, teacher trainees need to be prepared in ICT skills during their teacher training programme. Robbins (1998) too proposed that teacher preparation programmes should focus on the need for student-teachers to have ICT skills for their use, in the preparation of materials for teaching and learning activities.

Mansbach (2015) posits that online instructors can utilize technology to create activities that help learners develop both lower-level and higher-level critical thinking skills, for example, discussion forums and digital storytelling. Porter (2004) recommends that Digital storytelling (DST) takes the old craftsmanship of oral storytelling and employs a palette of specialized devices to weave individual stories utilizing pictures, graphics, music, and sound blended alongside the author's story voice. Several studies have shown that Digital storytelling goes past the capabilities of conventional narrating by generating student

interest, concentration, and motivation, facilitating student collaboration and organization of ideas, helping students to comprehend complex learning content, and presenting knowledge adaptively and importantly (Robin, 2016, 2008; Sadik, 2008; Van Gils, 2005).

Descriptive Statistics for ICT Knowledge

Primary Teacher Trainees were asked to indicate the level of knowledge they have about technologies that can be used in different subjects, enhancing their teaching approaches and enhance student's learning. Results are shown in Table 7 and discussed.

Table 7

Descriptive Statistics for ICT Knowledge

Items	N	Mean	*D*
I know about technologies that I can use for understanding and doing Mathematics	627	3.26	1.33
I know about technologies that I can use for understanding and doing literacy	627	3.32	1.26
I know about technologies that I can use for understanding and doing science	627	3.48	1.27
I know about technologies that I can use for understanding and doing social studies	627	3.51	1.26
I can choose technologies that enhance the teaching approaches for a lesson	627	3.39	1.28
I can choose technologies that enhance student's learning for a lesson	627	3.47	1.20
My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom	627	3.75	1.23
I am thinking critically about how to use technology in my classroom	627	3.80	1.22
I can adapt the use of the technologies that I am learning about to different teaching activities	627	3.65	1.21
I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn	627	3.59	1.22
I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom	627	3.49	1.20
I can provide leadership in helping others to coordinate the use of the content, technologies and teaching approaches at my school and/or district	627	3.49	1.24
I can choose technologies that enhance the content for a lesson	627	3.48	1.24
I can teach lessons that appropriately combine Mathematics, technologies and teaching approaches	627	3.35	1.29
I can teach lessons that appropriately combine literacy, technologies and teaching approaches	627	3.34	1.22
I can teach lessons that appropriately combine science, technologies and teaching approaches	627	3.48	1.23
I can teach lessons that appropriately combine social studies, technologies and teaching approaches	627	3.49	1.23
Grand mean		3.49	

Field data, 2020

Results in Table 7 indicate that the grand mean for Primary Teacher Trainees ICT knowledge is 3.49, which implies slightly above average. This is a good basis of good teaching with technology by primary teacher trainees in Uganda. Teacher knowledge has been reported as one of the key barriers to effective technology integration (Hew & Brush, 2007; Mishra & Koehler, 2006). According to the TPACK framework, certain technical tools (hardware, software, applications, learning-related methods, etc.) are best used to educate and guide students to a better, stronger understanding of the subject (Kurt, 2018).

The majority of the respondents reported that they averagely know (M = 3.26, SD = 1.33) about the technologies they can use for understanding and doing Mathematics and they know (M = 3.32, SD = 1.26) the technologies they can use for understanding and doing literacy. Teachers and curriculum developers must be knowledgeable decision-makers, with the ability to determine when and how technology can improve learning skills effectively and efficiently (ISTE, 2008). All schools and maths programs should provide students and teachers with access to teaching technology - including classroom hardware, handheld devices and labs with mathematical applications and resources, and Web-based resources - and adequate training to ensure its effective use (National Council of Teachers of Mathematics, 2015). In a balanced mathematics program, the use of technology techniques strengthens the teaching and learning of mathematics (Dick & Hollebrands, 2011). Teacher education programs and professional development should continue to update teacher trainees on the information and technology functionality in support of teaching and learning. The teacher trainees should be well equipped with the knowledge of mathematics education that take advantage of technology-enabled environments and the integration of digital tools into everyday teaching, incorporating gratitude for the power of technology and the impact it can have on students' understanding and use of mathematics. In addition to enriching students' knowledge as mathematics education students, the use of these tools enhances the opportunities offered by increasingly informed students about the convenience of information-driven communication and retrieval technologies (Gadanidis & Geiger, 2010; Project Tomorrow, 2011).

Also, research by Connor, Goldman, & Fishman (2014) indicates that technology-based professional development and specific software applications that support teachers' ability to individualize student instruction using assessment are generally effective in improving students' literacy. Huffstetter and colleagues (Huffstetter, King, Onwuegbuzie, Schneider, & Powell-Smith, 2011), examined whether Headsprout Early Reading supports preschoolers (n = 62) early learning skills. Headsprout uses a series of animated, collaborative lessons to help students learn the elements of sounds and visual words, to build their reading vocabulary. The results of this study, in which preschoolers were randomly assigned, revealed that preschoolers who used Headsprout daily for 8 weeks had a significantly greater benefit from early learning and oral language skills compared to preschoolers in the control group. Therefore, such technology-enabled environments should be understood and embraced by primary teacher trainees in Uganda.

Results further indicate that majority of the respondents agreed that they averagely know (*M* = 3.48, *SD* = 1.27) about the technologies they can use for understanding and doing science and also they averagely know (*M* = 3.51, *SD* = 1.26) about the technologies they can use for understanding and doing social studies. Many teachers graduate from teacher training institutions with limited knowledge of how technology can be used in the classroom (Brush, 1998). Henriques (2002) suggested a method of introducing science teaching technology - stating that students will learn better when teaching technology is included in the scientific methodology. Many scholars have noted that teachers with limited subject matter preparation are more likely to insist on memorizing different facts and algorithms; rely on textbooks without using learners' understanding as a guide for planning lessons; they use low-level questions and formal classroom activities in addition, they use only limited questions of students or comments in the classroom, leading to poor

student development of conceptual connections and misrepresentation of nature and structure of the subject (Carlsen, 1991; GessNewsome, 1999).

Also, many teachers strive to motivate students to learn (Heafner, 2004). Studies show that students tend to be less interested in social studies because they see it as a boring discipline (Schug, Todd, & Berry, 1984; Shaughnessy & Haladyana, 1985). Students often measure it as uninteresting and insignificance; therefore, students are not encouraged to study the content of social studies due to lack of its content value. Educators suggest that students' lack of interest in social studies is related to teaching methods used in the dissemination of information (Martorella, 1997). It is because of this evidence that the focus should be on teacher trainees' learning to acquire knowledge and understanding of the technologies they can use in teaching science and social studies for the benefit of their students in future. Some of the technologies for teaching and understanding science that are included in the school curriculum to support teaching and learning of science are electrical probes (sensors and software), dynamic modelling tools, interactive viewing tools, and integrated e-learning environments (Krajcik & Mun, 2014), Lego Mindstorms building kits (kits (features the RCX programmable brick, sensors, motors, and building piece) and Robolab software (Sullivan, 2008), Electric simulation ("EET electrical testing tool") (Jaakkola, Nurmi, & Veermans, (2011), Interactive powerful visualization from WISE in photosynthesis (energy [light to chemical] molecular modification) (Ryoo & Linn, 2014), Simulation-based inquiry used to learn about the greenhouse effect (Kukkonen, Kärkkäinen, Dillon, & Keinonen, 2014) Use microscope visual and remote electronics (Remote Microscopy Lab) in high school biology (Childers & Jones, 2015), Interactive dynamic and static visualizations to support the understanding of energy and matter transformation in life science (Ryoo & Bedell, 2017), use a virtual laboratory and a virtual lecture to help high school students improve their maritime literacy skills (Fauville). , 2017), The use of visual test (real labs) to teach machine concepts such as pulley systems (Sullivan, Gnesdilow, Puntambekar, & Kim, 2017), and those for teaching and understanding social studies include Newseum Digital Classroom, Google Expeditions, Kids Planet Discovery, Geo Walk, Barefoot World Atlas and Stack the Countries.

In addition, the majority of the respondents agreed that they can averagely choose (M = 3.39, SD = 1.28) technologies that enhance the teaching approaches for a lesson and they can averagely choose (M = 3. 47, SD = 1.20) technologies that enhance student's learning for a lesson. Teacher educators should skill teacher trainees with more technologies to integrate into their teaching approaches and enhance learning. The technology provides many tools that teachers can use inside and outside the classroom to improve student learning. Technologies such as flipped classroom, social media in the classroom and mobile learning all can improve learning in the presence or absence of the teacher, from anywhere and anytime.

Furthermore, respondents agreed that their teacher education program has caused them to averagely think more deeply (M = 3.75, SD = 1.23) about how technology could influence the teaching approaches they use in their classroom and the majority agreed that they are averagely thinking critically (M = 3.80, SD = 1.22) about how to use technology in their classroom. Since teacher trainees have this positive attitude towards technology and they are optimistic, they need to be supported to know how to use the available technologies for their future teaching. Teacher educators have a key role to play in preparing teacher trainees for active participation in a new era of global communication and new technological advances.

Read current books about the technologies you want to introduce in your classroom and learn how to integrate these technologies.

Also, the majority of respondents agreed that they can averagely adapt (M = 3.65, SD = 1.21) the use of technologies they are learning about to different teaching activities. Similarly, results in Table 12 indicate that majority of the respondents agreed that they can averagely select (M = 3.59, SD = 1.22) technologies to use in their classroom that enhance what they teach, how they teach and what students learn. These results are promising that teacher trainees can adapt the use of technologies to different teaching activities. Technology has become an important component of educating students. It allows them to develop critical thinking skills, learn new ideas, and express themselves creatively. Technology helps teachers to embrace three main learning styles: visual, auditory, and kinesthetic. Even teachers who prefer a traditional teaching style can use a few technological tools to supplement the content. If a teacher has access to a computer, laptop, projector, or iPad, these tools can meet the specific needs of each type of student.

Additionally, results indicate that majority of respondents agreed that they can averagely use (M = 3.49, SD = 1.20) strategies that combine content, technologies and teaching approaches that I learned about in their coursework in their classrooms. With the increasing advancement of technology, some teacher trainees do not have the right knowledge and training yet to effectively integrate technology to improve their students' learning. So teacher trainees should spend a lot of time and effort learning how to use technology and make it a useful tool to increase students' learning ability and to make their classes enjoyable. Be creative and don't focus on one technological advancement like the internet. There are other ways to keep pace with technological advances, and you should try to explore these options. Some of the approaches teacher trainees should also explore include; problem-based learning, competency-based education, active learning, flipped learning, student-created content, collaborative learning and blended learning.

Results in Table 7 show that majority of the respondents agreed that they can averagely (*M* = 3.49, *SD* = 1.24) provide leadership in helping others to coordinate the use of the content, technologies and teaching approaches at their school and/or district and they can also averagely choose (*M* = 3.48, *SD* = 1.24) technologies that enhance the content for a lesson. This perceived basic knowledge and confidence of integrating technology and approaches in teaching is a good start for primary teacher trainees. Teacher training colleges should put more efforts into developing and facilitating these teacher trainees in these competencies.

Respondents agreed that they can moderately teach (M = 3.35, SD = 1.29) lessons that appropriately combine Mathematics, technologies and teaching approaches, moderately teach lessons that appropriately combine literacy, technologies and teaching approaches (M= 3.34, SD = 1.22), science, technologies and teaching approaches (M = 3.48, SD = 1.23) and social studies, technologies and teaching approaches (M = 3.49, SD = 1.23). Several authors (e.g. Beauchamp & Parkinson, 2008; Keong, Horan & Daniel, 2005; Niess, 2005) find that the use of ICT improves the teaching of subjects related to science and Mathematics. ICTs introduce paradigm transformation from teacher-centred to learner-centred, from individual learning to collaboration learning (Collis & Moonen, 2001; Kafyulilo, Fisser & Voogt, 2011; Nieveen, Handelzalts, van den Akker & Homminga, 2005). The power of this linking ICT to classroom learning can have an impact on

student engagement by creating multiple student options to connect technology with their course content (Kisalam & Kafyulilo, 2011).

A study by Nelson, Voithofer and Cheng (2019), from a sample of 806 teacher educators across the United States found that technology knowledge and institutional support mediate the variation of TPACK and ISTE standard alignment across all teacher educators' subject areas. Nelson and his colleagues recommended that institutions should provide targeted support to teacher educators in all disciplines and should adopt appropriate technology frameworks for their programs. The Ugandan government should take a stand on this recommendation.

Comparison of Teacher Trainees ICT Competencies

Primary Teacher Trainees ICT Competencies were compared to know the progress of teacher training as far as ICT is concerned in relationship to pedagogical practices, as shown in Figure 3.

Figure 3

Comparison for ICT Competencies

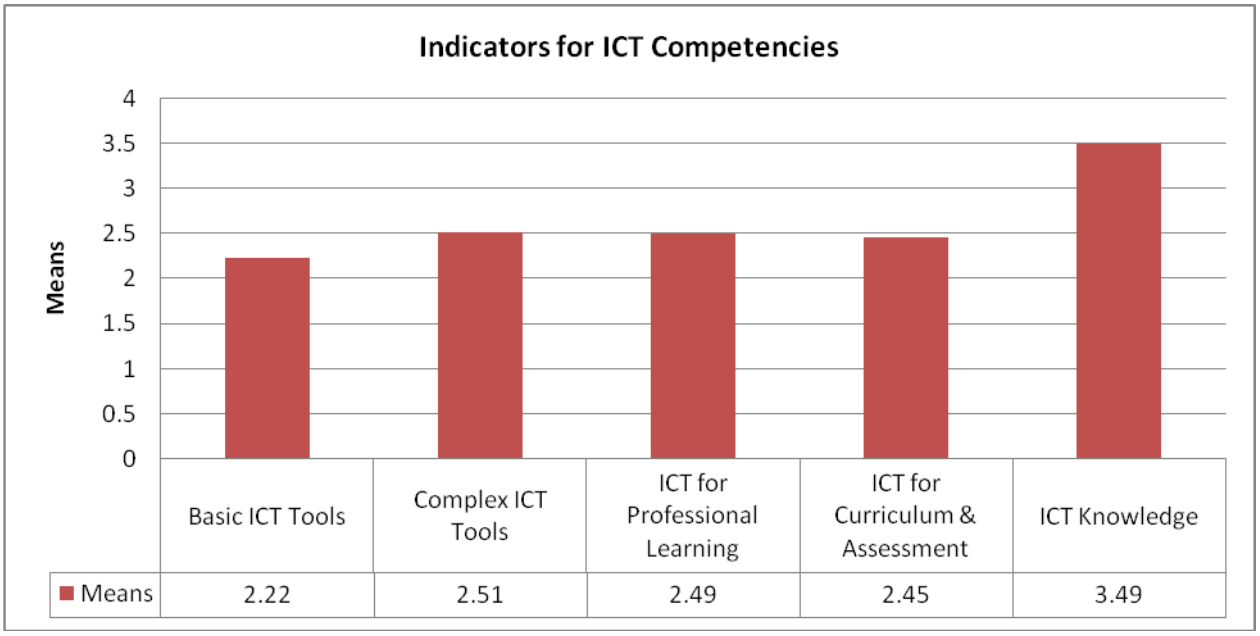


Figure 3 illustrate that Primary Teacher Trainees' ICT skills (Basic ICT tools, Complex ICT tools, ICT for professional learning and curriculum and assessment) are below average whereas Primary Teacher Trainees' ICT knowledge is slightly above average. This difference incompetence level can be justified by differentiating what is required for ICT skills and ICT knowledge. In most cases, ICT knowledge refers to theoretical information acquired about ICT whereas ICT skills refer to the practical application of that ICT knowledge. ICT knowledge can be learned whereas ICT skills require practical exposure and discovery. However, both knowledge and skill are required to be ICT competent. From a philosophical perspective, knowledge is intangible but skills can be made tangible by applying those skills to a context and getting the desired result. Skills, therefore, need much longer processes of practice than knowledge. This is because, in most cases, knowledge is something that you learn mentally and abstractly whereas skills include a certain amount of physical association or real-life learning.

Descriptive Statistics for Tutor's Mode of Instruction

Primary teacher trainees were asked to indicate how they perceive their tutors in modelling combining content, technologies and teaching approaches in their teaching. Results are shown in Table 8.

Table 8

Descriptive Statistics for Tutor's Mode of Instruction

Items	N	Mean	SD
My mathematics education tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.51	1.33
My literacy education tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.43	1.29
My science education tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.63	1.26
My social studies education tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.46	1.26
My instructional technology education tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.53	1.25
My professional education studies tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.61	1.27
My tutors outside of education appropriately model combining content, technologies and teaching approaches in their teaching	627	3.30	1.30
My tutors appropriately model combining content, technologies and teaching approaches in their teaching	627	3.63	1.22
Grand mean		3.51	

Field data, 2020

Results in Table 8 indicate that the grand mean for tutors appropriately modelling content, technologies and teaching approaches in their teaching is 3.51 as perceived by teacher trainees. This puts tutors' modelling at slightly above average. However, this is not sufficient in this digital era and since they are supposed to impart these competencies to teacher trainees.

The majority of Primary teacher trainees agreed that their Mathematics education tutors averagely model (*M* = 3.51, *SD* = 1.33) combining content, technologies and teaching approaches in their teaching. Appropriate and integrated use of technology has an impact on all aspects of mathematics education: what is taught in mathematics, how to teach mathematics and how to assess Mathematics (National Council of Teachers of Mathematics (NCTM), 2000). Teacher trainees should be assigned a task that involves a specific task or situation and that they need to learn to use and apply the appropriate technology to complete the task. Rios said, *"If teaching was all about content, then the best mathematicians would be among the best teachers. However, if you can combine your understanding of the content and ability to effectively work with your colleagues, and the knowledge on how your students learn, you will achieve effective teaching"* (Rios, 2019). In this way, teacher trainees can not only teach using the types of technology tools available but also learn them in the context of mathematical assessment, which helps to increase their content knowledge (Power & Blubaugh, 2005).

The majority of respondents also reported that averagely (M = 3.43, SD = 1.29) literacy education tutors appropriately model combining content, technologies and teaching approaches in their teaching. Watt

(2010) discusses children's learning about language and literacy skills which are evolving through technological mediation. Watt argues that the available evidence suggests that communication technology has far-reaching effects on language and reading skills and may even encourage the development of new media reading skills, as long as children are supported with language acquisition and appropriate content through development. Technology can help students discuss their ideas by bringing readers and writers together in the same classroom, and it can help students work together at different times with google texts and blogging. So combining these two factors, the development of literacy and technology, makes a good impression on education, a skilled teacher trainees to be equipped with.

Also, the majority of teacher trainees reported that their science tutors averagely model (*M* = 3.63, *SD* = 1.26) combining content, technologies and teaching approaches in their teaching likewise Social studies tutors who averagely model (*M* = 3.46, *SD* = 1.26) combining content, technologies and teaching approaches in their teaching. Teachers are expected to bring academic ideas to life through visual and practical learning lessons, for example, you can have an interactive whiteboard to display photos, videos, and other images and also let students participate in out-of-classroom experiments and local trips (Rios, 2019). This experience will help trainee teachers gain subject knowledge and technology integration into their future teaching.

Furthermore, results from Table 8 show that majority of teacher trainees reported that their instructional technology tutors averagely model (*M* = 3.53, *SD* = 1.25) combining content, technologies and teaching approaches in their teaching and also professional education tutors averagely model (M = 3.61, SD = 1.27) combining content, technologies and teaching approaches in their teaching. These tutors handle course units that are studied by all teacher trainees irrespective of the area of specialization. Therefore tutors should keep in mind that, Technology will not work in a classroom without teachers who are knowledgeable about both the technology itself and its functionality to meet educational goals. For teachers to incorporate digital technology into their practice, they need a constant understanding of existing technologies and their functionality (DeCoito & Richardson, 2018). In addition, teacher trainees reported that their tutors outside of education model averagely (M = 3.30, SD = 1.30) combining content, technologies and teaching approaches in their teaching. Generally, all tutors averagely model (M = 3.63, SD = 1.22) combining content, technologies and teaching approaches in their teaching. Although teacher trainees have perceived that their tutors have been averagely using different educational technologies, these results are not satisfactory in institutions of higher learning.

These findings are consistent with Balash's et al. (2011) assertion that even if educators were using different educational technologies, the use of technological tools was ineffective and ineffective in higher education institutions. In addition, Cuban (2001) found that teaching tools are less used in teaching while they are often used in research and management by lecturers. Future teachers need to be prepared to incorporate technology into their teaching and technical activities inappropriate ways by their tutors.

Rate of Tutor's Mode of Instruction

Primary Teacher Trainees were asked to rate their tutors using percentages on how they effectively model combining content, technologies and teaching approaches in their teaching. Results are presented in Table 9.

Table 9

Rate of Tutor's Mode of Instruction

Items	25% or less		26%-50%		51%-75%		76%-100%	
	Count		Count	%	Count	%	Count	%
In general, approximately what percentage of your teacher education tutors have provided an effective model of combining content, technologies and teaching approaches in their teaching?	121	19.3%	165	26.3%	240	38.3%	101	16.1%
In general, approximately what percentage of your tutors outside of teacher education have provided an effective model of combining content, technologies and teaching approaches in their teaching?	182	29.0%	219	34.9%	155	24.7%	71	11.3%
In general, approximately what percentage of your tutors have provided an effective model of combining content, technologies and teaching approaches in their teaching?	114	18.2%	125	19.9%	229	36.5%	159	25.4%

Field data, 2020

Results in Table 9 indicate that majority of primary teacher trainees 240(38.3%) put their teacher education tutors at a percentage of 51%-75% for effective modelling combining content, technologies and teaching approaches in their teaching. Also, the majority of teacher trainees 219(43.9%) rated their outside of education tutors to be at 26%-50% for effective modelling combining content, technologies and teaching approaches in their teaching. In general, the majority of teacher trainees 229(36.5%) put all their tutors at a percentage of 51%-75% for effective modelling combining content, technologies and teaching approaches in their teaching. These percentages are low depending on the current trend of teaching with technology.

Sprague (2004) noted that some teacher educators do not understand the type of teaching and learning technology supports, and they have developed a culture that does not include technology and are uncomfortable when that culture is challenged. On the other hand, some technology tutors are familiar with, or to a lesser extent, one area of educational content and are unaware of some of the problems teacher education needs to address (Sprague, 2004). Technology has not been part of their teacher education preparation (Norton & Sprague, 2002-2003).

Therefore, the technology skills tutors have developed were maybe self-taught, learned at professional development workshops, or learned from a technology proficient mentor. Most of the tutors in primary teacher training colleges in Uganda were not trained to teach with technology during their teacher education times. Though they may have some technology skills, their understanding of how to integrate technology effectively combining content and teaching approaches is limited. With a direct focus on the field of art and

design education in Uganda, there are no written studies on how teacher trainers (TEs) develop digital skills (Tusiime, Johannesen & Gudmundsdottir, 2019). However, modelling has traditionally been used in teacher education around the world to enhance digital competence (Dorgu, 2015).

Descriptive Statistics for Availability and Accessibility of ICT Infrastructure

Primary Teacher Trainees were asked to show how easy or difficult it is to access ICT infrastructure at college. It was assumed that limited or no access to ICT infrastructure by teacher trainees will result in low ICT competencies of teacher trainees for pedagogical practices. Results are presented in Table 10.

Table 10

Descriptive Statistics for Availability and Accessibility of ICT Infrastructure

Items	Not accessible		Restricted access		Free access	
	ıt	%	Count	%	Count	%
Are personal computers accessible for you as a student-teacher at the college?	321	51.2%	90	14.4%	216	34.4%
Are college computers accessible for you as a student-teacher at the college?	73	11.6%	188	30.0%	366	58.4%
Are videoconferencing systems accessible for you as a student-teacher at the college?	368	58.7%	120	19.1%	139	22.2%
Are interactive whiteboards accessible for you as a student-teacher at the college?	402	64.1%	117	18.7%	108	17.2%
Are Learning Management systems/VLE(WebCT, Moodle,padlet etc.) accessible for you as a student-teacher at the college?	378	60.3%	115	18.3%	134	21.4%
Are Audio equipment (including software) accessible for you as a student-teacher at the college?	262	41.8%	161	25.7%	204	32.5%
Are Digital photo cameras(including editing software) accessible for you as a student-teacher at the college?	337	53.7%	151	24.1%	139	22.2%
Are mobile phones accessible for you as a student-teacher at the college?	78	12.4%	118	18.8%	431	68.7%
Is the projection system accessible for you as a student-teacher at the college?	165	26.3%	211	33.7%	251	40.0%
Are Networked printers accessible for you as a student-teacher at the college?	281	44.8%	174	27.8%	172	27.4%
Is college television accessible for you as a student-teacher at the college?	137	21.9%	172	27.4%	318	50.7%
Is internet access accessible for you as a student-teacher at the college?	155	24.7%	53	24.4%	319	50.9%

Field data, 2020

Results in Table 10 indicate that majority of respondents 321(51.2%) reported that personal computers are not accessible for them as student teachers at the college compared to the majority of respondents 366(58.4%) that reported that college computers are freely accessible for them as student teachers at the

college. The majority of teacher trainees cannot afford a personal computer and also some colleges do not have enough computers and those with are restricted. College principals report that there is still a shortage of ICT facilities and laboratories, leaving the ICT skills that teachers demand, and PTCs remain divided over the use of ICT (Daily Monitor, 2019).

Also, the majority of respondents 368(58.7%) reported that videoconferencing systems are not accessible for them as student teachers at the college. Though findings have indicated that videoconferencing has not being embraced in teacher education programmes in Uganda, videoconferencing systems can connect people without travelling. This means that meetings can be set up between two or more people hence saving time and money. Tutors and teachers can coordinate activities and handle online lessons interacting with their learners. Some of the examples of videoconferencing systems are; Zoom, ezTalks, WhatsApp and Microsoft Teams. Typically, a videoconferencing system can be used to host video conferences, online training, webinars and video presentations in various industries such as education, training, business, government, health, legal, finance, military and more (ezTalks (n.d). Foronda and Lippincott (2014) examined the use of a videoconferencing system in a master's level nursing degree. Their relevant data in the study identified five emerging themes: fun, flexibility, ease of use, communication, and technical issues. Participants reported that using videoconferencing "makes learning comparable or better than face-to-face methods" (Foronda & Lippincott, 2014, p. 5). On the other hand, Lai and Pratt (2009) have identified technical difficulties and implementation problems that come with the use of videoconferencing technology in online teaching and learning. They found that its use did not improve teacher-student or student communication and reported the need for teachers' knowledge of technology integration when using videoconferencing programs. Similarly, Rehn et al. (2016, p. 313) highlighted the need for teachers to "learn to adapt to teaching methods and techniques" when using complementary videoconferencing. A supportive online learning environment includes teachers who use effective pedagogical practices to meet the needs of their students and to build good relationships with teacher and student to encourage student motivation and engagement (Lai, 2017).

Findings further indicate that interactive whiteboards are not accessible as reported by the majority of respondents 402 (64.1%). An Interactive Whiteboard (IWB) is a large, touch-sensitive (thus interactive) board that when used with a combination of a computer and digital projector facilitates interactive ICT engagement (NCTE, 2009). It can allow direct input via finger or stylus so that objects can be easily moved around the board or transformed by teacher or students (Mercer, Hennessy & Warwick, 2010). Unfortunately, most colleges, universities and other institutions of learning in Uganda miss out on this technology. Beeland (2001) reports on a study showing an increase in student engagement due to the use of interactive whiteboards. Morgan (2008) researched the use of the interactive whiteboard and found that the use of the interactive whiteboard as a teaching tool has a positive effect on student participation in class and leads to improved student behaviour.

In addition, the majority of respondents 378 (60.3%) reported that learning management systems are not accessible for them as student teachers at the college. A learning management system is a software-based or SaaS platform that assists with the management, delivery, and evaluation of an e-learning program (Mardinger, 2020). In short, it helps to bring training materials to a wide audience - think of everything from

online courses, to real-time teaching sessions. Using the LMS, teachers can assign work, share content, and postmarks while students can turn in work, view content, and collaborate on forums and with social-like features (Mansfield, 2019). Examples of learning management systems are Schoology, Moodle, Sakai, LearnDash and LearnPress. Miguel (2018) states that once the Learning Management System is set up, it can be accessed from anywhere with an internet connection, and this can provide flexibility for students and lecturers.

Similarly, audio equipment (including software) was reported by the majority of the respondents 262(41.8%) that they are not accessible for them as student teachers at the college. Yet, teacher trainees should be exposed to practical training in learning studios that teach them how to use sound signals and electronic sound control systems and are presented in recording techniques, sound mixing techniques. Teacher trainees should also learn to use audio technology tools such as musical instrument sequences, digital audio workstations, audio processors and microphones. Audio provides another quick, inexpensive way to text to connect with your students and provide up-to-date content, interviews, discussions or tutorials. Middleton (2013) emphasizes that audio has a proven ability to facilitate real engagement, allowing students to interact in a variety of ways with the outside world as listeners and publishers. Audio can be easily created with many desktop tools and small digital recording devices such as smartphones, a skill teacher trainees should be guided on.

Further majority of respondents 337(53.7%) reported that digital photo cameras including editing software are not accessible for them as student teachers at the college. Digital cameras are one of the most effective technologies in information and communication you can do at school. They improve student-teacher interaction. In Linda's article (2012), educators say that cameras can be used to record classroom projects and special events and that children include pictures in their reports and many media presentations. They can also edit photos to create all kinds of art. The skills a teacher trainee needs to make learning fun. However, mobile phones were reported by the majority of respondents 431(68.7%) that they are freely accessible by them as student teachers at the college. Currently, most colleges allow teacher trainees to use mobile phones unlike in the past when mobile phones were not allowed in the college. However, in an interview by Daily Monitor (2019) to college principals, some PTC principals in the country continue to restrict students from using phones- the simplest device in ICT compared to their counterparts in other professions. At the primary level, where many teachers are lacking in initial training, the mobile devices will ensure that meaningful English language audio penetrates the classroom together with visual aids, and backed up by lesson plans assisting the teachers in their use of the resources (Trucano, 2009). Cell phones are popular in developing countries simply because there is no wireless infrastructure, making wireless infrastructure cheaper and faster to use (Qusay, 2009). In addition, Qusay said many people access the internet on their cell phones because they do not have access to home or school or because desktop communication is too expensive. The cell phone is thus a computer for students in developing nations (Qusay, 2009). Thus, recent research efforts are aimed at empowering students to access content on their mobile phones. The introduction of applications in the field of education has led to the introduction of new learning methods (Roy, 2017). Roy says that there are fun games available on mobile apps that make students think better and help them understand things with a different eye. Thanks to mobile phones and a

variety of feature-focused programs, students can learn at their own pace and take their time in understanding things, as it all clicks (Roy, 2017).

Similarly, a projection system was reported by the majority of respondents 251(40.0%) to be freely accessible by them as student teachers at the college. However, this is a small percentage that implies that most likely tutors may not be using them in their teaching or they are restricted. Many teachers find that chalkboards are almost a thing of the past with the arrival of projectors in the classroom (Csinan WordPress, 2013). Csinan posted that, instead of writing notes across the board, teachers can use PowerPoint presentations, pictures and even a film as a teaching tool using projectors. Through projectors, teachers can now use films, slides, and pictures to teach students a variety of subjects. Teachers will also find that the internet is very useful since projectors can display web content throughout the classroom, rather than students accessing the information on individual computers if any. Using LCD projectors gives teachers access to students in many ways. Students enjoy seeing, hearing, and communicating with technology rather than simply reading a book or listening to a talk. Ozaslan & Maden (2013) concluded in their study that students learn better when subject knowledge is presented with specific visual tools. They, in turn, reported that teachers believe PowerPoint presentations make content more appealing; therefore, they help them to draw the attention of the students. Therefore, projectors are one of the devices colleges should have for the benefit of teacher trainees in terms of learning and getting familiar with its use.

Results in Table 10 further shows that the majority of respondents 281(44.8%) reported that networked printers are not accessible for them as student teachers at the college. A network printer is part of a workgroup or network of computers that can access all of the same printers simultaneously. The network printer does not need to have a physical connection to the network. Instead, it can be connected wirelessly and given to a workgroup. In teachers college, network printers can best meet the needs of multiple users (students) with a single printer. Trained teachers need a printer, especially colour printers, to make printouts from their desktops, laptops, phones, tablets, and so on. These printouts can be used for their teaching aids, to decorate their teaching practice files, coloured letters and to appreciate their typed work practice and notes.

Moreover, the majority of respondents 318(50.7%) reported that college television is freely accessible for them as student teachers at the college. Televisions are a source of news that trainee teachers need to be revitalized with the world around them. Television also broadcasts educational content for example politics, the environment and a social life that can be useful for teachers who are in training to plan their lessons. There are also stations that host experienced teachers to share their expertise with students, and this can encourage trainee teachers on how to manage television teaching and communication.

Also, the internet is freely accessible for student teachers at the college as reported by the majority of the respondents 319(50.9%). This is a fair start for some colleges. Internet is a very useful modern technology that helps us not only in our daily lives but also in the professional lives. For educational purposes, it is widely used to collect data and to conduct research or to supplement the knowledge of various subjects. The Internet has become a great tool for effective teaching and learning. Teachers can use it as a teaching tool by posting their teaching materials (notes and videos) on the school's website or forum. The learning process is attractive and unique with the use of instructional videos and notes. Teachers can teach using animations,

PowerPoint slides, and images to capture students' attention all powered by the internet. The importance of the internet as a learning tool is significant (Sharma, 2016). Sharma says the development of internet technology has improved the quality of education in all countries and changed the way students are taught in schools. This is why it is so important for the current generation to get internet education for their younger generations (Sharma, 2016). Students see Google as a new Teacher and the Internet as a school. The internet is vital to the transformation of our education system in various ways. Teachers can use the internet as a modern educational tool. The departments of education should provide the infrastructure that teachers and students can use to reap the benefits of technology in education. Opportunities to use the Internet in learning are high in Africa (Internetsociety, 2017).

According to the International Telecommunications Union (ITU), more than a quarter of Africa's population (341 million) have access to the Internet since 2016 and the ITU estimates that by the end of 2019, 51 percent of the world's population or four billion people, use the Internet (ITU, 2019). Countries also see improved broadband connectivity at the national level (through national spinal networks) and other countries through various underwater cables that reached the west and east coasts of the continent over the past decade (Internetsociety, 2017). There is a sufficient amount of broadband that can be used to facilitate international efforts to meet the goals of Sustainable Development in general and to facilitate interactive and equitable learning in particular (Internetsociety, 2017).

However, Uganda is currently ranked 153rd in the world with uninterrupted internet access where only 3 out of 1000 residents have access to a stable internet (ITU Report, 2017). While shared mobile internet can be easily accessible to anyone with a mobile device/subscriber, it can only apply to limited (home) personal use such as communication, social networking and video access (MoICT, 2018). It cannot empower high-bandwidth trading systems, which are in high demand for economic growth. Bandwidth costs are also very high in the country, compared to neighbouring countries ((MoICT, 2018).

Teacher trainees' accessibility of ICT infrastructure has been summarized and displayed on the graph in Figure 4 for easy comparisons.

Figure 4

Teacher Trainees' ICT Infrastructure Accessibility graph

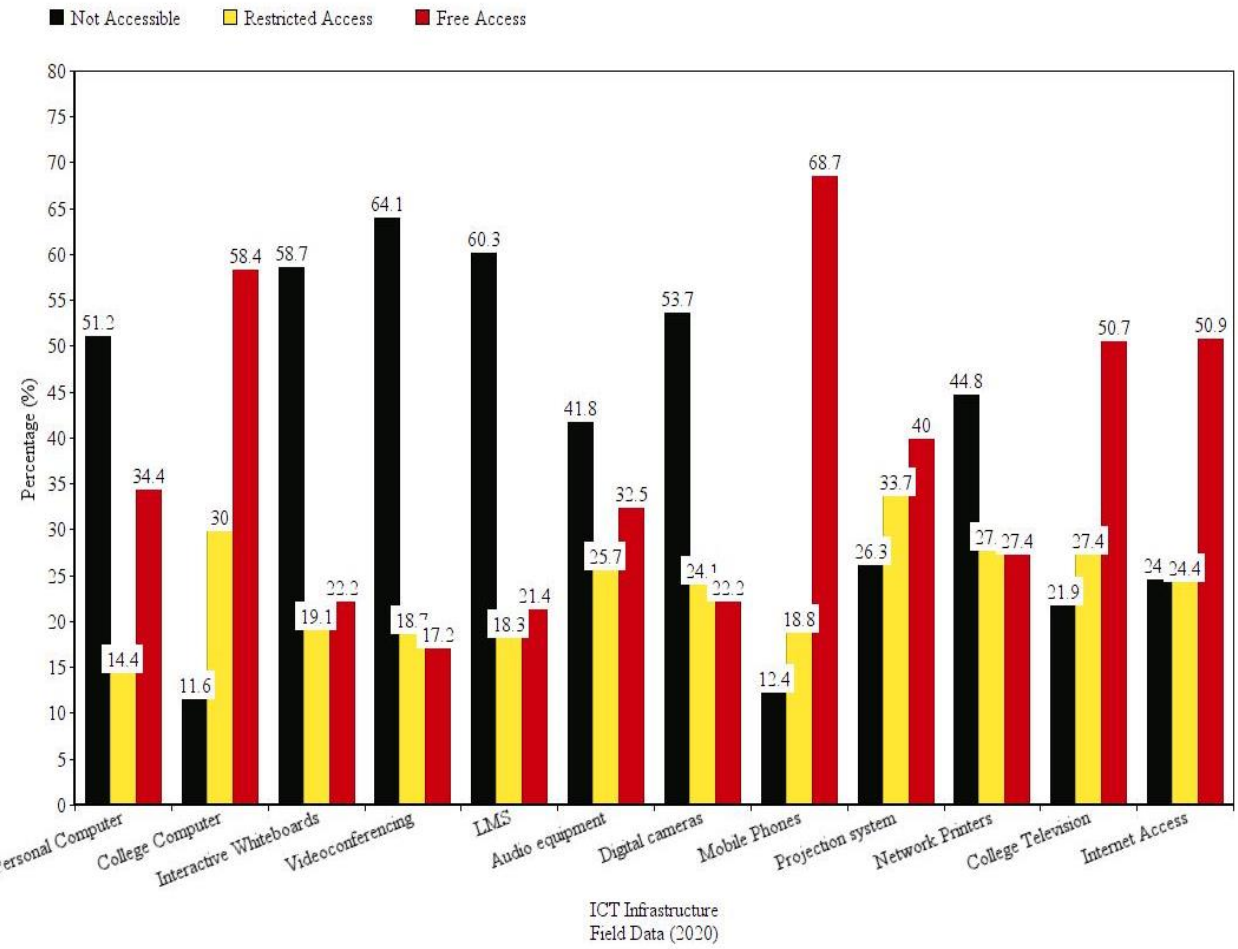


Figure 4 illustrate that only college computers, mobile phones, projection systems, college television and the internet are freely accessible by student teachers at the college. Personal computers, interactive whiteboards, videoconferencing, learning management systems, audio equipment and digital cameras are not accessible by teacher trainees.

Merged data for ICT Infrastructure

Quantitative and Qualitative data for ICT infrastructure in Primary teacher training colleges were collected using a questionnaire and observation schedule. The observer visited college ICT laboratories to evaluate the quality of ICTs available. Findings are displayed in Table 11.

Table 11

Merged Quantitative and Qualitative Findings

Quantitative findings	**Qualitative findings**
Personal computers not accessible (51.2%)	No personal computers were seen
College computers are accessible (58.4%)	Computers are available though with limited access
Videoconferencing systems not accessible (58.7%)	colleges have videoconferencing applications but not in use by trainees
Interactive whiteboards not accessible (64.1%)	No interactive whiteboards seen in the laboratory or class
Learning Management Systems not accessible (60.3%)	colleges have LMS but not in use
Audio equipment few available (32.5%)	colleges have simple audio equipment

Digital cameras not accessible (53.7%)	have digital cameras
Mobile phones are accessible (68.7%)	In of the colleges, trainees were seen with mobile phones
Projection system accessible (40%)	Sampled colleges have projectors though not used in the classroom most times
Networked printers not accessible (72.6%)	of the colleges have printers in the laboratory
College television accessible (50.7%)	All sampled colleges have television
Internet-accessible (50.9%)	One Core PTC has wireless internet, the rest do not have

Field data, 2020

Findings from the merged data Table 11 shows the consistency of quantitative data with qualitative data. Observations from all colleges indicate that they have computers.

However, there are facilities which were observed available in some colleges but not freely accessed by teacher trainees, such as computers, television and printers. This implies that some colleges are very restrictive or there is a shortage of staff to manage and control these infrastructures.

These findings are in agreement with the Ministry of ICT and the National Guidance report (MoICT, 2018) which shows that there remains a shortage of ICT facilities and laboratories, which leaves the ICT skills of the teacher trainees wanting. PTCs remain divided on the use of ICT. For instance, some PTC principals in the country continue to restrict students from using phones- the simplest device in ICT compared to their counterparts in other professions. Some colleges have been restricting the use of mobile phones because they distract students (Daily Monitor, 2019). However, lockdown experience has liberalized the use of mobile phones in most teacher training colleges. This will ease communication among students and their tutors and also self-study through internet access.

Descriptive Statistics for Pedagogical Practices

Teacher trainees were asked to indicate the level of agreement or disagreement with the statements regarding their pedagogical practices. Pedagogical practices were measured based on the activities teacher trainees do during their training to become professional teachers. These activities include lesson planning, lesson material development and assessment of pupils' learning done during school practice. Results are presented in Table 12.

Table 12

Descriptive Statistics for Pedagogical Practices

Items	N	Mean	SD
I have used ICT in lesson planning	627	2.00	1.31
I have used ICT in evaluating learning	627	2.16	1.37
I have used ICT in recording and record-keeping of information about how pupils are developing an understanding of new material	627	2.56	1.49
I have used ICT for assessing pupils	627	2.27	1.36
I have shared resources online to enhance my reputation as a student teacher	627	2.78	1.44
The resources I develop using ICT are of good quality and I would be happy to share them	627	2.94	1.45

I have used school or personal computer to record marks using a spreadsheet	627	2.77	1.44
I have used school or personal computer typing exam or tests for my learners	627	2.64	1.49
I have used school or personal computer to find information and resources on the internet	627	3.12	1.50
I have used school or personal computer to access resources using online databases	627	2.90	1.45
I have used school or personal computer to develop teaching resources e.g games, letters etc	627	2.85	1.47
I have used school or personal computer to develop digital content for learner use	627	2.73	1.44
I have used ICTs to self-learning in my subject area	627	3.15	1.50
I have used ICT to learn how to teach e.g. seeing tutorials online experts teaching	627	2.93	1.50
I have used ICT to access NCDC Primary curriculum online and e-books	627	2.63	1.48
I have used ICT to teach my pupils complex concepts e.g. digestion, machinery, reproduction, geography etc	627	2.59	1.51
Grand mean		2.69	

Field data, 2020

Results in Table 12 show the grand mean of 2.69. This implies slightly below average for teacher trainees pedagogical practices. The majority of respondents reported that their use of ICT in lesson planning is low (*M* = 2.00, *SD* = 1.31). Yet, Lesson planning is important when using ICTs; where less planning has taken place, research shows that student work is often less focused and can lead to lower gains (Trucano, 2005). New lesson plans can be developed and maintained effectively using ICT and teachers can access lesson plans developed by other teachers to assist them in their teaching (BECTA, 2002).

Similarly to evaluating learning using ICT (is perceived low by teacher trainees *(M* = 2.16, *SD* = 1.37), yet in OECD countries, research consensus holds that the most effective use of ICT is when a teacher, assisted by ICTs, challenges students' understanding and thinking, either through whole-class discussions or individual/small group work using ICTs (Trucano, 2005). Trucano adds that ICTs can be used to strengthen existing pedagogical practices and change the way teachers and students communicate.

Respondents further reported that their use of ICT in recording and record-keeping of information about how pupils are developing an understanding of new material is slightly below average (*M* = 2.56, SD = 1.49). Teacher trainees need to know that, ICT can help teachers evaluate and monitor students' progress compared to benchmark data. It can automate some of the tasks associated with recording and reporting pupils' attainment, and can, through the use of projected performance data, enable target setting and feedback to improve practice (BECTA, 2002). Teachers can use computers to record marks, calculate ratings, manage attendance and access data on student performance in online programs and assessments (Barroso, 2019).

Also assessment of pupils using ICT is low (*M* = 2.27, *SD* = 1.36). This is unfortunate to teacher trainees since assessment is one of their roles during teaching. However, the British Educational Communications and Technology Agency (BECTA) say ICT extends a variety of assessment methods available to teachers. Teachers should learn to use online education portfolios to assess students. Teachers can choose from a variety of online portfolio providers tailored to the needs of their class (Darrel & Bleiberg, 2013). Online testing works better than traditional paper tests because it allows for faster response/feedback and data (Barroso, 2019). Also, computer simulations can provide useful insights into learners' comprehension, and

certain assessment software may allow teachers to assess learners (BECTA, 2002). When used properly, diagnostic tools are integrated into Integrated Learning Systems (ILS), enabling the teacher to support learners, for example, by identifying and challenging misconceptions (BECTA, 2002). BECTA emphasizes that ICT can be used to demonstrate student work where students can store work in their files, or on their web pages, or have their work included in a school website. This can have positive effects on motivating and challenging other learners to produce quality work.

In addition, results show that majority of the respondents reported that sharing of resources online to enhance their reputation as student teachers slightly below average (M = 2.78, SD = 1.44). Sharing what you know, or asking someone else to share what they know, may not seem like such a big deal, but sharing information with peers can be a powerful tool to help teachers teach effectively in an integrated classroom (Malone, 2015). Malone adds that this often overlooked strategy is one of the best ways to find problems, find better ways, and find new or better teaching resources (Malone, 2015). In this digital age, most, if not all, teachers are online, meaning they have an 'online' name (Janelle, 2019). Janelle advises that modern teachers need to be able to manage their online reputation and which social media platforms are best for them. LinkedIn is a social network that you work with, but some profiles of social networking sites, such as Instagram or Facebook, should remain confidential and separate from learners (Janelle, 2019).

Primary teacher trainees also reported that they are slightly below average (M = 2.94, SD = 1.45) in developing quality resources for sharing using ICT. These teacher trainees need more practice and exposure to educational technologies. An InfoDev report puts it: “Teachers need extensive, continuous exposure to ICTs to be able to evaluate and select the most appropriate resources (Trucano, 2005). However, the development of appropriate pedagogical practices appears to be more important than the technical capabilities of ICT” (Trucano, 2005). The digital skills that 21st Century teachers should have include cloud storage and sharing solutions, social media, web editing, image editing, presentation software, and general multimedia (Kharbach, 2016).

Furthermore, results indicate that majority of respondents they were slightly below average (M = 2.77, SD = 1.44) in using school or personal computer to record marks using a spreadsheet and they were also slightly below average (M = 2.64, SD = 1.49) in using school or personal computer to type exam or tests for their learners. A survey of US teachers was conducted to obtain a summary of key technological skills in 2014. Some study participants reported that good typing skills are important as they are used every time a teacher sits down at a computer. They also report that the effective use of word processor, presentation software and spreadsheets is important for classroom management and production (Thompson, 2014). Indeed these skills are needed by teacher trainees in Uganda since they are relevant in almost all schools in Uganda, for typing communiqué, tests, home works and examinations for learners.

Additionally, respondents reported that they have averagely used (M = 3.12, SD = 1.50) school or personal computer to find information and resources on the internet and also slightly below average (M = 2.90, SD = 1.45) used school or personal computer to access resources using online databases. Every teacher should know what is available on the web in their subject area (Poole, 2012). Poole says the Web is a great resource for teaching and learning - and getting better every day. In addition, the academic technology specialist, Poole, thinks that conscientious technology teachers take the time to research what is available to enrich

their students' learning knowledge (Poole, 2012). Therefore every teacher should have good Web research skills because Web search has become an important skill for all computer users. Almost anything you can think of is available on the web - if you only know how to find it (Poole, 2012). Electronic information resource databases are one of the most technologically innovative libraries and are the most important resources for teaching, learning, and research and community development in any subject. E-resources databases is a resource where information is stored electronically and can be accessed through online networks. Some of the online information databases that teachers need to know include; ERIC, Google Scholar, Jstor, and CORE. They can also include national curriculum development centre (NCDC) online resources like books, teacher's guides and curriculum for different class levels.

The majority of respondents have used school or college computer slightly below average (M = 2.85, SD = 1.47) to develop teaching resources e.g. games, letters etc. Teacher trainers should be able to use computer programs to create simple teaching aids such as games and characters to teach children. Some of the most common uses of computers in education today include the continued use of educational software and programs that facilitate the online teaching of students (Barroso, 2019). Programs like iReady use computers to test students in reading and maths (Barroso, 2019). Educational software like iReady makes it easy to differentiate instruction so that courses meet the different learning needs of each student (Barroso, 2019).

Primary teacher trainees also have slightly below average (M = 2.73, SD = 1.44) developed digital content for learners' use using school or personal computer. With digital skills, trained Primary teachers should be able to make visual presentations, design websites for science projects and write book reviews as bloggers. Primary teacher trainees should have the same basic skills as filming a video using a digital video camera and editing a movie using movie editing software. Darrel & Bleiberg (2013) stipulates that students who successfully create, shoot, edit, and complete a movie with title cards, music and sound recording will learn to use a variety of technologies. These skills can help trainee teachers build more resources for their teaching.

Results in Table 18 continue to show that majority of the respondents have averagely used (M = 3.15, SD = 1.50) ICTs to self-learn in their subject area. By providing access to updated and additional learning resources, ICTs can enhance a teacher's self-study in his or her subject (Trucano, 2005).

Primary teacher trainees further reported that slightly below average used ICT (*M* = 2.93, *SD* = 1.50) to learn how to teach e.g. seeing tutorials online experts teaching. Teacher trainees should develop the habit of professional self-improvement by looking at the teaching professionals/experts. These professionals can be found online at the websites of other educational institutions and on social networking sites such as YouTube. It is believed that expert teachers perceive events in the classroom differently than novices (Fletcher-Wood, 2017). Thinking about lessons, expert teachers focus on the evidence students have learned, novice about their feelings (Borko & Livingston, 1989). In a study on pedagogical expertise, by Borko and Livingston (1989), they found that novice exhibited wasted time, inefficient planning, and encountered problems when student response efforts led them away from written study programs, less selective posts on display than experts. Experts also reverse problems by addressing the same situations they face, seeking to fully understand them and come up with practical solutions (Sternberg and Horvath, 1995).

Moreover, the majority of the respondents reported that they have slightly below average (M = 2.63, SD = 1.48) used ICT to access NCDC primary school curriculum online and e-books. Primary teacher trainees need to know that almost all teaching resources and policy documents are sent online by various education ministries and stakeholders. For example, the teaching guides for primary school teachers and the Ugandan primary school curriculum are available on the NCDC website so that all schools and teachers can use them. Therefore, they should get used to exploring ministry departmental websites for updates on what is happening in the field of education.

Also, primary teacher trainees slightly below average (M = 2.59, SD = 1.51) used ICT to teach their pupils complex concepts e.g. digestion, machinery, reproduction, geography etc. It is safe to say that almost all disciplines/subjects beginning with mathematics, science, languages, arts and humanities and other major fields can best be learned with technological tools and equipment (Ghavifekr, & Rosdy, 2015). According to Warwick and Kershner (2008), the importance and value of ICT should be recognized by teachers to make a meaningful lesson with the use of ICT. According to Scientific World (2019), using educational software, teachers, and students can learn about life situations in a more powerful way than traditional textbooks allow. For example, students can use the Internet to make visual trips to planets.

Finally, pedagogical practices for teachers using ICT may range from only minor improvements in teaching practices, using traditional methods, to the most important changes in their teaching approaches. ICTs can be used to strengthen existing teaching methods and change the way teachers and students communicate. The types of ICT applications are significantly related to teachers' teaching philosophies.

VIII. CONCLUSIONS

The study sought to establish teacher trainees ICT competencies for pedagogical practices in Uganda. The findings revealed that primary teacher trainees ICT competencies for pedagogical practices are low. The conclusions made were based on UNESCO ICT Competency Framework for Teachers and TPACK model requirements. Specifically, the following conclusions have been made:

(i) Although findings indicate that female trainees were many compared to males, it's because the sampled colleges had only females (single-sex teachers college)

(ii) Though primary teacher trainees in Uganda have low ICT skills, they have slightly above average ICT knowledge for pedagogical practices.

(iii) 21st Century teacher trainees need comprehensive ICT knowledge and skills that guide the use and application of ICT tools in their profession.

(iv) Despite the perceived level of tutors' mode of instruction being slightly above average, it has not been helpful to the teacher trainees to acquire the ICT competencies. And tutors' modelling combining content, technologies and teaching approaches in their teaching is not sufficient in this digital era.

(v) Regarding ICT infrastructures, most of the primary teacher trainees colleges have free access to ICT laboratory, mobile phones and other equipment but they have no required skills of applying these gadgets in their pedagogical practices. Also, the applications on these devices have not been explored for use by these primary teacher trainees in Uganda.

(vi) The pedagogical practices of primary teacher trainees are slightly above average, however, due to the reported low ICT competencies, they are not high and sufficient for globalised teaching.

(vii) The findings have shown a positive statistically significant relationship between ICT competencies and pedagogical practices implying that if teacher trainees ICT competencies increase even the pedagogical practices will improve.

(viii) The regression analysis results have indicated that both tutors' mode of instruction and ICT infrastructure moderate the relationship between teacher trainees' ICT competencies and pedagogical practices. This means that for primary teacher trainees to be fully competent in ICT for pedagogical practices, tutors must model to them or impart skills and knowledge to them and also ICT infrastructure must be available as resources.

(ix) These study findings are hoped to contribute to the teacher education curriculum planning and development regarding ICT in education

(x) Practically, the study has discussed what to be done by tutors and teacher trainees to have ICT competencies for pedagogical practices

IX. RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations are made:

(i) The Ministry of Education and Sports and the New National Institute of Teacher Education must make ICT in education a compulsory course unit for all levels of teacher education if they want teacher trainees to graduate with ICT competencies. They should emphasize both the practical application and theory.

(ii) The government of Uganda through the Ministry of Education and Sports must provide adequate and efficient computers and internet to teacher training colleges as they are the smallest colleges in the country if they are to produce ICT competent teachers.

(iii) Specialists in Educational Technology should be employed in all teacher training institutions because they can better plan and direct the proper use of technology in teaching and learning, rather than hiring non-teaching specialists to train teachers.

(iv) School practice management should also emphasize the role of the use of ICT by student teachers/teacher trainees in their planning and teaching.

(v) Teacher education institutions should be led by the UNESCO ICT Competency Framework for teachers and the TPACK model, as these models propose a set of skills and knowledge aimed at preparing pre-service teachers to become ICT users to help students and themselves benefit from technology.

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