The moderating effect of ICT Infrastructure and Tutors' Mode of Instruction on the relationship between Primary Teacher Trainees' ICT Competencies and their Pedagogical Practices in Uganda

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Abstract

Teacher Trainees' ICT Knowledge and Skills influence the future use of educational technology in teaching and learning. ICT has a huge impact on the changing landscape of education. It is a necessity for student teachers. The specific objectives of this study were: To determine the relationship between Primary Teacher Trainees' ICT competencies and Pedagogical Practices in Uganda; Determine the moderating effect of ICT infrastructure and tutors' mode of instruction on the relationship between Primary Teacher Trainees' ICT Competencies and their Pedagogical Practices in Uganda. The study used a cross-sectional, correlational survey design to collect data and establish the relationship between variables. For colleges, disproportionate stratified sampling technique and for students per selected college, convenient sampling was opted for. Geographically, this study was conducted in Primary Teachers Colleges, in the Central, Southwest, Western, Eastern and Northern Uganda. Only 2nd-year Primary Teacher Trainees (finalists) participated in this study. The study used a questionnaire to collect quantitative data. The data collected from the self-administered questionnaire was sorted, categorized and computerized using the 23.0 version of IBM SPSS for generation of inferential statistics. Correlations were run to predict the relationships between the study variables, and moderation analysis was done using multiple regressions. Results have indicated that there is a positive significant relationship between teacher trainees ICT competencies and their pedagogical practices. This relationship was found to be moderated by the tutor's mode of instruction and ICT infrastructure. Recommendations have been made to all stakeholders in teacher education.

Keywords:

ICT, Competencies, Pedagogical Practices, Mode of Instruction, ICT Infrastructure

INTRODUCTION

ICT knowledge and skills support teacher trainees' educational practices; in planning instruction, resource development and evaluation (Higgins & Packard, 2004). ICT currently offers a number of powerful tools to change conventional teaching to student-centered, technology-enhanced and collaborative (Rostogi & Malhotra, 2013). As the need for technology and personalized learning increases, there must be a clear shift in the use of technology (Marzilli et al. 2014). However, other variables such as ICT infrastructure and tutors' teaching strategies need to be considered in order for teacher trainees to acquire ICT knowledge and skills for teaching practices. In order for teachers to effectively adopt technology in their classrooms, they must receive adequate training before embarking on actual teaching (Brun & Hinostrosa, 2014; Tondour, Van Brock, Siddique & Screer, 2016; Usun, 2009). UNESCO recorded that 1.3 billion students worldwide could not attend school or university because of Covid-19 (UNESCO, 2020). Many countries have sought to improve radio and television content and to provide e-learning and resources for remote learning. In Uganda and Zambia, for example, UNESCO's Capacity Development for Education (CapED) conducted teacher assessments to determine ICT competence levels of teachers (UNESCO, 2020). In the short term, it will determine the type of ICT-related interventions that teachers will develop 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). It is therefore worth mentioning that this current study was in line with the global ICT agenda. However, according to a recent study, the Ministry of Education in Uganda did not make full use of technology during the difficult season when schools were closed; They lack ICT capabilities or have little or no ICT infrastructure for educational institutions (Nelson et al., 2020). Researchers (Higgins & Packard, 2004; Fox, Waters, Fletcher & Levine, 2012; Cisco, 2013) say that a school's broadband determines online content, functionality, and application. When teacher trainees are digitally educated and trained to use ICT, these approaches can lead to high-level thinking skills, provide teacher trainees with creative and personalized options to express their understanding, and better prepare them to cope with technological changes occurring in the society and workplace in the future. IT professionals in education such as; Higgins & Backard (2004) suggested that a teacher trainee should be confident in using different software designed to manage and manipulate text (such as Microsoft Word in the office suite). These experts emphasize it further; teacher trainees are able to carry out tasks for themselves (such as writing assignments) and prepare their teaching materials. Teacher trainees need to be aware of ICT's ability to support their work in the preparation of

teaching materials. It is hoped that ICT skills among teacher trainees will impart to them knowledge and skills that will include their future educational practices, learning resource development, lesson planning and evaluation of learning activities in schools. Information and Communication Technology (ICT) is gaining momentum in education as students emerge as the most active ICT users of computers and mobile phones with internet access (Hakoma & Hakoyama, 2011; Wentworth & Middleton, 2014). UNESCO (2009) states that ICT can help initiate educational transformation to improve the quality of education and improve learning outcomes through improved teaching methods, in order to achieve the goal of United Nations Sustainable Development Goal No. 4 (SDG4). Globally, the use of ICT in education is considered a key factor for economic growth, although educational practices and structures and economic growth are lavish and interrelated because Cosma (2005) describes comparisons between Finland, Hong Kong and Egypt for their solutions to the use of technology in education. Regarding. According to new research by Hawaii (2017), support and investment in ICT directly affects a country's performance, as opposed to the United Nations Sustainable Development Goals (SDGs), through education, capacity building and new service development.

Computers such as Myndools (Jonassen, Beck & Wilson, 1999) allow students to perform a variety of critical thinking activities. Therefore acquiring ICT skills by teacher trainers is important for the economic development of teachers, learners and any nation. These ICT competencies in education are a set of technical standards that define competence in the use of computer technology in the classroom (Lawrence & Veena, 2013). According to Yurs, Wolman and Crawl (2018) teachers need to be provided with new technologies because they accept the responsibility of producing technologically advanced citizens in the social development of the 21st century, where technological advances continue to flow. Consequently, understanding and developing the ability of pre-service teachers in the use of technology is the cornerstone in integrating technology into teaching. Knowledge and skills related to computer related skills are grouped into four general areas: (1) basic technical function, (2) personal and professional use of technical tools, (3) social, ethical and human issues and (4) application teaching technology (Lawrence & Veena, 2013). UNESCO defines these capabilities as UNESCO defines these capabilities 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 learning process resources. Teachers need to change their tradition by incorporating ICT into their daily teaching.

OBJECTIVES OF THE STUDY

The specific objectives of this study were:

1. To determine the relationship between Primary Teacher Trainees' ICT competencies and Pedagogical Practices in Uganda
2. Determine the moderating effect of ICT infrastructure and tutors' mode of instruction on the relationship between Primary Teacher Trainees' ICT Competencies and their Pedagogical Practices in Uganda.

HYPOTHESES

The study was guided by the following hypotheses:

1. There is no significant relationship between Teacher Trainees' ICT competencies and pedagogical practices in Uganda.
2. There is a moderating effect of quality of ICT infrastructure and perceived teacher trainees' tutors' mode of instruction on the relationship between Primary Trainees' ICT Competencies and Teacher Trainees' Pedagogical Practices.

MATERIALS AND METHODS

The study used a cross-sectional, correlational survey design to collect data and establish the relationship between variables. The study used a questionnaire as a tool to collect quantitative data on teacher trainees' ICT competencies, ICT infrastructure, Tutor's mode of Instruction and Pedagogical Practices. Geographically, this study was conducted in Primary Teachers Colleges located in the central region, Southwest, Western, Eastern and Northern Uganda using disproportionate stratified sampling. By content, it dealt with ICT infrastructures, Tutors' mode of Instruction, ICT Competencies and Teacher Trainees' Pedagogical practices. Only 2nd-year Primary Teacher Trainees (finalists) participated in this study. Data were analyzed using descriptive statistics (means, frequencies and percentages) as well as inferential statistics (correlations and regression analysis).

RESULTS AND DISCUSSION

Descriptive statistics for the study variables are indicated in tables, 1, 2, 3 and 4.

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. The items on the questionnaire are rated on 1-5 scale (Likert scale). Mean results were

interpreted using the scoring guide adapted from Mailizar and Fan (2019) as shown in Table1.

Table 1

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 could use; word processor, presentation software, web browser, email address, search engine, courseware, open educational resources, recording and archiving of student marks and online presence. Results are presented in Table 2 using mean (M) and standard deviation (SD).

Table 2

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 a 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

The results in Table 2 show that the grand mean for ICT basic tools scored by teacher trainees is 2.22. According to the scoring scale provided in Table 1, this puts teacher trainees' basic ICT skills at averagely low.

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. The results are shown in Table 3 using a scale of 1-4 from not at all to a large extent.

Table 3

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?	527	2.79	1.15
To what extent can you use authoring environments to produce online materials for your pupils?	527	2.16	1.00
Can you use a platform to manage, monitor, or assess the progress of your pupils?	527	2.31	1.07
Can you use social networks to interact with your pupils and/or colleagues?	527	2.81	1.13
To what extent can you use open educational resources?	527	2.50	1.09
Can you use ICTs to collaborate with other schools?	527	2.50	1.12
Grand mean			2.51

Field data, 2020

Results from Table 3 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.

Descriptive Statistics for ICT Skills on Teacher Professional Learning

To determine the level of skills in ICT for teacher trainees, respondents were asked if they could use ICTs to share digital resources, collaborate with professionals, become active members of the online community and use the internet in their professional learning. Results are presented in Table 4.

Table 4

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 4 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.

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 5.

Table 5

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 5 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 findings are in line with UNESCO (2011) which found that many teacher training institutions in developing countries lack the capacity to design and provide ICT training courses in education.

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 6.

Table 6

Descriptive Statistics for ICT Knowledge

Items	N	Mean	*SD*
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 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 6 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 for 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).

Descriptive Statistics for Tutor's Mode of Instruction

Primary teacher trainees were asked to describe how they perceived their tutors in modeling incorporating content, technology and teaching methods into their teaching. Results are shown in Table 7.

Table 7

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 7 indicate that the grand mean for tutors appropriately modeling content, technologies and teaching approaches in their teaching is 3.51 as perceived by teacher trainees. This puts tutors' modeling 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.

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 into low ICT competencies of teacher trainees for pedagogical practices. Results are presented in Table 8.

Table 15

Descriptive Statistics for Availability and Accessibility of ICT Infrastructure

Items	Not accessible		stricted access		Free access	
	Count	%	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 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%	153	24.4%	319	50.9%

Field data, 2020

In summary, results in Table 8 that only college computers, mobile phones, projection systems, college television and 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.

Descriptive Statistics for Pedagogical Practices

Primary teacher trainees were asked to indicate the level of agreement or disagreement with statements regarding their teaching practices using technology. Their 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 9.

Table 9

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 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 9 show the grand mean of 2.69. This implies slightly below average for teacher trainees pedagogical practices.

Hypothesis One

Hypothesis one stated that there is no significant relationship between Teacher Trainees' ICT Competencies and Pedagogical Practices in Uganda. Correlations were run to determine the relationship between ICT competencies (Knowledge and Skills) and Pedagogical Practices.
Results are shown in Tables 10 and 11.

Table 10

Correlations for ICT Knowledge and Pedagogical Practices

Variables		ICT Knowledge	Pedagogical Practices
ICT Knowledge	Pearson Correlation	1	.514**
	Sig. (2-tailed)		.000
	N	627	627
Pedagogical Practices	Pearson Correlation	.514**	1
	Sig. (2-tailed)	.000	
	N	627	627

Correlation is significant at the 0.01 level (2-tailed).

Results in Table 10 indicate that there is a strong positive statistical significant relationship between ICT Knowledge and Pedagogical Practices ($r = .514$, $\rho > .01$) at 0.01 level of significance. The relationship is positive implying that an increase in ICT knowledge increases pedagogical practices.

These findings are consistent with Rahman and Rahman (2015) in their research findings that have shown a positive relationship between knowledge and practice. Drent and Meelissen (2008) also found that strong ICT knowledge and skills are critical to using ICT in teaching. This study was of the view that when teacher trainees acquire ICT knowledge, they will improve pedagogical practices. Kazan and ELDaou (2016) conducted a study examining the effect of ICT training on a teacher's self-efficacy, ICT usefulness and attitudes, on the student's science education performance. The results showed a positive correlation of Pearson $r = .6$ between teachers' self-efficacy, knowledge, attitudes, and science results for special education students. Kazan and ELDaou again found that the first group participants, who were trained, were able to better explain and apply technology in the science class than the second group that were not trained (Kazan & ELDaou, 2016). This implies that the level of knowledge acquired is significant. Also, Felistas et al. (2016) investigated the impact of teacher's competency on ICT integration in teaching and learning in public high schools in Machakos County, Kenya. Their findings highlight a significant relationship between teacher knowledge and ICT integration. Flanagan and Shoffner (2013) suggest that perhaps the most difficult challenge for teachers is the lack of training and preparation for the use of technology in improved ICT teaching. However, descriptive results have shown that primary teacher trainees have a moderate knowledge of ICT but little use in pedagogical activities. This can be explained by the insufficient exposure to ICT infrastructure and the type of training they receive that does not have a technical model. Therefore, the increase in ICT knowledge would encourage these trainees to apply it in their teaching practices. Cox and his colleagues while reviewing literature on ICT and pedagogy concluded that very few teachers have extensive knowledge of the various ICT resources available in education and this means that their students are not given every opportunity to learn the ICT can offer them (Cox et al, 2003). Varol (2013) also

found that teachers had limited knowledge of ICTs and their level of ICT usage in teaching was low.

Table 11

Correlations for ICT Skills and Pedagogical Practices

Variables		1	2	3	4	5
Basic ICT Tools	Pearson Correlation	1	.639**	.538**	.662**	.475**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	627	627	627	627	627
Complex ICT Tools	Pearson Correlation	.639**	1	.629**	.715**	.546**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	627	627	627	627	627
Professional Learning	Pearson Correlation	.538**	.629**	1	.649**	.471**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	627	627	627	627	627
Assessment ICT Skills	Pearson Correlation	.662**	.715**	.649**	1	.563**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	627	627	627	627	627
Pedagogical Practices	Pearson Correlation	.475**	.546**	.471**	.563**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	627	627	627	627	627

**. Correlation is significant at the 0.01 level (2-tailed).

Results in Table 11 indicate that there is a statistical significant relationship between ICT skills and pedagogical practices ($\rho > .01$). All the constructs for ICT skills which measured basic ICT tools ($r = .475$, $\rho > .01$) complex ICT tools ($r = .546$, $\rho > .01$), professional learning ($r = .471$, $\rho > .01$), and assessment ICT skills ($r = .563$, $\rho > .01$) were found to be statistically significant and positively correlated with pedagogical practices. This implies that an increase in ICT skills increases the pedagogical practices.

The current findings are in agreement with those of Rastogi and Malhotra (2013) who found a strong relationship between ICT skills by teachers, their attitude towards ICT and the actual implementation of ICT in their teaching class in India. Rastogi and Malhotra explored the expertise of ICT skills, teachers' attitude towards ICT, and their experience with ICT and how to use ICT in their modern day of practice in India (Rastogi & Malhotra, 2013). Their assumption was that due to the existence of diversity and levels of ICT skills and attitudes of teachers or because of their diverse teaching practices, the real integration of ICT into teaching could be compromised. Also, in a study by Alazam et al. (2012) regarding the levels of ICT skills and the use of ICT in the classroom between technology educators and artisans in Malaysia, it was found that

there is a strong correlation between ICT skills and the integration of ICT in the classroom.

Aslan and Zhu (2017) also found that pre-service teachers' perceived competence of ICT strongly predicts the integration of ICT into teaching practice. These scholars were investigating the extent to which student- teachers were able to incorporate ICT into their teaching activities as part of their teaching program, as well as factors predicting the integration of ICT by teacher trainees before they join their real teaching job in Turkey. Scholars such as Zhou et al. (2010) suggest that pre-service teachers need to acquire the necessary skills to meet the needs of their students during their pre-service education. This shows that pre-service teacher training programs play an important role in enabling pre-service teachers to acquire and apply their ICT skills in their teaching practices. In this regard, Yıldırım (2000) emphasizes the importance of teachers having appropriate technical training during their pre-service education, if they are to meet the needs of students for the next century. Pre-service teachers should acquire the skills and knowledge necessary for the use of ICT in their pre-service learning process, and apply it in their pre-service and professional life (Yapıcı & Hevedanlı, 2012). It has been reported in a study conducted by Jung (2005) that alternative approaches to ICT, in order to achieve broader teaching goals, are recommended at the first level of teacher training and at a higher level.

Additionally, for school teachers to play an emerging role in helping the student acquire the 21st century skills needed; Teachers themselves need to learn ICT and be competent and must learn to integrate their technical knowledge and teaching skills in teaching the content of their subjects with 21st century skills (Garba, 2014). It is evident that ICT can help primary school teachers to be more effective in teaching, especially when they have the resources (BECTA, 2001). Therefore, the level of literacy in ICT and the skills of teachers are important in determining the success of ICT integration in schools (Mahmud & Ismail, 2010). However, the ability of teachers use ICT in their educational practices depends on teacher education and training, on the other hand; also, tutors who teach them (Garba, 2014). Therefore the enhancement of primary teacher trainees ICT skills would facilitate their pedagogical practices and future application of ICTs in their future real teaching. All of these findings attest to the remarkable interaction between teachers' ICT skills and pedagogical practices. The increase in ICT skills increases the effectiveness of teaching practices among teacher trainees.

Hypothesis Two

Hypothesis two stated that there is a moderating effect of availability and quality of ICT infrastructures and tutors' mode of instruction on the relationship between Teacher trainees' ICT competencies and pedagogical practices in Uganda. To determine the moderating effect of ICT infrastructure and tutor's mode of instruction on the relationship between ICT competencies and pedagogical practice a multiple regression analysis was done. Using a regression coefficient, the moderator analysis determines the cause-and-effect relationship between X and Y. A moderator can augment or even

reverse the effect of a causal effect, despite the fact that traditionally moderation indicates a weakening of that effect. The regression analysis was done with all variables combined as indicated in Table 12 and also when moderators are removed as indicated in Table 13. This was done to determine how much moderators contribute to the model.

Table 12

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.688[a]	.474	.467	12.48670

a. Predictors: (Constant), Infrastructure, Knowledge, Modelling, ICT Basics, Professional Learning, Tutor mode, ICT Complex Tools, Assessment

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86668.202	8	10833.525	69.482	.000[b]
	Residual	96357.061	618	155.918		
	Total	183025.263	626			

a. Dependent Variable: Pedagogical practices

b. Predictors: (Constant), Infrast, Knowledge, Modeling, ICT Basics, Professional Learning, Tutor, Complex ICT, Assessment

Regression Coefficients for all variables combined

Model	standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-12.384	2.605		-4.755	.000
ICT Basic Tools	.214	.116	.077	1.850	.065
ICT Complex Tools	.418	.167	.118	2.493	.013
Professional Learning	.210	.209	.041	1.004	.316
Assessment ICT skills	.562	.158	.173	3.550	.000
ICT Knowledge	.172	.048	.154	3.580	.000
Tutor's Mode	.231	.095	.104	2.432	.015
Modelling Rate	.348	.241	.050	1.441	.150
Infrastructure	.661	.104	.218	6.343	.000

a. Dependent Variable: Pedagogical Practices

Note: The model is significant where $\rho = .000$ hence $\rho < .01$ (2-tailed)

The regression model was found to be significant ($\rho < .01$) with the combination of ICT competencies, ICT infrastructure and Tutor's mode of instruction predicted pedagogical practices. Therefore we retain the alternative hypothesis which stated that there is a moderating effect of quality of ICT infrastructure and perceived teacher trainees' tutors'

mode of instruction on the relationship between Primary Trainees' ICT Competencies and Teacher Trainees' Pedagogical Practices. The Adjusted R square (.467) in the model summary table indicates that this model correctly predicts 46.7% of the variance in pedagogical practices.

The current findings are in line with those of Afutor (2020) in Ghana, who found that ICT infrastructure, ICT skills and other factors predict technological integration at 70.9%. Lau and Yuen (2014) have confirmed that ICT infrastructure and teacher ICT skills are closely linked to the successful implementation and integration of ICT in schools. Also, Baharuldin et al. (2019) concludes that Teacher's readiness to integrate ICT in the classroom acts as a fully mediator through the use of teacher ICT infrastructure. Tutors are role models in training students to become teachers, so it is important to assess their level of ICT implementation in college courses (Avidov-Ungar & Iluz, 2014). The low or negative use of ICT by tutors has the potential to reduce students's motivation (Makura, 2014), hence tutor's mode of instruction becomes significant in the teacher training process. Tutors who initiate a process that focuses on learning and teaching are able to perform well and incorporate technology into their teaching (Ertmer & Ottenbreit-Leftwich, 2010). Numerous studies have revealed that even though tutors are aware of the potential advantages of integrating ICT into their lessons, many of them continue to use ICT in a traditional way without making significant modifications to the ways in which students are taught and learn (Bransford et al., 2000). Tondeur et al., (2013) report that pre-service teachers often feel inadequate to use ICTs in teaching and learning. Due to a lack of appropriate software, materials, and hardware, tutors in training colleges are oftenly hesitant to adopt new technologies in their classroom (Goktas et al., 2009). This has an impact on their teaching strategies as well as the acquisition of ICT competencies by teacher trainees for their pedagogical practices. Studies report various barriers and difficulties encountered in teaching technology related to their beliefs and ideas, time management and resources, and a supporting technical and educational framework (Brzycki & Dudt, 2005; Goktas et al., 2009; Gomez et al., 2008; Maltz & DeBlois, 2005; Moser, 2007). All these findings support the assertion that ICT infrastructure and tutor's mode of instruction moderate the relationship between Teacher trainees' ICT competencies and their pedagogical practices.

To determine how much moderators contributed to the model, a regression analysis excluding the moderators was run. The results are displayed in Table 13.

Table 13
Regression Coefficients[a] without moderators

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adj.R^2
	B	td. Error	Beta			
(Constant)	-1.097	2.301		-.477	.634	.413
Basic ICT Tools	.265	.121	.095	2.191	.029	
ICT Complex Tools	.521	.174	.147	2.992	.003	
Professional Learning	.384	.217	.075	1.767	.078	
Assessment ICT	.705	.164	.217	4.296	.000	
ICT Knowledge	.293	.041	.262	7.129	.000	

a. Dependent Variable: Pedagogical Practices

The regression model was significant ($\rho < .01$) with ICT complex tools, Assessment ICT and ICT knowledge, whereas Basic ICT tools and professional learning skills were insignificant. The Adjusted R square value was .413. This indicates that 41.3% of the variance in pedagogical practices was explained by the model. Therefore, to get the effect of moderators, the Adjusted R square value for independent variables was subtracted from the moderators and independent variables combined (46.7% - 41.3%) giving 5.4% variance in pedagogical practices explained by the model. This implies that moderators; ICT infrastructure and tutor's mode of instruction contribute 5.4% of the variance in teacher trainees ICT competencies for pedagogical practices of primary teacher trainees in Uganda.

CONCLUSIONS

The findings have revealed that primary teacher trainees ICT competencies for pedagogical practices in Uganda are low. There is a statistical significant relationship between ICT competencies and pedagogical practices moderated by tutor's mode of instruction and ICT infrastructure. The following conclusions have been made:

1) Though primary teacher trainees in Uganda have low ICT skills, they have slightly above average ICT knowledge for pedagogical practices. 21st Century teacher trainees need comprehensive ICT knowledge and skills that guide the use and application of ICT tools in their profession.
2) 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' modeling combining content, technologies and teaching approaches in their teaching is not sufficient in this digital era.
3) Regarding ICT infrastructures, most of the primary teacher trainees colleges have free access to ICT laboratory, mobile phones and other equipments 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.

4) The Pedagogical practices of primary teacher trainees in Uganda are slightly above average, however, due to the reported low ICT competencies, they are not high and sufficient for globalised teaching.
5) The findings have shown a positive statistical significant relationship between ICT competencies and pedagogical practices implying that if teacher trainees ICT competencies increase even the pedagogical practices will improve.
6) 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.

RECOMMENDATIONS

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

(1) 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.
(2) The government of Uganda through 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.
(3) 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.
(4) School practice management should also emphasize the role of the use of ICT by student teachers / teacher trainees in their planning and teaching.
(5) Teacher education institutions should be led by the UNESCO ICT Competency Framework for teachers and the TPACK model, as these examples propose a set of skills and knowledge aimed at preparing pre-service teachers to become ICT users to help students benefit from the technology.

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Conflict of Interest

There is no conflict of interest to declare. This work has been part of my doctoral study.

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