INFORMATION COMMUNICATION TECHNOLOGY AND PRE-SERVICE TEACHERS' ACADEMIC PERFORMANCE IN SCIENCE SUBJECTS: A CASE OF PRIMARY TEACHERS' COLLEGES, IGANGA DISTRICT, UGANDA

BY

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A RESEARCH REPORT/DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF EDUCATION IN EDUCATIONAL FOUNDATIONS OF KYAMBOGO UNIVERSITY

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DECLARATION

I, Magenge Andrew, declare that this report on the topic "Information Communication Technology and Pre-service Teachers' Academic Performance in Science Subjects: A Case of Primary Teachers' Colleges in Iganga District" is my original work which has never been submitted to any institution of higher learning for award of a Master's degree.

Signature: _____

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Date: ……

APPROVAL

This report/dissertation titled “Information Communication Technology and Student Teachers’ Academic Performance in Science subjects: A Case Primary Teachers’ Colleges in Iganga District” by Magenge Andrew has been compiled with our guidance and it is now ready for submission with our consent as supervisors.

Signature: _____ Date: _____

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MR. SSEMANDA ENOSI

(Supervisor)

DEDICATION

This work is dedicated to my wife for the motivation to keep me moving despite life challenges.

ACKNOWLEDGEMENT

It is significant to highlight that many people and individuals contributed in one way or another during the time that this study report was being created. However, God the Almighty's guidance, protection, and mercies stand out particularly. I am heavily indebted to my Supervisors Dr. Julian Bbuye and Mr. Ssemanda Enosi. Without their kind inspiration and guidance, which allowed me to make this successful work, not much could have been accomplished. I also want to express my sincere gratitude to my classmate and coworkers for the amazing suggestions they gave that helped make this task successful.

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Thank you all.

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LIST OF ABBREVIATIONS

ARS	:	Audience Response System
CD	:	Compact Disk
CMM	:	Computerized Molecular Modeling
CONNECT-ED:		Connectivity for Educator Development Project
CRS	:	Classroom Response System
ICT	:	Information and Communications Technology
KyU	:	Kyambogo University
Lab	:	Laboratory
MBL	:	Main Board Layout
PTC	:	Primary Teachers' College
TETD	:	Teacher Education Training and Development
TIET	:	Teacher (Tutor), Instructor Education and Training
TTI	:	Teacher Training Institution
UNCST	:	Uganda National Council for Science and Technology
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
USMA	:	United States Military Academy

ABSTRACT

The study investigated the relationship between use of Information Communication Technology and pre-service teachers' academic performance in science subjects: A Case of Primary Teachers' Colleges in Iganga District, Uganda. The objectives of the study were to; explore the ICT resources available to facilitate the teaching/learning of Science subjects in Primary Teachers' Colleges, to examine pre-service teachers' interest towards use of available ICT resources in Science subjects in Primary Teachers' Colleges and to establish the relationship between the use of available ICT resources and pre-service teachers' academic performance in Sciences in Primary Teachers' Colleges in Iganga District. A cross-sectional survey design was adopted and the study employed qualitative and quantitative data collection methods and used correlation and descriptive approaches. From the questionnaires and interviews, a response rate of 95.2% was obtained from a sample of 229 respondents. Key findings showed that among the types of ICT equipment owned by pre-service teachers were laptops, Personal Computers, Desktop computers and smartphones for use in ICT lessons among others. The study found out that pre–service teachers had interest in using ICT to do given class assignments, this was achieved by use of computers, phones, internet among other ICT resources to do given Science assignments. According to pre service teachers, ICT eases the process of doing assignments and it also helped in research to ease the attempt of assignments in Science subjects. ICT also eased communication whereby fellow students communicated among themselves and also communicated to tutors concerning their Science studies using emails, whatsApp, facebook, google among others. On the relationship between the use of available ICT resources and Pre-service teachers' academic performance in Sciences in Primary Teachers' Colleges, the study found out that at Bishop Willis Core PTC, a weak positive correlation as per Spearman's correlation coefficient of r=0.174r = 0.174r=0.174 (p = 0.026), suggesting that access to functional computers and other ICT resources was positively associated with academic performance. In Walugogo PTC, a strong negative correlation, r=−0.669r = -0.669r=−0.669 (p = 0.000), indicating that the number of functional computers was associated with lower academic performance. The regression analysis revealed that Bishop Willis Core PTC demonstrated a strong relationship with an R2R^2R2 of 0.798. The presence of a well-equipped computer lab had a significant positive effect on academic performance ($p < 0.001$).While using ICT to facilitate teaching also contributed positively to academic performance ($p = 0.003$), the number of functional computers was not a significant predictor ($p = 0.109$. In Walugogo PTC, a moderate relationship with an R2R^2R2 of 0.647 was found. Similar to Bishop Willis, the availability of a well-equipped computer lab was significantly associated with better performance ($p < 0.001$), but neither ICT integration in teaching ($p = 0.720$) nor the number of functional computers ($p = 0.339$) significantly influenced academic outcomes. It was concluded that ICT plays a very important role in improving the academic performance in science subjects since it encourages research among the students, saves time, facilitate teaching and learning through creative presentations with simple animation functions among others but it is not an ultimate predictor. It was recommended that government should encourage and implement the use of ICT resources by tutors and pre-service teachers in the public and private Primary Teachers' Colleges not only in ICT teaching but also in Science subjects so as to make teaching and learning an easy and enjoyable process. The pre-service teachers should be acquainted with the skills and competences to teach using ICT infrastructure. They need to be acquainted with online assessment, conducting online classes and giving feedback to the learners to improve academic performance in science subjects. The teacher trainers (tutors) need to integrate the limited available ICT resources in their teaching/learning process.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study explores Information Communication Technology and Pre-service Teachers' Academic Performance in Science subjects: A Case of Primary Teachers' Colleges in Iganga District. Omariba et al,. (2016) state that ICT can improve student learning when teachers are informed about computers and understand how to integrate it into the curriculum. Schools employ a range of ICT tools to communicate, generate, transfer, save, and manage information. ICT occasionally has become crucial to the teaching-learning interaction through strategies like switching from chalkboards to interactive digital whiteboards, using students' own smartphones or other devices for learning during class time, and the "flipped classroom" model, where students watch lectures at home on a computer and use class time for more interactive exercises.

In this chapter, background, the problem statement, purpose, objectives, research questions, significance, scope, and conceptual framework of the study are discussed.

1.1 Background to the study

The background to the study is discussed according to historical, theoretical, conceptual, and contextual perspectives.

1.1.1 Historical Perspective

According to Walsham (2017), the term "ICT" has been used by academic researchers since the 1980s though it is only recently that it has been applied to the academic area that examines its use in teaching and learning. According to Web (2019), the British Royal Society's recommendation in 2012 was that the National Curriculum use computing with effect from

2014, which reflects the addition of computer programming into the curriculum that served as a signal for the integration of ICT into the curriculum. With this new development, various countries have tried and many and have succeeded in using ICT to enhance academic performance. Khalil (2018) states that ICT widely ignites learners' interest and its use contributes to universal access to education, equity in education, more efficient education management, governance and administration. Gomendio (2017) established that teachers in the United States, United Kingdom, Germany, Russia, and Japan always use computers in classrooms and that makes teaching/learning more versatile and goal-oriented, by promoting co-operation, and encouraging creativity in learning.

ICT applications are viewed as being extremely useful by 50% of respondents, according to Wael's study (2018, Saudi Arabia), which looked into how to use ICT to increase performance. However, only a small percentage of participants (4%) said they always use ICT applications to complete their homework. On the other side, Ghavifekr and Rosdy (2015) found that in China, a National Educational Technology Standard for Teachers was released with ICT at its core to enable 76% of the teachers to master necessary knowledge, skills, and application ability of ICT. Besides, Feng (2017) noticed that 97% of teachers in China are tasked to receive training and pass assessments based on the standard as a way of enhancing the use of ICT for improved performance of learners.

In a related development, Kinder (2019) indicates that in Germany and Poland, about 92% use of ICT is intended for quality education. In order to better understand the nature and significance of predictors for secondary school teachers' in-class use of information and communications technology, Kerstin (2019) found that 72% of use of digital media to promote quality education in Germany is based on school characteristics, teachers' attitudes and teacher collaboration.

According to Impedovo and Touhami (2016), a study conducted in three teacher training colleges in France (IUFM) into how Physics and Chemistry (Science) teachers are prepared to use ICT before 2010 found that trainee teachers use ICT sparingly because they frequently feel underprepare d, necessitating the creation of a draft training course that would encourage these teachers to use ICT in the classroom.

According to research by Simin et al (2016), Malaysia runs an ICT program for schools called the Smart School Project (SSP), where schools are encouraged to enlist the help of various stakeholders, parents, community groups, and private sector organizations on their own initiative because the MoE can only gradually equip schools with technology. Simin, et al. (2016) claim that SSP makes it possible for schools to get computers with Internet access, and teachers are encouraged to use those computers in their lesson plans.

UNESCO (2019) report shows that the introduction of ICT has also started to completely revolutionize the educational programs of many developing countries. However, there are still visible gaps in ICT integration whereby 52% developing countries have not fully adopted this approach. Alalubosa (2019)'s study in West of Africa shows that Nigeria introduced the use of ICT in teaching to enhance the teaching and learning of science subjects though attitudes of 65% teachers are negative and they stick to old ways of doing things, though the government is willing to provide electronic devices.

Nadera (2015) reported that Algeria's Ministry of Education is integrating ICT into the educational system and using it as a tool for teaching and learning in order to improve the management system's productivity, efficiency, and effectiveness. However, Marshall and Wal (2016) observed that teachers still do not want to use ICT in the teaching and learning process

and that there is still a significant disconnect between the use of technology for pedagogical goals and the intended outcomes.

ICT integration into teaching and learning will benefit students, teachers, tutors, parents, and the general community of a given country, according to a study by Margarete and Martin (2013). ICT policies also offer a rationale, a goal-setting framework, and a vision of how educational systems ought to operate. According to Bambino (2019), a number of international organizations from the United States, Norway, Germany, Ireland, and Sweden contacted the Uganda National Council for Science and Technology (UNCST) in 1998. The UNCST was given the chance to create ICT policy based on different industries, with a primary focus on education.

Glen (2017) states that Uganda's original national ICT policy was created in 2003. It was acknowledged in the policy framework paper that Uganda would have to adopt the principle of "lifelong education for all." The policy's objective 2 focuses on improving literacy and developing human resource capacity through a variety of strategies, such as: incorporating ICT into regular educational curricula along with other literacy; developing and managing ICT centers of excellence to provide basic and advanced ICT training; creating mechanisms that foster collaboration between industry and training; and establishing institutions.

The Uganda National Council of Science and Technology (UNCST) launched the nation's ICT policy formulation process in Uganda in 1998 (Torach et al., 2006). The UNCST presented a draft national ICT policy framework to the cabinet in 2002, five years later, and it was ratified the following year. Uganda would need to adopt the goal of lifelong education for all, according to the policy framework paper.

Teachers in Uganda play a crucial role in improving socioeconomic conditions in society by teaching kids and giving them the knowledge, skills, and habits they need to survive in a constantly changing environment. Edoru and Adebayo (2020) claim that Makerere University adopted ICT to increase the efficiency of educational services delivery. As a result, ICT benefits the community in commerce, medicine, education, and business success. Universities are therefore forced to integrate ICT in teaching, learning, and administrative tasks as a matter of necessity. The study found that factors contributing to the underutilization of ICT included a lack of ICT knowledge and skills, a constrained electrical supply, subpar PCs, and inadequate computer accessories.

The results of Mlay and Humphrey's (2019) study shows that ICT usage, family culture, school culture, and disposable income have a substantial impact on university students in Uganda's reading habits. However, the majority of the research on ICT and reading has been done in western nations.

ICT integration in Teacher education was piloted by Connectivity for education project (CONNECT-ed) in Shimoni Core PTC (Central), Mukuju Core PTC (Eastern), Gulu Core PTC (Northern) and Bushenyi Core PTC (Western) from 2000 – 2007. This led to the construction of computer laboratories in Primary Teachers' Colleges. KyU computer lab was equiped and it spearheaded the training of tutors in ICT. The project was later expanded to Kibuli CPTC, Ndegeya CPTC, Soroti CPTC and canon Lawrence PTC. The Ministry of Education and Sports (MoES) through the department of Teacher (Tutor), Instructor Education and Training (TIET) roled it down to all PTCs. This led to the introduction of ICT in the PTE curriculum. Tell us what happened after introduction.

1.1.2 Conceptual Perspective

In this study, Information and Communication Technology (ICT) is the independent variable. ICT is described by Kendra and Imaniyal (2020) as the integration of computer networks, telephone networks, and video and audio networks through a single cable or connection system. When managing tasks in the teaching and learning of science subjects in PTCs, ICT refers to the employment of the PowerPoint program, YouTube videos, Zoom meetings, radios, and televisions to make demonstrations and Instructional Materials. According to Agbetuyi (2017) and Showole et al (2015), Information and Communications Technology (ICT) is a broad term that emphasizes the importance of unified communications and the integration of telecommunications, including phone lines and wireless signals, computers, as well as necessary enterprise software, middleware, storage, and audio-visual systems, enabling users to access, store, transmit, and manipulate information.

According to Crouch and Mazur (2015), a pre service teacher is a student who is enrolled in a teacher preparation program, typically at a college or University, and has not yet began their teaching career.

MacRae et al., (2020) define Performance as completion of a task with application of knowledge, skills and abilities. In the study, the concept “Performance” details the completion of assignments after mastering concepts given to studnets in classrooms. It even extends to a level of obtaining average or above average marks. Academic performance in science refers to marks that a student has obtained after sitting for an examination, test or regular classroom work. It can also mean the knowledge obtained about use of ICT resources during the teaching/learning of science subjects such as Chemistry, Physics, Mathematics and Geography.

Primary Teachers' Colleges operationally refer to institutions mothered by Kyambogo University to train Grade III teachers who eventually qualify with a teachers' certificate to teach in primary schools.

1.1.3 Theoretical Perspective

The diffusion Theory advanced by Rogers in 2003 guided this study to explain integration of ICT during the teaching/learning of science subjects. The theory's fundamental premise is that technological breakthroughs diffuse or penetrate populations in a typical bell-shaped manner. The theory makes a distinction between five adopter segments in this diffusion pattern and makes fixed assumptions about their size, characteristics, and adoption determinants for each segment. According to Rogers (2015), a set of product features, including relative advantage, complexity, compatibility, trial ability, and observation, are thought to be responsible for determining innovativeness. For instance, it is hypothesized that innovators and early adopters see relative benefit as being higher than that of majority segments and complexity as being lower (Marez et al., 2015). The idea is pertinent to this study because it promotes the incorporation of ICT in education to keep up with the times, in which everyone thinks that using ICT makes work easier and improves service efficiency.

Globally, we live in an information society, and according to a study by Lieven et al (2011) about diffusion theory and the ICT environment, distribution, integration, use, and manipulation of (digital) information has grown to be a significant economic, political, and cultural activity worldwide. For this reason, it cannot be ignored in academic circles.

Diffusion theory was applied by Zhang et al. (2015) to examine patient acceptance and utilization of consumer e-health technologies. In the study, an electronic appointment scheduling

system was created and put into use in a primary healthcare clinic in a small Australian town. A 29-month longitudinal case study was conducted following system adoption. The overall adoption rate of the e-appointment service increased gradually from 1.5% at 3 months after implementation to 4% at 29 months, meaning that only the 'innovators' had used this new service, according to data gathered from the computer log records of 25,616 patients who visited the medical center during the entire study period and from in-depth interviews with 125 patients. Almost all patients rejected this innovation.This example is largely from the health profession but the theory can be adopted to inform the teaching/learning of science using ICT, as regards integration of ICT and performance of pre-service teachers in science subjects.

1.1.4 Contextual Perspective

Using ICT to improve and extend teaching and learning across a wide range of subject areas has proven challenging for many higher education institutions in Uganda, and understanding the issues regarding encouragement, support, and infrastructures required to achieve this has proven challenging. However, there are other institutions where the majority of the staff has incorporated ICT use into their working procedures, changing the way they now teach and study while also coming up with new ones. Despite having resources and an apparent willingness to utilize ICT, it is not clear whether both public and private Primary Teachers' Colleges in Iganga District have recorded successes with ICT use.

Failure to use ICT in the teaching/learning process results into lack of updated information about subject curriculum, lack of motivation for students to earn especially considering that this is era marred by use of smart phones among the youths, and finally reduction in the quality of education among others.

From primary to tertiary level educational institutions in Uganda, a number of efforts have been started to enhance digital literacy and ICT integration (Ghavifekr & Rosdy, 2015; Saavedra & Opfer, 2012;). Among the efforts in place, the Ministry of Education and Sports facilitates establishment of computer laboratories in PTCs to promote computer literacy among tutors and student teachers so that they develop 21st century skills needed for effective enhancement of the teaching/learning process (UNESCO, 2019). Nonetheless, the ICT skills and the academic performance of the graduates from these institutions is highly questionable today.

1.2 Statement of the Problem

Uganda's Ministry of Education and Sports is advocating for ICT integration in the teaching/learning processes to make the teaching/learning environments motivating to students, making them self-reliant and promoting goal-orientation, interactivity, and effective feedback (Rodrigues & Oliveira, 2014). Since 2015, ICT courses appear on the Primary Teacher Education Curriculum for Professional Studies as an independent aspect and also with related aspects in other disciplines offered by public and private PTCs. Despite this, students' scores in ICT related tasks and Science subjects (Integrated Science Education, Mathematics Education, Agriculture Education and Physical Education) are comparatively poor as observed from the Grade III final examinations results for the period 2017 to 2019 (Nabunya et al., 2020). Evidence shows examination scores are below 70%, scores in regular tests are below 50% for majority of the pre-service teachers. In the recent past, MoES also noted poor performance in Science related subjects during the release of Grade III certificate Examinations 2019 results despite government's interventions in PTCs including the effort to integrate ICT in the PTE curriculum, and thus retool tutors (MoES, 2020). This has serious implications on the quality and competence of the teachers in particular and primary education in general. In public and private

PTCs in Iganga District where this study was conducted, the student teachers' mastery and proficiency in ICT on one hand and their ability to apply the ICT knowledge and skills in science related subjects on the other, was in question. This was the knowledge gap and a critical issue which this study set out to address.

1.3 Purpose of the Study

The study was designed to establish the relationship between Information Communication Technology and Pre-service teachers' Academic Performance in Science subjects in Primary Teachers' Colleges in Iganga District.

1.4 Objectives of the Study

The study was guided by the following objectives;

i. To explore the ICT resources available to facilitate the teaching/learning of Science subjects in Primary Teachers' Colleges.
ii. To examine students' interest towards use of available ICT resources in Science subjects in Primary Teachers' Colleges.
iii. To establish the relationship between the use of available ICT resources and Pre-service teachers' academic performance in Sciences in Primary Teachers' Colleges.

1.5 Research Questions

The study was guided by the following questions;

i. What ICT resources are available to facilitate the teaching/learning of Science subjects in Primary Teachers' Colleges in Iganga?

ii. To what extent are pre-service teachers interested in the use of ICT as far as teaching of science is concerned?

iii. How does the use of ICT in Science subjects in Primary Teachers' Colleges in Iganga District improve performance in science subjects among pre service students?

1.6 Hypothesis

HO_1 There is no relationship between use of Information Communications Technology and Pre-service teachers' academic performance in Science subjects in Primary Teachers' Colleges in Iganga District.

1.7 Significance of the Study

The study may be crucial to the following stakeholders:

This study may be significant to District Education Administrators, policy makers at the Ministry of Education and Sports, College Principals, tutors, pre-service teachers and researchers as explained in the following paragraphs.

It may lead to findings that can be used by District administrators to establish whether PTCs have ICT equipment which can be used in the teaching/learning of science subjects. If otherwise, it may be a platform upon which to solicit for necessary ICT equipment for use.

To policy makers, the study may provide support information on the role of ICT integration in teaching/learning of science subjects such that mandatory policies are designed to ensure that ICT integration is made part of the approaches used in teaching of sciences in PTCs.

The study may also be of help to the Ministry of Education and Sports in providing necessary support to enhance ICT integration in the teaching/learning of science subjects in PTCs.

College Principals may use findings to lobby for resources such as ICT laboratory and equipment where they may be inadequate so as to enhance the integration of ICT for effective teaching/learning of Science subjects.

In the same vein, as a tutor of Science, this study provides extensive information on the relevance of using ICT in teaching of science subjects that other stakeholders advocated for and thus necessary for enhancing the quality of science education.

The findings may also add onto the existing pool of knowledge in the world of academia.

1.8 Scope of the Study

1.8.1 Content Scope

The study was limited to Information Communications Technology as the independent variable and Pre-service Teachers' academic performance in science related subjects in selected Primary Teachers' Colleges as the dependent variable (Ashley, 2021). The study specifically; explored the Information Communication Technology resources available to facilitate the teaching of science subjects in selected Primary Teachers' Colleges, ascertain the influence of students' interest towards use of ICT on academic performance in Science subjects in the selected Primary Teachers' Colleges, and establish the relationship between ICT and Pre-service teachers' academic performance in Science subjects in the selected Primary Teachers' Colleges.

1.8.2 Geographical Scope

The study was conducted in Iganga District, in Eastern Uganda. The study was conducted in Iganga because the researcher observed a high failure rate in Science subjects in the District (Ayub & Rahman, 2019). The study covered two (2) Primary Teachers' Colleges selected from

Iganga District. One (1) of them was a public (Government aided) Primary Teachers' College, and the other was a private College for comparative analysis.

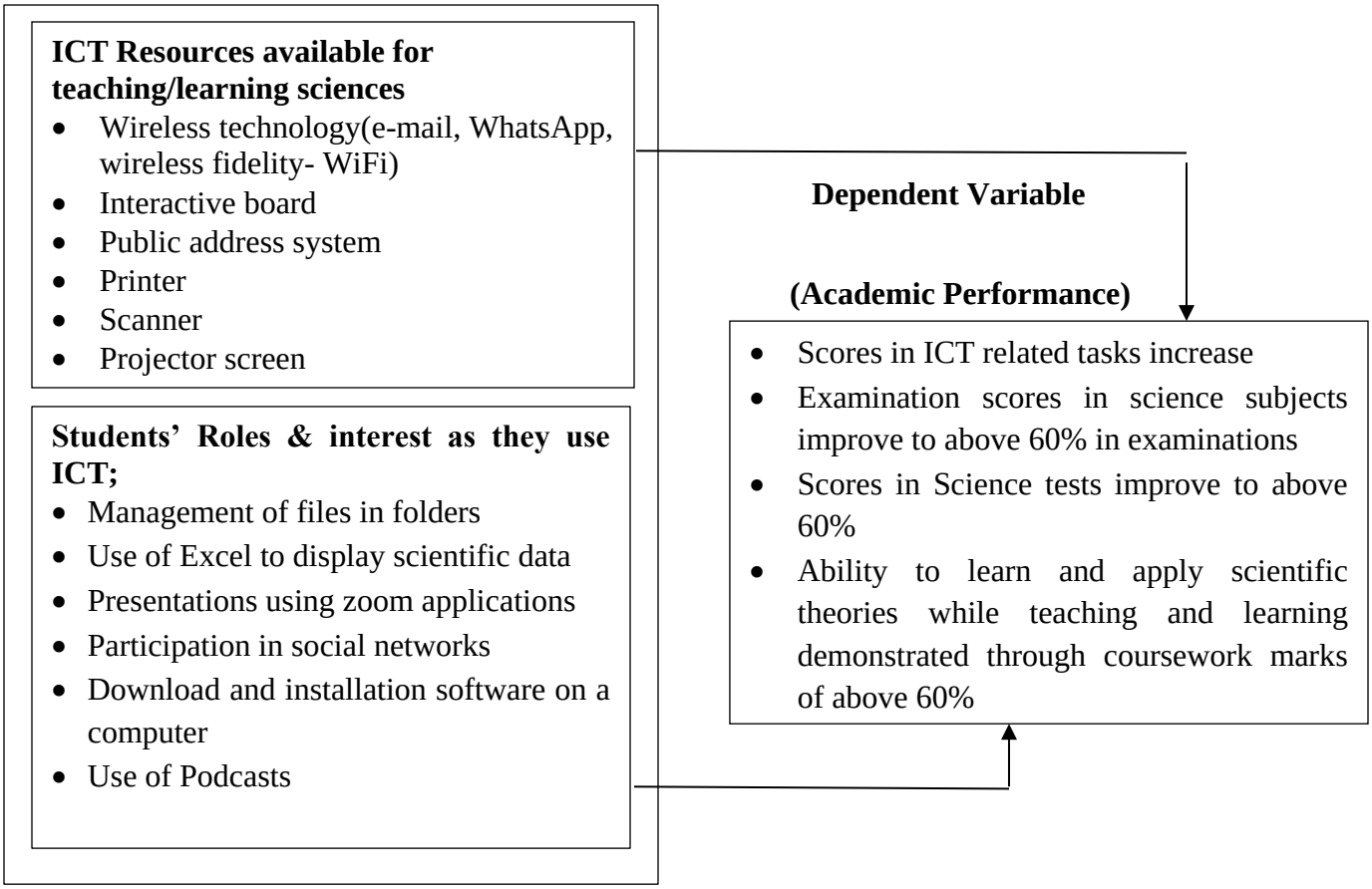
1.8.3 Time Scope

The study focused on a period ranging from 2016 to 2021 because during this period, vigorous reforms have been adopted and implemented as far as Information and Communications Technology is concerned. This was also due to the extensive outcry for the use of online teaching due to COVID-19 emergence that greatly hit the physical meetings and classroom interaction was hampered (Amanya et al., 2021).

1.9 Conceptual Framework

Independent variable

(Information Communication Technology)



Adopted by the researcher from, Source: Adefunke (2018); Aheimbisibwe (2019); Chandana et al (2011)

The conceptual framework clearly illustrates the assumption of the study. The independent variable (ICT) is measured through ICT resources and students' interests towards use of ICT resources. The assumptions are that ICT resources such as wireless technology, projector, and interactive boar, among others are expected to influence the Pre-service teachers' academic

performance. there is a belief that if Primary Teachers' Colleges provide or make the resources available, the possibility of enhancing scores in ICT related tasks are high.

It is also assumed that if the students' interest towards use of ICT is positive, they will go ahead and use available resources in the teaching/learning of science subjects, which in turn will lead to improved academic performance. However, the conceptual framework illustrates that even when the ICT resources are available and students' interests towards use of these ICT resources is positive, the attainment of good grades in subjects may fail especially considering that students may not have ICT literacy skills, and power supply may not be evident, among other things. Therefore, if it is established that ICT use really leads to students' academic performance but it's not reflected in PTCs, then these extraneous variables are acting as contradicting factors.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter explores literature related to ICT resources available to facilitate the teaching/learning of sciences, Students' Interest towards the use of ICT and relationship between ICT and Pre-service teachers' academic performance in sciences in Primary Teachers' Colleges.

2.1 The ICT resources and the teaching/learning of sciences

Morling et al (2018), audience response systems; A Classroom Response System (CRS) or Audience Response System (ARS), commonly called "Clickers" at the United States Military Academy (USMA), refers to a response system that allows instructors in a face-to-face classroom to collect real-time data that include such things as assessments, testing, or polls. According to Siau et al (2016), this ARS system is provided in schools mainly in America to help students become more interactive and adopt a more favorable attitude in many types of large undergraduate courses in information systems, computer science, engineering, biology, psychology, chemistry and a wide range of others with positive impact.

Bruillard (2013) states that spreadsheets and CD-ROMs are frequently encouraged for usage in science lectures. According to Kerstin (2019), CDROMs are seen as offering low-cost access, quick and simple search tools, and a plethora of material in numerous forms. It's also likely that students could benefit from thinking about the symbolic world of equations and formula, the macroscopic world of common materials, and laboratory procedures, courtesy of the interactive graphics and links present in CD-ROMs.

Data loggers and sensors are also used to facilitate the teaching/learning of sciences. Data loggers are essentially small, portable devices that may collect data from a variety of sensors. The collected data can then be altered in a variety of ways by some when linked to a PC. There are numerous varieties available on the market made expressly for use in schools. The majority of them may be utilized with detachable sensors, according to Di Francia et al., (2020). The most frequent sensors are those for temperature, sound, light, and movement. For many loggers, PH, voltage, conductivity, and location sensors are also available.

A lot of people use email as well. Since the middle to late 1980s, those schools who could afford them have had access to a number of user-free electronic mail (Email) networks, including National Geographic, Kidsnet, CompuServe, Dow Jones, and The Source. Chiu & Linn (2012) noted that university faculty have been using email to communicate with one another for a while, as have K–12 teachers recently. In some pre-service education classes at colleges of education, email is currently being tested to see if it enhances communication between students and instructors.

Another resource is the Internet, which offers a number of services that can be used in chemistry instruction. The usage of electronic discussion has been around for a while, and now teachers are beginning to organize courses and discover exercises or teaching resources on the web (Aksela, & Haatainen, 2019). In this study, 17 secondary school students utilized the Internet in three distinct lessons to research, review, and discuss ozone-related information (Menke, & Paesani, 2019). The first lesson's objectives were to gather and assess information regarding ozone, while the second and third lessons' objectives were to debate it. The students sent 20 messages during the first class, and over 100 messages during the discussion lessons.

The teaching and learning of science is also aided by computerized molecular modeling. In chemistry instruction, molecular models are frequently used to explain and investigate phenomena. However, there is typically only one kind of model utilized, and its significance is not given enough attention. The benefit of computerized molecular modeling (CMM) is the ease and comfort with which molecules of any size and color may be constructed for use in a variety of presentations (Menke, & Paesani, 2019). Therefore, having realized that molecular modelling is not only denied adequate attention but also not very common in schools, a study such as this, which investigates into the ICT resources available for the teaching of science in PTCs applies this literature to ascertain whether PTCs emphasize availability and utilization of the molecular modelling.

2.2 Students teachers' Interest towards the use of ICT

Adefunke (2018) claims that, along with reading, writing, and math, understanding ICT and mastering its fundamental skills and concepts are now considered to be crucial elements of education in America. ICTs, however, go beyond only "computers and computing-related activities," as is sometimes thought (Adefunke, 2018). Fortunately, this is not the case because, although while computers and their applications play a significant role in modern information management, other technologies and/or systems also contribute to the phenomena known as ICTs (Quiambao, 2023). These technologies are such as emerging smart tourism destination (STD) which relates to tourism activities Ivars, Marco, & Marzon (2019); Social media, mobile devices, portals, platforms for crowdsourcing, and planning assistance as stated by Yanliu (2018) as used during smart governance.

Olugbenga et al., (2016) established that Teachers and students in Austria, Finland, Sweden, Denmark, and the UK generally see online education favorably and possess relatively advanced IT skills. In these countries using ICT, according to Olugbenga et al. (2016), is the gathering, retrieval, use, storage, and communication of information with the aid of computers and other small electronic devices.

Oral presentations to sizable audiences of unresponsive students appear to have virtually little impact on actual learning, according to research from a variety of areas. According to Chandana et al (2011), most students in the Middle East do not develop conceptual grasp of basic electrical and mechanical processes through regular lectures, in contrast to practical learning.

In North Africa, Gablinske (2016) noted that laboratory activities enhance pre-service teachers' constructive social relationships and development of positive attitudes and cognitive growth including science process skills. In a related study, Bernhard (2018) found that involving students in scientific lab tools enables them to engage with the data being collected. Additionally, by conducting various experiments on their own, individuals gain first-hand knowledge. They also employ models to comprehend various scientific concepts and theories.

In South Africa, Amber (2018) argues that while scientific theories and concepts are challenging to teach straight from a book, they become simpler to comprehend as students become involved in utilizing laboratory equipment, for example. They typically don't begin to figure out what they were doing all day until after the lab, when writing up the results, and this laboratory acquaintance is possible through computer based exercises using science kits.

Pre-laboratory preparation is the key to achieving this since it ensures that students will benefit significantly more from the laboratory experience if they are aware of their tasks before they

arrive. To ensure that students are well-prepared and consequently more confident, one of Bristol Chem Lab's major advances has been to move the balance of work completed outside of the lab to before rather than after the practical session (ChemLabs, 2017).

The study by Gail et al (2009) in East Africa found that students' involvement in learning is significantly impacted by their own negative attitudes. For instance, girls have a negative attitude toward science because they perceive it as a difficult subject best left to boys. There are times when students dread studying science because teachers lack the necessary skills.

And studies done on classroom involvement and interactions in science practical lessons in Western countries especially America and Canada reported that, learners' participations especially in a mixed-sex classroom tends to be poorer during practical lessons for skill development, compared to that of a single-sex classroom (American Chemical Society, 2012 and Amber, 2018) but, this study was not intended to investigate about the same? Then indicate why you include it?

Airey and Linder (2017) cited several studies, which reported that students talked less, answered, and asked fewer questions during science practical lessons. However, most studies support the conclusion that students are always being involved in science practical lessons leading to the acquisition of science process skills, the results have not been uniform, particularly concerning the magnitude of the differences observed. (Gail et al, 2009) conducted a study about students' interests in ICT, out of which the conclusion was that the difference between level of involvement in practical activities and the level of acquisition of scientific skills with regards from teachers were smaller than earlier studies suggested. As stated earlier on, most of these

studies are talking about student performance and participation at secondary school level, which information may not be applicable in PTCs, but can be referred to, to inform PTC deliberations.

2.3 ICT and Pre-service Teachers' academic performance in sciences

Students can connect various representations of scientific events and processes by using a Main Board Layout (MBL). Over the past thirty years, MBLs have been the subject of much scientific study (Tinker, 2009). According to Russell et al (2004), MBL aids students in data collecting and visualization, helping them to read graphs. Since a machine performs the majority of the technical labor in real-time in IT environments, students are liberated to solve issues, produce knowledge, and use higher-order thinking abilities.

By relieving students of data collecting and processing in the lab, sensors and data loggers can enable them concentrate on problem-solving and knowledge creation while utilizing higher-order thinking skills (Rodrigues & Oliveira, 2014).

Each sort of representation in CMM has distinct qualities, which makes it advantageous for use in the classroom. The atoms and types of bonds in the molecule can be examined using structural formula representations, but their relative volumes are ignored. Ball-and-stick models take into account atom volume but not three-dimensional structure.

Students' comprehension of 3D molecular structure, spatial cognition, modeling expertise, and meaningful learning have all been demonstrated to improve when CMM is incorporated into chemistry lessons (Dori & Kaberman, 2012; Nakhleh, 2001). The use of pre-designed animated visual e-material is more widespread in the use of ICT in Chemistry teaching and learning in an effort to aid students in connecting the macroscopic, submicroscopic, and symbolic parts of science.

Another benefit of animated visual e-material is that it can be used to illustrate the dynamic nature of activity at the submicroscopic level and lessen the emergence of alternative conceptions or misconceptions related to fundamental chemical principles (Eilks et al., 2010; Ng, 2010).

According to Murcia (2010), interactive whiteboards can enhance multimodal presentations aesthetically and promote dialogue in classroom settings. Murcia (2010) contends that interactive whiteboard technology offers a way to meet the demand for students to encounter numerous representations in the classroom. It has been suggested that interactive whiteboards could promote active participation in academic science that is connected to modern real-world science via Internet-based technology.

Research on the use of sensors and data collectors in data generation within contemporary student-oriented learning systems is documented in a body of literature. Data collectors accept and analyze the quantifiable responses that sensors generate so that they can be measured. There is evidence that using sensors and data loggers can give pupils the chance to learn about chemical principles and processes.

Students' working memory might be less taxed by using a computer to gather and represent data, freeing them up for observation and interpretation (Friedler et al., 2019). In addition to the real-time effect, the flexibility of the technology promises to be a critical component in assisting inquiry-based or discovery learning approaches, where students are required to design experiments, gather and analyze data, and communicate and debate findings and ideas in small groups over an extended period of time (Bell et al., 2010).

Ssebuliba and Bbuye (2017) found that students' interest and eagerness had increased, teachers' attitudes toward the value of smartphones in the classroom had gradually improved, and classes were becoming more participatory and engaging. Due to slow Internet connectivity, some teachers had trouble accessing educational materials, while others needed training and knowledge to use appropriate OERs that encourage interactive learning. The study suggests retraining instructors to utilize mobile devices to access the Internet, usage of open educational resources (OERs), and participatory pedagogies, especially in settings where access to computers and the Internet is scarce.

Baguma (2018) looked at a total of 50 teachers who were specifically chosen from five universities' departments of ICT, management, and social sciences. Responses from participants were gathered using a questionnaire that was custom-made. Data analysis techniques included both quantitative and qualitative approaches. The results show that teachers were enthusiastic about integrating WBL into the teaching and learning process, but they ran into certain obstacles, including sluggish internet speeds, a lack of web-based resources, a lack of technical support, etc. It also suggested potential strategies for overcoming these challenges and offers actual proof on how to incorporate new information into existing literature.

According to Nfissi and Hicham (2017) , both teachers and students can benefit from modern technology. Through the employment of various instructional methods, they aid in the professional development of teachers. On the other side, students can raise their accomplishment levels since they have access to a variety of resources. For pupils to have the chance to perform correctly in the information age, ICT use in classroom activities is crucial. This study intends to investigate the relationship between the level of support offered by academic institutions and professors' usage of computer technology for instructional purposes. The data was analyzed

using a descriptive analysis of means and standard deviations. Additionally, inferential statistics were used to account for this correlation, primarily the Pearson Product Moment Correlation. The results showed a significant positive correlation ($r = 0.59$, p .01) between the two variables.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents research design, study area, study population, sample size, sampling techniques, and procedure to data collection, data analysis, and ethical considerations that was used in this study.

3.1 Research Design

A research design, according to Djuwari, (2021), is a framework for organizing research and responding to research questions. This study employed a cross-setional survey design which according to Tashakkori and Teddlie (2015), combines both qualitative and quantitative data gathering methods, correlation, and descriptive methodologies.

The study employed a mixed methods research approach which includes the use of both quantitative and qualitative data collection and analysis research methodologies in a single investigation (Cresswell, 2018). In mixed method study, researchers gather and interpret data using both quantitative and qualitative methods (Cresswell, 2018) and the goal of employing a mixed-methods research strategy was to fully comprehend the topic.

3.2 Study Area

The study was conducted in two PTCs in Busoga Sub region, Coordinates: 00°33′N 30°45′occupying and area of over 10,000 square Kilometers. The sub-region consists of 11 Districts namely; Bugiri, Buyende, Iganga, Jinja, Kaliro, Kamuli, Luuka, Mayuge, Namayingo, Namutumba (Uganda Bureau of Statistics, 2017) and the most recent Bugweri District. Busoga

sub-region is made up of 23 Counties, 102 sub-counties, 559 Parishes and 4,012 Villages (Uganda Schools Guide, 2019). The study was carried out in Iganga District. The District hosts a public PTC and two private PTCs. One public PTC was used in the study; namely; Bishop Willis Core PTC, Iganga, and one private PTC namely; Walugogo PTC.

3.4 Study Population

Alex and Caren (2019) define a study population as a group of individuals selected based on inclusion and exclusion criteria, which relate to the variables studied. In this study, the population comprised 837 pre-service teachers on pre-service programme, because of their experience in ICT use from the college; Four (4) computer laboratory technicians who organize labs and prepare materials for use and Twelve (12) tutors of science who teach science subjects and then the three (3) principals who supervise activities in colleges under study.

3.5 Sampling

According to Shantikumar et al. (2018), sampling is a technique that enables researchers to draw conclusions about a population based on data from a sample of the larger population without looking at every person. The sample size and sampling techniques utilized in this investigation are described in this section.

3.5.1 Sample Size

Little (2017) defines a sample size as the number of observations from a population through which statistical inferences for whole population are made. To cater for expenses, and use given time of not more than two months as effectively as possible to generate relevant data, the researcher scaled the study down to a manageable and accessible population. Consequently, Two (2) PTC out of three (3) PTCs were sampled by stratified and simple random sampling

techniques, considered for their status as government aided and privately owned to keep track with the topic of study for comparative analysis. The samples and distribution of sample size per college was as follows:

Table 3.1: Target population and sample size

Category	**Bishop Willis Core PTC**		**Walugogo PTC**		Sampling Technique
	Population (N)	Sample size (n)	Population (N)	Sample size (n)	
Principal	1	1	1	1	Purposive
ICT Lab technicians	3	3	1	1	Purposive
Tutors of Science subjects	4	4	4	4	Purposive
Pre-service teachers	280	155	45	39	Stratified Random
Total population	286	Total sample = 163	51	Total sample = 45	

Source: Bishop Willis Core PTC office records, Term II 2021 and Walugogo PTC office records Term II 2021.

The sample size for the respondents is designed as illustrated above. Punzalan (2012) stated that studies that involve survey use Krejcie and Morgan (1970) table to determine the sample size in quantitative studies. This means in Bishop Willis Core PTC, 1 Principal, 3 ICT Lab technicians, 4 Science tutors and 155 Pre-service teachers (Year One and Year Two) participated in the study while 1 Principal, 1 ICT Lab technician, 4 Science tutors and 39 Pre-service teachers (Year One and Year Two) from Walugogo PTC participated in the study as indicated in the table.

3.5.2 Sampling Procedures

In this study, the researcher adopted three sampling strategies-stratified, simple random and purposive sampling.

3.5.2.1 Stratified Sampling Technique

Stratified sampling is a probability sampling approach, according to Explorable.com (2019), that enables a researcher to split the study population into subgroups based on shared traits, which may not include the full population). Stratified sampling technique used to categorize the pre-service study population into pre-service teachers basing on their specialization and on their gender.

3.5.2.3 Purposive Sampling

When choosing members of the population to participate in the study, researchers use a technique called "purposeful sampling" (Foley et al., 2021). In this method, individuals are chosen for inclusion in the study based on the researcher's personal preferences. Principals, teachers of science courses, and ICT lab technicians were each directly included in the sample size for this study since, in the researcher's opinion, their departments had the most important information and they were the only persons running it. The study targeted Bishop Willis Core

PTC (Public) and Walugogo PTC (Private that were sampled purposively given their proximity within the District in lieu of constrained finances.

3.6 Data Collection Instruments

3.6.1 Self-Administered Questionnaire (SAQ)

Self-administered questionnaires are survey instruments intended to be completed by respondents without the assistance of the researchers gathering the data, according to Lavrakas (2008). Structured self-administered questionnaires were prepared for pre-service teachers. The questionnaire was structured into section: Section A for social demographic characteristics, other sections comprising the other items which help to respond to the research objectives/questions.

3.6.2 Interview Guide

According to Polak and Green (2015), an interview is a one-on-one interaction in which the interviewer and interviewee exchange primarily semi-structured questions and responses regarding a topic of interest. The researcher used an interview outline to collect data from each principal, science subject tutors and ICT lab worker in a PTC. The researcher conducted three interview sessions of 30minutes to one hour per session. Through interviews, the researcher held verbal discussions and interactions with the principals and tutors to obtain the in-depth information about the study objectives.

3.6.3 Observation Guide

Silvermann (2017) defines an observation guide as a tool that enables the researcher to obtain data through witnessing on-going behaviors regarding areas of interest for the study. Through observation, the researcher is able to uncover details that participants frequently miss and gain access to information that people would be reluctant to share in an interview. Using an

observation guide, the researcher observed and made remarks on availability and adequacy of ICT equipment in PTCs, observe students who use the ICT equipment and how they demonstrate their willingness, then also observe and report whether or not, these students are well facilitated in their endeavor to use ICT equipment.

3.7 Procedure for Data Collection

The researcher received official authorization from the office of research for graduate school in the form of an introductory letter after supervisors gave their approval to the plan. The letter of introduction was used to tell responders that the study is purely academic and that it has no intentions of injuring anyone physically or psychologically. Kyambogo University provided this consent on behalf of the university. While testing new data collection technologies, the researcher hired and trained three research assistants.

Thereafter, the researcher made appointments with principals, tutors of science subjects and other respondents about the dates of their convenience for data collection. If possible, only principals were engaged to make appointments that were not inconvenience the rest of the respondents. This is because the principal has authority to adjust college programmes, with or without consent of other members of the institution in their jurisdiction.

During the data collection process, the researcher together with an assistant carefully selected respondents as planned, and then directed the research assistant to distribute questionnaires to only the selected pre-service teachers and allow them to respond to it fully then collect copies of fully-filled sheets. A period of not more than two weeks was granted for pre-service teachers to fill and return tools. To ease collection of results, a selected tutor of science was tasked to receive filled questionnaires back from pre-service teachers.

On the other hand, the researcher was conducting interviews with principal, tutors of science subjects and ICT laboratory technician and making necessary observations in the laboratories. Whereas each college was visited more than two times, only one PTC was visited per day. Moreover, a letter of acceptance was fully signed by respondents from each college and given to the researcher as a basic proof of study in each case.

The collected data from each PTC was checked properly for inconsistencies, coded, entered in to personal computer, and analyzed for reporting by the researcher. Thereafter, the questionnaires and the recorded verbal responses were kept safely for future reference.

3.8 Data Quality Control

This consists of validity and reliability of the research instruments

3.8.1 Validity of the Instruments

As per Amin (2005), validity describes the level to which data gathered using research instrument items precisely reflects the real topic area of investigation and provides authentication that the collecting equipment is measuring what it's expected to be measuring. The validity of the instrument was ascertained by expert judgment by the help of the two supervisors such that the coefficient of validity is at least 0.7 as stated by Amin (2005). Therefore, the research instruments were considered valid only if the validity index was equal or greater than 0.7. The researcher made advantage of a Content Validity Index (CVI) to measure the validity of the instrument given by;

$$CVI = \frac{\text{No. of items declared valid}}{\text{Total No. of items}}$$

$$CVI = \frac{22}{26} = 0.85$$

It can be concluded that the questionnaire was valid for data collection since the CVI of 0.85 was above the recommended value of 0.7 according to Amin (2005).

3.8.2 Reliability of the Instruments

The reliability results were evaluated using a Cronbach Alpha threshold of 0.7 or higher. According to Crombach Alpha's scale for evaluating reliability, any score below 0.60 indicates an unacceptable level of reliability, while scores between 0.60-0.69 define results that are only marginally reliable, 0.70-0.79 results that are reliable, 0.80-0.90 results that are highly reliable, and >0.90 results that are extremely highly reliable.

3.9 Data Presentation and Analysis

3.9.1 Quantitative Analysis

Data was analyzed descriptively in Statistical Package for Social Scientists (SPSS) to obtain frequencies, percentages, mean and standard deviations. The demographic characteristics of respondents were analyzed using frequency and percentage ratings. To explore the ICT resources available to facilitate the teaching of sciences in selected Primary Teachers' Colleges, a summary table was prepared containing frequency and percentage responses against each ICT item. This was followed by analysis in percentages aligned with interpretations and researcher's observations respectively.

On the other hand, to ascertain the influence of students' interest towards use of ICT on academic performance in Science subjects in the selected Primary Teachers' Colleges, students' interest towards ICT was graded using mean and standard deviations. Average Mean and average standard deviation was calculated and used as a threshold to measure the strength of items. It is by statistical rule that any item scoring an equivalent or more than average mean

score with correspondingly less standard deviation compared to average standard deviation is of high bearing in line with intended explanation and statement under description. In addition, a compound regression analysis was run to determine the influence of each of the descriptions of pre-service teachers' interest towards use of ICT equipment and the performance in science subjects.

In order to establish the relationship between ICT and student teachers' academic performance in science subjects in the selected Primary Teachers' Colleges, two approaches were followed as above. First, items for ICT usage was determined and graded using the scale as indicated above in line with mean score and standard deviation. Later on, correlation analysis by Pearson model was run to establish the relationship between ICT and student teachers' academic performance in science subjects in the selected Primary Teachers' Colleges.

3.9.2 Qualitative Data Analysis

Thematic analysis was used to assess qualitative data. Thematic analysis is the process of finding common themes and patterns in a dataset in order to answer specific research questions (Henning & Van-Rensburg, 2004). Thematic analysis involved the transformation of key informants' views, opinions, and perceptions by the researcher into themes or patterns in relation to the research questions.

Data from interviews were analyzed using Creswell's (2018) six-step data analysis procedure. The first step, which involved organizing and preparing the data for analysis, involved transcription of interviews and focus group discussions to produce written transcripts. This step also included typing up field notes, cataloguing all the visual materials such as observation checklists, sorting and arranging the data. The second step involved reading through the data, in

order to reflect on the overall meaning and to gain a general sense of the information and ideas that the participants convey. Thirdly, coding of notes from the lesson observations and focus group discussions as well as interview transcripts followed, to reflect emerging ideas. In the fourth step, which is generalization, the researcher integrated the codes, thereby generalizing to form broader themes. Fifthly, the researcher provided descriptions of the themes and include quotable quotes (participants' voices) from the transcripts to illustrate them. The sixth step, which is interpretation, then followed, where the researcher used relevant literature to make sense of, as well as support the themes. During my own interpretation process, my experience as a former student informed my understanding of the participants' stories. To convey the participants' perceptions of their experiences accurately, I focused specifically on what they were saying, the conclusions they drew, and their intentions for future practice

3.10 Ethical Considerations

Given that some of the topics addressed have to do with the security of their job, care was taken to preserve respondents' or participants' reputations. In addition, participants and respondents were given the assurance that the study was conducted solely for academic objectives, and the self-administered surveys were purposefully anonymous.

In order to prevent the dissemination of false results and the fabrication of information, the researcher ensured that the findings were exactly what was presented. The researcher saw respect for knowledge and the quest of truth at this level. Each respondent was asked to sign a consent form in order to ensure all of this.

In order to encourage voluntary involvement in the study and to ensure that all respondents and participants received equal treatment, all respondents and participants were treated equally.

Flexibility was also built in so that it was quite possible for a participant or respondent to leave the activity at any point without being penalized.

A formal authorization letter from the Directorate of Research and Graduate Training was obtained to state that this study is entirely academic and prevent potential responder bias. Withholding participant/respondent identities to prevent traceability was done in accordance with their right to privacy.

The researcher made every attempt to maintain the highest anonymity by giving participants code names or numbers on all research notes and papers and by locking up notes and any other information that could be used to identify a participant. Additionally, participant information was kept private throughout because there was no requirement for the researcher to disclose abuse or suicidal risk situations.

All respondents and participants were treated equally to ensure their anonymity, allowing them to participate voluntarily and free from prejudice and unreal expectations. The researcher and responders established an agreement over the precise dates, time, and convenient location to collect data.

In order to make sure that no one's privacy was violated during audio recordings and interviews, respondents' signed consent and assent was collected. The responses were also treated with respect and dignity. Last but not least, all academics and researchers whose work was referenced in this study were correctly quoted and cited.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presents the findings of the study on Information Communication Technology and Pre-Service Teachers' Academic Performance in Science Subjects: A Case of Primary Teachers' Colleges, Iganga District, Uganda. The study involved participants from Bishop Willis Core Primary Teachers' College (PTC) and Walugogo PTC, including pre-service teachers and academic staff. The analysis and interpretation of the data collected were conducted in relation to the study objectives, research questions and hypotheses. The chapter begins with the response rate achieved in the study, followed by the demographic characteristics of the respondents. It then provides descriptive and inferential statistical analyses for the specific objectives that were set. The presentation of the data collected through questionnaires and interviews was done using statistical tables for clarity. The first section, 4.1, discusses the response rate registered in the study.

4.1 Response Rate

Table 4.2: Response Rates

Method	**Target response**	**Sample size**	**Response Rate (%)**
Bishop Willis Core PTC			
Questionnaires	174	163	93.68
Interviews	5	5	100
Total	**179**	**168**	**93.85**

Walugogo PTC			
Questionnaires	45	45	100
Interviews	5	5	100
Total	**50**	**50**	**100**

Source: Field data, 2021

In this study a total of 229 tools were administered, comprising 219 questionnaires and 10 interview guides. These tools targeted participants at Bishop Willis Core PTC and Walugogo PTC. Out of the 219 questionnaires distributed, 208 were completed and returned while all 10 interviews were successfully conducted. This represents an overall response rate of 94.8% for the questionnaires and 100% for the interviews. The response rate for Bishop Willis Core PTC was 93.68% for questionnaires with 163 out of 174 questionnaires completed, and a perfect 100% for the 5 interviews. Similarly, Walugogo PTC achieved a 100% response rate for both questionnaires (45 out of 45) and interviews (5 out of 5). The total response rate for Bishop Willis Core PTC was 93.85%, while Walugogo PTC maintained a 100% overall response rate. The high response rate conforms to the guidelines of Mugenda and Mugenda (2003), who suggest that a response rate of 50% is adequate for analysis and reporting, 60% is considered good, and 70% and above is excellent. The impressive response rate in this study was attributed to the researcher's efforts in personally administering the questionnaires and explaining the purpose of the study, thereby encouraging active participation. Additionally, follow-ups with respondents helped ensure the timely completion and submission of the questionnaires, contributing to the high overall response rate.

4.2 Respondents Bio-data

Before capturing information on the objectives that were set for the study, the researcher sought information on their background characteristics (age, gender, average number of students per stream) and their responses are recorded in the following tables and themes below

4.2.1 Age of the respondents

Table 4.3: Age of the Respondents

Age of Respondents	**Bishop Willis Core PTC**	**Walugogo PTC**
Under 20	71 (43.6%)	16 (35.6%)
From 20 – 29	88 (54.0%)	25 (55.6%)
From 30 – 39	1 (0.6%)	00
From 40 – 49	2 (1.2%)	2 (4.4%)
50 or more	1 (0.6%)	2 (4.4%)
Total	**163 (100.0%)**	**45 (100.0%)**

Source: Field data, 2021

The findings in Table 4.3 present the age distribution of student teachers at Bishop Willis Core Primary Teachers' College (PTC) and Walugogo PTC in Iganga District. At Bishop Willis Core PTC, a majority of respondents (54.0%) are between 20 and 29 years with a significant proportion also being under 20 years (43.6%). This indicates that the student population in this PTC is primarily young, likely fresh out of secondary school or early in their tertiary education. The low percentage of older respondents (1.2% aged 40-49 and 0.6% aged 50 or more) suggests that very few mature individuals are pursuing teaching certification in this institution. In comparison, Walugogo PTC shows a similar trend with 55.6% of its respondents being aged 20-

29 and 35.6% under 20, further emphasizing the youthfulness of the population. However, there is a slightly higher representation of older students with 4.4% of respondents aged 40-49 and 4.4% aged 50 or more. This reflects the flexibility of the teaching profession in attracting individuals from various age groups, particularly those seeking career changes or late professional development. When examining the potential impact of Information Communication Technology (ICT) on student teachers' academic performance in science subjects, these findings highlight the importance of tailoring ICT training and resources to a predominantly young and tech-savvy audience. Both colleges can leverage this youthful demographic to introduce innovative ICT-based teaching methods that enhance the learning experience in science subjects. For the older respondents, more tailored ICT training may be needed to ensure they are comfortable with digital tools, bridging the generational gap in technological competence and maximizing academic performance across all age groups.

4.2.2 Gender of the respondents

Table 4.4: Gender of the respondents

Gender of Respondents	**Bishop Willis Core PTC**	**Walugogo PTC**
Male	70 (42.9%)	27 (60.0%)
Female	93 (57.1%)	18 (40.0%)
Total	**163 (100.0%)**	**45 (100.0%)**

Source: Field data, 2021

The table 4.4 presents the gender distribution of respondents from two Primary Teachers' Colleges (PTCs) in Iganga District, Uganda, in relation to their academic performance in science subjects and the use of Information Communication Technology (ICT). In Walugogo PTC,

60.0% of the respondents were male while 40.0% were female. At Bishop Willis Core PTC, however, the gender distribution shows a higher percentage of female respondents (57.1%) compared to males (42.9%). These findings shows the gender distribution between the two institutions where Walugogo PTC has a majority of male respondents while Bishop Willis Core PTC has a predominance of female respondents. In regard to ICT and academic performance in science subjects, this variation in gender composition influenced the engagement and learning outcomes of pre-service teachers as this was essential for both PTCs to adopt gender-inclusive strategies in the integration of ICT to enhance the academic performance of all students in science subjects.

4.2.3 Average number of students per stream

Table 4.5: Average number of students per stream

Average Number of Students per Stream	Bishop Willis Core PTC	Walugogo PTC
Less than 30	11 (6.7%)	00
30-39	31 (19.0%)	00
40-49	23 (14.1%)	45 (100.0%)
50-59	56 (34.4%)	00
60 and above	42 (25.8%)	00
Total	**163 (100.0%)**	**45 (100.0%)**

Source: Field data, 2021

The table 4.5 presents the distribution of the average number of students per stream in two Primary Teachers' Colleges in Iganga District, Uganda. At Bishop Willis Core PTC, the majority of the streams (34.4%) have 50 to 59 students, followed by 25.8% of streams with 60 or more

students, and 19.0% with 30 to 39 students. A smaller percentage of streams have fewer than 30 students (6.7%) or 40 to 49 students (14.1%). In contrast, all streams at Walugogo PTC have an average of 40 to 49 students (100.0%). These findings suggest that there are differences in stream sizes between the two institutions with Bishop Willis Core PTC having a more varied distribution of student numbers per stream while Walugogo PTC maintains a uniform stream size. This variation in stream sizes influences classroom dynamics and the implementation of teaching strategies particularly in relation to Information Communication Technology (ICT) and its role in enhancing academic performance in science subjects.

4.2.4 Integration of ICT in the teaching/learning process of other subjects

Table 4.6: ICT Integration in the teaching/learning process

ICT Integrated in Teaching/Learning	Bishop Willis Core PTC	Walugogo PTC
Yes	115 (70.6%)	32 (71.1%)
No	48 (29.4%)	13 (28.9%)
Total	**163 (100.0%)**	**45 (100.0%)**

Source: Field data, 2021

The table 4.6 presents findings on whether Information Communication Technology (ICT) is integrated into the teaching and learning processes of other subjects in two Primary Teachers' Colleges in Iganga District, Uganda. At Bishop Willis Core PTC, 70.6% of the respondents indicated that ICT is integrated into the teaching and learning of other subjects while 29.4% reported that it is not. Similarly, at Walugogo PTC, 71.1% of the respondents reported ICT integration with 28.9% indicating that ICT is not used in the teaching of other subjects. These findings suggest a strong presence of ICT integration in both colleges with a similar majority of

respondents from both institutions confirming its use in teaching and learning processes. The integration of ICT contributes significantly to improving the academic performance of pre-service teachers, particularly in science subjects by providing access to digital resources and enhancing interactive learning experiences. However, the data also reveals that a notable proportion of respondents (around 30%) still experience a lack of ICT integration, suggesting the need for further investments in ICT infrastructure and training to ensure its full adoption across all subjects.

4.2.5 Ownership of ICT devices for Use in PTC

Table 4.7: Pre Service teachers' Ownership of ICT devices for use in PTC

ICT Device Owned	**Bishop Willis Core PTC**	**Walugogo PTC**
Desktop computers	81 (49.7%)	38 (84.4%)
Laptops	43 (26.4%)	7 (15.6%)
Tablet PC	31 (19.0%)	00
Netbooks for use in ICT lessons	8 (4.9%)	00
Total	**163 (100.0%)**	**45 (100.0%)**

Source: Field data, 2021

The table 4.7 presents the ownership of various ICT devices by respondents in two Primary Teachers' Colleges in Iganga District, Uganda. At Bishop Willis Core PTC, 49.7% of the respondents own desktop computers, 26.4% own laptops, 19.0% own tablet PCs and 4.9% own netbooks specifically for use in ICT lessons. In contrast, at Walugogo PTC, a majority (84.4%) of respondents own desktop computers while only 15.6% own laptops. There is no ownership of tablet PCs or netbooks reported among the respondents at Walugogo PTC. These findings

suggest that desktop computers are the most commonly owned ICT devices at both colleges, with a higher ownership rate at Walugogo PTC. The ownership of laptops is more prevalent at Bishop Willis Core PTC alongside other portable devices like tablet PCs and netbooks which are absent at Walugogo PTC. This variation in device ownership affects how students engage with ICT in their studies especially in the context of using technology to enhance academic performance in science subjects.

4.3 The ICT resources available to facilitate the teaching/learning of Science subjects

4.3.1 The ICT facilities in Primary Teachers' Colleges

The table presents the findings on the availability of ICT resources to facilitate the teaching and learning of science subjects in two Primary Teachers' Colleges, Bishop Willis Core PTC and Walugogo PTC.

Table 4.8: Responses on the availability of ICT facilities to facilitate the teaching/learning of science subjects in Primary Teachers' Colleges

Facilities/Conditions	**Strongly Agree (%)**	**Agree (%)**	**Not Sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
Bishop Willis Core PTC					
Computer lab with adequate space	21 (12.9%)	75 (46.0%)	27 (16.6%)	35 (21.5%)	5 (3.1%)
Computers with relevant software	13 (8.0%)	64 (39.3%)	40 (24.5%)	37 (22.7%)	9 (5.5%)
Adequate number of functional	15 (9.2%)	73	15	54	6 (3.7%)

computers		(44.8%)	(9.2%)	(33.1%)	
Safety and security equipment (e.g. fire extinguishers, air conditioners, relevant furniture)	18 (11.0%)	23 (14.1%)	69 (42.3%)	41 (25.2%)	12 (7.4%)
Walugogo PTC					
Computer lab with adequate space	3 (6.7%)	7 (15.6%)	4 (8.9%)	24 (53.3%)	7 (15.6%)
Computers with relevant software	2 (4.4%)	2 (4.4%)	2 (4.4%)	35 (77.8%)	4 (8.9%)
Adequate number of functional computers	0	2 (4.4%)	1 (2.2%)	34 (75.6%)	8 (17.8%)
Safety and security equipment (e.g. fire extinguishers, air conditioners, relevant furniture)	1 (2.2%)	3 (6.7%)	3 (6.7%)	28 (62.2%)	10 (22.2%)

Source: Primary data, 2021

The findings from table above shows that in Bishop Willis Core PTC, 12.9% of respondents strongly agreed that the computer lab has adequate space, 46.0% agreed, 16.6% were unsure and 21.5% disagreed while 3.1% strongly disagreed. In contrast, Walugogo PTC has a less favorable perception with only 6.7% of respondents strongly agreeing that the computer lab has adequate space and 15.6% agreed. A majority, 53.3% disagreed and 15.6% strongly disagreed with this statement. These findings indicate that Bishop Willis Core PTC has a more positive view regarding the availability of adequate space in the computer lab compared to Walugogo PTC, which may impact the effectiveness of science teaching and learning.

For example, one of the key informants from PTC1 said;

> *"The government has provided us with a full packed computer lab and now our students are embracing ICT"* (Respondent, P2).

From the observation, the researcher contends with the respondent that indeed the college received computers to support student learning through technology. This implies, the teaching and learning is moderately good.

The table above shows the availability of computers with relevant software. In Bishop Willis Core PTC, 8.0% of respondents strongly agreed that the computers have relevant software, 39.3% agreed, 24.5% were unsure while 22.7% disagreed while 5.5% strongly disagreed. In contrast at Walugogo PTC, only 4.4% strongly agreed and 4.4% agreed that relevant software is available. A majority 77.8% disagreed with this statement indicating a serious lack of relevant software for the computers. These findings suggest that Bishop Willis Core PTC has a better perception regarding the availability of computers with the necessary software which is vital for enhancing the learning experience in science subjects.

Regarding the adequacy of functional computers, in Bishop Willis Core PTC, 9.2% of respondents strongly agreed that there are enough functional computers, 44.8% agreed, 9.2% were unsure, 33.1% disagreed while 3.7% strongly disagreed. On the other hand, in Walugogo PTC, no respondents strongly agreed that there are adequate functional computers and only 4.4% agreed. A majority 75.6% disagreed while 17.8% strongly disagreed with the availability of functional computers. These findings indicate that Bishop Willis Core PTC is perceived more favorably in terms of the availability of functional computers which is essential for effective

teaching and learning of science subjects. During an interview with one of the key informants, when asked whether there is adequate number of functioning computers, he had this to say,

> "*We are having enough functioning computers in this college and they are serviced every after 3 months in order to maintain them and keep them functioning*" (Respondent P 1).

This means that they can be ready for use at any time necessary since they in good conditions. The teachers and students can enjoy these privileges without struggling.

In terms of safety and security equipment, in Bishop Willis Core PTC, 11.0% of respondents strongly agreed that safety and security equipment is available, 14.1% agreed, 42.3% were unsure, 25.2% disagreed and 7.4% strongly disagreed. In contrast, at Walugogo PTC, only 2.2% of the respondents strongly agreed, 6.7% agreed that safety and security equipment is present. A majority 62.2% disagreed and 22.2% strongly disagreed with this statement. These findings suggest that Bishop Willis Core PTC has a more positive perception regarding the availability of safety and security equipment compared to Walugogo PTC which may affect the safety of the learning environment.

4.3.2 Descriptive statistics on the availability of ICT Resources to Facilitate the Teaching and Learning of Science Subjects in Two Primary Teachers' Colleges

Table 4.9: Descriptive statistics on the availability of ICT resources to facilitate the teaching and learning of Science Subjects in Two Primary Teachers' Colleges

Facility/Condition	**Bishop Willis Core PTC**		**Walugogo PTC**	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Computer lab with adequate space	2.56	1.061	3.56	1.139
Computers with relevant software	2.79	1.058	3.82	0.834
Adequate number of functional computers	2.77	1.118	4.07	0.618
Safety and security equipment (e.g., fire extinguishers, air conditioners, relevant furniture)	3.04	1.065	3.96	0.878
Valid N (listwise)	163		45	

Source: Primary data, 2021

Computer Lab with Adequate Space: Bishop Willis Core PTC had a low mean score (2.56), indicating that many respondents felt the computer lab space was inadequate. The moderate standard deviation (1.061) suggests that while there were some respondents who found the space acceptable, the majority were dissatisfied. In contrast, Walugogo PTC had a high mean (3.56), reflecting a more favorable perception of the lab space's adequacy. The slightly higher standard deviation (1.139) indicates that although most respondents were satisfied, there were still some who felt differently. This comparison suggests that Walugogo PTC provides a more suitable environment for ICT activities in terms of space.

Computers with Relevant Software; At Bishop Willis Core PTC, the mean was low (2.79), suggesting that the availability of relevant software was perceived as inadequate by many. The low standard deviation (1.058) indicates that respondents largely agreed on this point, reinforcing the perception of insufficiency. Meanwhile, Walugogo PTC had a high mean (3.82), demonstrating strong agreement on the adequacy of computers with relevant software. The lower standard deviation (0.834) reflects that most respondents were consistently satisfied, contrasting sharply with the perceptions at Bishop Willis.

Adequate Number of Functional Computers: The mean at Bishop Willis was low (2.77), indicating a perception of insufficient functional computers. The moderate standard deviation (1.118) suggests that while a few respondents might have found the number acceptable, the overwhelming consensus was that it was inadequate. At Walugogo PTC, the mean was very high (4.07), indicating strong agreement on the adequacy of functional computers. The low standard deviation (0.618) reveals that nearly all respondents were satisfied with the number of functional computers available, reflecting a unified positive perception.

Safety and Security Equipment (e.g., fire extinguishers, air conditioners, relevant furniture): Bishop Willis Core PTC had a slightly above-average mean (3.04), suggesting fair perceptions of the safety and security equipment in place. The moderate standard deviation (1.065) indicates that while most respondents found the safety measures adequate, there were some dissenting opinions. In contrast, Walugogo PTC had a high mean (3.96), showing that safety and security measures were well-regarded. The lower standard deviation (0.878) indicates a high level of agreement among respondents, with minimal dissent regarding the adequacy of safety equipment.

The findings indicate that respondents from Walugogo PTC rated the availability and adequacy of ICT resources significantly higher across all items compared to Bishop Willis Core PTC. The higher means at Walugogo reflect greater satisfaction, suggesting that ICT resources are better provided and maintained. Additionally, lower standard deviations in Walugogo reflect a strong consensus on the positive perceptions of resources, whereas the moderate deviations in Bishop Willis indicate differing opinions, highlighting specific areas that require improvement. This comparison emphasizes a gap in ICT resource provision with Walugogo PTC demonstrating stronger support for the teaching and learning of science subjects.

4.3.2 Availability of ICT Resources in Primary Teachers' Colleges

The table 4.10 presents the findings on the availability of ICT resources to facilitate the teaching and learning of Science subjects in two Primary Teachers' Colleges: Bishop Willis Core PTC and Walugogo PTC.

Table 4.10: Availability of ICT Resources in Primary Teachers' Colleges

Facilities/Conditions	**Strongly Agree (%)**	**Agree (%)**	**Not Sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
Bishop Willis Core PTC					
Desktop Computers	15 (9.2%)	58 (35.6%)	35 (21.5%)	47 (28.8%)	8 (4.9%)
Laptops	10 (6.1%)	38 (23.3%)	61 (37.4%)	28 (17.2%)	26 (16.0%)
Smartphones	28 (17.2%)	73 (44.8%)	24 (14.7%)	23 (14.1%)	15 (9.2%)
Scanners and Printers	7 (4.3%)	10 (6.1%)	26 (16.0%)	84 (51.5%)	36 (22.1%)
Projector	26 (16.0%)	16 (9.8%)	9 (5.5%)	80 (49.1%)	32 (19.6%)
Wi-Fi and Modem Connectivity	24 (14.7%)	17 (10.4%)	8 (4.9%)	83 (50.9%)	31 (19.0%)
Data Bundles Connectivity	45 (27.6%)	69 (42.3%)	19 (11.7%)	24 (14.7%)	6 (3.7%)

Walugogo PTC					
Desktop Computers	5 (11.1%)	7 (15.6%)	5 (11.1%)	20 (44.4%)	8 (17.8%)
Laptops	4 (8.9%)	9 (20.0%)	7 (15.6%)	18 (40.0%)	7 (15.6%)
Smartphones	8 (17.8%)	23 (51.1%)	5 (11.1%)	6 (13.3%)	3 (6.7%)
Scanners and Printers	2 (4.4%)	6 (13.3%)	8 (17.8%)	19 (42.2%)	10 (22.2%)
Projector	8 (17.8%)	1 (2.2%)	8 (17.8%)	20 (44.4%)	8 (17.8%)
Wi-Fi and Modem Connectivity	0	0	4 (8.9%)	6 (13.3%)	35 (77.8%)
Data Bundles Connectivity	3 (6.7%)	21 (46.7%)	0	13 (28.9%)	8 (17.8%)

Source: Primary data, 2021

The findings revealed that in Bishop Willis Core PTC, 9.2% of respondents strongly agree that desktop computers are available, 35.6% agreed, 21.5% were unsure, 28.8% disagreed while 4.9% strongly disagreed. In contrast, Walugogo PTC shows slightly different results with 11.1% strongly agreeing and 15.6% agreeing that desktop computers are available. A majority of 44.4% of the respondents disagreed, 17.8% strongly disagreed with this statement. These findings indicate that while Bishop Willis Core PTC has a more favorable perception of the availability of desktop computers, Walugogo PTC faces challenges in this area.

The findings revealed that at Bishop Willis Core PTC, 6.1% of respondents strongly agreed that laptops are available, 23.3% agreed, 37.4% were unsure, 17.2% disagree while 16.0% strongly disagreed. In Walugogo PTC, 8.9% strongly agreed, 20.0% agreed that laptops are available, 40.0% disagreed while 15.6% strongly disagreed. These results suggest that both colleges have room for improvement regarding the availability of laptops, but Bishop Willis Core PTC still maintains a slightly more positive perception.

The findings revealed that in Bishop Willis Core PTC, 17.2% of respondents strongly agreed that smartphones are available and 44.8% agreed, 14.7% were unsure, 14.1% disagree while 9.2% strongly disagreed. Comparatively, Walugogo PTC shows a strong agreement of 17.8% and a majority of 51.1% agreed. This indicates a generally favorable perception of smartphone availability in both colleges with Walugogo PTC exhibiting higher agreement levels.

The findings revealed that for scanners and printers, Bishop Willis Core PTC shows low availability with only 4.3% strongly agreeing and 6.1% agreeing. A majority 51.5% disagreed, and 22.1% strongly disagreed. In contrast, Walugogo PTC has even poorer perceptions with 4.4% strongly agreeing and only 13.3% agreeing. A majority of 42.2% disagreed and 22.2% strongly disagreed. These findings suggest that both colleges face considerable challenges regarding the availability of scanners and printers.

The findings revealed that at Bishop Willis Core PTC, 16.0% strongly agreed that projectors are available and 9.8% agreed while 49.1% disagreed, 19.6% strongly disagreed. In Walugogo PTC, 17.8% strongly agreed and only 2.2% agreed, 44.4% of the respondents' disagreed and 17.8% strongly disagreed. These findings indicate that both colleges struggle with projector availability, but Walugogo PTC has a slightly more positive perception in this area.

The findings revealed that in Bishop Willis Core PTC, 14.7% of the respondents strongly agreed that Wi-Fi connectivity is available while 10.4% agreed. A majority 50.9% disagreed and 19.0% strongly disagreed. However, in Walugogo PTC, the majority of respondents 77.8%, strongly disagreed with the availability of Wi-Fi connectivity, indicating a lack of resources in this regard. These findings suggest that Bishop Willis Core PTC has a more favorable perception regarding internet connectivity compared to Walugogo PTC.

The findings revealed that in Bishop Willis Core PTC, 27.6% of the respondents strongly agreed that data bundles connectivity is available, 42.3% agreed, 11.7% were unsure, 14.7% disagreed while 3.7% strongly disagreed. On the other hand, in Walugogo PTC, only 6.7% of the respondents strongly agreed that that data bundle connectivity is available, 46.7% agreed, 28.9% disagreed while 17.8% strongly disagreed. These findings indicate that Bishop Willis Core PTC enjoys a more positive perception regarding data bundles connectivity which is important for facilitating ICT resources in teaching and learning of science subjects.

4.3.3 Descriptive statistics on the availability of ICT resources to facilitate the teaching and learning of Science subjects in two Primary Teachers' Colleges: Bishop Willis Core PTC and Walugogo PTC

Table 4.11: Availability of ICT Resources in Two Primary Teachers' Colleges

ICT Resource/Condition	**Bishop Willis Core PTC**		**Walugogo PTC**	
	Mean	Std. Deviation	Mean	Std. Deviation
Desktop Computers	2.85	1.092	3.42	1.270
Laptops	3.13	1.130	3.33	1.225

Smart phones	2.53	1.198	2.40	1.136
Scanners and printers	3.81	.991	3.64	1.111
Projector	3.47	1.344	3.42	1.323
Wifi connectivity and Modem connectivity	3.49	1.316	4.69	.633
Data bundles connectivity	2.25	1.123	3.04	1.331
Valid N (listwise)	163		45	

Source: Primary data, 2021

Desktop Computers: Bishop Willis Core PTC had a mean score of 2.85 for desktop computers, indicating a moderate level of availability. The standard deviation of 1.092 indicates that while some students feel the availability is adequate, others clearly perceive a lack of access. In contrast, Walugogo PTC reported a higher mean of 3.42, reflecting better access to desktop computers. The higher standard deviation of 1.270 shows that while many students find the resources satisfactory, there are still notable concerns among a subset of students about their availability.

Laptops: For laptops, Bishop Willis Core PTC achieved a mean of 3.13, indicating a relatively good level of access. The standard deviation of 1.130 suggests that while many students have a positive view of laptop availability, some express dissatisfaction. At Walugogo PTC, the mean was slightly higher at 3.33, which suggests better access to laptops. The standard deviation of 1.225 confirms that there are diverse opinions among students, with some experiencing better access than others.

Smartphones:

Bishop Willis Core PTC had a mean score of 2.53 for smartphones, indicating a lower level of availability. The standard deviation of 1.198 shows a clear divide in student experiences, with many lacking access entirely. Walugogo PTC recorded a similar mean of 2.40, reflecting comparable challenges in smartphone availability. The standard deviation of 1.136 indicates that students generally agree on this limitation, suggesting widespread dissatisfaction with access to smartphones.

Scanners and Printers: At Bishop Willis Core PTC, the mean for scanners and printers was 3.81, indicating strong availability of these resources. The standard deviation of 0.991 demonstrates a high level of consensus among respondents, with most students feeling satisfied with their access to these devices. Conversely, Walugogo PTC had a slightly lower mean of 3.64, indicating good availability but not as strong as that at Bishop Willis. The standard deviation of 1.111 shows some disagreement among students, suggesting that while many find the resources adequate, there are still those who feel access is insufficient.

Projectors: Bishop Willis Core PTC had a mean of 3.47 for projectors, indicating reasonable availability. The standard deviation of 1.344 suggests differing levels of satisfaction among students, with some finding projectors readily available while others do not. At Walugogo PTC, the mean was similar at 3.42, reflecting comparable access. The standard deviation of 1.323 indicates a similar distribution of opinions, with some students expressing satisfaction while others do not.

Wi-Fi and Modem Connectivity: For Wi-Fi and modem connectivity, Bishop Willis Core PTC had a mean of 3.49, reflecting solid access. The standard deviation of 1.316 indicates that

students have a mix of experiences regarding connectivity. In contrast, Walugogo PTC reported a significantly higher mean of 4.69, indicating excellent access to Wi-Fi and modem connectivity. The low standard deviation of 0.633 suggests that students largely agree on the high level of connectivity available, with very few expressing dissatisfaction.

Data bundles connectivity: Bishop Willis Core PTC had a mean of 2.25 for data bundles connectivity, indicating very low availability. The standard deviation of 1.123 reveals a significant disparity in access, with some students having no access at all while others might have better resources. Walugogo PTC, on the other hand, had a mean of 3.04, indicating moderate availability of data bundles. The higher standard deviation of 1.331 points to a wider range of student experiences, illustrating varied access to data connectivity across the student body.

The findings clearly indicate that Walugogo PTC generally provides better access to various ICT resources compared to Bishop Willis Core PTC, particularly in areas such as Wi-Fi connectivity. The higher means at Walugogo for most resources reflect a more favorable environment for using technology in teaching and learning. However, both institutions exhibit areas needing improvement, especially in smartphone and data bundles connectivity, where students report inadequate availability. The differing standard deviations highlight the diverse experiences among students, suggesting that targeted interventions are necessary to enhance ICT resource availability and accessibility across both colleges.

4.4 Students teachers' Interest towards the use of ICT at Bishop Willis Core PTC and Walugogo PTC

4.4.1 Whether students in College are actively involved in ICT activities

Table 4.12: Whether students in College are actively involved in ICT activities

Statement	Strongly Agree (%)	Agree (%)	Not Sure (%)	Disagree (%)	Strongly Disagree (%)
Bishop Willis Core PTC					
Regular use of email	9 (5.5%)	21 (12.9%)	19 (11.7%)	90 (55.2%)	24 (14.7%)
Conducting academic research electronically	30 (18.4%)	68 (41.7%)	14 (8.6%)	26 (16.0%)	25 (15.3%)
Presentation programs	9 (5.5%)	13 (8.0%)	14 (8.6%)	79 (48.5%)	48 (29.4%)
Walugogo PTC					
Regular use of email	3 (6.7%)	7 (15.6%)	2 (4.4%)	19 (42.2%)	14 (31.1%)
Conducting academic research electronically	9 (20.0%)	21 (46.7%)	4 (8.9%)	8 (17.8%)	3 (6.7%)
Presentation programmes	5 (11.1%)	11 (24.4%)	1 (2.2%)	18 (40.0%)	10 (22.2%)

Source: Primary data, 2021

The table above shows the findings on students' interest in using available ICT resources for science subjects at two Primary Teachers' Colleges, Bishop Willis Core PTC and Walugogo

PTC. In Bishop Willis Core PTC, only 5.5% of respondents strongly agreed that they regularly use email while 12.9% agreed, 11.7% were not sure, a majority 55.2% disagree, and 14.7% strongly disagree. Comparatively, in Walugogo PTC, the results are slightly better, with 6.7% strongly agreeing, 15.6% agreeing, 4.4% being unsure, 42.2% disagreeing, and 31.1% strongly disagreeing with this statement. These findings indicate that both institutions face challenges regarding regular email use, but Walugogo PTC shows a slightly more positive perception in this area.

When examining students' interest in conducting academic research electronically, Bishop Willis Core PTC shows more favorable results. A total of 18.4% of respondents strongly agreed, 41.7% agreed, 8.6% were not sure while 16.0% disagreed and 15.3% strongly disagreed. In comparison, Walugogo PTC exhibits similarly positive responses with 20.0% strongly agreeing, 46.7% agreed, 8.9% were not sure, 17.8% disagreed and only 6.7% strongly disagreeing. This suggests that both colleges share a relatively strong interest in using ICT for academic research with Walugogo PTC showing a slightly higher agreement.

In terms of using presentation programmes, Bishop Willis Core PTC again shows lower levels of interest. Only 5.5% of respondents strongly agreed, 8.0% agreed, 8.6% were not sure while a majority of 48.5% disagreed and 29.4% strongly disagreed. On the other hand, Walugogo PTC performs better with 11.1% strongly agreeing, 24.4% agreeing, 2.2% being unsure, 40.0% disagreeing and 22.2% strongly disagreeing. These findings suggest that Walugogo PTC has a more positive outlook toward the use of presentation programmes compared to Bishop Willis Core PTC, though both institutions face significant challenges in fully integrating this ICT tool.

The above findings were reaffirmed by majority of the student teachers who generally agreed that;

> *"We need to learn to use ICT because most of the assignments and activities are given to us online by our tutors, even applications for jobs today require a high level of ICT" noted a key informant from PTC 1* (Respondent ST1, ST 4 and T1).

This is true because most activities at college are done online today. The researcher keenly observed that some assignments were being submitted to the tutors online. However, in the private PTC, the students rarely used the online system for submission of the course works and assignments.

In addition to the above, one respondent reported that,

> *"During assemblies, the Principal usually emphasizes the need to learn the 21st century skills with major emphasis on ICT as observed by a key informant from PTC 2 (*Respondent ST3, ST4*). Another respondent noted, "I prefer storing my notes in sub folders and folders according to subjects" One of the respondents noted* (Respondent ST5, ST 3 and T2). In the contemporary world, ICT is highly used in storage of information.

This shows that the principals and teachers have started embracing digitalized teaching and learning. This was observed both in government and private PTCs. However, the private PTCs were struggling more than the government PTC in implementing the ICT integration.

Walugogo PTC demonstrates a more favorable perception of the use of ICT resources, particularly for academic research and presentation programmes, when compared to Bishop

Willis Core PTC. However, both colleges struggle with promoting regular email usage among their students. Encouraging broader ICT adoption in these areas could improve the academic integration of technology in science subjects at both institutions.

4.2.2 Descriptive statistics on students' Involvement in ICT Activities in Two Primary Teachers' Colleges

Table 4.13: Descriptive statistics on students' Involvement in ICT Activities in Two Primary Teachers' Colleges

Activity/Condition	**Bishop Willis Core PTC**		**Walugogo PTC**	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Regular use of e-mail	3.61	1.062	3.76	1.246
Conducting academic research electronically	2.68	1.355	2.44	1.198
Presentation programmes	3.88	1.091	3.38	1.370
Valid N (listwise)	163		45	

Source: Primary data, 2021

Regular use of e-mail: At Bishop Willis Core PTC, the mean score for regular use of e-mail was relatively high at 3.61, indicating that students actively utilize email as a communication tool. The standard deviation of 1.062 suggests that while most students engage with this activity, there is some variation in how frequently they use it, with a few students potentially using it less often. In contrast, Walugogo PTC had a slightly higher mean of 3.76, reflecting an even greater engagement with email communication among students. The higher standard deviation of 1.246

indicates a broader range of responses, suggesting that while many students use email regularly, some may not do so as consistently as their peers.

Conducting academic research electronically; For conducting academic research electronically, Bishop Willis Core PTC had a mean score of 2.68, indicating a moderate level of engagement in this activity. The high standard deviation of 1.355 implies that there is considerable variability in responses, with some students actively participating in online research while others do not engage much at all. Conversely, Walugogo PTC recorded a lower mean of 2.44, suggesting a lesser involvement in electronic academic research compared to Bishop Willis. The standard deviation of 1.198 indicates a relatively similar level of variability, pointing to a consistent pattern of low engagement among the students.

Presentation programmes; The mean score for the use of presentation programmes at Bishop Willis Core PTC was 3.88, indicating a strong involvement among students in creating presentations. The standard deviation of 1.091 suggests a moderate range of responses, with most students expressing interest in using presentation software. In comparison, Walugogo PTC had a mean of 3.38, reflecting lower engagement in this activity. The higher standard deviation of 1.370 indicates greater variability in responses, suggesting that while some students are actively engaged in using presentation programmes, others are less involved.

The findings revealed that students at both colleges exhibit varying levels of involvement in ICT activities. Bishop Willis Core PTC generally shows higher mean scores in email use and presentation programmes, indicating greater engagement in these areas compared to Walugogo PTC. However, both colleges demonstrate moderate involvement in conducting academic research electronically with Bishop Willis slightly ahead. The variability in standard deviations

across the activities indicates that while there is some consistency in engagement levels, there are also differences among individual student experiences. This comparison emphasizes the need for targeted strategies at both institutions to further enhance student involvement in ICT activities, particularly in areas like academic research, where engagement appears to be lower.

4.4.2 Student teachers' interest towards use of ICT

Table 4.14: Student's interest towards use of ICT

Student's interest	None (%)	A little (%)	A lot (%)
Bishop Willis Core PTC			
Learning to use computers	48 (29.4%)	107 (65.6%)	8 (4.9%)
Using ICT to do given class assignments	32 (19.6%)	103 (63.2%)	28 (17.2%)
Using ICT to communicate	77 (47.2%)	65 (39.9%)	21 (12.9%)
Using ICT to facilitate teaching and learning	74 (45.4%)	78 (47.9%)	11 (6.7%)
Producing a science text using word processing programmes	40 (24.5%)	48 (29.4%)	75 (46.0%)
Organizing computer files in folders	81 (49.7%)	48 (29.4%)	33 (20.2%)
Using a spreadsheet (e.g., Excel)	29 (17.8%)	95 (58.3%)	39 (23.9%)
Creating a presentation with animations	17 (10.4%)	119 (73.0%)	21 (12.9%)
Walugogo PTC			
Learning to use computers	16	28 (62.2%)	1 (2.2%)

	(35.6%)		
Using ICT to do given class assignments	5 (11.1%)	31 (68.9%)	9 (20.0%)
Using ICT to communicate	10 (22.2%)	17 (37.8%)	18 (40.0%)
Using ICT to facilitate teaching and learning	15 (33.3%)	10 (22.2%)	20 (44.4%)
Producing a science text using word processing programmes	17 (37.8%)	21 (46.7%)	7 (15.6%)
Organizing computer files in folders	34 (75.6%)	11 (24.4%)	
Using a spreadsheet (e.g., Excel)	18 (40.0%)	16 (35.6%)	11 (24.4%)
Creating a presentation with animations	5 (11.1%)	32 (71.1%)	8 (17.8%)

Source: Primary Data, 2021

The findings revealed that in Bishop Willis Core PTC, 29.4% of respondents indicated no interest in learning to use computers, while 65.6% indicated a little interest, and only 4.9% showed a strong interest. In contrast, Walugogo PTC had 35.6% of respondents showing no interest, 62.2% showing a little interest, and just 2.2% expressing strong interest. These findings suggest that while both colleges exhibit relatively low levels of enthusiasm for learning to use computers, Bishop Willis Core PTC students demonstrate slightly more interest than those at Walugogo PTC.

The findings further revealed that in Bishop Willis Core PTC, 19.6% of respondents expressed no interest in using ICT for class assignments, 63.2% showed a little interest, and 17.2% showed

strong interest. Comparatively, Walugogo PTC showed 11.1% of respondents with no interest, 68.9% with a little interest, and 20.0% with strong interest. These results suggest that Walugogo PTC students are somewhat more enthusiastic about using ICT for class assignments than their counterparts at Bishop Willis Core PTC.

Regarding the use of ICT to communicate, the findings revealed that in Bishop Willis Core PTC, 47.2% of respondents indicated no interest, 39.9% indicated a little interest, and only 12.9% showed strong interest. In contrast, Walugogo PTC showed a more favorable response, with 22.2% of respondents indicating no interest, 37.8% showing a little interest, and 40.0% expressing strong interest. These findings indicate that Walugogo PTC students have a significantly higher interest in using ICT for communication compared to Bishop Willis Core PTC students.

The findings also revealed that in Bishop Willis Core PTC, 45.4% of respondents indicated no interest in using ICT to facilitate teaching and learning, while 47.9% showed a little interest, and only 6.7% expressed strong interest. In contrast, Walugogo PTC showed more positive results, with 33.3% of respondents indicating no interest, 22.2% showing a little interest, and 44.4% showing strong interest. These findings suggest that Walugogo PTC students have a much greater interest in using ICT to support teaching and learning compared to Bishop Willis Core PTC students.

For producing science texts using word processing programmes, the findings showed that in Bishop Willis Core PTC, 24.5% of respondents had no interest, 29.4% showed a little interest, and 46.0% had strong interest. In Walugogo PTC, 37.8% of respondents had no interest, 46.7% showed a little interest, and 15.6% had strong interest. These results indicate that Bishop Willis

Core PTC students are far more interested in using word processing programmes for science texts than Walugogo PTC students.

In terms of organizing computer files into folders and subfolders, the findings revealed that in Bishop Willis Core PTC, 49.7% of respondents had no interest, 29.4% showed a little interest, and 20.2% had strong interest. In contrast, Walugogo PTC results indicated that 75.6% of respondents had no interest, and 24.4% had a little interest, with no respondents showing strong interest. These findings suggest that students at Bishop Willis Core PTC are more interested in organizing computer files compared to Walugogo PTC students.

Regarding the use of spreadsheets (e.g., Excel) to display scientific data, Bishop Willis Core PTC showed that 17.8% of respondents had no interest, 58.3% showed a little interest, and 23.9% expressed strong interest. At Walugogo PTC, 40.0% of respondents had no interest, 35.6% showed a little interest, and 24.4% had strong interest. These results suggest that interest in using spreadsheets is generally higher at Bishop Willis Core PTC, although Walugogo PTC shows a similar level of strong interest.

The findings revealed that in Bishop Willis Core PTC, 10.4% of respondents showed no interest in creating presentations with simple animation functions, 73.0% had a little interest, and 12.9% expressed strong interest. In contrast, Walugogo PTC showed that 11.1% of respondents had no interest, 71.1% had a little interest, and 17.8% had strong interest. These findings suggest that Walugogo PTC students are slightly more interested in creating presentations with animations compared to Bishop Willis Core PTC students.

The comparison indicates that Walugogo PTC students exhibit greater interest in using ICT for communication and facilitating teaching, while Bishop Willis Core PTC students show more

enthusiasm in technical tasks such as organizing files, using spreadsheets, and producing texts with word processing programmes. Both colleges, however, show areas for improvement in ICT engagement.

The above findings were reaffirmed by majority of the student teachers who generally agreed that;

> *"We need to learn to use ICT because most of the assignments and activities are given to us online by our tutors, even applications for jobs today require a high level of ICT" noted a key informant from PTC 1* (Respondent ST1, ST 4 and T1).

This is true because most activities at college are done online today. The researcher keenly observed that some assignments were being submitted to the tutors online. However, in the private PTC, the students rarely used the online system for submission of the course works and assignments.

In addition to the above, one respondent reported that,

> *"During assemblies, the Principal usually emphasizes the need to learn the 21st century skills with major emphasis on ICT as observed by a key informant from PTC 2 (*Respondent ST3, ST4*). Another respondent noted, "I prefer storing my notes in sub folders and folders according to subjects" One of the respondents noted* (Respondent ST5, ST 3 and T2). In the contemporary world, ICT is highly used in storage of information.

This shows that the principals and teachers have started embracing digitalized teaching and learning. This was observed both in government and private PTCs. However, the private PTCs were struggling more than the government PTC in implementing the ICT integration.

4.2.3 Descriptive statistics on student's Interest towards use of ICT in two Primary Teachers' Colleges

Table 4.15: Descriptive statistics on student's Interest towards use of ICT in Two Primary Teachers' Colleges

Student's Interest towards use of ICT	**Bishop Willis Core PTC**		**Walugogo PTC**	
	Mean	Std. Deviation	Mean	Std. Deviation
Learning to use computers	1.75	0.534	1.67	0.522
Using ICT to do given class assignments	1.98	0.608	2.09	0.557
Using ICT to communicate	1.66	0.697	2.18	0.777
Using ICT to facilitate teaching and learning	1.61	0.612	2.11	0.885
Producing a science text using word processing programme	2.21	0.815	1.78	0.704
Organizing computer files in folders and subfolders	1.72	0.805	1.24	0.435
Using a spreadsheet (e.g., Excel) to display scientific data	2.06	0.645	1.84	0.796
Creating a presentation with simple animation functions	2.26	0.942	2.07	0.539
Valid N (listwise)	**163**		**45**	

Source: Primary data, 2021

The findings showed that at Bishop Willis Core PTC, the mean score for learning to use computers was low (1.75), indicating that students showed limited interest in this activity. The standard deviation (0.534) suggests a slight range in opinions, with most respondents likely sharing similar views on their disinterest. In contrast, Walugogo PTC had an even lower mean (1.67), reflecting a similarly low interest among students in learning computer skills. The standard deviation (0.522) indicates that perceptions were closely aligned, suggesting a general consensus on the lack of interest.

Using ICT to complete class assignments: For using ICT to do given class assignments, Bishop Willis Core PTC had a mean of 1.98, still indicating limited interest. The standard deviation (0.608) shows some variation, but most students likely felt unenthusiastic about this aspect of ICT usage. At Walugogo PTC, the mean was slightly higher (2.09), suggesting a marginally better reception toward using ICT for assignments. The lower standard deviation (0.557) reflects more consistent responses, with a general feeling of slight interest.

The findings showed that Bishop Willis Core PTC had a low mean of 1.66 for using ICT to communicate, indicating minimal interest among students. The higher standard deviation (0.697) suggests that while many were disinterested, there were some students who found value in this activity. Conversely, Walugogo PTC had a much higher mean (2.18), showing that students exhibited a greater interest in using ICT for communication. The higher standard deviation (0.777) indicates a broader range of opinions, suggesting some strong enthusiasm among certain students.

Using ICT to facilitate teaching and learning: The mean at Bishop Willis Core PTC was notably low (1.61), reflecting a very limited interest in using ICT to facilitate teaching and learning. The

moderate standard deviation (0.612) implies that most students were aligned in their disinterest. On the other hand, Walugogo PTC had a higher mean (2.11), suggesting that students were more open to the idea of using ICT to enhance their teaching and learning experiences. The larger standard deviation (0.885) indicates some variation in responses, with some students showing a stronger interest.

Producing a science text using word processing programmes: At Bishop Willis Core PTC, the mean score was 2.21, which reflects a somewhat better interest compared to other activities, though still not high. The standard deviation (0.815) indicates a moderate range of responses. In contrast, Walugogo PTC had a lower mean (1.78) for this activity, suggesting less interest in producing science texts using word processing. The standard deviation (0.704) shows some agreement among students regarding this lack of interest.

Organizing computer files in folders and subfolders: Bishop Willis Core PTC had a mean of 1.72, indicating minimal interest in this organizational task. The higher standard deviation (0.805) suggests varying opinions, with some students potentially finding value in it. Walugogo PTC had a much lower mean (1.24), indicating even less interest in this activity. The low standard deviation (0.435) reflects a strong consensus on the disinterest among students.

Using a spreadsheet (e.g., excel) to display scientific data: The mean at Bishop Willis Core PTC was 2.06, indicating limited interest in using spreadsheets for displaying scientific data. The standard deviation (0.645) suggests some variability in student opinions. In contrast, Walugogo PTC had a lower mean (1.84), indicating slightly less interest in this task. The higher standard deviation (0.796) indicates a broader range of opinions, suggesting some students found this activity more engaging than others.

Creating a presentation with simple animation functions: Bishop Willis Core PTC had a mean of 2.26, reflecting a moderate interest in creating presentations. The standard deviation (0.942) indicates considerable variation in responses, with some students likely finding this task more appealing. Walugogo PTC, however, had a slightly lower mean (2.07), showing that while interest was present, it was not as high as at Bishop Willis. The standard deviation (0.539) suggests more consistent responses, indicating a general but modest interest.

The findings indicate that students at both colleges exhibited low to moderate interest in using ICT for various activities, but Walugogo PTC generally showed slightly higher means in several areas. The higher means in Walugogo PTC indicate a somewhat better reception of ICT activities, although students at both institutions appear to have limited engagement with most ICT uses. The variations in standard deviations reflect differing levels of interest among students, with some finding specific activities more engaging than others. This comparison highlights the need for both colleges to enhance student engagement with ICT resources to improve their effectiveness in teaching and learning environments.

4.4.3 Students attitudes towards learning of science subjects

Table 4.16: Students attitudes towards learning of science subjects at Bishop Willis Core PTC and Walugogo PTC

Statements	**Strongly Agree (%)**	**Agree (%)**	**Not Sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
Bishop Willis Core PTC					
Students find Science subjects difficult to learn	18 (11.0%)	62 (38.0%)	41 (25.2%)	28 (17.2%)	14 (8.6%)
Students believe Science is meant for male students	16 (9.8%)	24 (14.7%)	57 (35.0%)	49 (30.1%)	17 (10.4%)
Students rarely have practical lessons using ICT	16 (9.8%)	32 (19.6%)	52 (31.9%)	50 (30.7%)	13 (8.0%)
Students lose interest during science periods	11 (6.7%)	24 (14.7%)	37 (22.7%)	58 (35.6%)	33 (20.2%)
Tutors motivate students in class	16 (9.8%)	19 (11.7%)	61 (37.4%)	46 (28.2%)	21 (12.9%)
Walugogo PTC					
Students find Science subjects difficult to learn		21 (46.7%)	14 (31.1%)	10 (22.2%)	
Students believe Science is meant for male students	2 (4.4%)	4 (8.9%)	19 (42.2%)	15 (33.3%)	5 (11.1%)

Students rarely have practical lessons using ICT	1 (2.2%)	9 (20.0%)	17 (37.8%)	18 (40.0%)	
Students lose interest during science periods		10 (22.2%)	13 (28.9%)	14 (31.1%)	8 (17.8%)
Tutors motivate students in class	3 (6.7%)		20 (44.4%)	12 (26.7%)	10 (22.2%)

Source: Primary Data, 2021

The findings revealed that at Bishop Willis Core PTC, 11.0% of respondents strongly agreed that students find science subjects difficult to learn, while 38.0% agreed. A notable 25.2% were unsure, 17.2% disagreed, and 8.6% strongly disagreed. In contrast, Walugogo PTC shows different results, with 46.7% of respondents agreeing that students find science subjects difficult to learn, while 31.1% were unsure and 22.2% disagreed. These findings indicate that a higher proportion of students at Walugogo PTC perceive science subjects as difficult compared to Bishop Willis Core PTC.

The findings revealed that at Bishop Willis Core PTC, 9.8% of respondents strongly agreed that students believe science is meant for male students to learn, while 14.7% agreed. A significant 35.0% were unsure, 30.1% disagreed, and 10.4% strongly disagreed. In contrast, Walugogo PTC shows lower levels of agreement, with only 4.4% strongly agreeing and 8.9% agreeing that science is meant for male students. A majority of 42.2% were unsure, 33.3% disagreed, and 11.1% strongly disagreed. These findings suggest that Bishop Willis Core PTC has a slightly higher perception of gender bias in science compared to Walugogo PTC.

The findings revealed that at Bishop Willis Core PTC, 9.8% of respondents strongly agreed that students rarely have practical lessons using ICT, while 19.6% agreed. A notable 31.9% were unsure, 30.7% disagreed, and 8.0% strongly disagreed. In Walugogo PTC, only 2.2% strongly agreed and 20.0% agreed that practical lessons using ICT are rare, with 37.8% unsure and 40.0% disagreeing. These findings indicate that both colleges face challenges with the integration of ICT in practical lessons, but Walugogo PTC shows a greater concern about the lack of such opportunities.

The findings revealed that at Bishop Willis Core PTC, 6.7% of respondents strongly agreed that students lose interest during science periods, while 14.7% agreed. A significant 22.7% were unsure, 35.6% disagreed, and 20.2% strongly disagreed. In Walugogo PTC, 22.2% agreed that students lose interest during science periods, while 28.9% were unsure, 31.1% disagreed, and 17.8% strongly disagreed. These findings suggest that while both colleges have concerns about student engagement during science lessons, Bishop Willis Core PTC exhibits a more favorable perception in this regard.

The findings revealed that at Bishop Willis Core PTC, 9.8% of respondents strongly agreed that tutors motivate students in class, while 11.7% agreed. A notable 37.4% were unsure, 28.2% disagreed, and 12.9% strongly disagreed. In Walugogo PTC, 6.7% strongly agreed that tutors motivate students, with a significant 44.4% being unsure. Additionally, 26.7% disagreed and 22.2% strongly disagreed. These findings indicate that both colleges have room for improvement in motivating students through teaching, with Walugogo PTC showing a higher level of uncertainty regarding tutor effectiveness.

4.4.4 Student teachers' attitude towards teaching of Science subjects at Bishop Willis using ICT while teaching at the Core PTC s of Bishop Wills and Walugogo PTC

The findings as far as the above caption is concerned are displayed in Table 4.18;

Table 4.17: Findings on the attitude of teaching of science subjects at **Bishop Willis Core PTC and Walugogo PTC as per students responses**

Teaching of Science Subjects	**Strongly Agree (%)**	**Agree (%)**	**Not Sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
Bishop Willis Core PTC					
Tutors regularly use ICT to teach science subjects	44 (27.0%)	111 (68.1%)	8 (4.9%)		
Attending large classes using ICT is tedious	17 (10.4%)	68 (41.7%)	32 (19.6%)	34 (20.9%)	12 (7.4%)
The available ICT resources do not allow effective teaching of science	56 (34.4%)	53 (32.5%)	47 (28.8%)	7 (4.3%)	
Whenever tutors use ICT in Science, students enjoy the lesson	42 (25.8%)	30 (18.4%)	68 (41.7%)	16 (9.8%)	7 (4.3%)
Making Science subjects compulsory in PTE programme is a wise idea	42 (25.8%)	96 (58.9%)	11 (6.7%)	14 (8.6%)	
Walugogo PTC					

Tutors regularly use ICT to teach science subjects	12 (26.7%)	30 (66.7%)	3 (6.7%)		
Attending large classes using ICT is tedious	5 (11.1%)	19 (42.2%)	9 (20.0%)	10 (22.2%)	2 (4.4%)
The available ICT resources do not allow effective teaching of science	12 (26.7%)	9 (20.0%)	18 (40.0%)	5 (11.1%)	1 (2.2%)
Whenever tutors use ICT in Science, students enjoy the lesson	10 (22.2%)	30 (66.7%)	5 (11.1%)		
Making Science subjects compulsory in PTE programme is a wise idea	13 (28.9%)	27 (60.0%)	3 (6.7%)	2 (4.4%)	

Source: Primary data, 2021

The findings revealed that at Bishop Willis Core PTC, 27.0% of respondents strongly agreed that tutors regularly use ICT to teach science subjects, while 68.1% agreed. Only 4.9% were not sure. In contrast, Walugogo PTC shows similar results, with 26.7% strongly agreeing and 66.7% agreeing that tutors use ICT for teaching. This indicates an agreement among students that ICT is generally used in teaching science subjects at both colleges.

The findings revealed that at Bishop Willis Core PTC, 10.4% of respondents strongly agreed that attending large classes using ICT is tedious basing on the experiences they had on their teaching practice exercises, while 41.7% agreed, 19.6% were unsure, while 20.9% disagreed and 7.4% strongly disagreed. In Walugogo PTC, 11.1% strongly agreed and 42.2% agreed that attending

large classes using ICT is tedious. A total of 20.0% were unsure, while 22.2% disagreed and 4.4% strongly disagreed. These findings suggest that both colleges acknowledge the challenges of teaching large classes with ICT.

The findings revealed that at Bishop Willis Core PTC, 33.7% of respondents strongly agreed that the available ICT resources do not allow for effective teaching of science subjects, with 33.1% agreeing. A significant 28.8% were unsure, while only 4.3% disagreed. In Walugogo PTC, 26.7% strongly agreed that available ICT resources hinder effective teaching, and 20.0% agreed. Additionally, 40.0% were unsure, while 11.1% disagreed and 2.2% strongly disagreed. These results indicate a shared concern over the adequacy of ICT resources for effective teaching at both institutions.

The findings revealed that at Bishop Willis Core PTC, 25.8% of respondents strongly agreed that students enjoy lessons when tutors use ICT, with 18.4% agreeing. However, 41.7% were unsure, while 9.8% disagreed and 4.3% strongly disagreed. In Walugogo PTC, 22.2% strongly agreed and 66.7% agreed that students enjoy ICT-assisted lessons, with only 11.1% being unsure. These findings indicate that while both colleges report a perception of students' enjoying usage of ICT in lessons, Walugogo PTC has a significantly higher level of agreement.

The findings revealed that at Bishop Willis Core PTC, 25.8% of respondents strongly agreed that making science subjects compulsory in the PTE programme is a wise idea, with 58.9% agreeing. Only 6.7% were unsure, while 8.6% disagreed. In Walugogo PTC, 28.9% strongly agreed and 60.0% agreed with making science compulsory. A total of 6.7% were unsure, while 4.4% disagreed. These findings indicate a consensus at both colleges regarding the importance of making science subjects compulsory in the PTE programme.

4.5 ICT and Pre-service Teachers' academic performance in sciences

4.5.1 Findings on ICT and Pre-service Teachers' Academic Performance at Bishop Willis Core PTC and Walugogo PTC

Table 4.18: ICT and Pre-service Teachers' Academic Performance at **Bishop Willis Core PTC and Walugogo PTC**

Statements	**Strongly Agree (%)**	**Agree (%)**	**Not Sure (%)**	**Disagree (%)**	**Strongly Disagree (%)**
Bishop Willis Core PTC					
Pre-service teachers attend class regularly	18 (11.0%)	62 (38.0%)	47 (28.8%)	27 (16.6%)	9 (5.5%)
Pre-service teachers are always punctual for lessons	16 (9.8%)	24 (14.7%)	57 (35.0%)	48 (29.4%)	18 (11.0%)
Pre-service teachers actively participate in classroom activities	16 (9.8%)	55 (33.7%)	52 (31.9%)	32 (19.6%)	8 (4.9%)
Pre-service teachers always score good grades in continuous assessment in Science Subjects	11 (6.7%)	24 (14.7%)	36 (22.1%)	59 (36.2%)	33 (20.2%)
Pre-service teachers score good grades in end of term exams	16 (9.8%)	21 (12.9%)	58 (35.6%)	44 (27.0%)	24 (14.7%)
Pre-service teachers score good grades from Grade III	20 (12.3%)	29 (17.8%)	60 (36.8%)	36 (22.1%)	18 (11.0%)

Kyambogo University final examinations					
Walugogo PTC					
Pre-service teachers attend class regularly	5 (11.1%)	17 (37.8%)	13 (28.9%)	8 (17.8%)	2 (4.4%)
Pre-service teachers are always punctual for lessons	5 (11.1%)	7 (15.6%)	16 (35.6%)	13 (28.9%)	4 (8.9%)
Pre-service teachers actively participate in classroom activities	5 (11.1%)	15 (33.3%)	9 (20.0%)	14 (31.1%)	2 (4.4%)
Pre-service teachers always score good grades in continuous assessment in Science Subjects	3 (6.7%)	7 (15.6%)	10 (22.2%)	16 (35.6%)	9 (20.0%)
Pre-service teachers score good grades in end of term exams	4 (8.9%)	6 (13.3%)	16 (35.6%)	12 (26.7%)	7 (15.6%)
Pre-service teachers score good grades from Grade III Kyambogo University final examinations	5 (11.1%)	8 (17.8%)	17 (37.8%)	10 (22.2%)	5 (11.1%)

Source: Primary data, 2021

The findings revealed that in Bishop Willis Core PTC, 11.0% of respondents strongly agree that pre-service teachers attend class regularly while 38.0% agreed. A significant 28.8% were unsure, and 16.6% disagreed, with 5.5% strongly disagreeing. In contrast, Walugogo PTC shows similar

results, with 11.1% strongly agreeing and 37.8% agreeing that pre-service teachers attend class regularly. A majority of 28.9% were not sure, 17.8% disagreed, and 4.4% strongly disagreed. These findings suggest that both colleges generally have a favorable perception regarding class attendance among pre-service teachers.

The findings revealed that at Bishop Willis Core PTC, 9.8% of respondents strongly agree that pre-service teachers are always punctual for lessons, and 14.7% agreed. However, 35.0% were unsure, while 29.4% disagreed, and 11.0% strongly disagreed. In Walugogo PTC, 11.1% strongly agreed, and only 15.6% agreed that pre-service teachers are always punctual. A significant 35.6% were unsure, with 28.9% disagreeing and 8.9% strongly disagreeing. These results indicate that punctuality may be an area for improvement for both colleges.

The findings revealed that in Bishop Willis Core PTC, 9.8% of respondents strongly agree that pre-service teachers actively participate in classroom activities, and 33.7% agreed. A considerable 31.9% were unsure, while 19.6% disagreed and 4.9% strongly disagreed. In Walugogo PTC, the findings were slightly different, with 11.1% strongly agreeing and 33.3% agreeing. However, 20.0% were unsure, and 31.1% disagreed, with 4.4% strongly disagreeing. These findings indicate that while participation is generally perceived positively, both colleges have potential for improvement in fostering engagement.

The findings revealed that in Bishop Willis Core PTC, only 6.7% of respondents strongly agree that pre-service teachers always score good grades in continuous assessment in Science subjects, while 14.7% agreed. A significant 22.1% were unsure, and a majority of 36.2% disagreed, with 20.2% strongly disagreeing. Conversely, at Walugogo PTC, 6.7% strongly agreed, and 15.6% agreed, with 22.2% being unsure. A notable 35.6% disagreed, while 20.0% strongly disagreed.

These findings suggest that both colleges face challenges regarding the academic performance of pre-service teachers in continuous assessments.

The findings revealed that in Bishop Willis Core PTC, 9.8% of respondents strongly agree that pre-service teachers score good grades in end-of-term exams, while 12.9% agreed. A considerable 35.6% were unsure, with 27.0% disagreeing and 14.7% strongly disagreeing. In Walugogo PTC, 8.9% strongly agreed and 13.3% agreed, while 35.6% were unsure. A majority of 26.7% disagreed, with 15.6% strongly disagreeing. These results indicate a concerning trend in exam performance across both colleges.

The findings revealed that at Bishop Willis Core PTC, 12.3% of respondents strongly agree that pre-service teachers score good grades from Grade III Kyambogo University final examinations, while 17.8% agreed. A substantial 36.8% were unsure, with 22.1% disagreeing and 11.0% strongly disagreeing. In contrast, Walugogo PTC shows that 11.1% strongly agreed and 17.8% agreed, while 37.8% were unsure. A majority of 22.2% disagreed, with 11.1% strongly disagreeing. These findings suggest that while perceptions of academic performance vary, both colleges have room for improvement in supporting their pre-service teachers.

> *"Student teachers have improved on their academic performance after integrating ICT in the teaching/learning process" a tutor from PTC 1 noted (respondent T1, T2, and T4).*
>
> *"As students embrace ICT in the teaching/learning of Science subjects, the performance is gradually improving" tutors from PTC 2 indicated (respondent T1, T2).*
>
> *"The way to go is ICT integration in education because during the Covid-19 locked down, we conducted science lessons online" a tutor from PTC 1 emphasized (T2).*

Therefore, it is clear that both Government and Private PTC were noticing an improvement in the performance due to the integration of ICT. However, the speed at which the private PTC was operating was notably slow. In addition, the Private PTC entirely closed during the Covid-19 Lockdown.

4.5.2 Relationship between the use of available ICT resources and pre-service teachers' academic performance in Science subjects

The study investigated the relationship between the availability of ICT resources, particularly the adequate number of functional computers, and the academic performance of pre-service teachers in science subjects. Correlation analyses were conducted separately for Bishop Willis Core PTC and Walugogo PTC using Spearman's rank correlation coefficient, as detailed below.

Bishop Willis Core PTC

Correlations

			Adequate number of functional computers	The students' academic performance in Science subjects in this science subjects in this college is satisfactory
Spearman's rho	Adequate number of functional computers	Correlation Coefficient	1.000	.174*
		Sig. (2-tailed)	.	.026
		N	163	163
	The students' academic performance in Science subjects in this science subjects in this college is satisfactory	Correlation Coefficient	.174*	1.000
		Sig. (2-tailed)	.026	.
		N	163	163

*. Correlation is significant at the 0.05 level (2-tailed).

The analysis for Bishop Willis Core PTC revealed a positive but weak correlation between the availability of an adequate number of functional computers and students' academic performance in science subjects. The Spearman's correlation coefficient was r=0.174r = 0.174r=0.174, with a significance level p=0.026p = 0.026p=0.026, indicating that the relationship was statistically significant at the 0.05 level. This suggests that the availability of functional computers at Bishop Willis Core PTC is positively associated with better academic performance in science subjects, although the strength of the relationship is not particularly strong.

Walugogo PTC

Correlations

			Adequate number of functional computers	The students' academic performance in Science subjects in this science subjects in this college is satisfactory
Spearman's rho	Adequate number of functional computers	Correlation Coefficient	1.000	-.669**
		Sig. (2-tailed)	.	.000
		N	45	45
	The students' academic performance in Science subjects in this science subjects in this college is satisfactory	Correlation Coefficient	-.669**	1.000
		Sig. (2-tailed)	.000	.
		N	45	45

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

For Walugogo PTC, the results indicated a strong negative correlation between the availability of an adequate number of functional computers and students' academic performance in science subjects. The Spearman's correlation coefficient was r=−0.669r = -0.669r=−0.669, with a significance level p=0.000p = 0.000p=0.000, showing that the correlation was significant at the 0.01 level. This implies that, contrary to expectations, a higher number of functional computers was associated with lower academic performance in science subjects. This strong negative relationship suggests that other factors may be influencing the use of ICT resources in ways that negatively impact academic outcomes at Walugogo PTC.

The results suggest differing relationships between ICT resource availability and academic performance across the two colleges. At Bishop Willis Core PTC, a positive association indicates that access to functional computers may play a supportive role in improving academic performance. In contrast, the negative correlation observed at Walugogo PTC reflects underlying challenges, such as improper use of ICT resources, lack of effective integration in teaching, or other contextual factors that may hinder the intended educational benefits of ICT.

4.5.3 Regression Analysis to determine the relationship between availability of ICT resources and academic performance at Bishop Willis Core PTC and Walugogo PTC

Table 4.19: Comparison between Bishop Willis Core PTC and Walugogo PTC regarding the regression analysis of the relationship between the availability of ICT resources and academic performance

Comparison of Regression Analysis: Bishop Willis Core PTC vs. Walugogo PTC	**Bishop Willis Core PTC**	**Walugogo PTC**
Model Summary		
R	0.894	0.805
R Square	0.798	0.647
Adjusted R Square	0.795	0.622
Std. Error of the Estimate	0.523	0.711
Predictors	Using ICT to facilitate teaching and learning, Adequate number of functional computers, Computer lab with adequate space	Adequate number of functional computers, ICT is integrated in the teaching/learning process of other subjects, Computer lab with adequate space
Coefficients		
Variable	**B**	**t**
(Constant)	0.682	4.169
Computer lab with adequate	0.928	21.547

space		
Adequate number of functional computers	-0.061	-1.613
Using ICT to facilitate teaching and learning / ICT is integrated in the teaching/learning process of other subjects	0.219	2.991

The analysis at Bishop Willis Core PTC showed a strong relationship between ICT resources and pre-service teachers' academic performance with an R2R^2R2 of 0.798 indicating that about 79.8% of the variability in exam scores can be explained by the predictors. The presence of a computer lab with adequate space had a significant positive effect on academic performance ($p<0.001p < 0.001p<0.001$), highlighting the importance of accessible ICT facilities. While using ICT to facilitate teaching and learning also significantly contributed to better academic outcomes ($p=0.003p = 0.003p=0.003$), the number of functional computers did not significantly predict performance ($p=0.109p = 0.109p=0.109$), suggesting that other factors related to the quality of ICT integration might play a more pivotal role.

At Walugogo PTC, the model revealed a moderate relationship with an R2R^2R2 of 0.647, indicating that 64.7% of the variance in students' academic performance was accounted for by the predictors. The availability of a well-equipped computer lab showed a significant positive impact on performance ($p<0.001p < 0.001p<0.001$), emphasizing the role of ICT facilities in enhancing learning. However, neither the integration of ICT into teaching other subjects

(p=0.720p = 0.720p=0.720) nor the number of functional computers (p=0.339p = 0.339p=0.339) significantly influenced academic outcomes, suggesting that merely having ICT resources does not automatically translate to improved student performance.

These findings suggest that while the presence of ICT facilities such as a computer lab, plays a crucial role in supporting academic success, the quality of ICT integration into teaching practices is key to maximizing its benefits. Simply having a large number of computers or general ICT usage in other subjects may not significantly improve learning outcomes unless ICT is effectively used to facilitate interactive and engaging teaching methods. This highlights the need for a strategic approach to ICT utilization in education to enhance pre-service teachers' learning experiences and academic achievements in science subjects.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the discussions, Summary, conclusions and recommendations based on the specific objectives of the study.

5.1 Discussion of findings

5.1.1 The ICT resources available to facilitate the teaching/learning of science subjects

According to the study findings, it was revealed that one of the resources available to facilitate the teaching and learning is desktop computers; this is because desktop computers ease the load of work and it also encourages increased focus and continence when studying. During an interview with one of the Principals, he noted that; we provide computers to our students to ease their academic works, he added that computers offer increased efficiency to every student, they allow them to complete their assignments, check their grades, and make presentations even outside school hours". The findings are also in agreement with (Nitza & Yehudit, 2017).

Computers and Computerized molecular modeling is also used to facilitate the teaching/learning of sciences. The use of molecular models to illustrate and explore phenomena in chemistry teaching is widespread, this therefore shows that computers is one of the resources available to facilitate teaching and learning.

According to the findings, it was also revealed that internet is one the resources available, according to the respondents, during teaching and learning tutors tend to send work to students and also students sometimes respond using emails. This helps to save time and resources which facilitates easy teaching and learning of students at PTC. During an interaction with a key

informant, he said that" Internet is our major resource when teaching students because it eases the process of learning and teaching process and it also increases the academic performance especially in science subjects" the findings concur with (Aksela & Haatainen, 2019) who noted that the Internet provides several services that can be used in the teaching of Science subjects.

The study also shows that majority of the respondents agreed that there is a Computer lab with adequate space to facilitate teaching and learning process in PTCs, according to the respondents, computer labs and use of softwares helps to improve on quality of teaching and learning in sciences subjects. This finding also agrees with (Bell, et al., 2010) who noted that practical teaching and learning process in the labs helps students in internalizing scientific method and understanding mathematical science concept introduced

The study also found out that CD-ROMs and spreadsheets are among the resources available to use and to facilitate the teaching and learning process at PTCs. These are used to transfer data from a flash disk to a compact disk and other devices. This is more especially used by tutors transfer data to students. During an interaction with a tutor at one of the PTCs, he said, "we use CD-ROMS to burn work on Compact disks and give them to students for their revision" in the same line, Kerstin (2019) noted that CDROMs are thought to provide inexpensive access, quick and easy search mechanisms and a wealth of data in various forms.

5.1.2 Students' interests towards use of ICT Resources in Science subjects

According to results from Table 9, all the respondents agreed that students had interest in learning computers, this is due to increasing use of technology in most of the academic works which eases teaching and learning process. A Principal noted that, "our students are so much interested in learning computer and are interested in e-learning generally" in the line, Olugbenga

et al., (2016) in their study on students' interest in using ICT in Denmark and UK, they found out that teachers and students have a generally positive attitude towards e-learning and relatively advanced IT competences. This is in agreement with the researcher because many students have access to smartphones with internet.

The study also found out that students in Public and Private Primary Teachers' Colleges in Iganga District had interest in using ICT to do given class assignments, it was revealed that students do most of the assignments by use of computer, phones, using internet among other ICT resources more especially doing assignments for science subjects. According to students, ICT eases the process of doing assignments and it also helps to make research which helps to ease work. The researcher concurs with the findings and the views of Yanliu (2018) who noted that computers and their application play a significant role in modern information management and for learning purposes.

It was also found out that students have interest in using ICT to communicate, according to the respondents, students at the public PTCs use their phones mostly to communicate to their fellow students and tutors concerning their studies, use of emails, whatsApp, facebook, google among others which has eased the communication process. The story was the same with students in private PTCs. A respondent during the field study said that, "our students are so much interested in communicating using ICT more especially by use of phones and emails". The researcher agrees with the findings and concurs with Gablinske (2016) who noted that ICT communication enhances pre-service teachers' constructive social relationships and development of positive attitudes and cognitive growth including science process skills.

According to the study, it was found out that students in public PTCs were interested in using ICT to facilitate teaching and learning. It was interesting to note that students in private PTCs too were interested in using ICT to facilitate teaching and learning. As it was given by the respondents, students are interested using ICT equipment such as computers, phones among others to facilitate learning and teaching.

5.1.3 ICT and Pre-service Teachers' academic performance in sciences

According to the study findings, it was revealed that ICT results into satisfactory performance of students in science subjects, this was because the use of ICT in classroom practices is extremely significant for providing opportunities for students to function appropriately in an information era. In addition, the respondents said that ICT also helps the teachers in ensuring professional development and this helps in teaching students which encourages better performance in class. In the same line, Nfissi and Hicham (2017)'s study indicated that ICT help teachers develop professionally through the use of various ways of teaching. He added that Students, on the other hand, can increase their achievements in the sense that they access several materials. further, Nfissi and Hicham (2017) in his study he found out that the use of ICT in classroom practices is extremely significant for providing opportunities for students to function appropriately in an information age.

The study findings also shows that ICT greatly contributes to the students' academic performance in Science subjects in the college, according to the respondents, ICT reduces the workload of students and it enables them have more time to study and to make research which eventually helps them to improve on their performance more so in science subjects. The findings concur with Friedler, et al., (2019) who noted that using a computer to collect and represent data

might reduce the load on students' working memory and free them for observation and interpretation which helps them to improve on their performance.

5.2 Summary of the findings

5.2.1 The ICT resources available to facilitate the teaching/learning of science subjects

The findings revealed that respondents perceived Bishop Willis Core PTC to have a more favorable availability of ICT resources compared to Walugogo PTC. They noted that Bishop Willis Core PTC had better computer lab space, a higher availability of computers with relevant software and a sufficient number of functional computers. Additionally, respondents indicated that safety and security measures were more positively regarded at Bishop Willis Core PTC, contributing to a safer learning environment. While Walugogo PTC demonstrated greater overall satisfaction with certain resources, participants expressed concerns about significant gaps in smartphone availability and data bundle connectivity at both institutions, highlighting the need for targeted improvements. Furthermore, they noted that the varying experiences among students emphasized the necessity for interventions to enhance access to ICT resources in both colleges.

The study's findings indicated disparities in ICT use for teaching science subjects between Bishop Willis Core PTC and Walugogo PTC. It was reported that Bishop Willis Core PTC demonstrated moderate attitudes toward ICT, with a mean score of 2.83 for enjoyment and 3.07 for perceived effectiveness. In contrast, Walugogo PTC was noted to exhibit more favorable views, scoring 3.51 for enjoyment and 4.24 for effectiveness. However, both institutions faced significant challenges, as only 13.7% of respondents from Bishop Willis Core PTC felt adequately trained, while 4.4% at Walugogo PTC reported the same. Access to resources was also limited, with Walugogo PTC experiencing severe deficits in this area. Additionally, both institutions struggled with time constraints and insufficient institutional support with mean

scores of 3.00 and 2.89 for Bishop Willis Core PTC, sharply contrasting with Walugogo PTC's scores of 2.02 and 1.86, respectively. These disparities highlighted the urgent need for enhanced training, resource allocation, and institutional backing to effectively integrate ICT into science education at both institutions.

5.2.2 Students' interests towards use of ICT Resources in Science subjects

The findings indicated that students at Bishop Willis Core PTC and Walugogo PTC exhibited varying levels of interest and engagement with ICT resources for science subjects. While it was noted that regular email use was low at both institutions, it was reported that Walugogo PTC demonstrated slightly better engagement. However, students from both colleges expressed strong interest in conducting academic research electronically with Walugogo PTC having a marginally higher level of agreement. It was highlighted that, despite challenges in utilizing ICT for practical lessons and in maintaining student engagement during science periods, students at Bishop Willis Core PTC reported a more favorable outlook on engagement. Concerns regarding the adequacy of ICT resources for effective teaching were shared by both colleges, although it was noted that students at Walugogo PTC enjoyed ICT-assisted lessons more. Additionally, there was a consensus on the importance of making science subjects compulsory in the PTE programme, highlighting the necessity of prioritizing science education in teacher training.

5.2.3 ICT and Pre-service Teachers' academic performance in sciences

The findings regarding pre-service teachers' academic performance at Bishop Willis Core PTC and Walugogo PTC revealed important insights. At Bishop Willis Core PTC, a significant percentage of respondents indicated that pre-service teachers attend class regularly, reflecting a generally favorable perception of attendance. Similarly, Walugogo PTC reported comparable results. However, both colleges had a notable portion of respondents expressing uncertainty

about regular class attendance. Regarding punctuality, a small percentage of respondents from both institutions felt that pre-service teachers were always punctual, highlighting an area for improvement. In terms of classroom participation, responses indicated that engagement in activities was generally perceived positively, but a considerable percentage remained unsure. Both colleges faced challenges in academic performance, with only a limited number of respondents agreeing that pre-service teachers consistently scored well in continuous assessments. Additionally, exam performance showed a concerning trend, with low percentages of students achieving good grades in end-of-term exams and final examinations. However, tutors noted improvements in academic performance linked to ICT integration in teaching and learning, emphasizing the need for enhanced support from both government and private institutions.

The study examined the relationship between the availability of ICT resources such as functional computers and pre-service teachers' academic performance in science subjects. At Bishop Willis Core PTC, a positive but weak correlation was found with a Spearman's correlation coefficient of r=0.174r = 0.174r=0.174 (p = 0.026), suggesting that access to functional computers is positively associated with academic performance, although the relationship is not strong. In contrast, Walugogo PTC exhibited a strong negative correlation, r=−0.669r = -0.669r=−0.669 (p = 0.000), indicating that a higher number of functional computers was associated with lower academic performance. This surprising result suggests that factors beyond the mere availability of resources may be negatively influencing academic outcomes at Walugogo PTC.

The regression analysis further clarified the relationship between ICT resources and academic performance at both colleges. Bishop Willis Core PTC demonstrated a strong relationship, with an R2R^2R2 of 0.798, indicating that about 79.8% of the variability in exam scores could be explained by the predictors. The presence of a well-equipped computer lab had a significant

positive effect on academic performance ($p < 0.001$). While using ICT to facilitate teaching also contributed positively ($p = 0.003$), the number of functional computers was not a significant predictor ($p = 0.109$), suggesting that the quality of integration is crucial. In contrast, Walugogo PTC showed a moderate relationship with an R2R^2R2 of 0.647, accounting for 64.7% of performance variance. Similar to Bishop Willis, the availability of a well-equipped computer lab was significantly associated with better performance ($p < 0.001$), but neither ICT integration in teaching ($p = 0.720$) nor the number of functional computers ($p = 0.339$) significantly influenced academic outcomes. These findings highlight that while ICT facilities are essential for academic success, the effective integration of these resources into teaching practices is key to maximizing their benefits.

5.3 Conclusions

The study revealed that both Bishop Willis Core PTC and Walugogo PTC have ICT resources available to aid in the teaching and learning process, indicating that essential resources are at least on hand in both public and private institutions. However, public PTCs demonstrated greater access to ICT resources, including internet connectivity and functional computers, compared to their private counterparts. The integration of ICT in educational institutions has caused a paradigm shift, with many viewing it as a necessary tool for teaching and learning. As students are increasingly exposed to the possibilities of ICT, their perceptions have changed positively, leading to greater acceptance and use among tutors and teachers.

The findings indicate that some public and private Primary Teachers' Colleges have made significant efforts to incorporate ICT into their teaching practices and it is now expected that teacher applicants will utilize ICT effectively. However, the study also underscores the necessity for pre-service teachers to transition from traditional instructional methods to more innovative

approaches to ensure effective ICT integration. This shift is crucial for meeting the learning needs of 21st-century students. The study highlighted a connection between the availability of ICT resources and academic performance in science subjects. At Bishop Willis Core PTC, a positive correlation was found between access to functional computers and academic success, emphasizing the potential of ICT to enhance learning outcomes. In contrast, Walugogo PTC exhibited a strong negative correlation, indicating that merely having access to ICT resources does not necessarily lead to improved academic performance. This disparity points to the need for further investigation into factors such as training, institutional support, and the quality of ICT integration.

5.4 Recommendations

The Ministry of Education and Sports (MoES) and its agencies should invest more funds for the effective implementation of the use of ICT resources by pre-service teachers and in-service teachers in the public and private Primary Teachers' Colleges in Iganga District not only in ICT teaching but also in Science subjects so as to make teaching and learning an easy and enjoyable process and improve on academic performance in science subjects.

The college administration and other teacher educators should improve on its supervisory skills, implementation strategy and enhance the improvement of use of ICT resources within the colleges. This will help in the follow-up on the ICT infrastructural materials that will have been provided by the government and other stake holders.

The Ministry of Education, College administration and other key stakeholders should retool teacher educators of Science subjects on skills and competences to teach using ICT infrastructure. This will help to acquainted them with online assessment, conducting online

classes and giving feedback to the student teachers. This would help them to improve on the student teachers' academic performance in science subjects.

Additionally, Administrators of public colleges and proprietors of private colleges should prioritize provision of ICT resources for their institutions to enhance the teaching and learning of Science subjects for improved academic performance.

The college administrators and teacher educators should sensitize and guide pre-service students and in-service teachers to embrace the use of ICT in the teaching and learning process to improve the performance of Science subjects.

5.5 Areas of further studies

The study recommends the following suggestions for further study:

(i) Research on the perception of tutors and pre-service teachers towards the use of ICT in public and private Primary Teachers' Colleges.

(ii) Relevant strategies for using ICT to improve teaching and learning in public and private Primary Teachers' Colleges.

(iii) Tutor's role and competence in organizing, structuring, and guiding the whole process of ICT implementation in public and private Primary Teachers' Colleges.

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APPENDICES

Appendix 1: Questionnaire for Tutors

Dear respondent, my name is Magenge Andrew conducting a study to investigate about Information Communication Technology and Pre-service teachers' Academic Performance in Science Subjects: A case Primary Teachers' Colleges in Iganga District, as a basic requirement for an award of degree of Master of Education in Education Foundations of Kyambogo University. Your responses to the questions asked herein therefore contribute to the compilation of the required report.

Instructions:

Section A: Socio-Demographic Characteristics

1. Age
   a) Under 20 ☐
   b) From 20 - 29 ☐
   c) From 30-39
   d) From 40-49 ☐
   e) 50 or more ☐
2. Gender
   a) Male ☐
   b) Female ☐
3. Average number of students per stream
   a) Less than 30 ☐
   b) 30-39 ☐
   c) 40-49 ☐

☐ ☐

d) 50-59

e) 60 and above

4. ICT is integrated in the teaching/learning process of other subjects in this college

   a) Yes ☐

   b) No ☐

Section B: ICT Equipment available to facilitate teaching/learning of science subjects

5. Does this college provide students with ICT equipment?

   (a) Yes ☐

   (b) No ☐

6. Which of the following do you own for use in PTC?

   a) Laptops ☐

   b) Tablet PC ☐

   c) Desktop computers ☐

   d) Netbooks for use in ICT lessons ☐

7. Which of the following does the PTC provide to you for use during ICT lessons?

   (a) Laptops or tablet PC ☐

   (b) Desktop computers ☐

   (c) Netbooks for use in ICT lessons ☐

8. State the extent to which you agree about availability of each of the following in this college

No		Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
	Facilities					
1.	Computer lab with adequate space					
2.	Computers with relevant software					
3.	Adequate number of functional computers					
4.	Safety and security equipment e.g. fire extinguishers, air conditioners, relevant furniture					
	Resources: **Tutors have access to the following;**					
5.	Desktop Computers					
6.	Laptops					
7.	Tablets					
8.	Smart boards					
9.	Smart phones					
10.	Scanners					

11.	Projector					
12.	Printer					
13.	Wifi connectivity					
14.	Modem connectivity					
15.	Data bundles connectivity					
	Tutors in this college are actively involved in the following activities;					
16.	Regular use of e-mail					
17.	Conducting academic research electronically					
18.	Presentation programmes					

Section C: Students' interests towards use of ICT

Rate students in terms of how they are interested in each of the following;

No	**Students in this college have interest in;**	**None**	**A little**	**A lot**
1	Learning to use computers			

2	Using ICT to do given class assignments			
3	Using ICT to communicate			
4	Using ICT to facilitate teaching and learning			
5	Producing a science text using word processing programme			
6	Organizing computer files in folders and subfolders			
7	Using a spreadsheet (e.g., Excel) to display scientific data			
8	Creating a presentation with simple animation functions			
9	Creating a presentation with video or audio clips			
10	Participating in a discussion forum on the internet			
11	Downloading software on a computer			
12	Installing software on a computer			
13	Downloading curriculum resources from/to websites or learning platforms for students to use			
14	Uploading curriculum resources from/to websites or learning platforms for students to use			

SECTION D: TEACHING AND LEARNING OF SCIENCE SUBJECTS

SN	Teaching and learning of science subjects	SD	D	NS	A	SA
	Learning					
1.	Students find Science subjects difficult to learn					
2.	Students believe Science is meant for male students to learn					
3.	Students rarely have practical lessons using ICT					
4.	Whenever periods for studying science come, students lose interest					
5.	Tutors teach in a way that motivate students in class					
	Teaching					
1.	Teaching large classes using ICT is so tedious					
2.	Tutors in this college regularly use ICT to teach science subjects					
3.	The available ICT resources in this college do not allow effective teaching of Science subjects					
4.	Whenever tutors use ICT in Science, students enjoy the lesson					
5.	Making Science subjects compulsory in PTE programme is					

	a wise idea					

SECTION E: ICT and Pre-service teachers' academic performance

	Relationship between ICT and Pre-service teachers' academic performance	**SD**	**D**	**NS**	**A**	**SA**
1.	The students' academic performance in science subjects in this college is satisfactory					
2.	ICT greatly contributes to the students' academic performance in Science subjects in this college					

END

Appendix 2: Questionnaire for Laboratory Technicians

Dear respondent, my name is Magenge Andrew conducting a study to investigate about Information Communication Technology and Pre-service teachers' Academic Performance in Science Subjects: A case of Public and Private Primary Teachers' Colleges in Iganga District, as a basic requirement for an award of degree of Master of Education in Education Foundations of Kyambogo University. Your responses to the questions asked herein therefore contribute to the compilation of the required report.

Instructions:

Section A: Socio-Demographic Characteristics

9. Age
    a) Under 20 ☐
    b) From 20 - 29 ☐
    c) From 30-39 ☐
    d) From 40-49 ☐
    e) 50 or more ☐
10. Gender
    a) Male ☐
    b) Female ☐
11. Average number of students per stream
    a) Less than 30 ☐
    b) 30-39 ☐
    c) 40-49 ☐
    ☐

d) 50-59

e) 60 and above ☐

12. ICT is integrated in the teaching/learning process of other subjects in this college

a) Yes ☐

b) No ☐

Section B: ICT Equipment available to facilitate teaching/learning of science subjects

13. Does this college provide students with ICT equipment?

(a) Yes ☐

(b) No ☐

14. Which of the following do you own for use in PTC?

a) Laptops ☐

b) Tablet PC ☐

c) Desktop computers ☐

d) Netbooks for use in ICT lessons ☐

15. Which of the following does the PTC provide to you for use during ICT lessons?

a) Laptops or tablet PC ☐

b) Desktop computers ☐

c) Netbooks for use in ICT lessons ☐

16. State the extent to which you agree about availability of each of the following in this college

No		Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
	Facilities					
a)	Computer lab with adequate space					
b)	Computers with relevant software					
c)	Adequate number of functional computers					
d)	Safety and security equipment e.g. fire extinguishers, air conditioners, relevant furniture					
	Resources: **Lab Technicians have access to the following;**					
a)	Desktop Computers					
b)	Laptops					
c)	Tablets					
d)	Smart boards					
e)	Smart phones					

f)	Scanners					
g)	Projector					
h)	Printer					
i)	Wifi connectivity					
j)	Modem connectivity					
k)	Data bundles connectivity					
	Lab Technicians in this college are actively involved in the following activities;					
a)	Regular use of e-mail					
b)	Conducting academic research electronically					
c)	Presentation programmes					

Section C: Students' interests towards use of ICT

Rate students in terms of how they are interested in each of the following;

No	**Students in this college have interest in;**	**None**	**A little**	**A lot**
1.	Learning to use computers			
2.	Using ICT to do given class assignments			

3.	Using ICT to communicate			
4.	Using ICT to facilitate teaching and learning			
5.	Producing a science text using word processing programme			
6.	Organizing computer files in folders and subfolders			
7.	Using a spreadsheet (e.g., Excel) to display scientific data			
8.	Creating a presentation with simple animation functions			
9.	Creating a presentation with video or audio clips			
10.	Participating in a discussion forum on the internet			
11.	Downloading software on a computer			
12.	Installing software on a computer			
13.	Downloading curriculum resources from/to websites or learning platforms for students to use			
14.	Uploading curriculum resources from/to websites or learning platforms for students to use			

SECTION D: TEACHING AND LEARNING OF SCIENCE SUBJECTS

SN	**Teaching and learning of science subjects**	**SD**	**D**	**NS**	**A**	**SA**

	Learning					
1.	Students find Science subjects difficult to learn					
2.	Students believe Science is meant for male students to learn					
3.	Students rarely have practical lessons using ICT					
4.	Whenever periods for studying science come, students lose interest					
5.	Tutors teach in a way that motivate students in class					
	Teaching					
1.	Teaching large classes using ICT is so tedious					
2.	Tutors in this college regularly use ICT to teach science subjects					
3.	The available ICT resources in this college do not allow effective teaching of Science subjects					
4.	Whenever tutors use ICT in Science, students enjoy the lesson					
5.	Making Science subjects compulsory in PTE programme is a wise idea					

SECTION E: ICT and Pre-service teachers' academic performance

	Relationship between ICT and Pre-service teachers' academic performance	**SD**	**D**	**NS**	**A**	**SA**
1.	The students' academic performance in science subjects in this college is satisfactory					
2.	ICT greatly contributes to the students' academic performance in Science subjects in this college					

END

Appendix 3: Questionnaire for Pre-service teachers

Dear respondent, my name is Magenge Andrew conducting a study to investigate about Information Communication Technology and Pre-service teachers' Academic Performance in Science Subjects: A case of Public and Private Primary Teachers' Colleges in Iganga District, as a basic requirement for an award of degree of Master of Education in Education Foundations of Kyambogo University. Your responses to the questions asked herein therefore contribute to the compilation of the required report.

Instructions:

Section A: Socio-Demographic Characteristics

1. Age
   a) Under 20 ☐
   b) From 20 - 29 ☐
   c) From 30-39
   d) From 40-49 ☐
   e) 50 or more ☐
2. Gender
   a) Male ☐
   b) Female ☐
3. Average number of students per stream
   a) Less than 30 ☐
   b) 30-39 ☐
   c) 40-49 ☐

d) 50-59 ☐

e) 60 and above ☐

4. ICT is integrated in the teaching/learning process of other subjects in this college

   a) Yes ☐

   b) No ☐

Section B: ICT Equipment available to facilitate teaching/learning of science subjects

5. Does this college provide students with ICT equipment?

   (a) Yes ☐

   (b) No ☐

6. Which of the following do you own for use in PTC?

   a) Laptops ☐

   b) Tablet PC ☐

   c) Desktop computers ☐

   d) Netbooks for use in ICT lessons ☐

7. Which of the following does the PTC provide to you for use during ICT lessons?

   a) Laptops or tablet PC ☐

   b) Desktop computers ☐

   c) Netbooks for use in ICT lessons ☐

8. State the extent to which you agree about availability of each of the following in this college

No		Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
	Facilities					
a)	Computer lab with adequate space					
b)	Computers with relevant software					
c)	Adequate number of functional computers					
d)	Safety and security equipment e.g. fire extinguishers, air conditioners, relevant furniture					
	Resources: **Students in this college have access to the following;**					
a)	Desktop Computers					
b)	Laptops					
c)	Tablets					
d)	Smart boards					
e)	Smart phones					
f)	Scanners					

g)	Projector					
h)	Printer					
i)	Wifi connectivity					
j)	Modem connectivity					
k)	Data bundles connectivity					
	Students in this college are actively involved in the following activities;					
a)	Regular use of e-mail					
b)	Conducting academic research electronically					
c)	Presentation programmes					

Section C: Students' interests towards use of ICT

Rate students in terms of how they are interested in each of the following;

No	**Students in this college have interest in;**	**None**	**A little**	**A lot**
1.	Learning to use computers			
2.	Using ICT to do given class assignments			

3.	Using ICT to communicate			
4.	Using ICT to facilitate teaching and learning			
5.	Producing a science text using word processing programme			
6.	Organizing computer files in folders and subfolders			
7.	Using a spreadsheet (e.g., Excel) to display scientific data			
8.	Creating a presentation with simple animation functions			
9.	Creating a presentation with video or audio clips			
10.	Participating in a discussion forum on the internet			
11.	Downloading software on a computer			
12.	Installing software on a computer			
13.	Downloading curriculum resources from/to websites or learning platforms for students to use			
14.	Uploading curriculum resources from/to websites or learning platforms for students to use			

SECTION D: TEACHING AND LEARNING OF SCIENCE SUBJECTS

SN	Teaching and learning of science subjects	SD	D	NS	A	SA
	Learning					
1.	Students find Science subjects difficult to learn					
2.	Students believe Science is meant for male students to learn					
3.	Students rarely have practical lessons using ICT					
4.	Whenever periods for studying science come, students lose interest					
5.	Tutors teach in a way that motivate students in class					
	Teaching					
1.	Teaching large classes using ICT is so tedious					
2.	Tutors in this college regularly use ICT to teach science subjects					
3.	The available ICT resources in this college do not allow effective teaching of Science subjects					
4.	Whenever tutors use ICT in Science, students enjoy the lesson					
5.	Making Science subjects compulsory in PTE programme is					

	a wise idea					

SECTION E: ICT and Pre-service teachers' academic performance

	Relationship between ICT and Pre-service teachers' academic performance	**SD**	**D**	**NS**	**A**	**SA**
1.	The students' academic performance in science subjects in this college is satisfactory					
2.	ICT greatly contributes to the students' academic performance in Science subjects in this college					

END

Appendix 4: Interview Guide for Principals

1. In your view, as an administrator, in what ways is ICT important to the teaching of science subjects?
2. What are some of the ICT equipment needed in the teaching of science subjects?
3. Which of the ICT equipment needed for the teaching of science subjects are available in this college?
4. What is your opinion on pre-service teachers' interest in using ICT for learning Science subjects?
5. Which ICT skills can you spot, which science tutors normally use in teaching students?
6. How often, in terms of days in a week, do science tutors use ICT in teaching?
7. By mentioning a particular Science subject at a time, explain how the use of ICT can enhance academic performance in science subjects

Appendix 5: Interview Guide for Key Informants

1. What are some of the ICT resources available in your college?
2. Are they enough ICT resources to facilitate the pre-service teachers in the teaching/learning of Science subjects?
3. If yes, how?
4. If No, why?
5. Do pre-service teachers have interest in the use of ICT to facilitate the teaching/learning process?
6. If Yes, what shows that they have interest?
7. Comment on pre-service teachers' scores in Science subjects before the use of ICT.
8. Comment on pre-service teachers' scores in Science subjects when using ICT resources.
9. Has the use of ICT resources helped pre-service teachers to improve on the academic performance?
10. If Yes, how?
11. If No, why?

END