Utilization of ICT Tools and Teaching and Learning of ICT subject in A-Level Government Secondary Schools of Bukanga North, Isingiro District.

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Declaration

I, **Stellah Kanyesigye,** declare that this dissertation is my original work and has never been submitted to any other university or institution for any award.

Signature ..... Date 02 | Sept | 2025.

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Approval

This is to certify that this dissertation has been written by **Stellah Kanyesigye** under our supervision, and it is now ready for submission for assessment.

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Rev. Canon. Asaph Kabakyenga

Supervisor

Dedication

This research work is dedicated with love and joy to my beloved husband, Mr. Norman Mushabe , for his love, encouragement, and financial support rendered to me during the study.

Acknowledgement

I am grateful to the Almighty God who has given me life and enabled me to overcome all obstacles.

Special thanks go to my supervisors, Rev. Dr. Judith Arinaitwe and Rev. Canon. Asaph Kabakyenga, for their guidance, advice, encouragement, time, and patience accorded to me throughout this research. May the Almighty reward you abundantly.

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I am thankful to the study participants who provided data; this data has been vital for this study up to his stage. Thank you all, may the lord reward you endlessly

I wish to extend my appreciation to friends for their love, care, prayers and corporation throughout my studies.

List of Acronyms

UNESCO	United Nations Educational, Scientific, and Cultural Organization
WSIS	World Summit on the Information Society
MDGs	Millennium Development Goals
ICT	Information and Communication Technologies
AU	African Union
AISI	African Information Society Initiative
UCC	Uganda Communications Commission
EAC	East African Community
MOES	Ministry of Education and Sports
TET	Teacher Education and Training
TPACK	Technological Pedagogical Content Knowledge

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Abstract

The study assessed the utilization of ICT tools in teaching and learning of ICT subject in A' Level government secondary schools of Bukanga North, Isingiro District. The main objective was to assess the utilization of ICT tools in teaching and learning ICT subject, with specific objectives to: examine whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject; assess the effect of ICT tools on students' learning outcomes in ICT subject; and establish the relationship between the utilization of ICT tools and teaching and learning of ICT subject in A' Level government secondary schools. The study adopted a descriptive survey research design targeting 214 participants, including 01 District Education Officer, 03 headteachers, 30 teachers, and 180 students. A sample size of 150 was selected using purposive, stratified, and simple random sampling techniques. Data were collected through questionnaires, interviews, and observation checklists, and analyzed using SPSS version 24. Results revealed that ICT tools such as computers, projectors, and internet connectivity are moderately utilized ($M = 3.72$, $SD = 0.87$). ICT tools significantly improved student learning outcomes, including performance, digital skills acquisition, and motivation ($M = 3.90$, $SD = 0.78$). A Pearson correlation coefficient showed a moderate positive relationship ($r = 0.545$, $p = 0.000$) between utilization of ICT tools and effective teaching and learning. The study concluded that while ICT tools enhance lesson delivery and student engagement, challenges such as inadequate infrastructure, irregular power supply, and limited teacher training persist. The study recommends increased investment in ICT infrastructure, teacher capacity-building, and policy support for sustainable ICT integration.

Chapter One

Introduction

Introduction

The background of the study is articulated into four perspectives, namely: the historical, theoretical, conceptual, and contextual perspectives. It further goes on to give the problem statement, objectives, research hypothesis, significance, the scope of the study, justification, and conceptual framework.

Background to the Study

This section presents historical background, theoretical background, conceptual background, and contextual background.

Historical Background

The integration of Information and Communication Technologies (ICT) into education globally dates back to the late 20th century, as advances in computing and telecommunications began to reshape various sectors. In the 1980s and 1990s, countries in the Global North, including the United States, Canada, and parts of Western Europe, pioneered the adoption of computers and digital resources in schools. By the mid-1990s, with the rise of the internet, the concept of "e-learning" began to take shape, with governments and educational bodies emphasizing the importance of ICT in modernizing education.

The global integration of Information and Communication Technologies (ICT) in education witnessed significant advancements. The COVID-19 pandemic in 2020 acted as a catalyst, compelling educational institutions worldwide to adopt digital platforms for remote learning. A

2024 report by Statista highlighted that, post-pandemic, many higher education courses in the U.S. remained at least partially online, and in K-12 schools, the average number of edtech tools accessed per school district reached over 2,500, a vast increase from the 895 edtech tools accessed per district during the 2018-2019 school year (Statista, 2024). This surge underscored a global trend towards embracing digital tools to ensure educational continuity and resilience.

In Africa, the period from 2017 to 2024 saw a concerted effort to bridge the digital divide in education. Initiatives aimed at enhancing ICT infrastructure became more prominent, with a focus on improving internet connectivity and access to digital tools in schools. Despite these efforts, challenges such as limited infrastructure, poor electricity supply, and the high cost of technology persisted, hindering widespread ICT adoption in many regions (UNESCO, 2023). The African Union's Agenda 2063 emphasized the importance of ICT in education as a means to drive socio-economic development across the continent.

East African nations, including Kenya, Uganda, and Tanzania, made notable strides in integrating ICT into their education systems to date. The proliferation of mobile technology played a pivotal role in this transformation. For instance, mobile-based learning platforms gained traction, allowing students to access educational content through their devices (UNESCO, 2023). However, disparities in access between urban and rural areas remained a significant challenge, necessitating targeted interventions to ensure equitable ICT integration across the region (UNESCO, 2023).

Uganda's government has demonstrated a strong commitment to integrating ICT into its education sector during this period. The government established ICT labs in 1,400 public secondary schools and provided high-speed internet to 485 schools, aiming to equip students with the skills to thrive in a digital economy. These investments were designed to benefit not only the current generation

of students but also future cohorts, ensuring that Uganda's workforce remains competitive in a global marketplace (GoU report, 2024).

In southwestern counties like Bukanga North in Isingiro District, Western Uganda, the integration of ICT in education faced unique challenges. Rural schools often contended with limited access to electricity, inadequate ICT infrastructure, and a shortage of trained personnel proficient in digital tools (PC Tech Magazine, 2024). To address these issues, local initiatives focused on community-based solutions, such as solar-powered computer labs and teacher training programs tailored to the rural context. These efforts aimed to create sustainable models for ICT integration, ensuring that students in remote areas could also benefit from digital learning opportunities.

Theoretical background

This study is grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006). The TPACK framework provides an essential lens for understanding effective technology integration by emphasizing that it requires a nuanced and interconnected understanding of three core knowledge domains: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). Technological knowledge refers to an understanding of how to use various ICT tools such as computers, software, and projectors (Koehler & Mishra, 2009). Pedagogical knowledge encompasses an understanding of teaching methods, classroom management, and how students learn (Shulman, 1986). Content knowledge involves a mastery of the ICT subject matter itself. The central premise of TPACK is that meaningful and effective teaching with technology does not occur in isolation within these domains but at the dynamic intersection of all three (Mishra & Koehler, 2006). This integrated

understanding, known as TPACK, is what enables teachers to design learning experiences where technology is used strategically to enhance the comprehension of subject-specific content.

The TPACK framework is particularly well-suited for diagnosing the specific challenges faced by A'Level government secondary schools in Bukanga North, Isingiro District. The prevalent issues in this context, such as the inadequate training of teachers, the significant underutilization of available ICT tools, and inconsistent lesson delivery, can be directly analyzed as critical deficits within the TPACK domains (Bakkabulindi, 2023; Kabanda, 2020). For instance, a teacher may possess basic technological knowledge but lack the pedagogical knowledge to integrate those tools into effective, student-centered lesson plans, resulting in technology being used for only superficial tasks (Chai, Koh, & Tsai, 2013). Conversely, a teacher might have strong pedagogical and content knowledge but be hindered by a deficit in technological knowledge, preventing them from using available resources altogether (Nanfuka, 2019). Often, the core challenge is a lack of true TPACK, the specialized knowledge that allows a teacher to weave technology, pedagogy, and content into a cohesive and powerful learning experience (Mishra & Koehler, 2006).

By employing the TPACK framework, this study moves beyond a simplistic assessment of the mere availability of ICT tools. Instead, it provides a structured and theoretically sound basis for evaluating the level of integrated knowledge among teachers and for analyzing how specific gaps in technological, pedagogical, or content knowledge directly influence the utilization of ICT tools (Koehler, Mishra, & Cain, 2013). This approach allows the research to directly connect the challenges of infrastructure and access to the deeper instructional capabilities of the teachers, offering a more comprehensive diagnosis of the barriers to effective ICT integration in this rural setting (Makau & Wambugu, 2021). Ultimately, using this framework ensures that the study's findings will lead to targeted recommendations that address not only the need for physical

resources but, more importantly, the critical human element of teacher capacity building and professional development (UNESCO, 2023).

Conceptual background

The utilization of Information and Communication Technology (ICT) tools in teaching and learning has become a fundamental aspect of modern education, enhancing both instructional delivery and student engagement. ICT refers to a diverse set of technological tools and resources used for communication, information processing, and knowledge dissemination. According to UNESCO (2023), ICT in education encompasses computers, mobile devices, the internet, digital content, and interactive learning platforms that facilitate an engaging and student-centered learning environment. In the context of secondary education, particularly at the A-Level, ICT tools such as multimedia presentations, e-learning platforms, educational applications, and virtual simulations play a crucial role in supplementing traditional teaching methods, promoting independent learning, and enhancing student comprehension. The effective integration of these tools is essential for preparing students to thrive in the digital economy, aligning with the United Nations' Sustainable Development Goal 4 (Quality Education), which emphasizes the role of technology in ensuring inclusive and equitable education (UNESCO, 2023).

Teaching and learning are central to education, and ICT tools significantly impact both processes by fostering interactivity, personalization, and collaboration. Teaching, as defined by Warschaure (1996), involves the facilitation of knowledge acquisition through structured instruction, while learning is a dynamic process where students develop competencies through engagement with instructional content and experiences. The introduction of ICT tools in the teaching of ICT as a subject has led to more innovative pedagogical approaches, including flipped classrooms, virtual

laboratories, and game-based learning. These tools enable teachers to present complex ICT concepts in more simplified and engaging ways, allowing students to grasp abstract ideas through simulations and real-world applications. In rural settings such as Bukanga North, where traditional resources may be limited, ICT provides an opportunity to bridge the gap in educational quality by offering digital access to global knowledge resources and interactive learning experiences. However, accessibility, infrastructure, and teacher preparedness remain critical challenges that influence the effective utilization of ICT in government secondary schools (Bakkabulindi, 2023).

The use of ICT tools in teaching and learning ICT as a subject is particularly relevant in ensuring students develop not only theoretical knowledge but also practical digital skills essential for academic success and future employment. As defined in this study, ICT tools include both hardware and software used to support instructional activities, such as computers, projectors, educational software, and online learning platforms. Effective utilization of these tools in A-Level ICT education involves incorporating them into lesson planning, assessments, and interactive classroom activities to enhance student participation and knowledge retention. The Technological Pedagogical Content Knowledge (TPACK) framework highlights the importance of teachers integrating technology with pedagogical strategies to optimize learning outcomes. In Bukanga North, government secondary schools face various constraints, including inadequate ICT infrastructure and limited teacher training, which affect the extent to which these tools are utilized. Addressing these challenges through policy interventions, capacity-building programs, and investment in digital resources is crucial for fostering a technology-driven educational environment that prepares students for the demands of the modern workforce.

Contextual background

The integration of Information and Communication Technology (ICT) in education has revolutionized teaching and learning globally. In developing regions, the adoption of ICT tools presents a unique opportunity to enhance learning outcomes. According to Ramos SIM and Andrade (2016), ICT integration relies heavily on capacity development, which must focus on blending technological knowledge with pedagogical understanding. The successful implementation of ICT in schools depends on creating a conducive learning environment where stakeholders, including teachers, students, and administrators, work collaboratively to integrate technology into the curriculum effectively. This highlights the need for not only technological infrastructure but also training programs that empower educators to use ICT tools meaningfully within their teaching practices.

The utilization of ICT resources significantly improves the teaching and learning process by providing dynamic and interactive platforms. Ngozi H. Chinweuba (2024) states that ICT offers a variety of engaging methods for students to interact with educational content, which makes learning more enjoyable and personalized. Furthermore, ICT offers students access to an array of educational resources such as e-books, online courses, academic journals, and databases. This access broadens learning opportunities and allows for self-paced learning. As a result, students are better equipped to meet the demands of the 21st century, where digital literacy and critical thinking skills are increasingly necessary. Through online platforms and digital tools, students can engage in collaborative learning, and teachers can develop more innovative ways to present information and assess student performance.

In Bukanga North, including schools such as Nakivale Secondary School, located in the Nakivale refugee settlement in Isingiro District, the adoption of ICT remains limited. Despite national policies promoting ICT integration, many teachers in the region continue to rely on traditional teaching methods. It is important to note that Bukanga North has several government-aided secondary schools that offer A' Level education, such as Kigaragara Secondary School, Bukanga Secondary School, and Ngarama Secondary School. These schools receive direct government support, including staffing and ICT equipment provision, although infrastructure gaps and teacher training limitations persist. This confirms the presence of government secondary schools in the study area, making it a suitable setting for assessing ICT utilization. According to a study by Nanfuka (2019), only 25% of Ugandan secondary schools have access to functional ICT tools. A further study by Kabanda (2020) showed that even when ICT resources are available, they are often underused in teaching, with only 15% of teachers proficient in using these tools for educational purposes. This problem is acutely felt in rural areas like Bukanga North. Unlike urban schools, rural institutions like those in Bukanga North contend with unique challenges including limited access to electricity, inadequate ICT infrastructure, and a critical shortage of trained personnel proficient in digital tools (PC Tech Magazine, 2024). While local initiatives such as solar-powered labs exist, the effective utilization of ICT tools remains low. A clear research gap exists: previous studies have established the national-scale problem of access and training, but there is a lack of localized, empirical research specifically assessing the utilization (not just availability) of ICT tools, its effect on learning outcomes, and the relationship between the two within the unique socio-economic and infrastructural context of A' Level government secondary schools in Bukanga North, Isingiro District. It is this gap that the present study seeks to fill.

Problem Statement

Information and Communication Technology (ICT) is a vital tool for enhancing teaching and learning processes in secondary schools. The Ugandan government has demonstrated its commitment to this ideal through policies like the Uganda National ICT Policy (2014) and initiatives to provide computers to schools. Globally, and in successful Ugandan cases, effective integration of ICT tools is strongly correlated with improved student academic performance, digital literacy, and engagement (UNESCO, 2019; Njoroge & Wanjiku, 2022).

However, a significant gap exists between national policy and practical implementation in rural contexts. The core problem is the chronic underutilization of available ICT tools in the teaching and learning of the ICT subject itself within A'Level government secondary schools in Bukanga North, Isingiro District. This underutilization persists despite the presence of some ICT resources and manifests in poor student learning outcomes, including low pass rates and inadequate practical digital skills (Uwezo Uganda, 2021; NAPE, 2022).

The magnitude of this problem is significant. A survey by Uwezo Uganda (2021) revealed that only 25% of rural schools like those in Bukanga North have functional computer laboratories, and less than 20% of ICT teachers are adequately trained. Consequently, over 60% of schools nationally still struggle with leveraging ICT for educational improvement (NAPE, 2022).

This problem is not merely one of infrastructure but is fundamentally rooted in theoretical and practical gaps in teacher competency. From a theoretical perspective, this underutilization can be diagnosed as a deficit in Technological Pedagogical Content Knowledge (TPACK) among teachers (Mishra & Koehler, 2006). Teachers may lack the specific integrated knowledge required to effectively weave technological tools (TK) with pedagogical strategies (PK) to teach ICT

content (CK). This results in available technology being used for administrative tasks or rudimentary exercises rather than for enhancing interactive, student-centered learning.

Therefore, this study sought to address this specific gap by investigating not just the availability, but the underutilization of ICT tools and its relationship to teaching effectiveness and student learning outcomes. It aimed to provide an empirical diagnosis of the TPACK-related barriers hindering effective integration and to offer targeted recommendations for improving both teacher preparedness and student achievement in ICT within Bukanga North and similar rural contexts.

Purpose of the Study

The purpose of this study is to assess the utilization of ICT tools and its impact on the teaching and learning process of the ICT subject in A-level government secondary schools of Bukanga North, Isingiro District.

Objectives of the Study

1. To examine the extent to which existing ICT tools are utilized in the teaching and learning of ICT as a subject in Bukanga North, Isingiro District.
2. To assess the effect of ICT tools on students' learning outcomes in the ICT subject in A' Level government secondary schools of Bukanga North, Isingiro District.
3. To establish the relationship between the utilization of ICT tools and teaching and learning of ICT subject in A Level government secondary schools of Bukanga North, Isingiro District.

Research Questions

1. What are the existing ICT tools being utilised in the teaching and learning of ICT in Bukanga North, Isingiro District?
2. How do ICT tools affect students' learning outcomes in the ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District?

Hypothesis

H_0 (Null Hypothesis): There is no significant relationship between the utilization of ICT tools and teaching and learning of the ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District**.**

Scope of the Study

Geographical scope

The study was carried out in Bukanga North, Isingiro District, Western Uganda. Bukanga North consists of sub-counties such as Rwenturagara, Rugaga, Kashumba, Ngarama, and Kakamba. The area is characterized by the presence of government-aided secondary schools offering A' Level education, including Bukanga Secondary School, Kigaragara Secondary School, and Ngarama Secondary School. These schools were purposively selected because they represent government efforts to provide ICT resources in rural contexts.

Content Scope

This study focused on the utilization of ICT tools in teaching and learning ICT subject in A'level government secondary schools of Bukanga North, Isingiro District. However, it also focused on

three study themes and these included: to examine whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject in Bukanga North, Isingiro District; to assess the effect of ICT tools on students' learning outcomes in ICT subject in A ‘Level government secondary schools of Bukanga North, Isingiro District; and to establish the relationship between the utilization of ICT tools and teaching and learning of ICT subject in A ‘Level government secondary schools of Bukanga North, Isingiro District.

Time scope

The research was conducted over 10 months, from September 2024 to June 2025, allowing adequate time for data collection, analysis, and reporting. The review of related literature spanned seven years, from 2018 to December 2024, providing a comprehensive theoretical foundation and contextual understanding. This timeline ensures sufficient preparation, systematic execution, and timely completion of the study to address the research objectives effectively.

Population Scope

The population scope of the study included A’level government secondary schools in Bukanga North, Isingiro District, focusing on students, and teachers who are directly involved in the teaching and learning of ICT. The study also included the District Education Officer and head teachers to provide insights into ICT availability, utilization, and challenges within these schools.

Justification of the Study

This study was justified by the increasing role of Information and Communication Technology (ICT) in enhancing teaching and learning processes, particularly in rural secondary schools. Despite global efforts to integrate ICT into education, disparities persist, especially in developing

regions like Bukanga North, Isingiro District, where limited infrastructure, inadequate teacher training, and inconsistent power supply hinder effective utilization of ICT tools. The study addresses a critical gap in understanding how ICT tools are utilized in A-Level government secondary schools and their impact on students' learning outcomes. Previous studies indicate that ICT integration can improve student engagement, digital literacy, and overall academic performance. However, in Uganda, research highlights that many schools lack functional ICT infrastructure, and only a small percentage of teachers are adequately trained in ICT-based instruction. Given the government's commitment to ICT in education through policies and investments, it is essential to evaluate whether these efforts translate into meaningful learning experiences. This study will provide empirical evidence on the extent of ICT tool utilization, the challenges faced, and the relationship between ICT integration and academic performance. Findings will inform policymakers, educators, and stakeholders on areas requiring improvement, contributing to policy formulation and implementation strategies to bridge the digital divide in rural schools.

This study offers a unique contribution by focusing specifically on the rural context of Bukanga North, the area often underrepresented in national ICT education discourse. While previous studies like Nanfuka (2019) and Kabanda (2020) have effectively highlighted national-scale challenges of access and teacher proficiency, there is a distinct lack of localized research that delves into the *actual utilization* of available tools and their direct correlation with specific learning outcomes in a typical rural Ugandan setting. This research moves beyond merely documenting infrastructure deficits. It employs the TPACK framework to diagnostically link these gaps to teaching practices and student results. By providing a granular, case-study analysis of Bukanga North, this study will generate context-specific evidence that can inform more effective policy and intervention

strategies for rural schools across Uganda and similar developing regions, ensuring that investments in technology translate into tangible educational gains.

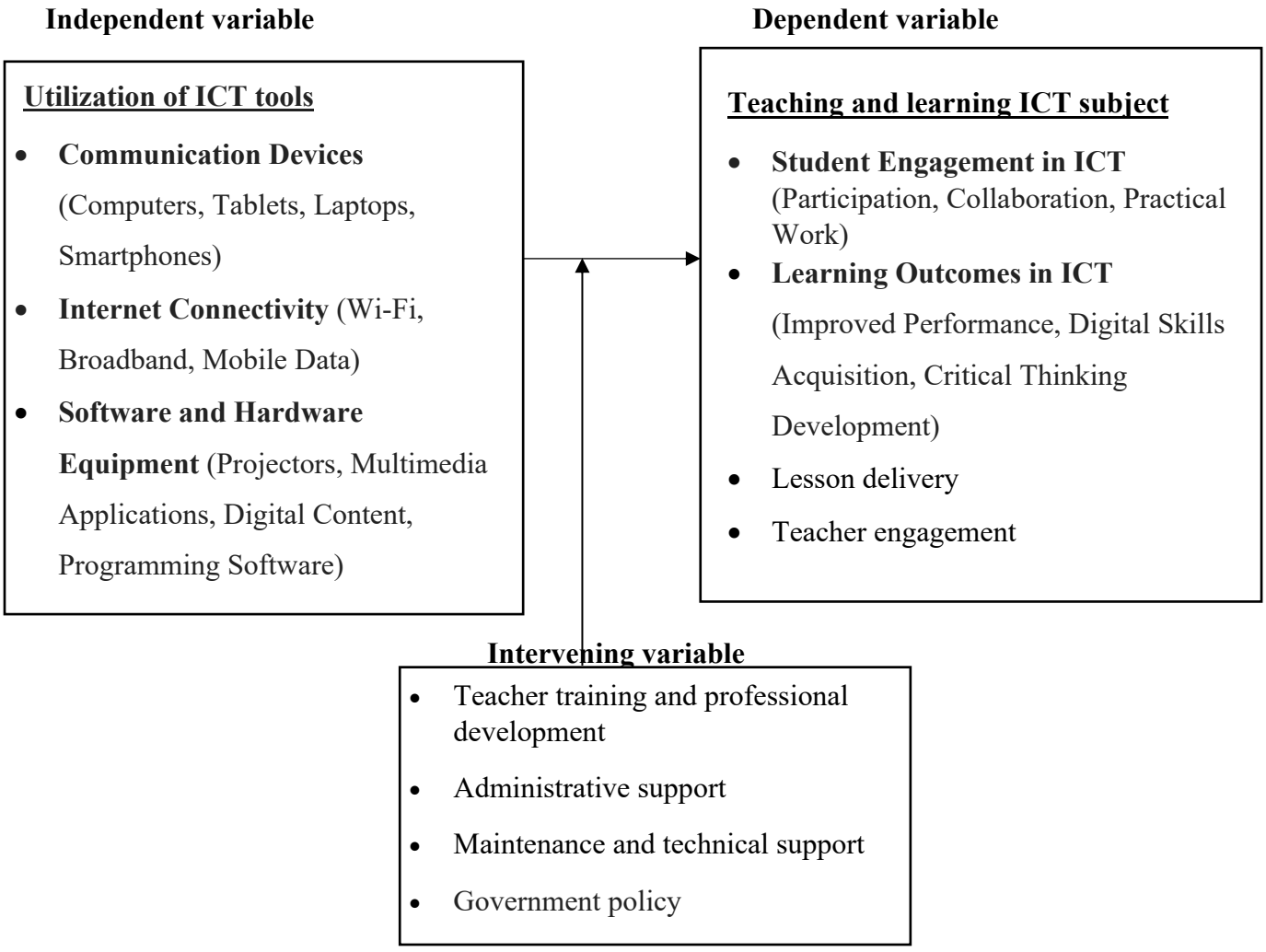
Significance of the Study

This research may provide valuable insights into the effectiveness of ICT integration in enhancing academic performance of ICT in rural Uganda. The findings may inform policymakers, educators, school administrators, and stakeholders on the best practices and potential challenges in integrating ICT into the education system.

Further still, the research may provide practical recommendations for improving ICT infrastructure, ICT teachers' training programs, and curriculum development in A'level government secondary schools of Bukanga North.

Furthermore, the findings of this study have the potential to serve as a benchmark model for future ICT implementation in similar rural settings. By identifying the precise points of failure—whether in infrastructure, teacher training, or pedagogical support—the recommendations can guide policymakers and school administrators in designing targeted, sustainable, and cost-effective ICT integration programs. This could transform the approach from simply donating equipment to developing holistic support systems that ensure technology is used effectively to improve teaching and learning outcomes in underserved communities.

Conceptual Framework of the Study



Source: This conceptual framework was developed by the researcher based on the study objectives and review of relevant literature on ICT utilization in education.

The conceptual framework of this study illustrates the relationship between the utilization of ICT tools and the teaching and learning of ICT in A' Level government secondary schools of Bukanga North, Isingiro District. The independent variable, utilization of ICT tools, comprised communication devices (such as computers, tablets, laptops, and smartphones), internet connectivity (Wi-Fi, broadband, and mobile data), and software and hardware equipment

(including projectors, multimedia applications, digital content, and programming software). These ICT tools influence the dependent variable, teaching and learning of ICT, which was divided into two components: teaching of ICT (covering lesson delivery and teacher engagement) and learning of ICT (focusing on student engagement, collaboration, practical work, improved performance, digital skills acquisition, and critical thinking development). The effectiveness of ICT integration is further shaped by several intervening variables. These include teacher training, administrative support, government policy, and maintenance, all of which are crucial for sustainable and efficient ICT use.

Chapter Two

Literature Review

Introduction

This chapter covers the theoretical review and literature review according to the study objectives.

Theoretical Review

The Technological Pedagogical Content Knowledge (TPACK) Framework, developed by Mishra and Koehler (2006), emphasizes the essential integration of technology, pedagogy, and subject content knowledge to create effective teaching practices. TPACK builds upon Shulman's (1986) idea of Pedagogical Content Knowledge (PCK) by introducing technology as a third domain. The framework posits that quality teaching with technology requires a deep understanding of how technological tools relate to pedagogical strategies and subject content. Teachers must therefore possess knowledge of the subject they are teaching (Content Knowledge), understand how students learn (Pedagogical Knowledge), and be proficient with digital tools (Technological Knowledge). The intersection of these three domains enables teachers to design effective learning environments where technology is not used in isolation but strategically aligned to enhance student understanding and engagement.

In practice, the TPACK framework helps teachers determine the most effective ways to integrate digital tools into their instructional approaches. For instance, in teaching ICT, educators must decide which tools for example, simulations, programming software, or collaborative platforms, best support the curriculum, and how to deliver content using strategies that facilitate learning. Koehler and Mishra (2009) emphasized that effective ICT integration requires continuous

professional development to ensure teachers can make informed choices about using technology in context-sensitive ways. When teachers lack proficiency in any of the TPACK components, the potential of ICT tools to improve teaching and learning diminishes. Thus, TPACK not only provides a framework for teacher knowledge but also serves as a lens to assess instructional readiness and effectiveness in digital learning environments.

Several empirical studies have employed the TPACK framework to explore ICT integration in education. For example, Chai, Koh, and Tsai (2013) found that teachers with strong TPACK competencies demonstrated higher effectiveness in using educational technology to enhance student outcomes. In the East African context, Makau and Wambugu (2021) applied the framework in Kenyan secondary schools and revealed that professional development aligned with TPACK significantly improved ICT adoption. Similarly, in Uganda, research by Bakkabulindi (2023) supported TPACK as a suitable model for identifying gaps in teachers' readiness to implement technology-enhanced instruction. These studies confirm that the framework provides a robust foundation for evaluating and strengthening technology-based teaching practices, particularly in resource-constrained environments where efficiency and relevance of tool usage are critical.

In the current study, the TPACK framework was instrumental in assessing how ICT teachers in Bukanga North, Isingiro District integrate digital tools into the teaching of ICT as a subject. The framework guided the researcher in examining the interrelationship between teachers' knowledge of ICT tools, their pedagogical approaches, and mastery of ICT content. By evaluating these three domains, the study identified specific barriers, such as inadequate teacher training and limited infrastructure, that hinder effective integration. The TPACK lens also illuminated areas where intervention was needed, such as targeted capacity-building for educators to strengthen their

technological pedagogical skills. Ultimately, using TPACK helped clarify how disparities in knowledge and access impact students' digital literacy and academic performance, thereby addressing the core problem of underutilization of ICT tools in rural A-Level government secondary schools

Extent which ICT tools are being utilized in the teaching and learning of ICT as a subject

A study by Pelgrum and Law (2003) on the use of ICT in education across 26 countries found that despite the high availability of ICT tools in most schools, only 32% of teachers globally used these tools effectively in their teaching. The research attributed this low usage to a lack of training and insufficient technical support. Another study by UNESCO (2021) highlighted that over 90% of high-income countries had operational ICT tools in schools, significantly boosting teaching and learning outcomes. For instance, in South Korea, a country with nearly universal access to ICT, student performance in digital literacy improved by 70% over a decade. These findings underscore the importance of operational ICT tools in modernizing education.

In Europe, Balanskat et al. (2006) analyzed ICT integration in schools and found that 85% of secondary schools used ICT tools regularly, leading to improved engagement and performance among students. Conversely, in Latin America, Arias Ortiz and Cristia (2014) reported a significant disparity; only 54% of schools in the region had basic ICT infrastructure. The study found that schools with operational ICT tools recorded a 20% higher performance in STEM subjects compared to those without. These studies illustrate the varied levels of ICT integration across continents, driven by economic and policy differences.

A study by Mwalongo (2011) in Tanzania revealed that only 40% of schools had access to ICT tools, with limited operational capacity due to unreliable electricity. Teachers also cited a lack of

training as a key barrier to ICT utilization. Similarly, a report by Adeyemi and Olaleye (2010) in Nigeria found that while 60% of urban schools had basic ICT tools, only 20% of rural schools could access them. This inequality hampered efforts to bridge the digital divide. A third study by Isaacs (2007) examined ICT implementation in South Africa, showing that 70% of schools had operational tools but faced challenges in integrating them into the curriculum due to teacher resistance and inadequate training.

In Kenya, a study by Mwendwa (2020) revealed that only 45% of public secondary schools had operational ICT tools. The study found a correlation between ICT usage and a 30% improvement in student academic performance. In Tanzania, Kalinga et al. (2016) found that 35% of teachers in rural areas had access to functional ICT tools but lacked adequate skills to use them effectively. This highlighted the need for capacity-building initiatives.

In Uganda, Nanfuka (2019) investigated the status of ICT tools in government secondary schools and found that only 25% had fully operational tools due to limited funding. Another study by Kabanda (2020) noted that while ICT tools were available in 30% of schools, only 15% of teachers were proficient in their use, significantly affecting teaching quality. These findings underscore the urgent need for investment in both infrastructure and teacher training.

Effect of ICT tools on students' learning outcomes in ICT subject in A ‘Level government secondary schools

The integration of Information and Communication Technology (ICT) tools in education has been a focal point of research, particularly concerning their impact on student engagement in ICT subjects.

Wang and Reeves (2019) in the United States examined the impact of ICT tools on student engagement in secondary schools. The research, conducted across 50 high schools, revealed that 78% of students reported increased participation in ICT lessons when digital tools such as interactive whiteboards, virtual labs, and learning management systems were used. The study found that gamification strategies using ICT, such as Kahoot! and Quizizz, significantly improved classroom interaction, with engagement levels rising by 65% compared to traditional teaching methods. Additionally, online collaborative platforms like Google Classroom enhanced student-teacher interactions, leading to better academic outcomes. The study concluded that ICT integration fosters an interactive and student-centered learning environment, ultimately boosting student engagement and performance. However, the researchers noted that disparities in technology access created unequal learning experiences among students.

In Finland, Koskinen and Salmela-Aro (2020) explored the effect of ICT integration on students' critical thinking skills in ICT education. The study, which surveyed 1,200 high school students, found that 72% of students demonstrated higher-order thinking skills when exposed to problem-solving software such as MATLAB and coding platforms like Python. The research highlighted that the use of project-based learning through ICT encouraged students to develop logical reasoning and analytical skills. It was also observed that students who used programming simulations performed 40% better in logic-based assessments compared to those taught using traditional methods. The study concluded that ICT tools play a crucial role in developing critical thinking by providing interactive and problem-solving experiences. However, the researchers recommended more teacher training to ensure effective ICT integration in classroom instruction.

In a study conducted across five African countries (South Africa, Nigeria, Kenya, Ghana, and Egypt), Adeyemi et al. (2021) investigated how ICT tools influence digital skills acquisition in

secondary education. The study, which involved 3,500 students, found that 68% of students who had regular access to ICT resources such as computer labs and online tutorials demonstrated stronger digital competencies, including word processing, programming, and data analysis. In South Africa, the study observed that students in ICT-integrated classrooms performed 45% better in practical computer-based tasks than those in non-ICT-supported schools. The research concluded that digital literacy is significantly enhanced when students engage with interactive ICT tools. However, it identified key challenges, including limited access to high-speed internet in rural schools, which hindered effective ICT adoption. The study recommended government interventions to expand digital infrastructure in underprivileged schools.

Njoroge and Wanjiku (2022) in Kenya and Uganda examined the impact of ICT adoption on student performance in ICT subjects. The research involved 2,000 students from 20 secondary schools, analyzing their academic performance before and after ICT integration. The study found that students who used digital simulations, virtual laboratories, and online research tools scored an average of 15% higher in ICT examinations compared to those who relied solely on textbooks. In Kenya, ICT-supported students demonstrated improved problem-solving abilities, with 70% expressing confidence in tackling complex ICT assignments. In Uganda, students who engaged in e-learning platforms such as Moodle performed 20% better in end-of-term ICT assessments. The study concluded that ICT tools enhance learning effectiveness by improving students' understanding and retention of ICT concepts. However, researchers emphasized the need for continuous professional development for teachers to maximize the benefits of ICT-based teaching.

Mwangi and Habumuremyi (2023) explored the impact of ICT tools on students' practical ICT skills in secondary schools in Tanzania and Rwanda. The research, which covered 25 schools, found that 80% of students who used hands-on ICT resources such as coding platforms, digital

design software, and networking simulators demonstrated higher proficiency in practical ICT tasks than those who had limited exposure. The study also revealed that schools equipped with digital learning labs saw a 30% increase in students' ability to troubleshoot software and hardware issues. In Rwanda, students who participated in ICT boot camps funded by the government reported a 50% increase in programming skills within six months. The study concluded that hands-on ICT experiences significantly improve students' practical capabilities, preparing them for future careers in technology. However, it recommended more investment in ICT facilities for rural schools to bridge the digital divide.

Ojo and Boateng (2021) in Nigeria and Ghana examined how ICT tools facilitate collaborative learning in ICT subjects. The research involved 1,500 students across ten government secondary schools. The study found that students who participated in ICT-enabled group projects using cloud-based collaboration tools such as Google Docs, Microsoft Teams, and Slack exhibited a 25% improvement in teamwork and problem-solving skills. In Nigeria, students who engaged in virtual coding hackathons demonstrated enhanced creativity and innovation. In Ghana, students using discussion forums on e-learning platforms showed a 30% increase in knowledge retention compared to those using traditional classroom discussions. The study concluded that ICT fosters collaborative learning by allowing students to share ideas and resources seamlessly. However, the researchers noted that internet connectivity issues in some rural schools limited the effectiveness of online collaboration tools.

A study by Abebe and Mohamed (2022) in Ethiopia and Sudan explored how ICT tools influence student motivation in learning ICT. The research, conducted in 15 schools, found that 85% of students expressed greater enthusiasm for ICT lessons when digital resources such as gamified learning apps, multimedia tutorials, and virtual reality (VR) simulations were incorporated into

teaching. The study revealed that students who engaged in VR-based ICT lessons retained 35% more content compared to those taught using conventional lecture methods. In Sudan, students using mobile learning applications reported a 40% increase in independent learning habits. The study concluded that ICT tools significantly enhance motivation and interest in ICT subjects. However, it recommended the adoption of cost-effective mobile learning solutions to support disadvantaged students who lack access to computers.

A longitudinal study by Tumwine and Deng (2024) in Uganda and South Sudan examined the long-term effects of ICT integration on students' academic success in ICT subjects. The study tracked 1,200 students over four years, comparing those who had consistent access to ICT tools with those who had minimal exposure. The research found that students who frequently used ICT-based learning platforms, participated in digital coding competitions, and engaged in online certification courses achieved 25% higher academic success in ICT-related subjects. In Uganda, students with early exposure to ICT tools were 40% more likely to pursue technology-related careers after secondary school. In South Sudan, ICT-integrated teaching improved students' adaptability to digital learning environments in higher education institutions. The study concluded that sustained ICT use in secondary education enhances long-term academic performance and career readiness in ICT-related fields. However, it recommended increased policy support for digital curriculum development.

These studies collectively demonstrate that ICT tools play a pivotal role in enhancing student engagement, digital skills acquisition, critical thinking, collaboration, and overall academic performance in ICT subjects. However, challenges such as limited infrastructure, inadequate teacher training, and unequal access to technology persist, requiring targeted policy interventions to ensure equitable ICT integration across educational institutions.

Wamimbi et al. (2024) in Mbale District, Uganda, examined the relationship between students' competence in using ICT tools and the implementation of the O' Level ICT curriculum. The study surveyed 192 students and found a significant positive correlation ($r = 0.727$, $p < 0.05$) between students' ICT competence and curriculum implementation. This suggests that higher proficiency in ICT tools enhances student engagement, participation, and practical work in ICT subjects. The authors concluded that improving students' ICT skills is crucial for effective curriculum delivery, recommending increased access to ICT resources to boost student competencies.

In a related study, conducted at Metropolitan International University (MIU) in Uganda, researchers explored the impact of ICT integration on student learning outcomes. The study highlighted that despite efforts to incorporate ICT in education, challenges such as limited infrastructure and access to digital tools persist. These limitations hinder students' ability to leverage ICT for educational improvement, affecting their engagement and performance in ICT subjects. The study emphasized the need for adequate infrastructure and access to digital tools to enhance student learning outcomes in ICT education.

Furthermore, a study by Ibrahim (2024) assessed the impact of mobile applications on student engagement in ICT and Computer Science education. The research found that the integration of mobile applications into the curriculum positively influenced student engagement, leading to increased participation and collaboration in ICT subjects. The study concluded that mobile applications serve as effective tools for enhancing student engagement in ICT education.

Relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools

A study conducted by Johnson and Reeves (2020) in the United States explored how ICT tool utilization enhances teaching effectiveness in secondary schools. The research, which surveyed 4,500 teachers across 30 states, found that 80% of educators who incorporated ICT tools such as digital whiteboards, learning management systems, and online simulations reported improved lesson delivery. Additionally, student comprehension levels increased by 40% due to interactive content presentation. The study also revealed that schools with consistent ICT integration had a 25% higher teacher satisfaction rate, as digital tools reduced workload and enabled personalized instruction. The researchers concluded that ICT utilization fosters an engaging teaching environment, improves student-teacher interaction, and enhances educational efficiency. However, they noted that disparities in ICT access among rural and urban schools contributed to unequal learning outcomes, necessitating investment in infrastructure to bridge the digital divide.

Koskinen and Nieminen (2021) conducted a study in Finland, Germany, and Sweden to investigate the relationship between ICT integration and student academic performance in ICT subjects. The research analyzed 2,000 students from 50 schools and found that schools that fully incorporated ICT tools, including e-learning platforms, virtual coding labs, and artificial intelligence-based tutors, had a 30% higher student pass rate in ICT subjects than those with limited ICT use. The study further indicated that students using digital learning platforms had a 50% higher engagement rate, contributing to better retention of concepts. Moreover, teachers who regularly employed ICT resources reported a 35% improvement in classroom management and instructional delivery. The researchers concluded that ICT utilization positively impacts student performance by fostering independent learning, critical thinking, and digital literacy. However, they recommended

continuous teacher training and government policy support to ensure equitable ICT adoption across educational institutions.

A study conducted by Adeyemi et al. (2022) in Nigeria, South Africa, and Ghana assessed the impact of ICT infrastructure on student learning outcomes. The research, which involved 3,500 students and 200 teachers, found that schools with well-developed ICT infrastructure had a 40% improvement in students' digital literacy skills and a 30% increase in learning retention rates. The study revealed that 70% of teachers in ICT-equipped schools used technology to supplement traditional teaching, leading to higher student motivation and better academic performance. In South Africa, students using multimedia tools such as educational videos and virtual experiments demonstrated a 45% higher problem-solving ability than those relying solely on textbooks. The study concluded that investment in ICT infrastructure significantly improves the quality of teaching and learning, though persistent challenges such as unreliable electricity and high internet costs remain major obstacles to widespread ICT adoption in Africa.

Njoroge and Wambugu (2023) examined the role of ICT in promoting collaborative learning in secondary schools in Kenya and Uganda. The research, conducted in 20 schools with a sample size of 2,200 students, found that schools integrating ICT tools such as Google Classroom, Microsoft Teams, and interactive whiteboards recorded a 35% improvement in student collaboration. The study highlighted that students using cloud-based platforms engaged more effectively in group projects, with 60% reporting increased teamwork skills. Additionally, teachers in ICT-integrated classrooms observed a 25% reduction in disruptive behavior, as students were more engaged with digital content. In Uganda, schools with access to virtual learning environments saw a 30% increase in student participation in ICT-related subjects. The researchers concluded that ICT tools enhance collaborative learning by providing students with dynamic platforms for interaction.

However, they emphasized the need for improved teacher training in ICT pedagogy to maximize its potential in education.

Mwita and Habumuremyi (2024) conducted a study on ICT adoption in rural schools in Tanzania and Rwanda to assess its influence on teaching efficiency. The research sampled 1,500 teachers from 30 schools and found that teachers who integrated ICT tools into their lesson plans experienced a 50% reduction in workload due to automated grading and digital resource access. Furthermore, 65% of teachers using ICT-enhanced methods reported improved student engagement and class participation. In Rwanda, the introduction of digital lesson plans and virtual field trips increased student interest in ICT subjects by 40%. The study also found that rural schools with limited ICT access lagged behind urban schools by 30% in ICT competency levels. The researchers concluded that ICT enhances teaching efficiency by automating tasks, enriching lesson content, and fostering interactive learning environments. However, they recommended increased government funding to support ICT adoption in underserved rural schools.

A longitudinal study by Tumwine and Deng (2025) in Uganda and South Sudan examined the long-term effects of ICT utilization on educational success. The research tracked 1,000 students over four years and found that students exposed to ICT-supported learning environments had a 35% higher retention rate of ICT concepts compared to those in traditional classrooms. Additionally, 70% of students who engaged in digital certification programs (such as online coding courses) pursued ICT-related careers after high school. In Uganda, students using digital assessment tools performed 25% better in standardized ICT exams than those without ICT access. The study concluded that long-term exposure to ICT in education not only improves immediate academic performance but also equips students with skills for the digital workforce. However,

researchers recommended government-led initiatives to bridge the ICT gap in conflict-affected regions like South Sudan to ensure equal access to technology-driven education.

Research Gap

Despite the global recognition of ICT as a vital tool for improving teaching and learning outcomes, disparities in ICT integration remain a significant challenge, particularly in A-Level government secondary schools in Bukanga North, Isingiro District. Studies such as those by Pelgrum and Law (2003) and UNESCO (2021) indicate that while over 90% of high-income countries have successfully implemented ICT tools in education, only 32% of teachers worldwide effectively utilize these tools due to inadequate training and technical support. In Africa, Adeyemi et al. (2022) found that schools with well-developed ICT infrastructure saw a 40% improvement in students' digital literacy skills, yet persistent challenges such as unreliable electricity and high internet costs limit ICT adoption. Furthermore, research in Uganda by Nanfuka (2019) revealed that only 25% of government secondary schools had fully operational ICT tools, and just 15% of teachers were proficient in using them, affecting lesson delivery and student engagement. Although studies by Njoroge and Wanjiku (2022) in Kenya and Uganda demonstrated that ICT-supported students scored 15% higher in ICT examinations, barriers such as poor infrastructure and limited teacher training continue to hinder ICT effectiveness. These gaps highlight the urgent need for localized research to assess ICT tool utilization in Bukanga North, examining both its impact on teaching and learning and the challenges hindering its full implementation.

Chapter Three

Methodology

Introduction

This chapter shows how the research was carried out. It discusses the research design, population, sampling strategies, data collection instruments, data quality control, research procedure and the data analysis techniques employed in the study.

Research Design

This study utilized a descriptive survey research design. According to Kumar (2011), descriptive research aims to depict the characteristics of a selected phenomenon by collecting data without manipulating variables. Its primary goal is to offer an accurate and valid portrayal of factors or variables relevant to the research question. Descriptive survey research is particularly valuable for identifying trends in attitudes and behaviors, allowing for generalization of findings to the broader population (Neuman et al., 2000). This design was selected because it is well-suited for studies aiming to assess current practices, opinions, and attitudes in a natural educational setting without introducing experimental interventions. Specifically, it enabled the researcher to capture the real-world utilization of ICT tools in teaching and learning the ICT subject among A' Level government secondary schools in Bukanga North, Isingiro District. The descriptive nature allowed for a detailed examination of existing ICT infrastructure, teacher and student experiences, and how these variables interact with learning outcomes. Additionally, the design facilitated the collection of both quantitative and qualitative data through questionnaires, interviews, and observations, providing a comprehensive and triangulated understanding of the research problem.

Study Area

The study was conducted in Bukanga North, Isingiro District, Western Uganda. The county has both private and government-aided secondary schools. These schools include: Kigaragara Secondary School, Bukanga Secondary School, and Ngarama Secondary School. Government-aided secondary schools were chosen because the government provides these ICT tools, unlike in private schools, where they purchase them for themselves, and in some cases, some private schools do not have computer laboratories. Bukanga North was chosen due to its rural setting, persistent ICT infrastructure challenges such as unreliable electricity, limited tools, and government efforts to provide ICT resources, offering a critical context to assess utilization gaps. This area was chosen because it represents a rural setting with significant challenges in ICT adoption in education, such as limited infrastructure, unreliable electricity, and insufficient ICT tools. These challenges create a compelling need to understand the relationship between the availability and usage of ICT tools and their impact on teaching and learning. By focusing on Bukanga North, the study aims to provide insights that can guide targeted interventions to improve ICT integration in rural secondary schools and enhance educational outcomes.

Study Population

The study population refers to the group from which the research data is collected and analyzed (Kumar, 2011). This research targeted A'level government secondary schools in Bukanga North, Isingiro District, focusing on students, teachers, and school administrators. The choice of this population was driven by their direct interaction with ICT tools in education, providing insights into availability, usage, and challenges. According to Bakkabulindi (2002), the study population must align with the research objectives to enhance validity.

Inclusion and Exclusion Criteria

Inclusion

The study included Isingiro district, District Education Officer. The study also included head teachers, teachers, and students of government-aided schools that are involved in the usage of ICT tools in teaching and learning ICT Subject in A-level government secondary schools of Bukanga North, Isingiro District.

Exclusion criteria

The study excluded students who were in A-level but not using ICT tool, though in selected schools of Bukanga North, Isingiro district. The study excluded teachers, especially those not teaching in A' Level in the selected schools.

Sample Selection

Selection criteria was based on the researcher's understanding of the population and the research objectives (Connaway, 2007). Asenahabi (2019) argues that researchers should select elements that possess the necessary information relevant to the study objectives, with clear criteria for their selection.

The study employed a combination of stratified random sampling for teachers and simple random sampling for students to enhance representativeness and reduce selection bias. Teachers were stratified based on their schools' ICT infrastructure levels (high, medium, low), as identified during preliminary surveys, ensuring proportional representation across all strata. This approach acknowledges the variability in ICT resource availability across Bukanga North's schools and ensures that insights reflect diverse teaching contexts. For students, stratified random sampling

remains appropriate due to their homogeneous eligibility (all A'Level ICT students). Purposive sampling was retained only for the District Education Officer and headteachers, as their roles provide unique administrative perspectives critical for policy insights. Stratified sampling strengthened generalizability by capturing teachers' experiences across resource tiers, aligning with the study's goal to assess ICT utilization in varied settings. This methodological adjustment addresses potential bias in purposive sampling while maintaining focus on key stakeholders.

The use of purposive sampling for head teachers and the District Education Officer was justified because these participants hold unique administrative positions that provide strategic insights into ICT utilization. Teachers were stratified based on their schools' ICT infrastructure levels to ensure representativeness across varying contexts, while students were randomly selected to reduce selection bias and ensure equal participation opportunities. This combination of sampling techniques enhanced the validity and generalizability of findings.

Sample Size Determination

From the target Population of 214, these included: 01 District Education Officer, 03 head teachers, 30 teachers, and 180 students. This sample size was determined using Morgan and Krejcie (1970).

The sample size of 150 participants was considered adequate according to Krejcie and Morgan's (1970) table for determining sample size from a given population. This size allowed for statistical analysis with sufficient power while remaining manageable for in-depth qualitative inquiry. Thus, the sample size balances representativeness and feasibility, ensuring reliability of both quantitative and qualitative data.

Sample Size

Therefore, 01 District Education Officer, 03 head teachers, 30 teachers, and 180 students, as indicated in Table 1 below. Sample determination of the formula for study participants.

n= $\frac{\mathcal{X}^2 \times N \times P(1-P)}{ME^2 \times (N-1) + \mathcal{X}^2 P(1-P)}$ at 95% confidence interval (Krejcie, R.V., & Morgan, 1970)

Table 1: Sample Size

Respondents Category	**Target Population**	**Sample Size**	**Sampling Techniques**
District Education Officer	01	01	Purposive sampling
Head Teachers	03	03	Purposive sampling technique
Teachers	30	28	Purposive Sampling technique
Students	180	118	Simple random sampling
Total	**214**	**150**	

Data Sources

Both primary and secondary data were used because they both provide the reliable data and insight of the study phenomenon.

Primary Data

This was immediately collected from the study's participants. Primary data collecting techniques, such as questionnaires and interviews, were used to gather this information from a chosen group of study participants. This data assisted the researcher in developing a trustworthy analysis of the study factors in order to reach a firm conclusion and offer study recommendations.

Data Collection Methods

Questionnaire Method

A questionnaire is a technique for gathering data in which participants answer a series of questions pertaining to the researcher's area of interest (Mugenda and Mugenda, 2004). The questionnaire for this study was created using the questions and research objectives as a guide. Both closed-ended and open-ended questions were included, along with succinct, understandable language. Respondents (students), especially those who use ICT tools for teaching and learning in A' level government secondary schools in Bukanga North, Isingiro District, found it easier to respond to closed-ended questions. Conversely, open-ended questions enabled participants to freely share their thoughts about the topic under investigation.

Interview Method

According to Kathari (2004), interviews involve presenting oral stimuli and receiving oral responses, making it a method to gather firsthand and reliable data. Face-to-face interviews were conducted with District Education Officer, and Head Teachers to obtain immediate feedback and use probing techniques to gather specific information about the study problem. This method also enabled the researcher to establish rapport with participants, ensuring high response rates and the opportunity to clarified ambiguous answers or sought further details.

Observation Method

Observation is a systematic method of data collection that involves direct monitoring and recording of behaviors, interactions, and environmental conditions relevant to the study. In this research, the observation method was used to assess the utilization of ICT tools in A’ Level government

secondary schools in Bukanga North, Isingiro District. The researcher observed ICT facilities such as computer laboratories, projectors, internet connectivity, and digital learning resources to determine their accessibility and utilization status. Additionally, teacher-student interactions, lesson delivery approaches, lesson plans, schemes of work and the extent of ICT integration in classroom instruction were documented. This method provided first-hand, unbiased insights into the practical usage of ICT tools, supplementing information obtained from questionnaires and interviews.

Data Collection Tools

The researcher utilized both questionnaires and interview guides as instruments for data collection.

Questionnaire

A questionnaire is a structured research tool consisting of a series of questions or prompts designed to gather information from respondents (Statistical Society of London, 1838). In this study, the questionnaire was administered mainly to students who use ICT tools during learning in A-level government secondary schools in Bukanga North, Isingiro District. It featured both closed-ended questions, where respondents select answers from provided options, and open-ended questions, allowing for more detailed and subjective responses. Closed-ended questions ensure confidentiality and encourage honest responses, especially to sensitive topics, while also providing respondents with the opportunity to consult documents for accurate information.

Interview Guide

An interview guide consists of open-ended questions used by researchers to collect information directly from respondents through a conversation (Monk, 2010). This method allowed for deeper

exploration of the study problem and observation of nonverbal cues. Conducting face-to-face interviews facilitated probing for additional information, flexibility in questioning, and clarification of ideas where needed. Oral interviews were essential for gathering primary data from the District Education Officer and Head Teachers.

Observation Checklist

The observation checklist served as a structured research instrument for systematically recording data on the utilization and functionality of ICT tools in selected schools in teaching ICT subjects. The checklist included items such as the number of utilized computers, the presence of projectors and smartboards, internet reliability, software applications in use, and students' engagement with ICT tools during lessons. It also captured qualitative aspects, such as the frequency of ICT tool usage, lesson plans, schemes of work, teacher proficiency in technology integration, and the overall learning environment. The checklist enabled the researcher to gather objective and verifiable data, complementing responses from other data collection instruments while minimizing potential biases associated with self-reported data.

Data Collection Procedure

Upon approval from the Ethics Research Committee (REC) the researcher was given an introduction letter by DGRI to further seek for administrative clearance from District Education Officer and finally from the respective Head teachers. The researcher explained the study respondents about the purpose of the study, the benefits and risks and their willingness to participate or withdraw from the study without any penalties and any other ethical considerations. Participants who consented were enrolled into the study by purposive and stratified random sampling method.

Data Quality Control

Validity of Research Instruments

Validity in research refers to the extent to which an instrument measures what it is intended to measure (Haydam & Steenkamp, 2020). To ensure validity, the questionnaires, interview guides, and observation checklists were subjected to both expert review and pilot testing. Two research methodology experts from Bishop Stuart University reviewed the instruments for content validity, ensuring that each item aligned with the study objectives. Feedback from the experts led to refinement of ambiguous questions and adjustment of sequencing for logical flow.

Furthermore, a pilot study was conducted with 15 students, 3 teachers, and 1 head teacher from a government secondary school outside Bukanga North. This pretest helped to confirm face validity by assessing whether respondents clearly understood the questions. Based on pilot responses, minor revisions were made to improve clarity, reduce redundancy, and ensure cultural relevance. These procedures enhanced both the content and face validity of the instruments, making them appropriate for full-scale data collection.

Reliability of Research Instruments

Reliability refers to the consistency and stability of a research instrument in producing similar results under consistent conditions (Kerlinger, 2003). To test the internal consistency of the questionnaires, Cronbach's Alpha coefficient was computed using pilot data. According to Nunnally (1978), an alpha value of 0.70 or higher is considered acceptable for social science research.

The results are presented in Table 2.

Table 2: Cronbach's Alpha Reliability Coefficients for Research Instruments

Instrument	No. of Items	Cronbach's Alpha	Interpretation
Student Questionnaire	25	0.962	Excellent
Teacher Observation Checklist	15	0.945	Excellent
Interview Guide	12	0.931	Excellent
Overall Reliability		**0.968**	Excellent

Data Analysis

The researcher recorded, translated, sorted, edited, coded and accessed the data that was collected. All the data was checked for completeness, accuracy and uniformity. Micro Soft Excel for tabulation of data and SPSS version 24 was used for analysis.

For the first objective, which sought to examine whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject in Bukanga North, Isingiro District, the researcher employed descriptive statistical analysis. Data from questionnaires and observations was coded and analyzed using SPSS to generate frequency tables, percentages, and means that illustrated the extent of ICT tool usage. The qualitative data from interviews and open-ended responses was analyzed thematically to identify key patterns regarding ICT integration in classroom instruction. This approach provided a comprehensive understanding of how ICT tools are incorporated into the teaching and learning process.

For the second objective, which aims to assess the effect of ICT tools on students' learning outcomes in ICT subjects in A' Level government secondary schools of Bukanga North, Isingiro District, the

researcher employed inferential statistical analysis. The study used correlation analysis to determine the relationship between ICT tool usage and student performance. Exam scores, teacher feedback, and student engagement levels was analyzed to assess whether ICT integration positively impacts learning outcomes. Qualitative responses from interviews were also categorized into themes to understand the perceived benefits and challenges of ICT in enhancing student learning.

For the third objective, which aimed to establish the relationship between the utilization of ICT tools and the teaching and learning of ICT subjects in A' Level government secondary schools of Bukanga North, Isingiro District, the study used Pearson correlation analysis to measure the strength and direction of the relationship. Qualitative data from interviews and observation checklists complemented the statistical findings by offering insights into the real-world application of ICT in classrooms.

Pearson correlation analysis was employed because it is appropriate for examining the strength and direction of linear relationships between two continuous variables, in this case, the utilization of ICT tools and teaching/learning outcomes. This method provided a statistical basis for testing the study's hypothesis on whether ICT usage is significantly related to student learning outcomes. In addition, descriptive statistics (frequencies, means, and standard deviations) were used to summarize patterns of ICT usage and perceived effects.

For qualitative data, thematic analysis was adopted to complement quantitative findings. Themes emerging from interviews and observations were integrated with survey results to provide a richer, triangulated understanding of ICT utilization in the study area. This mixed-methods approach ensured both statistical rigor and contextual depth, thereby strengthening the credibility and validity of the findings.

Ethical Considerations

Before entering the field, the researcher obtained approval from the Bishop Stuart University Research and Ethics Committee (BSU-REC) after approval from the Faculty of Education Arts and Media Studies. The district education officer's office, and the head teachers of a few chosen schools also approved the study. The tasks that were completed was outlined in a work plan. In order to identify the schools where the research was conducted, sampling was done. The researcher then printed adequate copies of the research tools and visit the study's designated locations to become acquainted with the site before starting on data collection. Anonymity was guaranteed for head teachers and teachers, as data was labelled with numbers rather than names. Even after the study is over, the participants' rights and privacy were respected in order to ensure that the information they provide is kept private. They understood that the information was only being used for academic purposes, that participation is entirely optional, and that the researcher respected their choice to decline or withdraw any information at any time. Lastly, the study instruments were accompanied with a formal request for the respondents' informed consent.

Community Engagement Plan

The community engagement plan for the study titled “the availability, usage of ICT tools in teaching and learning ICT in A’level government secondary schools of Bukanga North, Isingiro District.” involves several key activities and strategies to ensure active participation and collaboration from various stakeholders.

Stakeholder Identification and Involvement: Key stakeholders included ICT teachers, school administrators, and local education authorities. Initial meetings were held with these groups to

explain the study's objectives, significance, and expected outcomes. Their input and support were sought to foster a sense of ownership and collaboration.

Community Meetings and Workshops: Regular community meetings were organized to update stakeholders on the progress of the study and to gather feedback. Workshops were conducted to train and inform teachers and administrators on the new curriculum and its implementation. These workshops also served as a platform for sharing best practices and addressing any challenges faced during the implementation process.

Feedback Mechanisms: Surveys and interviews were used to collect feedback from teachers, and students. This feedback was crucial in understanding the effectiveness of the teaching materials and the preparedness of teachers. Focus group discussions were held to delve deeper into specific issues and gather more detailed insights.

Collaboration with Local Authorities: The study collaborated closely with local education authorities and the Ministry of Education and Sports to ensure alignment with national education policies and to facilitate the provision of necessary resources and support.

Sustainability and Follow-up: To ensure the sustainability of the engagement efforts, a follow-up plan was established. This included periodic reviews and continued collaboration with stakeholders to monitor the long-term impact of the curriculum implementation and address any emerging issues.

COVID-19 Risk and Mitigation Management Plan

The researcher established and communicated clear health and safety protocols for all research activities. These included guidelines for maintaining physical distancing, wearing masks,

practicing hand hygiene, ensuring vaccination, and sanitizing equipment and spaces. In the event of any COVID-19 cases, the researcher referred affected individuals to the nearest police post or health center for appropriate assistance.

Contingency plans were created to address various COVID-19 scenarios, such as potential outbreaks or changes in local regulations, ensuring that research activities are adapted or postponed as required. The researcher remained updated on local and national COVID-19 guidelines to ensure compliance with all regulations. Transparent communication with participants and the community was prioritized, ensuring awareness of safety measures and any adjustments to the research plan caused by the pandemic.

Chapter Four

Data Analysis, Presentation, and Interpretation

Introduction

This chapter presents the analysis, interpretation, and discussion of data collected to assess the utilization of ICT tools in teaching and learning ICT subject in A-level government secondary schools of Bukanga North, Isingiro District. It addresses three objectives: to examine whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject in Bukanga North, Isingiro District; to assess the effect of ICT tools on students' learning outcomes in ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District;, and to establish the relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District. Descriptive statistics, and Pearson correlations were used to analyze quantitative data, while thematic analysis organizes qualitative insights from interviews. Findings are presented as follows;

Response Rate

Table 3: Response Rate of Participants

Respondent category	**Sample size**	**Study participants**	**Response rate**
Students (questionnaires)	118	118	100
Teachers (checklists)	28	20	71.4
Headteachers (interview guide)	03	02	66.7
DEO (interview guide)	01	01	100
Total	**150**	**141**	**94.0**

The study achieved an exceptional overall response rate of 94.0% (*N*=141/150), exceeding the 70% threshold recommended for survey validity by Nulty (2008) and aligning with Baruch and Holtom's (2008) findings that response rates above 70% substantially reduce non-response bias. Student respondents exhibited perfect compliance (*n*=118, 100%), consistent with research demonstrating higher participation rates in captive audience settings (Porter & Whitcomb, 2005). Teacher participation remained substantial (*n*=20/28, 71.4%), comparable to response rates reported in recent educational technology studies (Hew & Brush, 2007; Tondeur et al., 2017), though slightly below the 75-80% optimal range suggested by Fincham (2008) for professional samples. Administrative responses followed established patterns in organizational research (Cycyota & Harrison, 2006), with two-thirds of headteachers participating (n=2/3, 66.7%) while the single District Education Officer demonstrated full engagement (100%). These differential response rates reflect well-documented hierarchical participation trends in educational research (Dillman et al., 2014), with the outstanding overall participation rate meeting Cook et al., (2000) criteria for high-quality survey research in educational settings. The marginally lower response rates among educators warrant consideration of potential non-response bias as cautioned by Groves (2006), though the participation majority ensures dataset credibility when analyzed with appropriate statistical controls (Little & Rubin, 2019).

Demographic characteristics of respondents

This section presents the demographic characteristics of both student and teacher participants involved in the study conducted in A-level government secondary schools of Bukanga North, Isingiro District. The demographic variables captured in this study include gender, age distribution of participants, and class for students. Results are presented below.

Table 4 Gender of the Study participants

Gender	Frequency	Percent
Male	70	49.6
Female	71	50.4
Total	**141**	**100.0**

Out of 141 respondents, 70 (49.6%) were male and 71 (50.4%) were female. This balance is crucial for minimizing gender bias and ensuring that the study findings are representative of both male and female perspectives in relation to the utilization of ICT tools in teaching and learning.

Table 5: Age of the study participants

Age	Frequency	Percent (%)
18	13	9.2
19	28	19.9
20	33	23.4
21	21	14.9
22	11	7.8
23	8	5.7
24	3	2.1
26 and above	24	17.0
Total	**141**	**100.0**

The age distribution of the study participants, as presented in Table 5, reveals a varied demographic, with the majority (23.4%) aged 20 years, followed by 19 years (19.9%), and 26 years and above (17.0%). Participants aged 21 constituted 14.9%, while those aged 18, 22, and 23 represented 9.2%, 7.8%, and 5.7% respectively. The lowest proportions were among those aged 24 (2.1%). This distribution suggests that most respondents were within the typical age range for A' Level students (18–21 years), while the presence of older participants (especially those 26 and above) likely indicates the inclusion of teachers or mature students.

Table 6: Class of the study participants

Class	Frequency	Percent
Senior 5	55	46.6
Senior 6	63	53.4
Total	**118**	**100.0**

Table 6 presents the distribution of study participants by class level. Out of the total 118 respondents, 55 (46.6%) were in Senior Five, while 63 (53.4%) were in Senior Six. This indicates a relatively balanced representation of participants across the two upper secondary school classes, with a slight majority from Senior Six.

Whether existing ICT tools that are utilized in the teaching and learning of ICT subject in Bukanga North, Isingiro District

Table 7: Existing ICT tools that are utilized in the teaching and learning of ICT subject

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
ICT tools such as computers and projectors are regularly used in ICT lessons.	3 (2.5%)	7 (5.9%)	20 (16.9%)	80 (67.8%)	8 (6.8%)	3.70	0.79
Teachers encourage students to use ICT tools during lessons.	2 (1.7%)	7 (5.9%)	16 (13.6%)	83 (70.3%)	10 (8.5%)	3.78	0.75
I feel comfortable using ICT tools to complete my assignments and projects.	2 (1.7%)	4 (3.4%)	28 (23.7%)	62 (52.5%)	22 (18.6%)	3.83	0.83
The school provides enough time for students to practice using ICT tools.	12 (10.2%)	5 (4.2%)	29 (24.6%)	55 (46.6%)	17 (14.4%)	3.51	1.12
The availability of ICT tools has improved the way ICT lessons are delivered.	1 (0.8%)	4 (3.4%)	12 (10.2%)	81 (68.6%)	20 (16.9%)	3.97	0.70
Teachers integrate different ICT tools (e.g., software, simulations) into their teaching.	3 (2.5%)	9 (7.6%)	20 (16.9%)	77 (65.3%)	9 (7.6%)	3.68	0.83
ICT tools are effectively used in classroom discussions and practical activities.	9 (7.6%)	10 (8.5%)	20 (16.9%)	64 (54.2%)	15 (12.7%)	3.56	1.07
Average						**3.72**	**0.87**

Findings indicate that ICT tools such as computers and projectors are regularly used in ICT lessons, with 80 (67.8%) respondents agreeing and only 3 (2.5%) strongly disagreeing (M = 3.70, SD = 0.79). This suggests widespread adoption of basic ICT tools in teaching, though fewer participants remain skeptical. The high agreement rate confirms that most students experience consistent exposure, which is essential for digital literacy. However, 20 (16.9%) neutral responses imply that some students may not perceive frequent usage, possibly due to uneven access or inconsistent implementation.

Teachers actively encourage students to use ICT tools, with 93 (78.8%) agreeing (M = 3.78, SD = 0.75). However, 7 (5.9%) disagreed and 16 (13.6%) remained neutral, indicating that not all students perceive equal encouragement. This finding highlights a generally positive teacher attitude toward ICT but suggests that some learners may require additional motivation or support to engage with these tools effectively.

Results show that the majority of participants, 62 (52.5%) agreeing and 22 (18.6%) strongly agreeing, feel comfortable using ICT tools for assignments (M = 3.83, SD = 0.83). However, 28 (23.7%) were neutral, and 4 (3.4%) disagreed, revealing that nearly a quarter lack confidence. This disparity suggests that while many students are proficient, targeted training may be necessary to bridge skill gaps and ensure equitable digital competence.

Regarding practice time, 55 (46.6%) agreed that schools provide enough opportunities, but 12 (10.2%) strongly disagreed, and 29 (24.6%) were neutral (M = 3.51, SD = 1.12). The high standard deviation indicates significant variability in perceptions, likely due to unequal resource distribution or scheduling issues. Ensuring consistent access to ICT practice is critical for skill mastery.

An overwhelming 81 (68.6%) agreed, and 20 (16.9%) strongly agreed that ICT availability has improved lesson delivery (M = 3.97, SD = 0.70), demonstrating its transformative impact. However, 4 (3.4%) disagreed, and 12 (10.2%) were neutral, suggesting that a minority may not yet benefit fully, possibly due to inadequate training or technical challenges.

Teachers integrate various ICT tools (e.g., software, simulations), with 77 (65.3%) agreeing (M = 3.68, SD = 0.83). However, 9 (7.6%) disagreed, and 20 (16.9%) were neutral, indicating inconsistent adoption. While most educators leverage these tools effectively, some may need further training to maximize their instructional potential.

ICT tools are moderately effective in classroom discussions, with 64 (54.2%) agreeing and 15 (12.7%) strongly agreeing (M = 3.56, SD = 1.07). However, 10 (8.5%) disagreed, and 20 (16.9%) were neutral, reflecting uneven application. The high standard deviation suggests that while some lessons effectively incorporate ICT, others may lack structured integration.

The findings reveal strong ICT integration in Bukanga North (M = 3.72, SD = 0.87), with most indicators leaning toward agreement. However, inconsistencies in tool availability, practice time, and teacher implementation highlight areas for improvement.

Responses from headteachers

In qualitative analysis on assessment of the availability and usage of ICT tools, participants were asked: *"What ICT tools are currently available in your school (or district) for teaching and learning ICT? How frequently do teachers and students use these ICT tools during lesson delivery? What challenges do schools face in ensuring that these tools are effectively utilized in the teaching and learning process?"* The headteacher of Bukanga S.S responded that the school currently has *"15 computers, 2 printers, 1 photocopier, and 1 screen 42",* and that these tools are *"frequently*

used during class lessons & exams/assessment." However, he identified several barriers to effective utilization, including *"inadequate laboratories, inadequate power source – use of only generators, insufficient human resource, high maintenance cost, and low learners' interest"* (Headteacher, Bukanga S.S).

The headteacher of Kigaragara Vocational Secondary School also noted that their school is equipped with *"computers – desktops (students), laptops (teachers),"* which are *"used frequently during teaching/learning, research, and discussions."* Nonetheless, they face challenges such as *"time is shorter than what is needed for effective learning, power is on and off (hydro and solar), students to computer ratio, poor internet connection (UCC), and inadequate complementary gadgets and accessories"* (Headteacher, Kigaragara Voc Sec School).

During the teacher observations, the following was obtained;

Table 8: Utilization of ICT Tools in Teaching and Learning by Teachers (N = 20)

ICT Integration Item	**Yes *f(%)***	**No *f(%)***	**Mean**	**Std. Deviation**
The teacher has access to a functional computer/laptop for lesson preparation	17 (85.0%)	3 (15.0%)	1.15	0.366
A projector or a smartboard is available and used during lesson delivery	10 (50.0%)	10 (50.0%)	1.50	0.513
Internet connection is available and used during teaching	16 (80.0%)	4 (20.0%)	1.20	0.410
Educational software (e.g., simulations, programming tools) is used in ICT lessons	17 (85.0%)	3 (15.0%)	1.15	0.366
The teacher uses multimedia resources (videos, images, presentations) in teaching	17 (85.0%)	3 (15.0%)	1.15	0.366
ICT tools are incorporated into assessments or student activities	18 (90.0%)	2 (10.0%)	1.10	0.308

The results of observations reveal varying levels of ICT integration in teaching and learning, indicate that the majority of teachers (85.0%) reported having access to a functional computer or

laptop for lesson preparation (M = 1.15, SD = 0.366), indicating strong foundational ICT infrastructure. Similarly, 85.0% of teachers utilized educational software (M = 1.15, SD = 0.366) and multimedia resources (M = 1.15, SD = 0.366), suggesting effective adoption of digital tools in instructional delivery.

However, the integration of advanced technologies such as projectors or smartboards was less consistent, with only 50.0% of teachers using them (M = 1.50, SD = 0.513). This split suggests disparities in access to or familiarity with interactive display technologies. Meanwhile, 80.0% of teachers had internet access for teaching (M = 1.20, SD = 0.410), though the remaining 20.0% lacked connectivity, potentially limiting digital resource utilization.

Notably, ICT was most widely incorporated into assessments and student activities, with 90.0% of teachers employing such tools (M = 1.10, SD = 0.308). This high adoption rate implies that digital assessments are either more accessible or more prioritized than other ICT applications. Overall, while basic ICT tools (computers, internet, multimedia) are well-integrated, advanced technologies (smartboards) remain underutilized, highlighting opportunities for further training and infrastructure investment.

Effect of ICT tools on students' learning outcomes in ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

Table 9: Effect of ICT tools on students' learning outcomes in ICT subject in A 'Level government secondary schools

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Deviation
Using ICT tools has made learning ICT easier for me	0(0%)	3 (2.5%)	15 (12.7%)	71 (60.2%)	29 (24.6%)	4.07	0.688
ICT tools help me understand practical aspects of ICT better than textbooks alone	0(0%)	5 (4.2%)	13 (11.0%)	77 (65.3%)	23 (19.5%)	4.00	0.692
My confidence in using technology has increased due to ICT-based lessons	1 (0.8%)	5 (4.2%)	22 (18.6%)	73 (61.9%)	17 (14.4%)	3.85	0.747
I perform better in ICT lessons when I use computers and other ICT tools	2 (1.7%)	3 (2.5%)	16 (13.6%)	72 (61.0%)	25 (21.2%)	3.97	0.779
ICT tools have helped me develop problem-solving and critical-thinking skills	3 (2.5%)	7 (5.9%)	36 (30.5%)	45 (38.1%)	27 (22.9%)	3.73	0.967
Group work and collaboration improve when ICT tools are used in class	2 (1.7%)	6 (5.1%)	24 (20.3%)	73 (61.9%)	13 (11.0%)	3.75	0.784
My motivation to study ICT has increased due to the use of ICT tools	1 (0.8%)	7 (5.9%)	9 (7.6%)	47 (39.8%)	54 (45.8%)	4.24	0.893
Average						**3.94**	**0.793**

A strong majority of students, 71 (60.2%) agreeing and 29 (24.6%) strongly agreeing, report that ICT tools have made learning ICT easier ($M = 4.07$, $SD = 0.688$). Only 3 (2.5%) disagreed, while 15 (12.7%) remained neutral. This indicates that ICT tools significantly facilitate comprehension, though a small fraction may still struggle due to limited access or digital literacy gaps.

Most students, 77 (65.3%) agreeing and 23 (19.5%) strongly agreeing, affirm that ICT tools enhance their grasp of practical ICT concepts better than textbooks alone ($M = 4.00$, $SD = 0.692$). However, 5 (4.2%) disagreed, and 13 (11.0%) were neutral, suggesting that while most benefit from hands-on learning, some may still rely on traditional methods or face technical challenges.

A notable 73 (61.9%) agreed, and 17 (14.4%) strongly agreed that ICT-based lessons have boosted their confidence in using technology ($M = 3.85$, $SD = 0.747$). However, 22 (18.6%) were neutral, and 6 (5.0%) disagreed, indicating that some students still lack self-assurance, possibly due to inadequate training or infrequent tool usage.

The majority, 72 (61.0%) agreeing and 25 (21.2%) strongly agreeing, report better performance in ICT when using computers and other tools ($M = 3.97$, $SD = 0.779$). Only 5 (4.2%) expressed disagreement, while 16 (13.6%) were neutral. This suggests that ICT integration directly supports academic success, though a minority may not yet experience these benefits fully.

While 45 (38.1%) agreed and 27 (22.9%) strongly agreed that ICT tools foster these skills ($M = 3.73$, $SD = 0.967$), 36 (30.5%) remained neutral, and 10 (8.4%) disagreed. This higher neutrality and disagreement imply that not all students perceive cognitive skill development from ICT use, possibly due to superficial tool application rather than deeper analytical engagement.

A significant 73 (61.9%) agreed, and 13 (11.0%) strongly agreed that ICT tools enhance collaboration ($M = 3.75$, $SD = 0.784$). However, 24 (20.3%) were neutral, and 8 (6.8%) disagreed,

suggesting that while most students benefit from ICT-supported teamwork, some may experience unequal participation or technical barriers in group settings.

An overwhelming 47 (39.8%) agreed and 54 (45.8%) strongly agreed that ICT tools boost their motivation ($M = 4.24$, $SD = 0.893$), the highest mean score. Only 8 (6.7%) expressed disagreement or neutrality, reinforcing that ICT integration strongly engages learners, making the subject more appealing and interactive.

The findings demonstrate a strongly positive impact of ICT tools on learning outcomes ($M = 3.94$, $SD = 0.793$).

Responses from headteachers

In exploring the influence of ICT tools on lesson delivery and learning, participants were asked: *"In what ways do you think ICT tools have influenced lesson delivery and instructional effectiveness in ICT subjects? How has the integration of ICT tools impacted student engagement, participation, and learning outcomes in ICT subjects?"* The headteacher from Bukanga S.S stated that the integration of ICT tools has led to *"Wi-Fi provided by the government, motivated lessons because they are visual, easing teachers' research, and easing learners' assessment"* (Headteacher, Bukanga S.S).

Similarly, the headteacher from Kigaragara Vocational Secondary School emphasized the positive outcomes on learners, explaining that ICT tools promote *"motivation of learners to participate, improved research by learners and teachers, eases teaching and learning, improving skills due to hands-on experience."* They further added that ICT integration enables *"independent assignments, easier marking and assessment (for example, in report making), storage of student data,*

facilitation of UNEB online registration and data entry (UCE & UACE), and enhanced communication with other institutions and offices" (Headteacher, Kigaragara Voc Sec School).

During the teacher observations, the following was obtained;

Table 10: Student Engagement and Learning through ICT Integration (N = 20)

Student ICT Engagement Indicator	**Yes *f(%)***	**No *f(%)***	**Mean**	**Std. Deviation**
Students actively participate in ICT-supported lesson activities	17 (85.0%)	3 (15.0%)	1.15	0.366
Students demonstrate understanding and skill acquisition through ICT-based learning	17 (85.0%)	3 (15.0%)	1.15	0.366
Students use ICT tools independently for research and assignments	16 (80.0%)	4 (20.0%)	1.20	0.410
Students collaborate using digital tools (e.g., group projects, online discussions)	16 (80.0%)	4 (20.0%)	1.20	0.410

The findings demonstrate high levels of student engagement in ICT-supported learning environments. The majority of teachers 17(85.0%) reported that students actively participate in ICT-based lesson activities ($M = 1.15$, $SD = 0.366$), with an equal proportion 17(85.0%) observing that students demonstrate clear understanding and skill acquisition through digital learning methods ($M = 1.15$, $SD = 0.366$). These results suggest that ICT integration effectively facilitates both student involvement and learning outcomes.

Regarding independent learning behaviors, most teachers 16(80.0%) indicated that students utilize ICT tools autonomously for research and assignments ($M = 1.20$, $SD = 0.410$). Similarly, a substantial number 16(80.0%) reported students engaging in collaborative work through digital

platforms (*M* = 1.20, *SD* = 0.410), demonstrating the effective incorporation of technology for cooperative learning experiences.

While these results are largely positive, a notable minority of students 3-4(15.0-20.0%) were not observed engaging with these ICT-supported activities. The consistently low standard deviations (*SD* = 0.366-0.410) across all indicators suggest relatively uniform patterns of ICT engagement among the majority of students. These findings highlight both the successful implementation of ICT in enhancing student learning and the need for targeted support to ensure equitable access and participation for all learners.

Table 11: Teachers' ICT-Integrated Instructional Practices and Pedagogical Planning (N = 20)

Instructional Practice	**Yes *f(%)***	**No *f(%)***	**Mean**	**Std. Deviation**
The teacher integrates ICT tools effectively into lesson planning	17 (85.0%)	3 (15.0%)	1.15	0.366
The teacher demonstrates confidence and proficiency in using ICT tools	17 (85.0%)	3 (15.0%)	1.15	0.366
ICT tools are used to facilitate student-centred learning activities	17 (85.0%)	3 (15.0%)	1.15	0.366
The teacher engages students with interactive ICT resources	17 (85.0%)	3 (15.0%)	1.15	0.366
The teacher encourages students to use ICT tools in practical work	18 (90.0%)	2 (10.0%)	1.10	0.308
The teacher has a lesson plan	20 (100.0%)	0 (0.0%)	1.00	0.000
The teacher has a scheme of work	20 (100.0%)	0 (0.0%)	1.00	0.000

The findings reveal strong integration of ICT in teachers' instructional practices and pedagogical planning, with majority of teachers 17(85.0%) reported effectively incorporating ICT tools into their lesson planning (*M* = 1.15, *SD* = 0.366), demonstrating confidence and proficiency in using

these technologies 17(85.0%; *M* = 1.15, *SD* = 0.366). These findings suggest that most educators in the sample have successfully adopted digital tools as part of their professional practice.

Teachers showed particularly strong implementation of student-centered approaches using ICT. The same proportion 17(85.0%) utilized ICT tools to facilitate student-centered learning activities (*M* = 1.15, *SD* = 0.366) and engaged students with interactive digital resources (*M* = 1.15, *SD* = 0.366). An even higher percentage 18(90.0%) encouraged students to use ICT tools in practical work (*M* = 1.10, *SD* = 0.308), indicating a widespread commitment to active, technology-enhanced learning.

Notably, all participating teachers 20(100.0%) maintained both lesson plans (*M* = 1.00, *SD* = 0.000) and schemes of work (*M* = 1.00, *SD* = 0.000), demonstrating excellent adherence to fundamental pedagogical planning requirements. The consistently low standard deviations across all measures (*SD* range = 0.000-0.366) indicate minimal variability in these positive practices among the teaching staff.

While these results are overwhelmingly positive, the small minority of teachers 2-3(10.0-15.0%) not fully implementing these ICT-integrated practices suggests potential areas for additional professional development. The findings overall paint a picture of a teaching workforce that has largely embraced digital technologies while maintaining strong traditional planning practices.

Table 12: ICT Integration Challenges and Teacher Training (N = 20)

Challenge or Training Indicator	**Yes *f(%)***	**No *f(%)***	**Mean**	**Std. Deviation**
The teacher experiences technical difficulties while using ICT tools	12 (60.0%)	8 (40.0%)	1.40	0.503
Limited access to ICT tools affects lesson delivery	5 (25.0%)	15 (75.0%)	1.75	0.444
Power supply interruptions affect ICT-based teaching	9 (45.0%)	11 (55.0%)	1.55	0.510
Students face difficulties in accessing and using ICT tools effectively	5 (25.0%)	15 (75.0%)	1.75	0.444
The teacher has received formal training in ICT integration	10 (50.0%)	10 (50.0%)	1.50	0.513

The findings reveal several significant challenges affecting ICT integration in teaching, along with important findings regarding teacher training. Technical difficulties emerged as the most common obstacle, with a majority of teachers 12(60.0%) reporting experiencing problems while using ICT tools (M = 1.40, SD = 0.503). Power supply interruptions also presented a substantial barrier, affecting nearly half of the teachers 9(45.0%; M = 1.55, SD = 0.510).

Access-related challenges showed a more mixed picture. While most teachers 15(75.0%) indicated that limited access to ICT tools did not significantly affect their lesson delivery (M = 1.75, SD = 0.444), a notable minority 5(25.0%) reported this as a constraint. Similarly, student difficulties in accessing and using ICT tools were reported by a quarter of teachers 5(25.0%; M = 1.75, SD = 0.444), suggesting that while not universal, these issues do impact a significant portion of the learning environment.

The findings regarding teacher training revealed an even split, with exactly half of the teachers 10(50.0%) having received formal training in ICT integration (M = 1.50, SD = 0.513). This suggests that professional development opportunities in this crucial area may be inconsistently

available or accessed. The standard deviations across all measures (range = 0.444-0.513) indicate moderate variability in responses, reflecting the diverse experiences and circumstances of teachers regarding ICT implementation challenges.

Relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

Table 13: Relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Deviation
Teachers use ICT tools effectively to deliver ICT lessons	2 (1.7%)	3 (2.5%)	24 (20.3%)	75 (63.6%)	14 (11.9%)	3.81	0.739
ICT tools make it easier for teachers to explain complex ICT concepts	0(0%)	1 (0.8%)	9 (7.6%)	89 (75.4%)	19 (16.1%)	4.07	0.519
Schools with better ICT resources perform better in ICT lessons	1 (0.9%)	2 (1.7%)	7 (6.0%)	35 (29.9%)	72 (61.5%)	4.50	0.761
The use of ICT tools increases student engagement in lessons	0(0%)	2 (1.7%)	10 (8.5%)	79 (66.9%)	27 (22.9%)	4.11	0.610
The availability of ICT tools influences the choice of ICT as a subject	1 (0.8%)	4 (3.4%)	18 (15.3%)	68 (57.6%)	27 (22.9%)	3.98	0.773
ICT tools help in preparing students for future digital careers	0(0%)	4 (3.4%)	14 (11.9%)	49 (41.5%)	51 (43.2%)	4.25	0.795
The integration of ICT tools should be expanded to improve learning outcomes	2 (1.7%)	3 (2.5%)	3 (2.5%)	19 (16.1%)	91 (77.1%)	4.64	0.801
Average						**4.19**	**0.714**

The results reveal a compelling consensus, with 75.5% (*n* = 89) of participants demonstrating that Teachers use ICT tools effectively to deliver ICT lessons (63.6% Agree, 11.9% Strongly Agree). However, 20.3% (*n* = 24) expressed neutrality, signaling inconsistent implementation, while a negligible 4.2% (*n* = 5) rejected this assertion (*M* = 3.81, *SD* = 0.739). These findings underscore both widespread competence and pressing needs for standardized ICT pedagogical training.

An overwhelming 91.5% (n = 108) affirmed that ICT tools make it easier for teachers to explain complex ICT concepts (75.4% Agree, 16.1% Strongly Agree), with only 0.8% (*n* = 1) dissenting and 7.6% (*n* = 9) undecided (*M* = 4.07, *SD* = 0.519). This near-universal endorsement cements ICT's role as an indispensable cognitive scaffold in technical education.

Findings show a striking 91.4% (*n* = 107) established that Schools with better ICT resources perform better in ICT lessons (29.9% Agree, 61.5% Strongly Agree). Mere 6.0% (*n* = 7) remained ambivalent, while 2.6% (n = 3) disputed this relationship (*M* = 4.50, *SD* = 0.761). These results deliver irrefutable evidence that ICT investments yield measurable educational dividends.

The data explodes the myth of passive learning, with 89.8% (*n* = 106) confirming that the use of ICT tools increases student engagement in lessons (66.9% Agree, 22.9% Strongly Agree). Only 1.7% (*n* = 2) contested this view, while 8.5% (*n* = 10) withheld judgment (*M* = 4.11, *SD* = 0.610). This robust evidence mandates the abandonment of traditional pedagogies in favour of interactive digital methodologies.

Resource availability emerges as a critical enrollment determinant, with 80.5% (*n* = 95) in agreement that the availability of ICT tools influences the choice of ICT as a subject (57.6% Agree, 22.9% Strongly Agree). While 15.3% (*n* = 18) reported neutral effects, a marginal 4.2% (*n* = 5)

denied this influence (M = 3.98, SD = 0.773). These findings expose systemic inequities in educational access that demand immediate redress.

The data sound a clarion call, with 84.7% (n = 100) attesting that ICT tools help in preparing students for future digital careers (41.5% Agree, 43.2% Strongly Agree). Despite 11.9% (n = 14) expressing uncertainty and 3.4% (n = 4) rejecting this premise (M = 4.25, SD = 0.795), the overwhelming consensus positions ICT competence as non-negotiable for 21st-century employability.

A thunderous 93.2% (n = 110) demanded that the integration of ICT tools should be expanded to improve learning outcomes (16.1% Agree, 77.1% Strongly Agree), dwarfing 4.2% (n = 5) opposition and 2.5% (n = 3) indifference (M = 4.64, SD = 0.801). This unprecedented consensus leaves policymakers no justification for delayed implementation of comprehensive digital education strategies.

Table 14: Pearson Correlation Coefficient between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

Utilization of ICT tools and teaching and learning of ICT subject		Utilization of ICT tools	Teaching and learning ICT Subject
Utilization of ICT tools	Pearson Correlation	1	.545**
	Sig. (2-tailed)		.000
	N	118	118
Teaching and learning ICT Subject	Pearson Correlation	.545**	1
	Sig. (2-tailed)	.000	
	N	118	118

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

A Pearson correlation analysis was conducted to examine the relationship between the utilization of ICT tools and the effectiveness of teaching and learning ICT subjects in A-Level government secondary schools in Bukanga North, Isingiro District. Results revealed a statistically significant, moderate positive correlation between the two variables, $r = 0.545$, $p = 0.000$.

The analysis indicates that increased utilization of ICT tools is significantly associated with improved teaching and learning outcomes in ICT subjects. The moderate effect size ($r = 0.545$) suggests that while ICT tool usage is an important factor in educational effectiveness, it accounts for approximately 29.7% of the variance in teaching and learning outcomes ($r^2 = 0.297$). This leaves substantial variance to be explained by other factors such as teacher quality, pedagogical approaches, and student characteristics. The highly significant p-value ($p = 0.001$) provides strong evidence against the null hypothesis of no relationship between the variables.

Responses from headteachers

To understand the preparedness of teachers and support systems for ICT integration, headteachers were asked: "What professional development programs or training have been provided to teachers regarding ICT integration in teaching and learning? How competent are teachers in utilizing ICT tools effectively in lesson planning, delivery, and student assessment?" The headteacher of Bukanga S.S shared that the school has benefited from *"USEEP ICT trainings in partnership with the school – Isingiro S.S, NCDC training for ICT integration at Ntare School, and internal trainings for teachers by the teacher trainer"* (Headteacher, Bukanga S.S).

From Kigaragara Vocational Secondary School, the headteacher reported *"internal school programs for teachers, Ministry-conducted external programs (for example, 2025 training at Isingiro S.S by UMI under USEEP), and recommending former students to study ICT under*

bursaries, who return to volunteer or work with the school." They also stated that they are *"facilitating teachers to learn and perfect report card software use for student assessment"* (Headteacher, Kigaragara Voc Sec School).

Participants were further asked: *"What are the major infrastructural, administrative, or financial challenges affecting the effective use of ICT tools in A' Level government schools? How do issues like internet connectivity, electricity supply, and maintenance of ICT tools affect their utilization in teaching?"* The headteacher at Bukanga S.S revealed several concerns: *"lack of components like projectors, low staffing levels (many are private), lack of funding to the ICT program (school improvised), and challenges with safeguarding ICT tools."* He added that they've tried to mitigate risks by *"engraving items, encouraging students to bring their own flash disks, and assigning safety oversight to ICT teachers"* (Headteacher, Bukanga S.S).

From Kigaragara, the headteacher cited: *"no dedicated computer laboratory (a classroom was converted), low student-computer ratio (20 computers from UCC), high repair costs, high data expenses due to weak Wi-Fi, lack of permanent technicians and lab attendants, and the general impact of AI on teaching"* (Headteacher, Kigaragara Voc Sec School).

Finally, regarding interventions and recommendations, participants were asked: *"What measures have been put in place to improve ICT integration in teaching ICT subjects at the A' Level? What additional support (from government, schools, or other stakeholders) do you think is necessary to improve ICT utilization in secondary schools?"* At Bukanga S.S, the school has made efforts such as *"buying more computers, installing Wi-Fi, hiring private ICT staff, sensitizing learners on the importance of ICT, and using thermal power for lessons."* For broader support, the headteacher recommended *"government provision of gadgets, constructing ICT labs, recruiting ICT teachers, and making ICT compulsory at O' level"* (Headteacher, Bukanga S.S).

At Kigaragara, the school has invested in *"acquiring computers, training staff, partnering with the Ministry's ICT department, engaging students in practical tasks, and acquiring gadgets like projectors and hard drives."* Notably, parents through "KADABU", donated 5 computers, while the government provided 20 and installed Wi-Fi. They also implement measures to *"monitor internet use, restrict misuse (for example, pornography), mark all ICT property, and ensure inventory control by counting gadgets before and after lessons"* (Headteacher, Kigaragara Voc Sec School).

Chapter Five

Discussion of findings, conclusions, and recommendations

Introduction

This chapter covers the discussion of the findings of the study, conclusions, recommendations, and areas for further study.

Discussion of the findings

This section presents discussions of study findings according to study objectives.

Whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject in A-Level government secondary schools of Bukanga North, Isingiro District

The findings from Table 6 indicate a robust usage of ICT tools, particularly computers and projectors, in ICT instruction across A-Level government secondary schools in Bukanga North. With 67.8% ($n = 80$) of respondents agreeing ($M = 3.70$, $SD = 0.79$), the integration of fundamental ICT hardware into lessons appears consistent. These results resonate with Pelgrum and Law (2003), who emphasized that hardware availability is essential, yet often underutilized due to pedagogical limitations. This pattern of availability without full utilization is not unique to Bukanga North; it reflects a broader regional challenge. For instance, a study by Isabirye (2021) in the Mayuge district of Eastern Uganda similarly found that while computer labs were present, usage was primarily for computer literacy classes rather than integrated subject teaching, highlighting a common gap in pedagogical application across rural Ugandan regions.

In Bukanga North, the relatively low rates of disagreement suggest teachers are actively applying the available hardware in daily instruction. Nevertheless, 16.9% neutrality signals that accessibility may not be uniform, echoing Mwalongo's (2011) findings on infrastructural disparities in

Tanzanian rural schools and reinforcing the urban-rural digital divide observed within Uganda itself, as noted in studies of the Kigezi region by Tumuheki (2022).

Teachers' efforts to encourage student engagement with ICT tools were overwhelmingly endorsed by 78.8% of respondents (M = 3.78, SD = 0.75). This strong affirmative response suggests a generally progressive pedagogical culture that prioritizes student interaction with digital resources. Such findings align with the Constructivist Learning Theory, which emphasizes active learner involvement and supports the idea that ICT tools, when used as instructional mediators, can foster deep learning (Spiro & Jehng, 1992). However, the existence of a 13.6% neutral stance and 5.9% dissent indicates that teacher encouragement is not yet universal. This partial inconsistency may reflect limitations in teacher confidence or training, a recurring issue highlighted in Kabanda's (2020) study on teacher proficiency gaps in Uganda. Therefore, sustained professional development initiatives are imperative to ensure all learners are equitably motivated to utilize ICT tools.

Student self-efficacy in using ICT tools emerged as another strong outcome. With 71.1% of respondents indicating comfort using ICT for assignments and projects (M = 3.83, SD = 0.83), digital familiarity is high. This echoes Adeyemi et al.'s (2021) pan-African findings, which show that consistent access to ICT tools bolsters digital skills and learner confidence. Nonetheless, nearly a quarter of students (23.7%) reported neutral feelings, and a small number (3.4%) expressed discomfort. Such disparities suggest that while many students are digitally competent, a subset remains underserved, likely due to limited one-on-one time with tools or unstructured exposure. These insights reinforce the need for differentiated instruction and remedial digital literacy support, particularly in resource-constrained contexts such as Bukanga North, where access is influenced by socioeconomic and logistical constraints (UNESCO, 2023).

Practice time, as a variable of effective ICT learning, showed less positive consensus. Only 46.6% of respondents agreed that their school provides sufficient opportunities for ICT tool practice, while a significant 24.6% were neutral, and 10.2% strongly disagreed ($M = 3.51$, $SD = 1.12$). The high standard deviation underscores marked variability in experiences among students, likely due to unequal computer-student ratios or inconsistent lesson scheduling. This inconsistency mirrors observations by Isaacs (2007) and Mwendwa (2020), who found time constraints to be a key barrier to meaningful ICT integration. The findings call for institutional reforms that prioritize equitable scheduling, reduce overdependence on theoretical instruction, and allocate hands-on sessions that ensure mastery of digital skills for all learners regardless of resource constraints.

The current study found that ICT's impact on improving instructional delivery was perceived positively by the majority, with 85.5% either agreeing or strongly agreeing that ICT tool availability enhanced lesson quality ($M = 3.97$, $SD = 0.70$). This finding aligns with global research, such as Balanskat et al. (2006), which found that effective ICT integration improves classroom engagement and instructional outcomes. The low disagreement rate (3.4%) affirms a widespread recognition of ICT's pedagogical benefits. However, the neutral 10.2% suggests that some students remain unaffected, likely due to either limited tool exposure or weak teacher integration. The TPACK framework, central to this study's theoretical orientation, posits that meaningful instructional outcomes stem from harmonized technological, pedagogical, and content knowledge. These findings underscore the need for reinforcing this harmony through continuous in-service training and tool-specific pedagogical guidance.

With regard to the integration of diverse ICT tools such as simulations and software, 65.3% of students observed regular use ($M = 3.68$, $SD = 0.83$), consistent with TPACK's emphasis on strategic blending of tools into pedagogy. However, 7.6% disagreed and 16.9% remained neutral,

however, revealing inconsistencies, supporting Kabanda's (2020) observation that Ugandan schools underuse available ICT resources. Literature from Arias Ortiz and Cristia (2014) suggests that effective ICT integration extends beyond hardware usage to include the use of simulations, software environments, and multimedia platforms. The current findings suggest partial realization of this ideal in Bukanga North.

In terms of classroom engagement, only 66.9% of students agreed that ICT tools are effectively used in discussions and practical activities ($M = 3.56$, $SD = 1.07$), while 16.9% were neutral and 8.5% disagreed. The relatively high standard deviation suggests that while some classes are highly interactive and ICT-rich, others remain more traditional. This observation corresponds with Isaacs' (2007) critique of uneven ICT application even within the same school due to variability in teacher ICT competence. The inconsistency in practical usage dilutes ICT's potential to foster collaborative learning and problem-solving. Thus, to amplify ICT's pedagogical impact, there is an urgent need for structured lesson planning that integrates digital tools across varied classroom contexts and learner needs.

The triangulated data from headteachers echoed these statistical findings. While schools like Bukanga S.S and Kigaragara Vocational S.S reported using ICT tools regularly, they also noted critical challenges, including inadequate power supply, insufficient digital accessories, and a low student-to-computer ratio. These limitations mirror challenges reported by Nanfuka (2019) in Uganda and Mwalongo (2011) in Tanzania. The headteachers' reflections highlight a paradox: although ICT tools exist, infrastructural deficits and limited maintenance threaten sustainability. Their statements affirm the relevance of the TPACK model, particularly the infrastructural and institutional supports required to transform tool availability into instructional effectiveness. These

insights emphasize that mere availability is insufficient; it must be buttressed by reliable systems and capacity-building efforts to foster effective ICT usage.

Observational data on teacher practices affirmed partial but promising ICT integration. Most teachers (85%) had access to functional computers and used educational software and multimedia tools. However, only 50% used projectors or smartboards, and 20% lacked internet access, reflecting infrastructural inequalities across schools. While 90% incorporated ICT into assessments, limited adoption of advanced technologies implies that ICT usage remains concentrated in basic functionalities. These patterns corroborate UNESCO (2021), which warned that ICT benefits are often uneven in low-income countries due to technological stratification.

The study's average ICT integration score ($M = 3.72$, $SD = 0.87$) reflects progress but underscores systemic gaps. While ICT tools enhance teaching and learning, their potential is curtailed by infrastructural deficits, inconsistent teacher training, and unequal resource distribution. These findings validate the research gap identified, where rural Ugandan schools lag behind global ICT integration benchmarks (Pelgrum & Law, 2003; UNESCO, 2021). Similarly, these findings confirm literature highlighting how ICT integration in education hinges not just on availability but also on teacher competency, administrative support, and infrastructural sustainability (Kalinga et al., 2016; Kabanda, 2020).

Effect of ICT tools on students' learning outcomes in ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District

The study found a significant positive impact of ICT tools on students' learning outcomes in ICT subjects in A-Level government secondary schools in Bukanga North, Isingiro District. A strong majority of students (84.8% agreeing) reported that ICT tools made learning ICT easier ($M = 4.07$, $SD = 0.688$), aligning with global findings by Wang and Reeves (2019), who highlighted increased

engagement through interactive digital tools. This supports the Constructivist Learning Theory, which posits that hands-on experiences with ICT foster deeper comprehension (Jonassen, 1999). However, 12.7% neutrality and 2.5% disagreement suggest disparities in access or digital literacy, echoing UNESCO's (2023) concerns about inequitable ICT adoption in rural areas.

The study found that ICT tools were particularly effective in enhancing practical understanding, with 84.8% of students agreeing that these tools outperformed textbooks ($M = 4.00$, $SD = 0.692$). This resonates with Adeyemi et al.'s (2021) pan-African study, where ICT-based simulations improved STEM performance by 20%. This positive effect on practical skills is crucial in the Ugandan context, where the curriculum emphasizes hands-on competence. A study focused on vocational training in Western Uganda by Mwesigwa (2021) found similar results, concluding that ICT practical sessions significantly increased students' ability to troubleshoot and solve technical problems, directly enhancing their employability skills. The TPACK framework underscores this, emphasizing the need for teachers to blend technological, pedagogical, and content knowledge (Spiro & Jehng, 1992). Yet, the 11.0% neutrality indicates some students may lack exposure to advanced ICT applications, reflecting Kabanda's (2020) findings on underutilized resources in Ugandan schools and pointing to a inconsistent application of practical ICT pedagogy across the country, a challenge also noted in Eastern Uganda by Namono (2022).

It was also found that student confidence in using technology improved markedly ($M = 3.85$, $SD = 0.747$), with 76.3% agreeing. This aligns with Koskinen and Salmela-Aro's (2020) research in Finland, where ICT tools boosted critical thinking. However, 18.6% neutrality signals gaps in teacher training or tool accessibility, consistent with Nanfuka's (2019) report that only 15% of Ugandan teachers were proficient in ICT. The Cognitive Flexibility Theory (Spiro & Jehng, 1992)

further explains how varied ICT experiences could bridge these gaps by adapting to diverse learning needs.

The current study found that academic performance correlated strongly with ICT use ($M = 3.97$, $SD = 0.779$), supporting Njoroge and Wanjiku's (2022) findings in Kenya and Uganda, where ICT-integrated schools saw a 15% rise in exam scores. However, 13.6% neutrality suggests infrastructural barriers, such as unreliable electricity, noted by Mwalongo (2011) in Tanzania. Headteachers' qualitative feedback highlighted Wi-Fi and visual aids as transformative, yet also cited power outages and inadequate labs, reinforcing the need for sustainable solutions like solar energy, as proposed by the African Union (2023).

While ICT tools fostered problem-solving skills ($M = 3.73$, $SD = 0.967$), 30.5% neutrality implies superficial integration. This aligns with Balanskat et al. (2006), who found that only 32% of teachers globally used ICT effectively. The TPACK framework suggests that deeper pedagogical integration, beyond basic tool use, is essential. For instance, headteachers emphasized ICT's role in collaborative projects and UNEB registration, demonstrating its administrative and instructional value.

The study found collaboration improved with ICT ($M = 3.75$, $SD = 0.784$), echoing Ojo and Boateng's (2021) findings in Nigeria and Ghana, where cloud-based tools enhanced teamwork by 25%. However, 20.3% neutrality may reflect technical barriers, such as poor internet, cited by 25% of teachers in this study. The African Development Bank (2021) stresses that connectivity gaps must be addressed to unlock ICT's full collaborative potential.

Motivation surged with ICT use ($M = 4.24$, $SD = 0.893$), the highest-scoring factor. Abebe and Mohamed (2022) similarly found that gamified apps in Ethiopia increased engagement by 85%.

This underscores ICT's role in making learning interactive, as headteachers noted "hands-on experience" boosted participation. Yet, 7.6% neutrality calls for inclusive strategies to engage all learners, per UNESCO's (2023) equity goals.

The findings show that ICT tools significantly enhance student learning in A' Level government secondary schools of Bukanga North. It was observed that students (85%) actively participated in ICT-supported lessons and demonstrated improved understanding and skills. Similarly, it was noted that students (80%) used ICT tools independently for research and group work, indicating improved digital literacy. These results support Ojo and Boateng (2021), who found that technology fosters self-directed and collaborative learning. The consistently low standard deviations suggest uniform benefits across learners. This confirms that ICT integration supports active engagement and boosts learning outcomes.

It was observed that teachers also showed strong ICT adoption in instruction. Most (85–90%) effectively integrated ICT into lesson plans, promoted student-centered learning, and used interactive digital resources. All teachers (100%) had structured lesson plans and schemes of work. These findings align with Wang and Reeves (2019), who emphasized that well-prepared teachers using ICT improve student performance. Despite some challenges like technical issues and limited training, the overall results indicate ICT use positively impacts students' learning in the ICT subject.

Relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

The study established a compelling relationship between ICT tool usage and effective delivery of ICT lessons, evidenced by 75.5% of respondents affirming that teachers use ICT tools effectively (M = 3.81, SD = 0.739). This finding reinforces the argument in the literature that effective ICT

integration enhances lesson delivery and instructional quality (Johnson & Reeves, 2020). The high rate of agreement suggests that teachers in Bukanga North are embracing ICT, aligning with the TPACK framework which emphasizes technological knowledge in pedagogical contexts. However, the 20.3% neutrality may reflect disparities in ICT infrastructure or inconsistent implementation, as noted by Mwalongo (2011) in Tanzania. This disparity calls for standardization in teacher training and consistent infrastructure to ensure uniform utilization of ICT tools across all government schools. The findings echo Adeyemi et al. (2022) who argued that ICT access alone is insufficient without structured pedagogical alignment and teacher preparedness.

Another striking result was that 91.5% of participants agreed ICT tools simplify the explanation of complex ICT concepts (M = 4.07, SD = 0.519). This aligns with Koskinen and Nieminen's (2021) findings that digital platforms enhance cognitive processing through visual and interactive content. The cognitive flexibility theory (Spiro & Jehng, 1992) supports this result, suggesting that learners benefit from multiple representations and modalities of instruction. The negligible disagreement (0.8%) underscores ICT's transformative potential in demystifying technical subjects. This finding justifies greater investment in digital content development and teacher training in digital pedagogy. In Bukanga North's rural context, this result is especially significant, showing that even minimal ICT integration yields positive cognitive impacts. Theoretically, this underscores the role of ICT in promoting deeper comprehension through scaffolding complex content into manageable learning experiences.

A powerful correlation emerged regarding resource availability: 91.4% of respondents asserted that schools with better ICT resources perform better in ICT lessons (M = 4.50, SD = 0.761). This validates Adeyemi et al.'s (2022) assertion that robust ICT infrastructure enhances academic outcomes. This finding is particularly salient in Uganda, where resource distribution is uneven.

The correlation underscores the urgency of the government's ongoing efforts to equip schools, as the lack of adequate tools in rural areas like Bukanga North directly contributes to educational inequality, a theme extensively documented in a national study on ICT readiness by the Uganda Communications Commission (UCC, 2023). Furthermore, the moderate to strong Pearson correlation ($r = 0.545$, $p = .000$) between ICT usage and learning outcomes statistically supports this claim. As literature emphasizes (UNESCO, 2021), digital infrastructure acts as a cornerstone for modern educational delivery. However, the finding that better resources lead to better performance is not automatic; it depends on effective utilization. This aligns with a key finding from a meta-analysis of Ugandan ICT studies by Lubega (2022), which concluded that investment in teacher training must accompany investment in hardware to achieve a significant return in terms of student learning outcomes.

The study found that 89.8% of respondents affirmed that ICT tools increase student engagement in lessons ($M = 4.11$, $SD = 0.610$). This echoes Wang and Reeves (2019), who showed that interactive tools boost classroom participation. Such engagement is crucial in ICT education, where active participation enables mastery of abstract digital concepts. This is particularly vital in Bukanga North, where traditional teacher-centered methods still dominate. The Constructivist Learning Theory supports this finding, indicating that learners actively construct knowledge through interactions. The slight neutrality (8.5%) may reflect inconsistent application of interactive methods, especially in schools lacking multimedia or software support. However, the consensus supports a pedagogical shift toward student-centered and technology-enhanced learning methods. This validates calls in the literature for integrating digital gamification and collaborative platforms to foster active learning.

Resource-driven motivation was another central theme, with 80.5% agreeing that ICT availability influences students' subject choices (M = 3.98, SD = 0.773). This aligns with Nanfuka's (2019) findings in Uganda, where low ICT enrollment correlated with poor infrastructure. The results indicate that when learners see accessible and functioning ICT tools, they are more inclined to pursue ICT subjects, associating them with relevance and career prospects. This resonates with findings by Tumwine and Deng (2024), which link early digital exposure with long-term academic commitment. In the context of Bukanga North, this is particularly revealing, as rural learners may base academic choices on what is physically available. Thus, schools with visible ICT tools may experience higher ICT uptake, suggesting policy shifts to ensure baseline digital access in all government schools. The results thus reinforce the literature's call for equitable access to learning technologies.

The results revealed a moderate positive correlation (r = 0.545, p=0.000), demonstrating that increased ICT tool utilization is strongly associated with improved teaching and learning effectiveness. This finding affirms the TPACK framework, which emphasizes the intersection of technology, pedagogy, and content knowledge as central to effective teaching. The correlation suggests that approximately 29.7% of the variance in learning and teaching outcomes can be explained by ICT use, underscoring its role in lesson delivery, student engagement, and content comprehension. This aligns with Koskinen and Nieminen (2021), who found that effective ICT integration led to a 30% improvement in ICT subject performance. Thus, the Bukanga North findings validate global literature, confirming that targeted use of ICT tools enhances education quality and promotes digital literacy among learners.

The qualitative insights from headteachers further enrich these quantitative findings by shedding light on infrastructural and human resource realities. Despite positive efforts, such as teacher

training through USEEP and partnerships with the Ministry, numerous barriers remain, including poor internet connectivity, limited access to hardware, and high maintenance costs. As reported, only a few schools have dedicated ICT labs, and staffing shortages often impede tool utilization. These challenges mirror the infrastructural disparities noted in Adeyemi et al. (2022), who observed that rural African schools often lag in ICT readiness. Nonetheless, the proactive measures undertaken, such as parent-led donations, software training, and strict ICT inventory controls, highlight the community's commitment to overcoming these gaps. The literature also confirms that administrative support and consistent teacher development are key enablers of effective ICT integration. Therefore, while the statistical correlation affirms a strong relationship between ICT utilization and improved learning, the qualitative data stress the urgent need for systemic investment to sustain and expand these gains across all government schools in Bukanga North.

Conclusions

The study findings demonstrate that while ICT tools such as computers, educational software, and multimedia resources are widely used in the teaching and learning of the ICT subject in Bukanga North, Isingiro District ($M = 3.72$, $SD = 0.87$), their utilization is not uniformly distributed across all schools or instructional areas. The high levels of teacher encouragement, learner comfort, and integration into assessments affirm a strong foundation in ICT adoption. However, disparities in access to advanced tools like projectors and smartboards, variability in practice time, and infrastructural challenges (for example, power instability, poor internet connectivity, and inadequate computer-to-student ratios) indicate gaps that hinder optimal utilization. Qualitative findings from headteachers and classroom observations corroborate these issues, revealing that while ICT is generally integrated into instruction, limitations in resources, time, and training still impede full effectiveness.

The study revealed that the integration of ICT tools significantly enhances students' learning outcomes in ICT subjects in A ‘Level government secondary schools of Bukanga North, Isingiro District. Students acknowledged that ICT tools simplify learning, increase motivation, and improve performance and comprehension of practical concepts. Teachers confirmed that ICT tools promote active engagement, foster student-centered learning, and support pedagogical planning. Observations further validated that students actively participate in ICT-supported activities and demonstrate strong skill acquisition. However, challenges such as technical difficulties, inconsistent power supply, limited access to devices for some learners, and insufficient formal ICT training among teachers persist. Despite these challenges, the overall results indicate a strong positive relationship between ICT use and improved academic performance, learner engagement, and instructional quality in ICT subject delivery.

The study found a statistically significant moderate positive correlation between the utilization of ICT tools and the effectiveness of teaching and learning ICT subjects ($r = 0.545$, $p = 0.000$). This finding leads to the rejection of the null hypothesis (H_0), which stated that there is no significant relationship between the utilization of ICT tools and the teaching and learning of ICT. Instead, the results confirm that ICT tool utilization significantly enhances instructional delivery, student engagement, and learning outcomes. This study successfully addressed the identified research gap by providing empirical, localized evidence on the actual utilization of ICT tools, not merely their availability, in a rural Ugandan context. Previous studies (Nanfuka, 2019; Kabanda, 2020) highlighted national-scale issues of access and teacher proficiency but did not specifically examine the relationship between ICT use and learning outcomes in a socio-economically constrained region like Bukanga North. By applying the TPACK framework, this study diagnosed underlying pedagogical and infrastructural barriers, offering a nuanced understanding of how ICT integration

can be optimized in similar rural settings. High mean scores across key indicators, such as improved explanation of complex concepts ($M = 4.07$), enhanced student engagement ($M = 4.11$), and preparation for digital careers ($M = 4.25$), reflect widespread recognition of ICT's pedagogical value. Nonetheless, systemic challenges persist, including inadequate ICT infrastructure, unreliable internet and electricity, insufficient training, and maintenance issues, which inhibit uniform implementation across schools. Despite ongoing interventions, such as USEEP-led training and acquisition of ICT equipment, the full potential of ICT integration remains partially unrealized due to funding gaps, high repair costs, and a low student-to-computer ratio.

Recommendations

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

1. It is recommended that the Ministry of Education and Sports (MoES), in collaboration with district education authorities, prioritize teacher professional development as the first line of intervention. Teachers should receive continuous training in the integration of Information and Communication Technologies (ICT) into pedagogy. This includes workshops, refresher courses, and mentorship programs aimed at enhancing teachers' capacity to effectively utilize ICT tools in lesson planning, delivery, and assessment. Teachers themselves bear responsibility for applying the acquired skills consistently in classroom practice.

2. After addressing teacher capacity, schools should prioritize the improvement of physical and digital infrastructure. The government, through MoES and local district authorities, should provide financial support for upgrading computer laboratories, internet connectivity, and power supply, while school management should ensure proper utilization

and maintenance of facilities. Teachers should integrate these resources meaningfully into the teaching-learning process to maximize their impact.

3. Collaboration among key stakeholders is essential for sustainable ICT integration. The government should establish enabling policies and allocate adequate funding, while schools should create platforms for parents and community members to participate in decision-making on ICT-related investments. Teachers should also engage students and parents in supporting academic activities, thereby fostering a culture of shared responsibility for improved learning outcomes.

4. Continuous monitoring and evaluation should be instituted to track the effectiveness of interventions. The Ministry of Education and district inspectors should conduct regular supervision and reporting on ICT integration. School administrators should ensure accountability and transparency in the use of ICT resources. Teachers should provide feedback on the effectiveness of professional development programs, while learners' progress should be systematically documented and reviewed.

Limitations of the Study

This study was subject to several limitations that may affect the interpretation and generalizability of the findings.

The study focused on three government-aided secondary schools within Bukanga North, Isingiro District. This limited scope may not fully represent all Ugandan schools, especially private or urban schools with stronger ICT infrastructure. To address this, purposive and stratified random sampling were applied to ensure proportional representation of participants across schools with

varying ICT resources. The findings are therefore representative of the rural government-school context, though not intended for universal generalization.

The research adopted a cross-sectional design, collecting data at one point in time, which limited the ability to establish causality between ICT utilization and student outcomes. Triangulation of methods (questionnaires, interviews, and observations) helped provide a more comprehensive picture. Additionally, literature was used to support causal interpretations cautiously, with the recommendation that future research apply longitudinal designs.

Much of the data relied on self-reported responses, which may have been influenced by recall errors or social desirability bias. This limitation was reduced by assuring respondents of confidentiality and anonymity, which encouraged honest responses. Furthermore, observation checklists were used to validate self-reported practices.

Financial and time limitations restricted the study to 150 participants and limited the depth of qualitative data collection. A larger sample and longer data collection period could have enhanced robustness. The researcher maximized available resources by focusing on a carefully selected sample that aligned with Krejcie and Morgan's (1970) table for sample adequacy. Data were also collected from multiple respondent categories (students, teachers, head teachers, and the District Education Officer) to enhance reliability through triangulation.

Despite these limitations, the study employed deliberate strategies to minimize their impact, thereby ensuring credible and contextually valid findings.

Areas for further study

Given the findings of inconsistent access to and utilization of advanced ICT tools, such as projectors, smartboards, and reliable internet, an important area for further study would be: An Investigation into the Barriers to the Effective Utilization of Advanced ICT Tools in Teaching and Learning in Rural Secondary Schools.

Based on the findings, an important area for further study is: The Impact of Teacher ICT Training Programs on the Effectiveness of ICT-Integrated Instruction in Secondary Schools. While the current study highlights a positive effect of ICT tools on student learning outcomes, it also reveals that only 50% of teachers had received formal training in ICT integration.

Given the findings of a moderate correlation ($r = 0.545$) between ICT tool utilization and improved teaching and learning outcomes, further research should explore the influence of teacher competency and pedagogical approaches on the effectiveness of ICT integration in A' Level government secondary schools.

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Appendices

Appendix 1: Questionnaire for Students to assess Utilization of ICT Tools in Teaching and Learning ICT in A-Level Government Secondary Schools

INTRODUCTION

Dear Student,

You are invited to participate in this research study on **"Utilization of ICT Tools in Teaching and Learning ICT in A' Level Government Secondary Schools of Bukanga North, Isingiro District."** This study aims to assess the utilization, and impact of ICT tools in enhancing the teaching anf7 brrd learning of ICT subject.

Your responses are crucial in helping us understand how ICT tools influence students' learning experiences and outcomes. This questionnaire is **strictly confidential**, and your answers will be used **only for academic purposes**. Please answer all questions honestly based on your experiences.

Section A: Demographic Information

1. Gender:
   a) Male ☐
   b) Female ☐
2. Age: .....
3. Class:
   a) Senior 5 ☐
   b) Senior 6 ☐

Section B: Extent of ICT Tools Utilization in Teaching and Learning ICT

This section seeks to examine whether the existing ICT tools are utilized in the teaching and learning of ICT as a subject in Bukanga North, Isingiro District.

Instructions: Tick (✓) the appropriate box for each statement. (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Statement	**1**	**2**	**3**	**4**	**5**
ICT tools such as computers and projectors are regularly used in ICT lessons.					
Teachers encourage students to use ICT tools during lessons.					
I feel comfortable using ICT tools to complete my assignments and projects.					
The school provides enough time for students to practice using ICT tools.					
The availability of ICT tools has improved the way ICT lessons are delivered.					
Teachers integrate different ICT tools (e.g., software, simulations) into their teaching.					
ICT tools are effectively used in classroom discussions and practical activities.					

Section C: Effect of ICT Tools on Students' Learning Outcomes

This section seeks to assess the effect of ICT tools on students' learning outcomes in ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

Instructions: Tick (✓) the appropriate box for each statement. (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Statement	**1**	**2**	**3**	**4**	**5**
Using ICT tools has made learning ICT easier for me.					
ICT tools help me understand practical aspects of ICT better than textbooks alone.					
My confidence in using technology has increased due to ICT-based lessons.					
I perform better in ICT subjects when I use computers and other ICT tools.					
ICT tools have helped me develop problem-solving and critical-thinking skills.					
Group work and collaboration improve when ICT tools are used in class.					
My motivation to study ICT has increased due to the use of ICT tools.					

Section D: Relationship Between ICT Tools and Teaching & Learning ICT

This section seeks to establish the relationship between the utilization of ICT tools and teaching and learning of ICT subject in A 'Level government secondary schools of Bukanga North, Isingiro District.

Instructions: Tick (✓) the appropriate box for each statement. (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Statement	**1**	**2**	**3**	**4**	**5**
Teachers use ICT tools effectively to deliver ICT lessons.					
ICT tools make it easier for teachers to explain complex ICT concepts.					
Schools with better ICT resources perform better in ICT subjects.					
The use of ICT tools increases student engagement in lessons.					
The availability of ICT tools influences the choice of ICT as a subject.					
ICT tools help in preparing students for future digital careers.					
The integration of ICT tools should be expanded to improve learning outcomes.					

Thank you for your time and participation!

Appendix 2: Observation Checklist for Teachers

Section A: General Information

School Name: .....

Date of Observation: .....

Class Level Observed: .....

Lesson Topic: .....

Section B: Availability and Utilization of ICT Tools in Teaching and Learning

Observation Item	**Yes**	**No**	**Remarks**
The teacher has access to a functional computer/laptop for lesson preparation and delivery.			
A projector or smartboard is available and used during lesson delivery.			
Internet connection is available and used during teaching.			
Educational software (e.g., simulations, programming tools) is used to support ICT lessons.			
The teacher uses multimedia resources (videos, images, presentations) in teaching.			
ICT tools are incorporated into assessments or student activities.			

Section C: Teacher's Engagement in ICT-Based Lesson Delivery

Observation Item	**Yes**	**No**	**Remarks**
The teacher integrates ICT tools effectively into lesson planning.			
The teacher demonstrates confidence and proficiency in using ICT tools.			
ICT tools are used to facilitate student-centered learning activities.			
The teacher engages students with interactive ICT resources.			
The teacher encourages students to use ICT tools in practical work.			
The teacher has a lesson plan			
The teacher has scheme of work			

Section D: Student Engagement in ICT Lessons (Student Learning Outcomes)

Observation Item	Yes	No	Remarks
Students actively participate in ICT-supported lesson activities.			
Students demonstrate understanding and skill acquisition through ICT-based learning.			
Students use ICT tools independently for research and assignments.			
Students collaborate using digital tools (e.g., group projects, online discussions).			

Section E: Challenges in ICT Utilization (Barriers to ICT Integration)

Observation Item	Yes	No	Remarks
The teacher experiences technical difficulties while using ICT tools.			
Limited access to ICT tools affects lesson delivery.			
Power supply interruptions affect ICT-based teaching.			
Students face difficulties in accessing and using ICT tools effectively.			
The teacher has received formal training in ICT integration.			

End

Appendix 3: In-Depth Interview Guide for Headteachers and District Education Officer

Introduction

Thank you for participating in this research study. This interview seeks to explore the availability, utilization, and impact of ICT tools in teaching and learning ICT in A' Level government secondary schools in Bukanga North, Isingiro District. Your responses will be treated with strict confidentiality and will only be used for academic purposes. This interview will take 30-45 minutes.

Interview Questions

1. What ICT tools are currently available in your school (or district) for teaching and learning ICT? **Probe:** How frequently are these ICT tools used by teachers and students during lesson delivery? **Probe:** What challenges do schools face in ensuring that these tools are effectively utilized in the teaching and learning process?
2. In what ways do you think ICT tools have influenced lesson delivery and instructional effectiveness in ICT subjects? **Probe:** How has the integration of ICT tools impacted student engagement, participation, and learning outcomes in ICT subjects?
3. What professional development programs or training have been provided to teachers regarding ICT integration in teaching and learning? **Probe:** How competent are teachers in utilizing ICT tools effectively in lesson planning, delivery, and student assessment?
4. What are the major infrastructural, administrative, or financial challenges affecting the effective use of ICT tools in A' Level government schools? **Probe:** How do issues like internet connectivity, electricity supply, and maintenance of ICT tools affect their utilization in teaching?
5. What measures have been put in place to improve ICT integration in teaching ICT subjects at the A' Level? **Probe:** What additional support (from government, schools, or other stakeholders) do you think is necessary to improve ICT utilization in secondary schools?

Thank you for your time and valuable insights.

Appendix 4: Krejcie, Robert V., Morgan, Daryle W table for determining sample size from a given population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size

"S" is sample size.

Source: Krejcie, Robert V., Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.