UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

A STUDY OF ICT USAGE AMONG SENIOR HIGH SCHOOL STUDENTS IN THE GA WEST MUNICIPAL DISTRICT IN GHANA.

BY:

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS IN DEVELOPMENT STUDIES DEGREE.

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DECLARATION

I, Daniel Amewuda, hereby pronounce that this dissertation is my authentic creation, except where due acknowledgment has been made to other sources. This dissertation was produced under the supervision of Dr. Fred Dzanku, in accordance with the regulations established by the University of Ghana. I further affirm that this dissertation has not been presented, whether partially or entirely, for any other degree at any academic institution.

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DEDICATION

This work is dedicated to God, whose purpose, wisdom, knowledge, and understanding have guided me, and whose zeal has driven me to impact lives. To my parents, Mr. Robert Amewuda and Mrs, Theresah Amewuda, whose vision for my education and tireless sacrifices provided the foundation for this achievement. Your unwavering determination and support have been a blessing. To myself, for the strength and resilience I've displayed throughout this journey. And to all those striving to make the world a better place for this generation and those to come.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
AITI-KACE	Ghana-India Kofi Annan Centre of Excellence in ICT
Adjen Kotoku SHTS	Adjen Kotoku Senior High Technical School
Amasaman SHTS	Amasaman Senior High Technical School
BECTA	British Educational Communications and Technology Agency
CENDLOS	Centre for National Distance Learning and Open Schooling
CIC	Community Information Centres
EMIS	Education Management Information System
ESP	Education Strategic Plan
GES	Ghana Education Service
GIFEC	Ghana Investment Fund for Electronic Communications
GSS	Ghana Statistical Service
ICT	Information and Communications Technology
ISSER	Institute of Statistical Social and Economic Research
MOOC	Massive Open Online Courses
Navs SHTS	Navs Senior High Technical School
OECD	Organisation for Economic Co-operation and Development
SHS	Senior High School
SHTS	Senior High Technical Schools
STEM	Science, Technology, Engineering, and Mathematics
UTAUT	Unified Theory of Acceptance and Use of Technology

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ABSTRACT

This research investigates ICT usage among senior high school students in the Ga West Municipal District, Ghana. The study assessed the extent of ICT usage, its impact on student learning experiences, and the challenges and opportunities associated with ICT integration in schools. An explanatory sequential mixed-methods approach was employed, integrating quantitative and qualitative methods. Data were collected from 300 students across three schools and four in-depth interviews conducted with ICT administrators and tutors. Quantitative analysis entailed mainly descriptive analysis, while qualitative data were thematically analyzed using NVivo software to explain and expand upon the quantitative findings.

The study results indicated that all surveyed students have used ICT in school but 70% of students demonstrated low ICT usage, using ICT for less than two hours per week, while 13% engaged at moderate usage, with 17% showing high usage. Despite the overall low engagement, 72% of students who use ICT at school reported improvements in their academic performance, and 60% noted enhancements in their overall learning experiences due to ICT use. However, access challenges were prominent, with 87% of students facing restrictions on ICT use, primarily confined to scheduled class times. Access restrictions limit independent learning opportunities. Qualitative findings reinforced these challenges, highlighting the scarcity of resources and insufficient digital skills as key barriers. Despite these obstacles, 93% of students expressed a strong desire for increased ICT use, and 99% were aware of the available ICT resources, indicating significant potential for enhancing ICT integration.

The findings show the importance of addressing infrastructural limitations, expanding access to ICT resources, providing operational funds and improving digital literacy among students for fully leveraging the educational benefits of ICT. Targeted interventions are recommended.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The Information and Communications Technology (ICT) revolution has transformed worldwide economies, societies, and education. The digital economy, which amalgamates ICTs and ICT services, accounted for 15% of the global GDP in 2019, equivalent to $11.5 trillion. Projections indicate that this figure will reach 20% of the global GDP, approximately $23 trillion, by 2025. In Africa, the digital economy surged from $100 billion in 2008 to $125 billion in 2016 and is predicted to exceed $300 billion by 2025 (McKinsey, 2013; World Bank Group, 2019).

Given the growth of the digital economy, ICT has emerged as a formidable catalyst for knowledge production, skill enhancement, job creation, and economic development (Ngoma, 2010; OECD, 2011; Adeoye et al., 2013; Valberg, 2020; Burbules et al., 2020). Consequently, the possession of digital skills and the utilization of digital technologies offer invaluable avenues for active participation in learning and the workforce, as well as the enhancement of overall quality of life of people (Mbarika et al., 2007; and Bejaković & Mrnjavac, 2020).

In Ghana, as in many other countries, ICT is recognized as a vital tool for enhancing the quality of education and equipping students with the necessary skills for employability in the digital age (Al-Rahmi et al., 2020). Ghana's policy commitment to ICT integration in education is underscored by several interventions, including the ICT for Accelerated Development (ICT4AD) policy, the ICT in Education Policy, and the current Education Strategic Plan (2018–2030), which prioritizes equitable access to digital tools and infrastructure for all learners. The integration of ICT is further evidenced by school-based interventions such as the iBox system, iCampusGH

platform, and Ghana Learning TV, as well as the distribution of laptops and smart devices to students and teachers.

Despite these efforts, ICT usage remains uneven across schools, especially at the senior high school level, where disparities in infrastructure, support, and accessibility persist. Research suggests that while ICT labs, digital resources, and multimedia tools are available in some schools, access is limited and actual usage among students is often constrained by contextual factors such as location, infrastructure, teacher capacity, and school policy (Gyesi, 2020; Bayuo et al., 2022; Gbordzekpor, 2020).

Senior high school students represent a crucial demographic of interest for ICT usage, development of digital skills, and youth employability, especially given their large population and the need for higher education and workforce readiness. Moreover, the Ga West Municipal District presents a compelling case for examining ICT usage in senior high schools due to its demographic diversity and educational significance. This district hosts the largest rural population in the Greater Accra region (Ghana Statistical Service, 2021, pp. 42–45). This demographic and infrastructural variation offers a unique lens for investigating how school-level, personal, and contextual factors influence the extent and impact of ICT usage among students. Studying this area allows for the identification of gaps and opportunities that could inform targeted strategies for enhancing digital inclusion and educational equity.

1.2 Problem Statement

Ghana recognizes the importance of preparing its youth for the digital era. The country has embarked on multifaceted initiatives to integrate ICT into its educational systems while fostering ICT usage among its youth, especially at the senior high school level. These initiatives, from policy

formulations to ICT infrastructure development and teacher training programs, underscore the nation's commitment to equipping its students with the requisite digital competencies. Prominent are the 2007 Education Restructurings, the ICT for Education Policy, and the International Girls-in-ICT Day (Government of Ghana, 2015; Ministry of Communication and Digitalization, Ghana, n.d.). The Ministry of Education also launched initiatives to equip schools with computer labs, expanded internet connectivity, distributed laptops to teachers and students, and improved teacher competencies (Ministry of Education, 2015; Yalley, 2022; Adomako et al., 2022). These initiatives aim to advance ICT accessibility and usage in schools to promote equity and quality education.

Amidst the efforts to enhance ICT integration into education, there is a need to explore the extent of ICT usage among senior high school students and its effect on student's learning experiences, particularly those within peri-urban and rural districts. Notably, Ga West Municipal District—with its unique blend of rural and urban populations and infrastructural disparities—presents a strategic location to investigate how ICT is accessed and used in such diverse educational settings. While the intentions behind school-level ICT initiatives are explicitly geared towards promoting ICT usage, it is unclear whether senior high school students, who constitute over one million youth, are actively utilizing ICT and tapping into its boundless potential, especially in school. Thus, a deeper understanding is required of how students engage with ICT, the extent of their usage, and the influence it has on their learning experiences. Yalley (2022) affirms this by asserting that amidst the ongoing ICT integration, local school-level (meso level) necessitates exhaustive research to examine the effects of varied factors, measured on different levels and reported by different actors on the dependent ICT integration variable.

Furthermore, it is essential to recognize that despite the promises of enhanced education through ICT initiatives, significant challenges persist within school settings, which subsequently affect ICT

usage. These challenges, as documented by some scholars, include infrastructure limitations, unequal access to technology, shortages of ICT support staff, and the necessity for practical pedagogical approaches (Adomako et al., 2022; Yalley, 2022; Antwi et al, 2018; Soma, Nantomah, & Adusei, 2021). However, existing studies tend to focus more on general or teacher-level barriers, with limited focus on the specific post-intervention challenges students face when attempting to use ICT tools. In particular, little empirical evidence exists on how these challenges unfold within peri-urban districts like Ga West and how they affect ICT's impact on students' learning experiences.

Moreover, while ICT's potential to improve learning is well-documented, few studies have critically assessed how ICT use tangibly enhances or hinders students' learning experiences or academic performance, especially from the students' perspective. Despite its inclusion as a key objective in ICT education strategies, this link remains underexplored in literature.

The study seeks to bridge these gaps by providing empirical insights into the intricacies of ICT utilization, conditions for ICT usage, available impediments, and their implications for student learning experiences in senior high schools in the Ga West Municipal District.

1.3 Research Objectives

The primary objective of this study is to investigate ICT usage among senior high school students in the Ga West Municipal District of Ghana. Specifically, the research aims to:

i. Examine the extent of ICT usage among senior high school students.
ii. Identify the key challenges and opportunities associated with ICT usage among senior high school students.
iii. Assess the effect of ICT usage on students' learning experiences.

1.4 Significance of the study

This study holds considerable importance in multiple areas, particularly in education, digital skills development, and socioeconomic progress in the Ga West Municipal District. First, it addresses the critical need for enhancing education and fostering digital literacy in response to the increasing global digitization. The research provides essential insights into the current state of digital education in the district, which can guide curriculum development and pedagogical improvements tailored to students' evolving digital needs.

Second, the study offers valuable contributions to informed policymaking and academic research. Its findings can serve as a foundation for decision-making by educators, policymakers, and administrators in shaping educational policies and digital skills programs. The study also bridges a research gap, contributing to the academic discourse on ICT integration in education and serving as a reference for future research on youth and technology.

Finally, the research has significant implications for youth empowerment and employability. The study highlights strategies to equip students with essential digital competencies, improving their prospects for employment, entrepreneurship, and participation in the digital economy. In summary, this research not only enhances educational practices in the Ga West Municipal District but also has broader relevance, potentially influencing educational policies in similar peri-urban regions and contributing to the global movement towards digital transformation in education.

1.5 Scope of the Study

The scope of this study centres on exploring the level of utilization, challenges, opportunities, and implications of ICT use among senior high school students in the Ga West District of Ghana. Several crucial factors delimit it. Firstly, regarding geography, the research is confined to the Ga

West District, situated within the Greater Accra Region of Ghana. The primary participants of the study include senior high school students enrolled in both public and private schools within the Ga West District, along with ICT administrators and tutors.

The study also scrutinizes the extent of ICT usage, emphasizing the breadth of application across various dimensions, frequency and duration of ICT use, and activities performed. Moreover, it delves into digital proficiency, use conditions, and technology's impact on student learning experiences. It explores critical challenges and opportunities linked to ICT usage in senior high school education. Additionally, the research assesses how ICT usage influences teaching and learning dynamics, student engagement, and academic outcomes.

1.6 Organization of study

This study is meticulously structured to guide readers through exploring ICT usage among senior high school students in the Ga West Municipal District of Ghana. Chapter One offers an introductory overview, presenting the study's background, problem statement, research objectives, and significance. It outlines the research scope and lays the foundation for subsequent chapters.

Chapter Two is organized into four main sections. The Conceptual Review defines key concepts such as ICT usage, and student learning experiences. The Theoretical Review introduces the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which explains how various constructs impact ICT adoption. The Empirical Review discusses various issues from literature, including ICT policy, infrastructure, access, usage patterns, challenges, and its impact on student learning outcomes. Finally, the Conceptual Framework presents the study's framework, illustrating the relationships between the key variables guiding the research.

Chapter Three elaborates on the research methodology, elucidating the chosen design, ethical procedures, data collection methods, analysis techniques, and considerations. It provides the rationale for methodological decisions. Chapter Four presents the data analysis and findings, systematically reporting outcomes from surveys, interviews, and observations, organized in alignment with research objectives.

Chapter Five synthesizes research findings with literature reviewed in Chapter Two, interpreting results, identifying trends, and examining their impact on student learning experiences. It concludes with recommendations, implications, and suggestions for future research. Finally, a complete reference section adheres to citation guidelines.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explores the current literature on the use of ICT in education, with a specific focus on senior high school settings. It provides a thorough analysis that includes conceptual and theoretical discussions, critical empirical studies, and a conceptual framework to situate the study. The review highlights the current state of ICT usage in SHSs, explores influencing factors, evaluates outcomes, and identifies gaps that justify the study's contribution.

2.2 Conceptual Review

2.2.1 The Concept of ICT Usage

In their study on ICT adoption in small and medium-sized enterprises, Lucchetti and Sterlacchini (2004) described ICT adoption as the extent to which businesses incorporate ICT into their operational processes. Therefore, at the individual level, ICT usage refers to the application of digital tools and platforms for communication, information retrieval, learning, and productivity. It includes both the frequency and purpose of technology engagement, as well as users' proficiency. In the educational setting, ICT usage goes beyond access to include integration into teaching, learning, and administrative tasks. High levels of ICT engagement among students are typically associated with increased digital skills, improved academic performance, and enhanced learning experiences (Youssef et al., 2022).

UNESCO (2009) highlights ICT as essential to expanding educational opportunities, while the International Telecommunication Union (ITU, 2019) emphasizes the role of digital awareness in

driving usage. ICT adoption in schools is therefore a multidimensional concept shaped by infrastructure, accessibility, user motivation, and institutional support.

2.2.2 Student Learning Experience

Learning experiences encompass the interactions, tasks, environments, and resources that contribute to students' academic growth or learning outcomes. These include instructional methods, peer collaboration, hands-on learning, and engagement with digital tools. These experiences may take place in traditional academic environments, such as classrooms, or in non-traditional settings like virtual engagements, internships or service-learning projects (Degerman & Wallo, 2024; Bouilheres et al., 2020). Effective learning experiences enhance knowledge acquisition, critical thinking, and skill development. In technology-rich environments, ICT plays a central role in shaping experiences that are interactive, student-centered, and outcomes-driven (Borland & James, 1999).

2.3 Theoretical framework - Unified Theory of Acceptance and Use of Technology (UTAUT)

The theoretical framework of this study is anchored in the UTAUT, which provides an extensive lens for understanding the factors influencing ICT adoption and usage among senior high school students in the Ga West Municipal District. UTAUT offers a framework to analyze how various factors such as school-level and individual factors drive students' decisions to adopt and use ICT in their educational activities.

Developed by Venkatesh et al. (2003), UTAUT integrates elements from several established models to explain how individuals accept and use new technologies. UTAUT identifies four

primary constructs that influence technology adoption: Performance Expectation (PE), Effort Expectation (EE), Social Influence (SI), and Facilitating Conditions (FC).

- PE refers to students' belief that using ICT will improve their academic performance, such as enhancing their learning experiences or boosting their academic outcomes.
- EE focuses on the perceived ease of using ICT tools and platforms, assessing whether students find ICT resources user-friendly and accessible.
- SI examines how external pressures from teachers, peers, and parents affect students' decisions to use ICT in their learning activities.
- FC relate to the availability and accessibility of ICT resources and infrastructure that support students' usage of technology.

UTAUT has been widely acknowledged for its capacity to explain technology adoption across various settings, including education, business, and healthcare (Venkatesh et al., 2003).

Behavioral Intentions (BI) and Actual Behaviour or Use (AB)

In addition to the core UTAUT constructs, this study incorporates BI and AB, variables originally derived from the Theory of Reasoned Action but integrated into the UTAUT model. These variables are essential for understanding students' intentions to use ICT and their real-world behavior concerning ICT adoption.

- **BI** reflect students' readiness and willingness to use ICT for academic purposes (An et al., 2023). This includes their attitudes toward the potential benefits of ICT and their motivation to integrate technology into their learning activities.

- **AB** measures how frequently and in what contexts students engage with ICT, such as during classroom activities, in the library, or at home. AB assesses duration of use and the tangible application of ICT tools in daily learning routines.

Combining BI and AB, this study captures not only the factors that influence ICT adoption but also how these factors translate into actual usage patterns (An et al., 2023). This provides a more comprehensive understanding of the extent of use and the determinants of ICT use.

2.3.1 Relevance of UTAUT to the Study

The selected UTAUT constructs, along with BI and AB, provide a comprehensive framework for examining ICT usage among senior high school students. FC help identify the technical and organizational infrastructure that supports or hinders ICT use, while SI explains the external pressures affecting students' decisions to adopt technology. PE captures students' perceptions of ICT's value in improving academic performance, and BI and AB assess their readiness and actual engagement with ICT.

2.4 Empirical Review

2.4.1 Global Historic Account of ICT Usage in Education

The evolution of ICT in education spans from the 1950s to the present, reflecting major technological shifts and their growing impact on teaching and learning. Early adoption began with programmed learning machines in the 1950s, primarily used for problem-solving in science and engineering (Molnar, 1997). This was followed by the introduction of personal computers in the 1970s, which enabled individualized learning and led to the development of educational software and multimedia resources (Hawkins & Sheingold, 1986; White, 2007; Schacter & Fagnano, 2015).

The 1990s marked a significant turning point with the emergence of the internet, allowing global access to educational content and the rise of e-learning platforms (Chatti et al., 2015).

In the 2000s, the expansion of Web 2.0 technologies, including social media, wikis, and blogs, enhanced collaborative learning and communication (Chatti et al., 2015). The era also witnessed the rise of mobile learning and ubiquitous computing, fueled by increased connectivity and personal device ownership. More recently, innovations such as Massive Open Online Courses (MOOCs), extended reality (XR), and artificial intelligence (AI) have further transformed education. MOOCs offer free, large-scale online learning opportunities (Ouadoud, Rida, & Chafiq, 2021), while XR and AI support immersive, experiential learning—especially in remote or complex scenarios (Pomerantz, 2019; Sung et al., 2016; Wang & Reeves, 2015).

Overall, the historical progression of ICT in education has led to the widespread use of digital tools such as computers, the internet, MOOCs, and emerging technologies, fundamentally reshaping traditional educational models and promoting more engaging and personalized learning environments.

2.4.2 Overview of ICT in Education in Ghana - Policy and Regulatory Framework

Ghana's approach to integrating ICT into education is shaped by a range of policies and strategic plans aimed at modernizing the sector and improving learning outcomes. The foundation was laid with the ICT for Accelerated Development (ICT4AD) policy introduced in 2003, which focused on equipping students with ICT skills, enhancing teaching and learning, and preparing youth for technology-driven careers (Republic of Ghana, 2003). This was followed by the 2007 educational reforms, which emphasized human capital development through expanded ICT access and infrastructure in schools, including computer labs, internet connectivity, and teacher training

(Ministry of Education, 2015; Adomako et al., 2022). As noted by Aikins and Arthur-Nyarko (2019, as cited in Soma et al., 2021), the policy also aimed to ensure ICT literacy at every educational level.

Building on these foundations, Ghana's 2008 ICT in Education Policy laid out strategic goals across seven thematic areas, targeting improvements in infrastructure and digital literacy among educators and learners (Malcalm, 2012). The Education Strategic Plan (ESP) 2010–2020 expanded these goals by emphasizing ICT integration into curricula and promoting digital literacy across all school levels (Ministry of Education, 2012). The ongoing ESP 2018–2030 continues this agenda by prioritizing equitable access to ICT in rural areas, professional teacher development, and the use of ICT in STEM education, all while aligning with national development goals (Ministry of Education, 2019).

This commitment has yielded results. According to the Ghana Education Fact Sheets I 2020 report by UNESCO and partners, ICT participation among students increased significantly—from 6% in lower secondary to 23% at the senior high school level—indicating growing ICT engagement in education (Arthur et al., 2020). This trend highlights the importance of sustained investments in ICT infrastructure and resources to further support digital learning in senior high schools.

2.4.3 Initiatives and Institutions for Capacity Building

Ghana’s strategic approach to ICT integration in education has consistently emphasized both infrastructure development and capacity-building. Recognizing that digital access without the requisite skills leads to underutilization, national efforts have prioritized training and institutional support for both students and teachers. This commitment is evident in various projects and initiatives targeting digital literacy, equitable access, and pedagogical transformation using ICT.

A foundational effort in this direction was Ghana's participation in the NEPAD e-School Initiative, launched by the African Union in 2003. The initiative aimed to equip primary and secondary schools across Africa with ICT infrastructure and training to improve education quality. In Ghana, pilot schools were provided with computer laboratories, internet access, and digital learning content, enabling both students and teachers to gain firsthand experience with digital technologies (Evoh, 2007; Ministry of Education, 2008). Although implementation varied across schools due to technical and financial limitations, the NEPAD initiative served as a critical springboard for Ghana's later ICT policies and projects.

The country also established key institutions to institutionalize ICT capacity-building efforts. One of the earliest was the Centre for National Distance Learning and Open Schooling (CENDLOS), founded in 2002 as the President's Special Initiative on Distance Learning (PSI-DL). CENDLOS focused on developing and broadcasting educational content on national television, which supported students in remote areas with limited classroom resources (Cullen, Mallet, & Murphy, 2019; Mallet et al., n.d.; CENDLOS, n.d.). This initiative bridged gaps in content delivery and served as a model for educational media in the digital age.

Furthermore, the Ghana-India Kofi Annan Centre of Excellence in ICT (AITI-KACE), established in 2003, has played a central role in ICT human capital development. Managed by the Ministry of Communications and Digitalization, AITI-KACE offers targeted training for educators, students, and public institutions. The centre also supports the development of ICT-integrated curricula and conducts research to inform educational technology policy (Kubuga, Ayoung, & Bekoe, 2021; AITI-KACE, n.d.). Together, these institutions have reinforced the foundation laid by early initiatives like NEPAD, sustaining momentum for ICT-based educational reform in Ghana.

2.4.4 School-Based ICT Infrastructure Projects

To support ongoing capacity-building efforts, Ghana has implemented a series of school-based ICT infrastructure and platform-based projects aimed at enhancing digital access and promoting technology integration in senior high schools. Among the most prominent is the Ghana SHTS Connectivity Project, a collaborative initiative involving the Ministry of Education, USAID, Vodafone, and the Ghana Education Service. This project targets internet connectivity, teacher training in digital literacy, and the inclusion of ICT-based content in curricula, providing a holistic approach to embedding technology in education (Awoonor-Williams, 2013; GESCI, 2012).

The 2013 partnership between the Ghanaian government and RLG Communications Inc. was another critical intervention, supplying laptops to students and teachers and delivering ICT training at the district level. This initiative marked a substantial step towards democratizing access to digital devices and skills (Douglas, 2015, as cited in Adomako et al., 2022).

In addition, the development of digital platforms like iBox and iCampusGH addressed the need for both offline and online learning tools. iBox provides access to interactive and multimedia content without requiring internet connectivity, while iCampusGH has engaged over 1.3 million students through a web-based interface for revision and remote learning (Adie, Bisong, & Obuop, 2023; CENDLOS, n.d.).

In response to the COVID-19 pandemic, Ghana Learning TV was introduced as a televised solution to ensure learning continuity for students nationwide. This intervention delivered recorded lessons aligned with the SHS curriculum (MultiChoice Ghana, 2020). Projects like OpenSTEM Africa, in partnership with The Open University UK, further contributed to digital learning by

offering science applications and teacher training resources (Addae-Kyeremeh et al., 2021). These initiatives collectively address both general education and subject-specific gaps in ICT integration.

Efforts have also been made to bridge rural-urban divides and promote gender inclusion. The rollout of Community ICT Centres (CICs) by the Ghana Investment Fund for Electronic Communications expanded digital access to rural communities (Ibrahim, 2018; GIFEC, n.d.).

Additionally, the Girls-in-ICT initiative empowers girls through targeted ICT training, mentorship, and the provision of digital tools (Ministry of Communication and Digitalization, n.d.). More recent interventions such as the One Laptop per Child program and the Ghana Smart Schools Project—aimed to distribute tablets to 1.3 million SHS students and construct 100 smart schools—demonstrate Ghana's sustained commitment to digitalizing its educational landscape (Steeves & Kwami, 2017; Wiafe, 2024). These coordinated efforts collectively reflect a strategic and inclusive vision for ICT-driven educational reform.

2.4.5 Factors that influence ICT Usage in Secondary Education

The effective integration and utilization of ICT in senior high schools (SHTSs) are shaped by multiple interrelated factors. These can be broadly categorized into three main domains: demographic, personal, and school-level factors (Silva et al., 2023; Gerick et al., 2017). Each of these domains includes specific variables that determine students' access to and engagement with digital technologies. Understanding these factors is vital for designing interventions that enhance ICT adoption and improve educational outcomes.

I. Demographic Factors

Demographic influences include age, gender, socioeconomic status, and geographical location have been widely acknowledged as significant determinants of ICT usage. These variables can affect access to ICT resources and attitudes towards technology, contributing to differences in ICT proficiency and usage patterns (Silva et al., 2023). Students in urban schools generally have better ICT access than those in rural areas due to disparities in infrastructure and resource allocation (Arrington, 2021; Ateboh, 2018). Socioeconomic status also plays a critical role, with students from wealthier households more likely to own ICT devices and afford internet access (Van Dijk, 2006). While young students are typically more adept with technology (Neyens & Childers, 2017), digital engagement can decline with age due to reduced familiarity (Pew Research Center, 2019). Gender-related norms may also shape ICT usage, with cultural expectations potentially limiting female students' exposure to technology (Hilbert, 2011; Ono & Zavodny, 2003).

While demographic factors are well-researched, many studies generalize trends without exploring how these variables interact at the local or institutional level. Few Ghana-based studies disaggregate findings by location in school-level contexts, particularly at the SHS level. This study addresses that gap by examining the intersection of gender and school locality in ICT access and usage patterns.

II. Personal/Individual Factors

Students' intrinsic motivation and their ability to effectively use ICT tools are critical determinants of their engagement with technology (Goldhammer et al., 2016; Shroff, 2008). Such personal factors including student motivation, attitudes toward technology, digital literacy, and prior experience are vital to understanding students' engagement with ICT. Motivated students with

strong interest in technology are more likely to adopt and use ICT tools (Teo, 2014; Liaw et al., 2007). Attitudinal perceptions—whether positive or negative—significantly shape behavioral intentions to use technology (Cai et al., 2017). Furthermore, digital literacy, often gained through self-directed learning or formal instruction, is directly linked to ICT usage effectiveness (Gilster, 1997; Hargittai, 2005; Ng, 2012). Prior exposure to ICT improves confidence and enhances adaptability to new digital environments (Van Dijk, 2006; Bunz et al., 2007).

While global studies recognize the importance of personal interest and digital skills, Ghana-specific literature on how these factors affect students' ICT use particularly within SHS environments is limited. This study contributes by examining how personal interest, proficiency in ICT, and individual resources influence ICT use within the structured school setting.

III. School-Level Factors

School-level factors remain among the most influential determinants of ICT usage in senior high schools, as they directly shape students' access to and engagement with technology in their academic environment (Silva et al., 2023). These factors include the availability and quality of ICT infrastructure, institutional policies governing technology use, teacher competency and support, and the school's location and overall resource base.

The availability of ICT resources—such as functional computer labs, tablets, and reliable internet connectivity—plays a foundational role in facilitating meaningful technology use. Schools that are better resourced in this regard are more likely to foster active student engagement with ICT (Gerick et al., 2017). However, availability alone is insufficient. The quality of infrastructure—defined by the state of hardware, software, and maintenance services—also greatly influences how well ICT can be integrated into daily educational activities. Poor computer-to-student ratios and frequent

maintenance issues often compromise ICT implementation (OECD, 2009; Rodden, 2010; Debra & Arthur, 2018).

Institutional policies and school regulations such as those that determine access to computer labs outside of scheduled lessons or ICT usage rules can positively or negatively affect students' ability to benefit from available ICT infrastructure or services. Supportive policies that promote flexible access, curriculum integration, and teacher development create more conducive learning environments (Tondeur et al., 2008). Meanwhile, restrictive policies can undermine the potential benefits of even the most advanced ICT tools.

Teacher support is another critical driver. Educators who are well-trained, confident, and committed to integrating technology into their pedagogy can significantly influence students' use of ICT. Teachers who demonstrate ICT use in classroom activities and encourage student engagement tend to foster higher usage rates (BECTA, 2004; Edefiogho, 2005; Debra & Arthur, 2018). Without this support, students may lack the guidance and motivation needed to fully exploit ICT tools.

Finally, the type and location of the school also play a crucial role. Urban schools typically benefit from better infrastructure and connectivity than rural schools, which face more significant resource constraints (Pelgrum, 2001; Tondeur et al., 2008; Trucano, 2005). This urban-rural divide contributes to disparities in ICT access and usage, highlighting the importance of targeted interventions to address infrastructural gaps.

While numerous studies have highlighted the impact of infrastructure and teacher capacity, less attention has been paid to how institutional rules and student feedback influence actual usage. In the Ghanaian SHS context, empirical evidence on how students perceive access rules, teacher

encouragement, and school type remains limited. This study addresses this gap by analyzing students' lived experiences across urban and rural schools in Ga West Municipality.

Conclusion

In conclusion, ICT usage is not determined by a single factor but by the dynamic interplay between demographic background, personal motivation and skills, and the educational environment. While international literature provides a broad understanding of these factors, gaps remain in the Ghanaian context—particularly at the senior high school level. This study responds to those gaps by adopting a student-centered lens to explore how these factors collectively shape ICT usage and its impact on learning experiences in Ga West Municipality.

2.4.6 State of ICT in Ghanaian Senior High Schools

The state of ICT infrastructure in Ghanaian senior high schools significantly influences students' access, engagement, and educational experiences. Although the integration of ICT has received policy support, the reality on the ground remains mixed. Antwi et al. (2018) note that several schools have installed computer systems and internet connections, enabling students and teachers to share information and enhance learning. However, these facilities are unevenly distributed.

According to UNESCO Institute for Statistics data, while 78.6% of SHSs have access to electricity, only 34.9% have computers designated for teaching and learning, and 39.4% are connected to the internet (Taddese, 2020). This suggests that nearly two-thirds of schools lack sufficient ICT infrastructure—limiting consistent usage for academic purposes.

Moreover, some schools have adopted multimedia tools like projectors and interactive boards, but usage remains limited. Gbordzekpor (2020), in a study of mathematics teachers, observed that

although multimedia tools are present, their integration into instruction is minimal, signaling a need for further capacity-building and training. Similarly, while tools like search engines, LMS platforms, and e-resources exist, studies show that student usage is not widespread. For example, Bayuo et al. (2022) found that although teachers frequently use digital tools for lesson preparation, ICT integration into science teaching—and student learning—remains low. Gyesi (2020) highlights how digital libraries in schools such as Okuapeman SHS have expanded access to information literacy resources, though the reliance on functional computers underscores the persistent digital divide.

In summary, while infrastructure exists in varying forms across Ghanaian SHSs, significant disparities remain in access, usage, and effectiveness. Many schools lack the basic digital tools necessary for meaningful integration. Moreover, student-level usage is not consistently documented, highlighting the need for empirical studies that examine how students are engaging with available ICT resources. This study seeks to fill that gap by providing a district-level analysis within the Ga West Municipality.

2.4.7 Common use of ICT among SHTS students

Debra and Quaenoo's study in December 2018 indicate that while SHTS students in Ghana utilize computers and related ICT gadgets, their usage is predominantly during computer classes. Most respondents (91.9%) reported using computers primarily in these classes, with significantly lower usage observed in other subjects such as science, music, arts, social sciences, mathematics, and language classes. In the Northern region, Shaibu and Abubakari (2021) found that students primarily used ICT for acquiring computer skills, communication, and entertainment rather than for academic purposes.

Debra and Quaenoo (2018) highlight that most students do not extensively use ICT applications for assignments, lessons, and homework. Approximately 54.2% of the sampled students indicated they did not use ICT applications for these academic purposes. The use of ICT resources for collaborative schoolwork was found to be significantly dependent on the class level, with SHTS 1 students less engaged in collaborative work involving ICT resources than SHTS 3 students.

Kwesi Gyesi's study on "The Use of Computers by Students to Access Information Literacy: Case of Okuapeman Senior High School, Ghana" highlights the diverse information needs of students. While the majority (87.5%) use ICT primarily for academic purposes, such as researching assignments, dissertations, projects, and presentations, students also engage with ICT for various other purposes. Okuapeman students with access to ICT facilities utilize productivity software, educational software, and online tools for interactive exercises and quizzes, which enrich their academic experiences.

Gyesi's study further reveals that 17.5% of Okuapeman SHTS students use ICT for entertainment, including activities such as watching videos, streaming music, and playing online games. This demonstrates that students engage with ICT not only for academic purposes but also for leisure, underscoring the diverse roles ICT plays in their lives. In contrast, a study by Oduro and Nketsia (2019) found that most SHTS students primarily use ICT for entertainment, such as watching videos, playing games, and browsing social media, rather than for academic activities. This contrast highlights differing patterns of ICT usage across student populations.

2.4.8 Extent of ICT Use in SHTS

Although substantial research exists on ICT adoption in education, most studies focus on institutional or teacher-level integration, especially at the tertiary level (Tondeur et al., 2017;

Ertmer & Ottenbreit-Leftwich, 2010). There is comparatively limited literature on how frequently and in what contexts SHS students use ICT tools. Existing research emphasizes dimensions such as frequency, duration, context, and user categorization especially at the tertiary level of education.

Frequency and Duration of Use

Scholars have commonly assessed ICT use through time-based categorizations such as daily, weekly, or termly use (Hsu et al., 2013). Evidence suggests that regular and purposeful ICT use can enhance academic outcomes, particularly when tools are used effectively (Wang et al., 2014). However, some studies caution that longer usage does not always equate to better learning—emphasizing that the quality and relevance of engagement are more critical than mere duration (Li & Ma, 2010; Cavanaugh et al., 2009).

Categorization of ICT Usage

The literature also presents various approaches to categorizing ICT users. Typically, users are classified into low, moderate, and high users based on the frequency and intensity of their engagement with technology (O'Brien & Toms, 2010; Becker, 2000). Low users might engage with ICT infrequently or for minimal periods, while high users are those who integrate ICT into their daily routines extensively. Moderate users fall between these extremes, demonstrating a balanced yet significant engagement with technology (Wartella et al, 2013; UNICEF, 2017; Twenge et al, 2018).

Categorization has often been operationalized through self-reported surveys, usage logs, and observational studies (Mouza et al., 2011). For example, a study by Hsu et al. (2013) utilized a combination of survey data and usage logs to categorize students' ICT use, providing a nuanced understanding of their interaction with technology. Similarly, Mouza et al. (2011) used

observational techniques to categorize students, revealing insights into how different levels of usage impact learning outcomes.

Despite these advancements, there is a noticeable gap in literature regarding the systematic categorization of secondary students' ICT usage especially in Ghana. While existing studies provide valuable insights into general usage patterns especially at the tertiary level, further research is needed for the categorization and exploration at the secondary level. This study seeks to address that gap by providing empirical evidence on SHS student ICT usage in Ghana and proposing relevant user typologies to support more targeted interventions.

2.4.9 ICT-Related Challenges in SHS

The integration of ICT in Ghanaian senior high schools encounters several key challenges. Policy restrictions on personal electronic devices, such as mobile phones, aim to reduce distractions during academic hours and intentionally limit students' access to ICT tools for learning. Moreover, there is a conflict in existing policy preventing the use of personal devices and some government interventions providing personal electronic devices to students and teachers. This creates a conflict between preserving academic focus and promoting technological engagement (Aklasu, 2023; Aggor et al., 2020; Kaledzi, 2016).

Infrastructure deficits remain a critical concern. Limited access to computers, multimedia tools, and internet facilities restricts students' ability to fully engage with ICT for academic purposes. Studies from different regions, including Manya Krobo and the Northern Region, underscore how inadequate infrastructure continues to impair ICT utilization despite growing student interest (Shaibu & Abubakari, 2021; Yalley, 2022; Debrah & Quaenoo, 2018; Bariham, 2022). Power

instability further exacerbates this situation, as inconsistent electricity supply often leads to damaged equipment and disrupted learning (Sey, 2013; Soma et al., 2021).

Financial limitations also play a significant role in limiting ICT adoption. High costs associated with purchasing hardware, software, and maintaining systems prevent many schools—particularly those in less privileged areas—from sustaining ICT investments. The burden is intensified by high bandwidth costs and a shortage of technical personnel (Bayuo et al., 2022; Gbordzekpor, 2023; Association of African Universities, 2014; Mereku et al., 2009). Even when infrastructure exists, underutilization is common due to lack of training and maintenance resources.

Beyond infrastructure, human capacity and social dynamics contribute to the challenges. Teachers often lack adequate ICT skills, which inhibits classroom integration of technology (Bariham, 2022). Gender disparities also persist, with studies pointing to cultural biases, lack of role models, and insufficient female participation in ICT education (Debrah & Quaenoo, 2018; Addotey, 2018). These trends are reflective of broader societal patterns that reinforce inequality in access to technological opportunities.

Critically, many of these challenges are not new, yet interventions have yielded uneven results. As noted by Edefiogho (2005) and Antwi et al. (2018), these constraints—ranging from equipment shortages to policy and training gaps—are symptomatic of deeper structural inequalities in Ghana's educational system. The urban-rural divide continues to widen, often benefiting elite or urban schools over their rural counterparts (Natia & Al-hassan, 2015; Inkoom, 2009).

In sum, although there have been targeted efforts to improve ICT integration, unresolved issues such as infrastructure limitations, inadequate teacher capacity, and social inequities still constrain ICT usage in SHSs. These persistent barriers underscore the need to assess whether current

resources and interventions are truly enhancing students' learning experiences—especially in rural and peri-urban settings, where digital inclusion is often least realized.

2.4.10 Benefits of ICT Use for Students

ICT usage provides numerous benefits to students, enhancing the quality of education. According to Shonubi et al. (2018), ICT tools enable students to access diverse learning materials, such as online books, journals, videos, and multimedia resources. This access improves students' ability to study and engage with learning materials, enhancing their educational experience. UNESCO (2015) also highlights ICT as an enabler for democratizing education, providing access to a wealth of information and knowledge, and facilitating global information sharing. Gyesi (2020) also asserts that "the use of computers by students to access information literacy is very important and integral because it forms the basis for lifelong learning".

ICT tools also support personalized learning, allowing educational experiences to be tailored to individual student needs, interests, and abilities, promoting more profound understanding and knowledge retention (Bloom, 2016). Additionally, Wang and Reeves (2015) found that gamification in education enhances student motivation and engagement.

Furthermore, ICT facilitates communication, collaboration, and networking among students and other stakeholders. Online forums, wikis, and social media platforms promote sharing ideas, knowledge, and perspectives, enhancing critical thinking, problem-solving skills, and communication (Dabbagh & Kitsantas, 2012).

2.4.11 Impact of ICT use on Student Learning Experiences

The use of ICT in education has been widely recognized for its potential to improve the quality of teaching and learning. Abdallah et al. (2021) argue that tools such as computers, smart boards, projectors, and tablets enhance instructional delivery, making lessons more interactive and effective. Similarly, Wuanka (2017), in a study on multimedia instruction in basic schools for the deaf, found that teachers viewed ICT positively, noting its capacity to improve comprehension and engagement. Although this study focused on basic schools, its findings have implications for secondary schools, where visual and multimedia tools can similarly support improved learning outcomes. Supporting this, Antwi et al. (2018) highlight that visual aids can significantly boost retention and student interest, aligning with findings that people retain 90% of visual content, compared to 70% of spoken information (Shabiralyani et al., 2015, citing Cuban, 2001).

Empirical evidence from Ghanaian SHSs affirms these benefits. Debra and Arthur (2018) found that ICT use correlates positively with enhanced teaching practices and student productivity. Teachers' and students' increased use of ICT facilitated better instructional design, student engagement, and academic efficiency. This aligns with broader international research by Kirschner and van Merriënboer (2018) and Tamim et al. (2011), who noted that ICT promotes personalized learning, collaboration, and academic performance by enabling access to educational resources.

Beyond academic performance, ICT proficiency contributes to students' long-term professional and personal development. The American Institutes for Research (2020) reported that national investments in educational technology can result in substantial economic benefits, with some countries observing GDP growth of up to 10%. These macroeconomic findings highlight the role of ICT in fostering productivity, innovation, and lifelong learning.

In summary, ICT use in SHSs enhances student learning by improving access to information, fostering critical thinking, and supporting interactive pedagogies. However, the extent of this impact often depends on the quality of integration and users' proficiency. While positive correlations are evident, more localized and context-specific studies are needed to understand how these benefits are experienced across diverse student populations and educational environments.

2.5 Conceptual Framework

The conceptual framework depicted in the image below illustrates the intricate relationships among various factors influencing the usage of ICT in educational settings, specifically focusing on how the factors collectively impact students' learning experiences. The framework classifies selected variables from the UTAUT for the study.

2.5.1 Key Concepts/Constructs and their relationship in the Conceptual Framework

1. **Demography**: Measures characteristics like geographical location of school attended and gender. Age is not considered due to its uniformity among senior high school students. However, the geographical location of school attended, and gender significantly affect access to ICT resources and attitudes toward technology. These factors influencing FC, SI, and BI and shape ICT proficiency and actual usage patterns.

2. **School-Level Factors**: School-level factors encompass institutional characteristics that influence students' educational experiences. Key elements include:

    i. **Availability of ICT Resources**: Measures the accessibility and quality of ICT tools. It affects FC, which support technology use.

ii. **School Regulations on ICT Use**: Measures institutional regulations, restrictions or policies on ICT. These policies influence FC and EE, impacting actual use.

iii. **Teacher Support**: Measures students' ICT proficiency and support received from teachers. This affects SI, shaping students' intentions, acceptance and use of technology.

3. **Individual/Personal Factors**: Individual factors refer to personal characteristics that affect behavior, decision-making, and interactions with technology. These include:

i. **Personal Interest in ICT Use**: Measures students'intrinsic motivation towards technology. This impacts BI and actual usage.

ii. **Proficiency in ICT Use**: Measures digital literacy. It affects EE and PE, impacting actual usage.

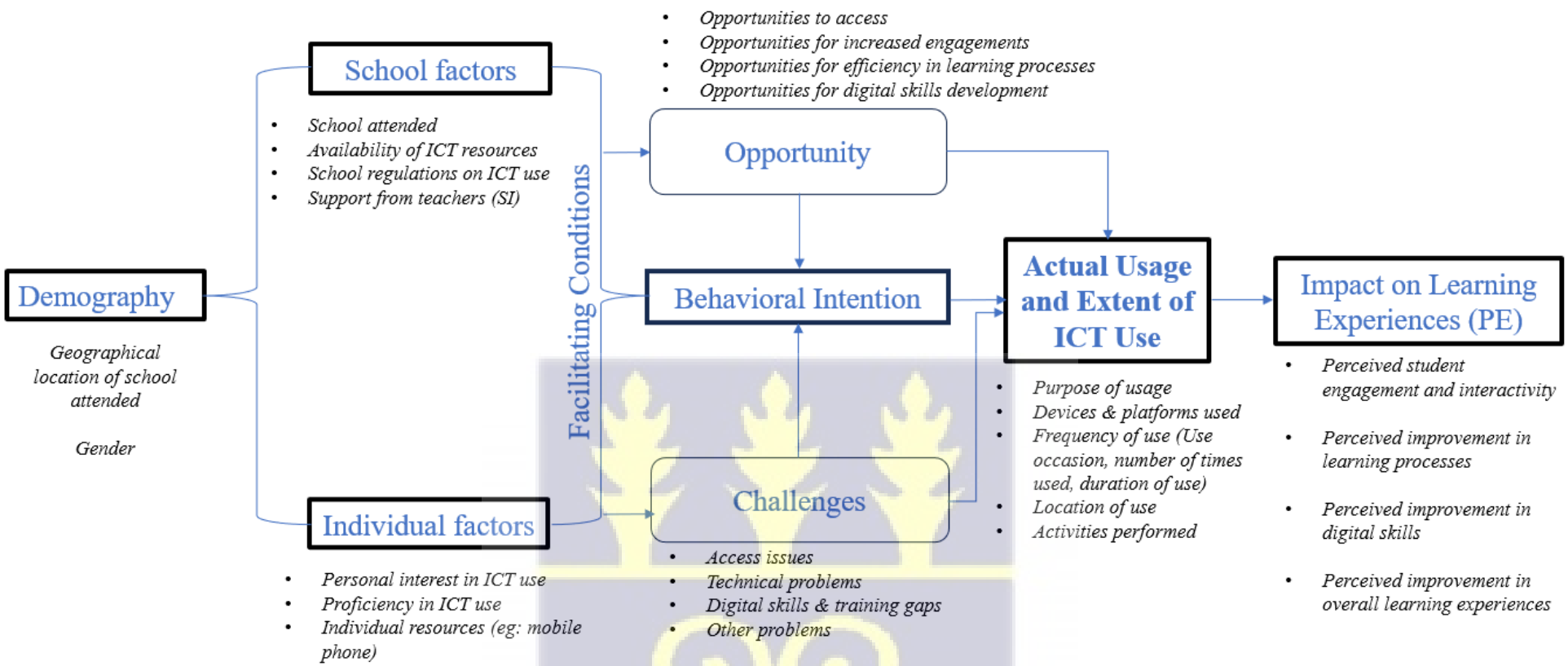
iii. **Individual ICT Infrastructure**: Measures access to personal devices. It influences FC and actual engagement with technology.

4. **Opportunities and Challenges**:

i. **Opportunities**: FCs can create opportunities for students, such as improved access to learning materials and interactive engagement. When FCs are favorable, they enhance opportunities for teaching and learning and align with PE, as students anticipate that technology will boost their academic performance.

ii. **Challenges:** Measures barriers such as limited access, lack of digital skills and technical issues, affecting FC and PE. Inadequate FCs present challenges that hinder effective ICT use, impeding students' ability to fully integrate technology into their learning.

Figure 1: Conceptual Framework



Source: Author's construct, 2024.

5. **Extent of Use**:

   i. **Purpose and Context**: Measures reasons for ICT use, including context and location. This correlates with BI, and AB and PE.

   ii. **Devices and Platforms Used**: Measures the types of devices and software utilized by students, aligning with AB.

   iii. **Frequency of Use:** Measures how often ICT is used, number of times used per occasion, and duration of use per use occasion. The frequency of ICT usage is critical in understanding usage patterns and their educational impact.

6. **Learning Experiences**: Refers to and measures the impact of ICT on students' educational outcomes such as interactive engagement, skills development, learning processes, and academic performance. These outcomes align with PE and FCs.

Overall, demographic, individual/personal, and school factors establish facilitating conditions that influence BI and AB. These factors either present opportunities or pose challenges for ICT use, thereby affecting BI and AB. In turn, these influences impact PE and overall learning outcomes.

Conclusion:

Chapter 2 provided a thorough review of the literature on ICT usage among senior high schools. It employed the UTAUT theoretical framework, examined key concepts, and relevant findings from previous studies. The chapter examined the historical context of ICT in education, identified factors that influence usage, discussed associated challenges from literature, among others. The review identified gaps in literature, including the need to examine the extent of ICT use among secondary students, and classify students into ICT usage groups while assessing post-intervention challenges and opportunities for ICT use.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the study provides an overview of the research methodology adopted to achieve its objectives. Therefore, the Chapter illuminates the chosen research design, methodological processes, and ethical procedures utilized. It explicates the inner workings of the research processes, shedding light on the rationale behind methodological choices, procedures, techniques, and tools employed to investigate ICT usage among senior high school students in the Ga West Municipal District.

3.2 Profile of the Study Area – Ga West Municipal District

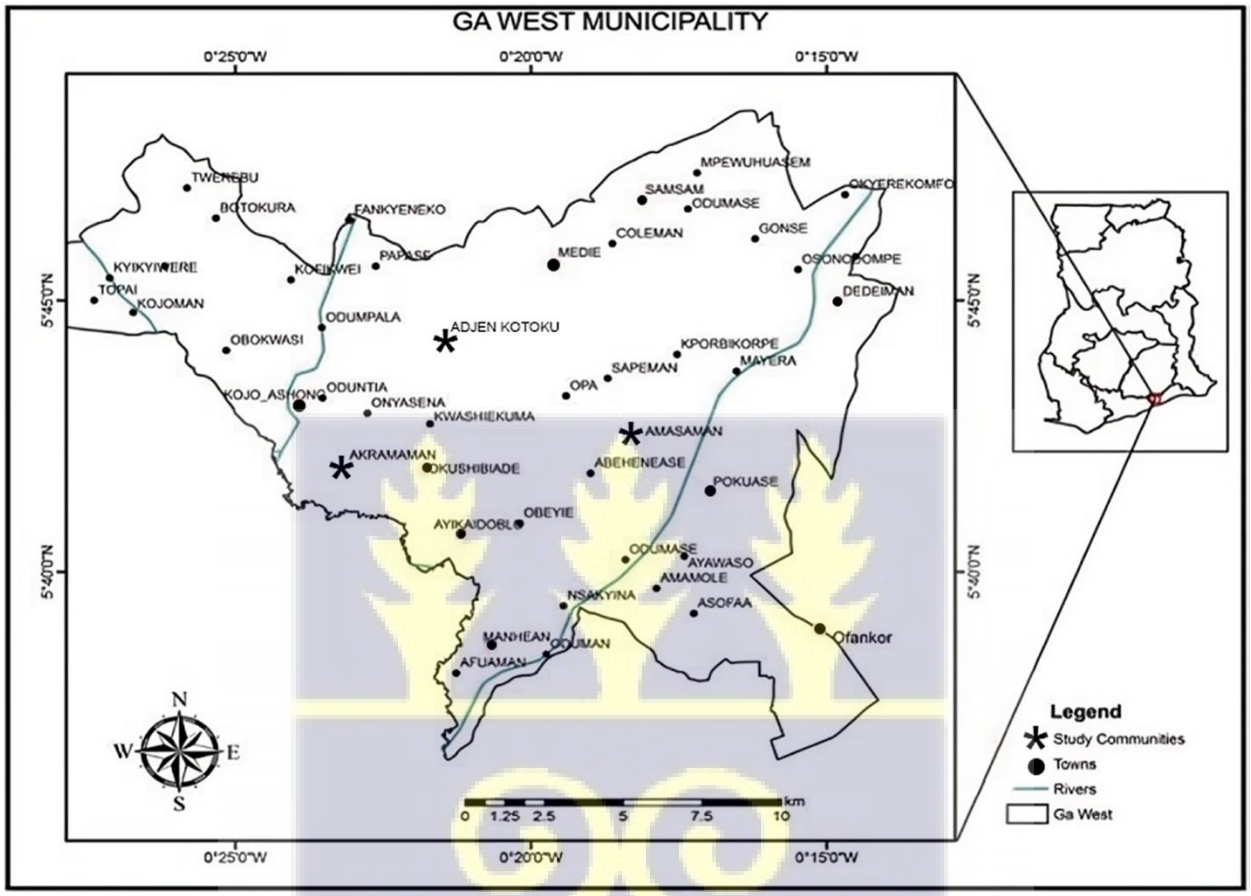
The choice of Ga West Municipality as the study site was both strategic and purposeful. Ga West is one of the most demographically diverse districts in the Greater Accra Region, encompassing both urban and rural areas, and hosting a mix of public and private senior high schools.

Ga West Municipal District is one of Ghana's 261 Metropolitan, Municipal, and District Assemblies (MMDAs), and part of the 29 MMDAs in the Greater Accra Region. The district is situated in the western part of the Greater Accra Region, with Amasaman serving as its capital town. Geographically, the Ga West Municipal District is positioned between latitudes 5°35° North and 5°29' North and longitudes 0°10' West and 0°24' West.

The Ga West Municipal District covers an approximate land area of 284.08 square kilometers and encompasses approximately 412 communities. It shares its boundaries with several neighboring districts. To the east, it borders the Ga East Municipal and Accra Metropolitan Assembly, while

to the north, it shares borders with the Akwapim South District. To the south, the district shares boundaries with the Ga South and Ga Central Municipals.

Figure 2: Map of Ga West Municipal District Showing Sampled Communities



Source: Adapted from Yirenya-Tawiah, Dzidzo (2020).

Figure 2 shows a map of the Ga West Municipal District, highlighting the sampled communities. This figure has been adapted from Yirenya-Tawiah's (2020) work, "Urban Waste as a Resource: The Case of the Utilisation of Organic Waste to Improve Agriculture Productivity Project in Accra, Ghana". Modifications include the addition of study area markers indicated by asterisks (*), changes in color scheme, and a repositioned legend to enhance clarity and focus on the specific communities sampled for this study.

As of the 2021 Population and Housing Census, the district has a population of 314,299 residents, with 155,543 males and 158,756 females. The rural population accounts for 31% of the populace, constituting the largest rural populace in the Greater Accra region (GSS PHC, 2021). The Ga West Municipal District is governed by the Ga West Municipal Assembly, composed of seventeen (17) Electoral Areas, further grouped into four (4) administrative zonal councils.

3.3 Senior Secondary Statistics and Target Population in Ga West Municipal

The EMIS report for the 2018/19 school year reveals that the Ga West Municipal District hosts a total of three (3) public senior high schools and five (5) private senior high schools. Notably, all three public senior high schools are situated within urban areas, whereas two (2) out of the five private senior high schools are in rural areas of the district. However, recent data from the EMIS division of the Ga West Municipal Education Office for the 2023 school year show that only one private secondary school remains operational, while the other four have ceased operations (Ga West Municipal Education Office, 2023). Consequently, the current statistics indicate the presence of 3 public and 1 private secondary school within the district. All of them are operational and mixed-gender institutions. They all have electricity, which is essential for this study.

Table 1: Senior High Technical Schools in Ga West Municipal District

Type of School	Name	Location	Location Type	Gender Composition
Public	Amasaman Senior High/Tech	Amasaman	Urban	Mixed
	Adjen Kotoku Senior High	Adjen Kotoku	Peri-urban	Mixed
	Akramaman Senior High	Akramaman	Peri-urban	Mixed
Private	Navs Secondary Technical	Adjen Kotoku	Peri-urban	Mixed

Source: Author's construct, 2024

Etikan et al. (2016) conceptualize a target population as the complete group selected by the researcher for investigation within a study. In the context of this research, the target population comprises SHTS students in Form 3, alongside ICT tutors and ICT facility managers (administrators) within senior high schools situated in the Ga West Municipal District. The primary unit of analysis centers on SHTS students, particularly those in their third year of study. Furthermore, ICT tutors and facility managers, directly engaged in overseeing and instructing ICT utilization among students, are incorporated into the target population. This approach ensures the inclusion of perspectives from both students and key stakeholders involved in managing and using ICT resources within the school setting.

3.4 Research Design

The study employed explanatory sequential mixed-methods design, integrating both quantitative and qualitative research methodologies. The first phase involved collecting and analyzing the quantitative data from sampled students. This approach was well-suited to measure the extent of ICT usage, such as frequency of use, challenges faced and the impact of ICT on learning experiences.

Following the analysis of the quantitative data, the second phase of the research design commenced with the qualitative research segment. The purpose was to provide further explanations or clarifications on the quantitative data analyzed. This allowed for in-depth exploration of selected thematic areas including the state of ICT infrastructure, conditions for ICT usage within the schools, as well as the challenges and relationship between student ICT usage and learning experiences. Thus, the qualitative phase provided thorough insights that were not easily quantifiable.

This design was chosen over other mixed-method approaches (e.g., exploratory sequential or convergent parallel designs) because the explanatory sequence begins with general patterns and then digs deeper into contextual meanings, making it particularly effective when quantitative results need explanation (Creswell & Plano-Clark, 2017). In contrast to convergent or exploratory designs, the explanatory model allowed the researcher to first identify statistical relationships and trends and then explore the underlying "why" behind those trends.

As emphasized by Creswell and Plano-Clark (2017), this sequential integration allows researchers to combine the strengths of both deductive (quantitative) and inductive (qualitative) reasoning. It enhances the robustness, depth, and reliability of findings, especially in social science research. Ivankova, Creswell, and Stick (2006) further highlight that this approach improves both internal validity and contextual understanding, particularly when studying multifaceted issues like ICT integration in education.

3.4.1 Sources of Data

Data sourced for the study encompasses a combination of secondary and primary data. Secondary data was accessed from the Population and Housing Census (PHC) conducted in 2021 by the Ghana Statistical Service (GSS), the Education Management Information System (EMIS) data of the Ghana Education Service for the 2018/2019 and 2022/2023 academic year and supplemented by an array of school data[1] available at the Ga West Municipal Assembly. The websites of the participating schools and the Ga West Municipal Assembly served as additional secondary data sources, providing valuable information for the research. Additionally, primary data was collected

[1] Ga West Municipal District Education Office Data

from sampled senior high school students and ICT tutors and administrators through surveys and in-depth interviews.

3.5 Research Methods

This research combines quantitative methods through a survey of students with qualitative methods via in-depth interviews with selected ICT tutors or administrators, and observations to facilitate a holistic understanding of the subject matter. The specific techniques, procedures, and strategies used to collect data are situated within the dynamics or characteristics of the study area.

3.5.1 Quantitative Method

The quantitative research component of this study was deployed through a survey. The survey aimed to obtain quantifiable data for understanding, describing, and examining the phenomena and relationships concerning ICT usage among senior high school students in the Ga West Municipal District. The survey targeted students from sampled SHTS in the district and was administered using the Computer Assisted Personal Interview (CAPI) format.

3.5.1.1 Sampling Strategy - Quantitative

A structured and systematic sampling approach was employed to ensure representativeness, validity, reliability, and transparency in the study. This method provided equal opportunities for participation among senior high schools and their students within the district. All four senior high schools in the district were considered as primary units for data collection.

A stratified sampling technique was utilized to ensure representation across different program offerings within the schools, a strategy deemed effective for heterogeneous populations (Parsons, 2017). This process involved dividing the student population into distinct subgroups, or strata,

based on their program offerings, accounting for potential variations in ICT access, utilization, and experiences among students.

Table 2: Sampled Schools and Their Program Offerings

	Name of SHTS	Agriculture	Business	General Arts	General Science	Home Economics	Technical
1	Amasaman SHTS	x		x	x	x	x
2	Adjen Kotoku SHTS		x	x		x	x
3	Navs SHTS		x	x		x	x

Source: Author's construct, 2024

The stratified sampling followed three steps: (1) identification of program offerings, (2) selection of classes, and (3) random selection of students. Specific classes and students were chosen randomly from within each program offering. From Table 2, General Arts, Home Economics and Technical are the programmes that are offered by all three schools.

Form 3 students (SHTS 3) were deliberately selected for the study due to their extended time in school, positioning them to provide valuable insights into their ICT usage and its impact on learning. A simple random sampling method was applied using class registers and a random number generator, ensuring equal and unbiased participation opportunities.

This carefully planned strategy captured a holistic view of diverse student experiences while promoting generalizability and fair representation of the study's findings.

3.5.1.2 Sample Size and Sample Distribution:

According to High (2000), the magnitude of a study's sample holds paramount importance in yielding meaningful results. High underscores the significance of adequately sizing the sample to

ensure the reliability and validity of the research outcomes. To determine the sample size for each school, the Krejcie and Morgan Table (1970) was used. The utilization of the Krejcie and Morgan method for estimating sample size in research is a widely accepted practice in academia (Chuan & Penyelidikan (2006).

The Krejcie and Morgan Table provides a systematic approach for determining the appropriate sample size based on a predetermined formula. The guideline for determining the appropriate sample size is based on the total population which in this case is the total population of the selected schools or a subset of the overall population, herein Form 3 students.

Unlike some other methods, Krejcie and Morgan's approach offers a straightforward solution, as it involves consulting a pre-established table rather than conducting complex calculations. This simplifies the process for researchers, allowing rapid ascertainment of the required sample size without the need for extensive statistical analysis.

Table 3: Sample Breakdown Per School Using Krejcie and Morgan Table

	Name of SHTS	SHTS 3/Form 3/F3			% of F3 Student Population Per School	Krejcie and Morgan Table	Number of Students Sample Per School	Adjusted Sample Size
		M	F	TOTAL				
1	Amasaman SHTS	225	172	**397**	53.3%	**248**	53.3%*248 = **132**	132
2	Adjen Kotoku SHTS	152	146	**298**	40%		40%*248 = **99**	100
3	Navs SHTS	35	15	**50**	6.7%		6.7%*248 =**17**	34
	Total Form 3 Student Population	**412**	**333**	**745**	**100%**		**248**	**266**

Source of SHTS 3 data: Municipal Education Office, Ga West: 2023.

Akramaman Senior High School was not included in the sample size calculation because it does not have Form 3 students. Based on the student data received, the total Form 3 population across the sampled schools is 745 which corresponds to 248 sample size on the Krejcie and Morgan's table. After determining the overall sample size, it was distributed across the selected schools based on the percentage share of Form 3 student population per school.

The sample size was further disaggregated by gender. To ensure that no school had a sample size less than 10 when disaggregated by gender, the sample size obtained through the Krejcie and Morgan Table was slightly adjusted for Navs and Adjen-Kotoku SHTS as shown in the table above. The table below also provides an adjusted sample breakdown by gender.

Table 4: Adjusted Sample Breakdown by Sex Per School

		Sample Per School	**% Share of Adjusted Sample**	**Male %**	**Female %**
1	Amasaman SHTS	132	50%	75	57
2	Adjen Kotoku SHTS	100	39%	50	50
3	Navs SHTS	34	11%	24	10
	Total Form 3 Student Population Sampled	**266**	**100%**	**149**	**117**

Source: Author's construct, 2024.

The sample size underwent further disaggregation based on gender. As illustrated in the preceding table, to maintain a minimum sample size of 10 for each school when disaggregated by gender, slight adjustments were made to the sample sizes obtained from the Krejcie and Morgan Table for Navs and Adjen-Kotoku SHTS.

In conclusion, the sample size and distribution were designed to ensure that each school's representation in the study reflects its actual student population, maintaining proportionality and fairness in the selection process.

3.5.1.3 Survey Instrument and Data Collection

To ensure the effectiveness and accuracy of the quantitative data collection, a thorough approach was employed in the development and administration of the survey instruments. The process began with aligning the questionnaire with established knowledge from the literature review and research objectives. The questions were thematically designed to gather data relevant to the study's aims.

The initial draft of the survey instrument underwent refinement through collaboration with the academic supervisor, whose feedback improved the clarity and relevance of the questionnaire. After these revisions, the Ethical Clearance Committee reviewed and validated the instrument, ensuring it adhered to ethical standards. Upon approval, the survey was finalized and prepared for piloting, pretesting, and scripting.

The survey was managed using the Computer Assisted Personal Interviewing (CAPI) format through the Survey Solutions platform, a tool developed by the World Bank. CAPI offers several advantages over traditional methods, including improved data quality, faster data processing, and reduced costs (Baker, Bradburn, & Johnson, 1995). Survey Solutions further integrates survey management with the interview process, offering comprehensive features for survey planning and execution (Radyakin, 2018).

Prior to data collection, five data collectors were trained in a three-day session to familiarize them with the research objectives, ethical procedures, and the use of the Survey Solutions software. A piloting phase allowed data collectors to practice using the software and refine their skills.

Following this, a pretest was conducted with students from Action Remedial Senior High School to identify and address ambiguities in the questionnaire. Feedback from the pretest led to further refinements.

The finalized survey was administered using tablets, a method shown to reduce errors from skip patterns and improve data reliability (Caeyers, Chalmers, & De Weerdt, 2012; Benstead et al., 2017). The use of tablets enabled real-time data entry and monitoring, enhancing the quality of the data collection process. These rigorous steps ensured that the quantitative data collection was accurate and reliable, minimizing errors and ensuring the validity of the research findings.

3.5.2 Qualitative Methods

The qualitative component of this study was designed as an explanatory phase within the explanatory sequential mixed-methods design. Following the collection and preliminary analysis of quantitative data, the qualitative phase sought to provide deeper contextual understanding and explanation of the patterns and relationships observed in the survey results. This approach is particularly suited for studies aiming to uncover both measurable trends and the meanings behind them (Creswell & Plano Clark, 2018).

A phenomenological approach was adopted to capture the lived experiences and institutional perspectives of individuals who directly interact with or manage ICT infrastructure in the selected schools. This design allowed for exploration of how ICT is used, the institutional constraints that shape such usage, and the perceived effects on students' learning experiences. The qualitative findings thus serve to enrich and explain the quantitative results, fostering a more nuanced interpretation of ICT integration in the school context.

3.5.2.1 Sample Size and Selection Criteria

A total of six IDIs were planned across three public senior high schools in the Ga West Municipal District. Each school expected to provide two participants, typically an ICT tutor and an ICT lab administrator or facility manager, selected for their direct engagement with the planning, management, and delivery of ICT-related teaching and infrastructure. These participants were identified in consultation with school administrators based on their institutional roles and technical knowledge within their respective schools.

The selection employed purposive sampling, a non-probability method ideal for identifying information-rich respondents who could offer in-depth insights relevant to the research objectives (Etikan, Musa, & Alkassim, 2016). This method was well-aligned with the study's aim to understand ICT usage from the standpoint of institutional actors most knowledgeable about existing practices and constraints.

Although FGDs with students were initially considered to complement the IDIs, they were ultimately excluded due to logistical and resource limitations. Conducting FGDs across multiple schools would have required additional personnel, time, transportation, and coordination for ethical clearance and parental consent. Given these constraints, it was determined that a quantitative survey would efficiently capture student perspectives on ICT usage.

3.5.2.2 Qualitative Instruments and Data Collection

The main instrument for qualitative data collection was a IDI guide, developed in alignment with the study's objectives and grounded in the theoretical constructs from UTAUT and related empirical literature. The initial guide was drafted alongside the questionnaire and refined through

iterative feedback from the academic supervisor. Additional revisions were made following ethical review and approval by the university's Ethical Clearance Committee.

The IDI guide included open-ended questions that addressed several key areas: the availability and quality of ICT infrastructure, institutional regulations on ICT use, teacher and administrative support for ICT integration, observed student usage patterns, and perceived challenges and opportunities for enhancing ICT usage in the school environment.

Data were collected through face-to-face interviews conducted by the researcher in each school. Participants were given the opportunity to reflect and respond freely, with probing used to elicit deeper insights. The interviews were audio-recorded with participants' consent and supplemented by field notes and observational data. Observations focused on the condition of ICT infrastructure, student access patterns, and environmental cues. An observational checklist was developed to ensure consistency across schools. These qualitative insights served to illuminate institutional dynamics surrounding ICT usage and allowed for deeper interpretation of the student-level data gathered through the survey.

3.6 Measurement and Definition of Variables

Table 5 provides an overview of the key variables involved in the study, defining each one and explaining how it will be measured. This includes both independent variables, which are manipulated or categorized to observe their impact, and dependent variables, which are the outcomes being measured. Additionally, control variables that help account for external influences and moderating variables that might affect the relationships between the primary variables are identified.

Table 5: Operationalization of variables of interest

Variable Category	Variable Name	Definition	Measurement
Demographic Factors	Geographical Location of School (SHTS) Attended	The specific the geographical location of the SHTS attended by the student.	Survey questions with response options listing locations of all schools.
	Gender of Student	Student's gender identity.	Survey question with response options: "Male," and "Female"
Personal / Individual Factors	Personal Interest in ICT Use (BI)	Student's interest and enthusiasm for using ICT.	Survey question with scale: "I like to use ICT" to "I do not like using ICT."
	Proficiency in ICT Use (EE / BI)	Student's self-reported skill level in using ICT.	Survey question with Likert scale: "Basic" to "Advance."
	Individual ICT Resources (FC)	Availability of personal ICT resources for the student.	Survey question on the type of personal ICT resources.
School Level Factors	Availability of ICT Resources (FC)	ICT resources available in the school.	Survey questions with response options: Type of ICT infrastructure and qualitative interviews and observational data from researcher.
	School Regulations on ICT Use (FC)	Policies and rules regarding ICT use in the school.	Survey question with response options: "students can use ICT lab anytime; Students can use for personal studies; Students can only use during ICT hours, etc."
	Support from Teachers (SI)	Level of support and encouragement from teachers for ICT use.	Survey responses from students and interviews with ICT tutors on support provided.
Extent of ICT Usage (Actual Behaviour)	Devices & Platforms Used (AB)	Types of ICT devices and platforms used by students.	Survey question listing various devices and platforms for students to select.
	Purpose of Usage (AB)	Reasons for using ICT resources.	Survey question with response options such as "Academic," "Entertainment," "Social Networking."
	Frequency of Use - Use Occasion (AB)	How often students use ICT resources in each period.	Survey question with response options: "Never," "Monthly," "Weekly," "Daily."

Variable Category	Variable Name	Definition	Measurement
Extent of ICT Usage (Actual Behaviour)	Frequency of Use - Number of Times Used (AB)	Number of times ICT resources are used within a specified period.	Survey question with numerical response options.
	Duration of Use (AB)	Average length of time spent using ICT resources.	Survey question with response options: "Less than 30 minutes," "30-60 minutes," "More than 60 minutes."
	Activities Performed (AB)	Specific activities performed using ICT resources.	Survey question listing activities like "Research," "Homework," "Communication, etc."
Key Challenges	Access Issues	Problems related to access to ICT resources.	Survey question with response options: "No issues," "closed ICT labs," "No internet, etc." Interview responses from ICT tutors and administrators.
	Technical Problems	Problems with the functionality of ICT resources.	Survey question with response listing problems for selection.
	Digital skill gaps	Deficiency in digital skills for effective ICT use.	Survey question with response options. Interview responses from ICT tutors and administrators.
Key Opportunities	Enhanced Access to Learning Materials	Availability of improved learning materials due to ICT use.	Survey question with response options: "Not Improved," "Slightly Improved," "Significantly Improved."
	Increased Engagement	Degree of increased engagement attributed to ICT use.	Survey question with Likert scale: "Not Engaged" to "Highly Engaged."
	Perceived Improvement in Learning	Student's perception of improved learning due to ICT.	Survey question with Likert scale: "No Improvement" to "Significant Improvement."
	Other Benefits	Additional perceived benefits of ICT use.	Survey question with open-ended responses for listing other benefits.

Variable Category	Variable Name	Definition	Measurement
Learning experiences	Perceived Student Engagement and Interactivity (PE)	Students' perception of their engagement and interaction with ICT in learning.	Survey question with Likert scale. Qualitative data from interviews and observations, analyzed for themes related to engagement, learning processes, and digital skills.
	Perceived Improvement in Learning Processes (PE)	Perceived enhancement in learning processes due to ICT use.	Survey question with Likert scale. Qualitative data from interviews and observations, analyzed for themes related to engagement, learning processes, and digital skills.
	Perceived Improvement in Digital Skills (PE)	Improvement in students' digital skills as perceived by them.	Survey question with Likert scale. Qualitative data from interviews and observations, analyzed for themes related to engagement, learning processes, and digital skills.
	Perceived Improvement in Overall Learning Experiences (PE)	Overall improvement in learning experiences due to ICT.	Survey question with Likert scale. Qualitative data from interviews and observations, analyzed for themes related to engagement, learning processes, and digital skills.

3.7 Data Analysis and Presentation

In the explanatory sequential mixed-method research design, data analysis is conducted in two distinct phases, corresponding to the quantitative and qualitative components of the study before a synthesis of both.

3.7.1 Quantitative Data Analysis:

For Objective One, several key techniques including descriptive statistics and categorization based on statistical thresholds, observed behavioural patterns and institutional constraints were employed to assess the extent of ICT usage among students. Descriptive statistics were first utilized to summarize central tendencies and variability in ICT usage, calculating metrics such as the mean, median, standard deviation, and percentiles. Following this, students were categorized based on their weekly usage as follows: (a) Low Usage: Up to 2 hours per week (b) Moderate Usage: 2.1 to 5 hours per week (c) High Usage: 5.1+ hours per week. The percentage distribution of students across these categories was then calculated.

The categorization was supported by the observation that students are typically expected to attend ICT classes for at least one hour per week, particularly core students, with slightly more frequent sessions for elective ICT students depending on lab availability. This baseline exposure formed the basis for the low usage category, encompassing students with minimal access to ICT resources through classes or occasional use of school or personal devices. The moderate usage category included students with more consistent access, often through elective courses or extracurricular activities within the school. The high usage category comprised students who significantly exceed standard classroom requirements, often due to involvement in extracurricular ICT activities or access to personal or shared devices. However, all categories face limitations such as competition

for lab time, restrictions on personal device usage, and the limited availability of school ICT resources. Therefore, these underpinning together with statistical thresholds informed the classification of the extent of usage among students.

For Objective Two, the quantitative analysis employed descriptive statistics and cross-tabulation or Chi-square analysis where needed. Descriptive statistics provided a summary of the frequency and types of challenges and opportunities reported by students, with percentages and mean scores calculated to offer an overview of their prevalence.

To address Objective Three, descriptive statistics along with Chi-square analysis, were used to assess the perceived impact of ICT on student learning experiences. This approach provided valuable insights into students' overall perceptions of ICT's influence on learning experiences and academic performance.

3.7.2 Qualitative Data Analysis:

Using NVivo software, qualitative data were thematically analyzed to explore the nuances of ICT usage, challenges, opportunities, and their impact on student learning experiences. With a focus on Objectives One and Two, the analysis identified recurring themes and patterns within the responses, providing meaningful insights and a deeper understanding of the study's objectives. This analysis complemented and affirmed the quantitative findings, enriching the overall interpretation of the study.

3.7.3 Synthesis and Reporting of Quantitative and Qualitative Data

In the final phase of data analysis, findings from both quantitative and qualitative phases were integrated using an explanatory sequential design. Triangulation was employed to validate and

deepen the understanding of ICT usage, challenges, opportunities, and their impact on student learning experiences. By combining quantitative survey data with qualitative interview insights, the study cross-verified findings to enhance the credibility and depth of the conclusions.

Data integration was organized around the research objectives, with the quantitative phase providing a broad overview and the qualitative phase offering detailed explanations. The synthesized findings comprehensively addressed the research objectives, and implications for policy, practice, and future research were discussed. The reporting process adhered to rigorous academic standards, ensuring transparency, credibility, and relevance for stakeholders in the education sector.

3.8 Inclusion and Exclusion Criteria:

The inclusion and exclusion criteria used for the study are designed to ensure that the participants selected for the study are representative of senior high school students in the Ga West Municipal District and can provide relevant and reliable data on ICT usage. The following criteria were applied to the sample selection:

3.8.1 Inclusion Criteria:

- **Attendance at One of the Selected Schools:** Students must be enrolled in one of the four operational Senior High Schools in the District, either public or private.
- **Enrolment in Senior High School Form 3:** Only students who were in their third year (Form 3) of senior high school were included. This criterion ensured that participants had sufficient exposure to the school's ICT resources and could provide informed responses based on their experience.

- **Willingness to Participate:** Students who participated must voluntarily agree to participate in the study. Informed consent (and assent in the case of minors) was a prerequisite for participation.
- **Representation of Program Offerings:** Students from all academic tracks available in these schools, such as science, arts, business, and vocational programs, were given equal opportunities to participate, ensure a diverse range of perspectives.

3.8.2 Exclusion Criteria:

- **Non-SHTS Form 3 Students:** Students who are not in SHTS Form 3 were excluded from partaking in the study. Excluded participants comprised students from lower grades (Form 2 and Form 1) and recent graduates.
- **Students from Non-Selected Schools:** Students attending schools outside the four identified Senior High Schools in the Ga West district were excluded from the study.
- **Unwillingness to Participate or Inability to Provide Consent:** Students who were unwilling to participate or those unable to provide informed consent from either teachers, parents or guardians were excluded.
- **Inaccessibility**: Participants who are unable to participate in data collection sessions due to reasons such as illness, absence from school during data collection periods, or other scheduling conflicts will be excluded.

3.9 Ethical Considerations

This study has been conducted with the utmost commitment to ethical standards. It has been guided by a strong sense of responsibility towards the participants and the broader community, ensuring that the research is completed with integrity and respect for the rights and well-being of all.

3.9.1 Approvals from Required Entities

In the pursuit of ethical integrity and compliance, this study has undergone a comprehensive ethical review and approval process. The University of Ghana's Office of Research, Innovation and Development (ORID) - Ethics Committee for Humanities (ECH) conducted a thorough examination of the research protocols, affirming that its design and methods are ethically sound. See appendix one for the ECH approval. Moreover, approvals were also granted by the Ga West Municipal Assembly, the Ga West Municipal Education Office and the participating schools. Appendix two is an approval letter from the Assembly.

To ensure the ethical conduct of the study, meticulous steps were taken at every stage of the research process. The design of the study itself was carefully crafted to avoid or minimize any potential harm or discomfort to the participants. Special attention was paid to the development of data collection instruments, which were designed with clarity and simplicity to facilitate participants' understanding of the research objectives and procedures.

In the administration of data collection instruments, enumerators maintained a high level of professionalism, respecting the autonomy of the participants. Informed consent, a critical ethical requirement, was obtained from all individuals who took part in the study. This process ensured that participants were well-informed about the research's purpose, the methods employed, and any

potential risks involved. Participants were also made aware of their right to withdraw from the study at any point without any consequence.

Anonymity and confidentiality were upheld as paramount principles in this research study. No personal identifiable information was used or will be used in any of the reports or publications likely to stem from the study. Data was carefully anonymized and aggregated to prevent the identification of individual participants, safeguarding their privacy and confidentiality.

3.9.2 Gender Equality Measures:

Gender equity has been addressed through various measures by ensuring fair and balanced representation of gender in the study design, data collection and analysis and reporting. The following measures were applied:

- **Balanced Sampling:** The stratified random sampling method was derived with gender balance integrated into the sample. This means that for each stratum provided a proportionate number of male and female students were represented.
- **Gender as a Key Variable:** In both the survey and qualitative components, gender was considered as a significant variable. This allows the study to analyze and compare the ICT usage, attitudes, experiences, and challenges specific to different genders.
- **Implementing Gender-Sensitive Data Collection Tools:** Survey questions and interview protocols were designed to be gender-sensitive, ensuring that they are appropriate and relevant to all genders. This included avoiding gender-biased language and assumptions.
- **Analysis of Gender-Based Differences and Similarities:** The data analysis focused on identifying any gender-based differences or similarities in ICT usage, access, attitudes, and

their impacts on student learning. This highlighted any gender disparities that may exist and provided insights into how these can be addressed.

- **Inclusive Reporting:** The study's findings and conclusions are reported in a way that acknowledge and give equal importance to the experiences and perspectives of gender. Gender-related findings are highlighted to inform policy and practice in ICT.

3.10 Conclusion

In sum, Chapter 3 has detailed the research methodology, specifying the mixed-methods approach, data collection methods, sampling procedures, data analysis techniques, and ethical considerations. These methodological choices aim to provide a broad and rigorous exploration of ICT usage among senior high school students in the Ga West Municipal District.

CHAPTER 4

RESULTS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the results and discussions of the findings from the study, aligning with the established objectives. The analysis is grounded in both theoretical and conceptual frameworks, offering detailed understanding of the study's key areas of inquiry. The chapter is structured using the research objectives. For each research objective, the first part focuses on the quantitative data, presenting a detailed analysis of the numerical findings. The second part uses the qualitative findings to clarify the quantitative, ensuring a robust discussion of the research objectives.

4.2 Demographic Data of Respondents

The study surveyed 300 students from the three sampled senior high schools in the Ga West District. Amasaman SHTS had the largest representation, accounting for about 50% of the total respondents, followed by Adjen Kotoku Senior High at 39%, and Navs SHTS at 11%.

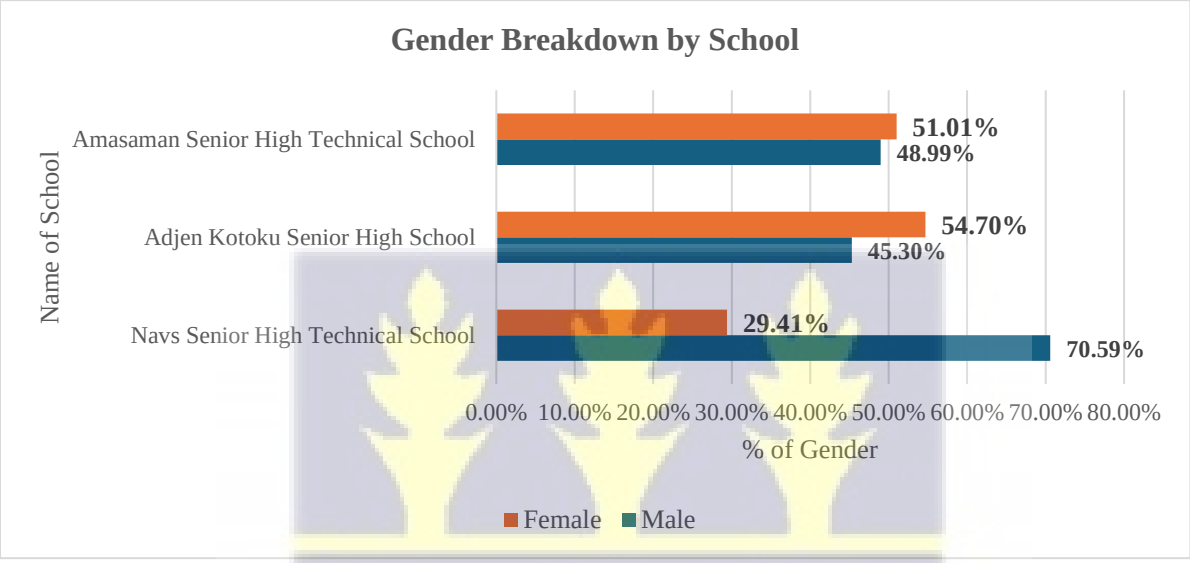
4.2.1 Gender Breakdown

The gender distribution in the sample was balanced, with an equal number of male and female respondents (50% each). Amasaman SHTS and Adjen Kotoku Senior High exhibited nearly equal or female-leaning gender distributions, while Navs SHTS was predominantly male. See Figure 3.

4.2.2 Age Distribution

Most participants were between 17-19 years old, accounting for 78% of the sample. This age group was followed by students aged 20-22 years, who made up 12%, while those aged 14-16 years represented 9% of the respondents. Only 1% of the participants were 23 years or older.

Figure 3: Gender Breakdown by School



Source: Author's Field Survey, 2024

4.2.3 Programme Offering

The most popular programme among the students was Technical, with 34% of the respondents enrolled in this stream, reflecting the technical orientation of all the sampled schools. General Arts was the second most prevalent programme at about 33%, followed by Home Economics at 26%. Other programmes like Business, Agriculture, and General Science had lower representation, collectively comprising the remaining portion of the sample.

4.2.4 Qualitative Sample Achievement

The qualitative analysis involved four IDIs conducted with ICT administrators and tutors from the selected senior high schools. Although six in-depth interviews were initially planned, only four were conducted due to unavailability of one ICT tutor and the absence of another. At Navs SHTS, the ICT tutor also managed the lab, resulting in a single participant for that institution. Nonetheless, all sampled schools participated in the qualitative studies.

4.3 Objective 1: Extent of ICT Usage

To understand the extent of ICT usage among students, the study examined the available ICT resources, the awareness of students of available ICT resources and how students utilize those resources within the surveyed schools.

4.3.1 Awareness and Availability of ICT Infrastructure, Devices, and Tools

The survey data indicates a high level of student awareness regarding ICT resources in the schools. Almost 99% of the respondents were aware of ICT or computer labs, making it the most recognized resource. Additionally, about 68% of students were aware of TV/Radio resources for teachers/staff, and 52% acknowledged the presence of multimedia devices like projectors. 54% of students were aware of the availability of students' personal ICT devices within the school environment. Despite the high awareness discussed, some school resources like school library computers and TV/Radio for students were less recognized, recording 47% and 36% respectively.

4.3.1.1 Gender Breakdown of Awareness

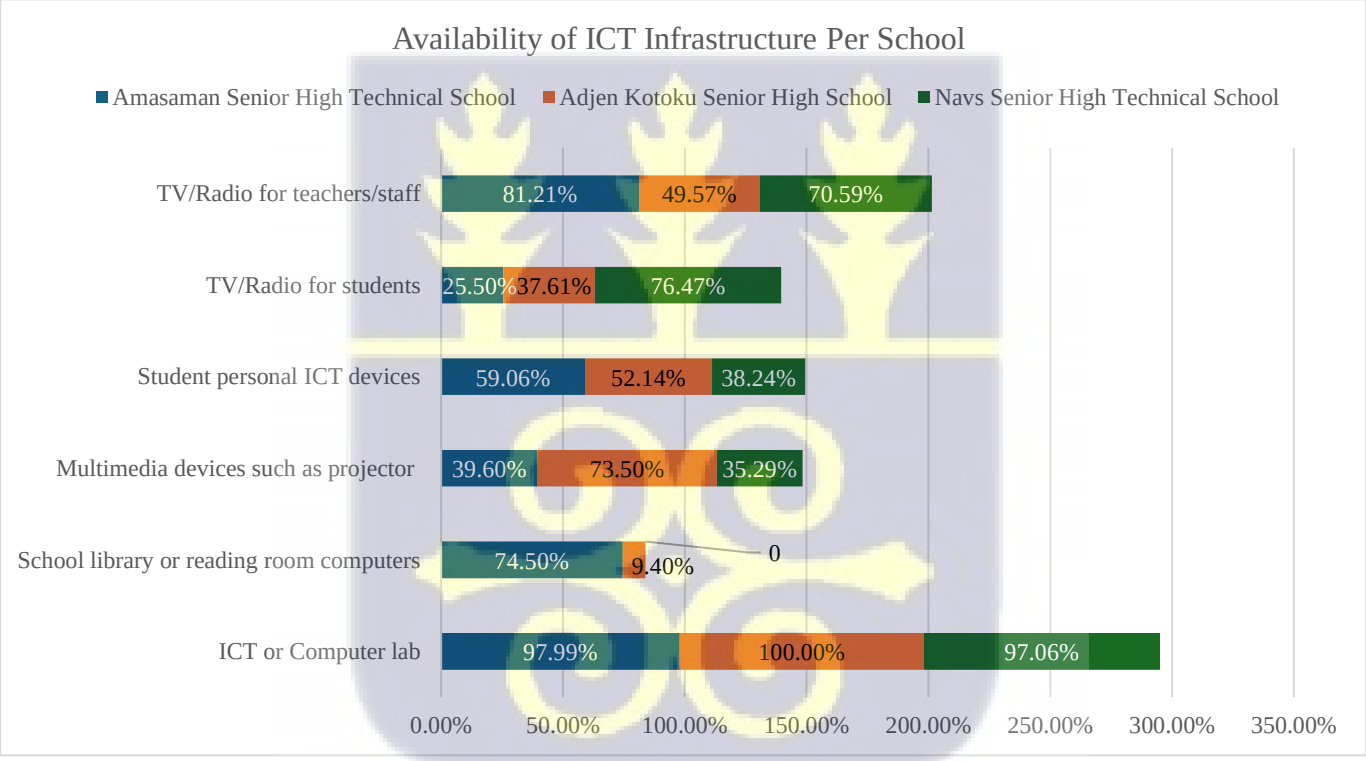
Both genders reported similar levels of awareness across most resources, with minor variations. For instance, 100% of female students were aware of the ICT labs, compared to 97% of male

students. Additionally, female students showed slightly higher awareness of available multimedia devices (55% compared to 49%) and personal ICT devices (57% compared to 51%).

4.3.1.2 Awareness of ICT Infrastructure by School

Awareness of ICT labs was high across all schools, with Adjen Kotoku SHTS reporting 100%, followed closely by Amasaman SHTS (98%) and Navs SHTS (97%). However, awareness of other ICT infrastructure, such as school library computers, varied widely. See Figure 4 below.

Figure 4: Availability of ICT Infrastructure Per School



Source: Author's Field Survey, 2024.

Only 9% of students at Adjen Kotoku SHTS were aware of library computers, compared to 75% at Amasaman SHTS and 56% at Navs SHTS, and therefore, further clarifications were needed especially for Adjen Kotoku. Similarly, awareness of multimedia devices like projectors was low

across schools, with Amasaman SHTS at 40% and Navs SHTS at 35%. For personal ICT devices, Amasaman SHTS had the highest awareness (59%), followed by Adjen Kotoku SHTS (52%), and Navs SHTS (38%).

4.3.1.3 Qualitative Explanation of Availability of ICT Infrastructure, Devices, and Tools

The qualitative analysis reveals several key themes concerning the availability and state of ICT resources in the sampled schools. The findings suggest that although ICT resources are present in the schools, their limited quantities, functionality and reliability are often compromised, making access to these resources inconsistent and challenging for both students and teachers.

One administrator noted reflecting the situation is the limited number of functional computers and peripheral devices available in the schools: *"We only have the computers and a projector. In the ICT lab, we have about 25 computers for now, but the functional ones are about 14"* (ICT Administrator/Tutor 4). Another ICT teacher corroborated, noting that *"We have about 25 computers for now, but the functional ones are about 14... At the moment the school doesn't have library computers… There are no computers in our classrooms…"* (ICT Administrator/Tutor 2). In clarifying the availability of library computers, one tutor noted that *"There school does not have the library computers, what you see here [laptops] belong to individual librarians and some tutors."* (ICT Administrator/Tutor 1).

Peripheral devices like projectors are also in limited supply and use. A tutor stated, *"We have one projector, that is normally used in the [ICT] lab… and then we have a PA [public address] system which sometimes it's attached to it"* (ICT Administrator/Tutor 2). Another tutor noted, *"When you came to the school, I believe you've seen that we have only one projector…"* (ICT

Administrator/Tutor 3). The researcher notes seeing the presence of computers at the respective ICT labs, and at least one projector in each school.

Concerning availability of Internet infrastructure and services, an administrator expressed that *"So, we have Internet access but as it stands now, students are not allowed to use electronic gadgets on campus, so it's not like accessible to them. But in their lab, they have access to the Internet, so the Internet is restricted to the lab only"* (ICT Administrator/Tutor 3). Another administrator notes that *"There's the government provided internet access, but the problem is that normally when it is time for admissions, then we have access, but at the moment when there is no serious academic admission ongoing and stuff, there is no data for it [the access points or internet] to function"* (ICT Administrator/Tutor 2)

4.3.2 Usage of Available ICT Infrastructure or Devices or Tools

The data on usage of available ICT resources shows that the school ICT or computer lab is the most utilized facility, with 97% of students engaging with it. Additionally, 44% of students stated that multimedia devices are used in their school, while 41% of students expressed that they have accessed ICT resources in school libraries or reading rooms. Notably, 29% of students use their personal ICT devices in school, a usage rate similar to the 30% who reported using tutor or staff ICT devices.

Table 6:Usage of ICT Facilities or Devices by School and Gender

Which of the ICT facilities or devices do you use when you are at school? (MR/MA)	Name of Schol			Gender		
	Amasaman SHTS	Adjen K. SHTS	Navs SHTS	Male	Female	Total
School ICT or Computer lab	94.63%	99.15%	97.06%	95.33%	98.00%	96.67%
Library or reading room computers	65.77%	8.55%	47.06%	39.33%	43.33%	41.33%
Multimedia devices such as projector in classrooms	24.16%	72.65%	35.29%	39.33%	49.33%	44.33%
Tutor devices	41.61%	22.22%	8.82%	20.00%	40.67%	30.33%
Personal phone/tablet/laptop	21.48%	35.90%	38.24%	34.67%	23.33%	29.00%
TV/Radio for students	4.70%	7.69%	61.76%	12.00%	12.67%	12.33%
TV/Radio for teachers/staff	38.26%	34.19%	5.88%	29.33%	36.67%	33.00%

Source: Author's Field Survey, 2024.

4.3.2.1 Gender Breakdown of Usage of ICT Resources

Female students show slightly higher usage of the school's ICT lab, with 98% compared to 95% of male students. Also, female students report greater usage of school library computers (43% vs. 39% of males). However, male students demonstrate higher reliance on their personal ICT devices (35% vs. 23% for females). Moreover, a significant disparity exists in the use of tutor/staff devices, with 41% of females utilizing them compared to 20% of males.

4.3.2.2 Usage of ICT Resources by School

Across all schools, the ICT or computer lab remains the most widely used facility, with 95% of students at Amasaman SHTS, 99% at Adjen Kotoku SHTS, and 97% at Navs SHTS. However, the usage of other ICT resources varies considerably by school. For example, 66% of students at Amasaman SHTS use school library computers, compared to just 9% at Adjen Kotoku SHTS.

4.3.2.3 Qualitative Explanation on Usage of ICT Resources

The qualitative findings highlight the effect of the limited quantities, functionality and reliability of ICT resources on usage, limiting access to use for both students and teachers. One ICT tutor emphasized this challenge by stating, *"We have a school population of about 1,500 students, and all these students are supposed to do core ICT course... it means more like 20 computers for 1,500 students. That's a lot of pressure and that makes it physically impossible to run the subject as we have to due to the limited ICT resources especially in the ICT lab"* (ICT Administrator/Tutor 1).

Another ICT administrator explained that, due to the limited resources, the ICT labs are not open for free use by students unless it is for class-related activities. The tutor opined that: *"So, with the lab, at least we do visitations [class sessions] twice a week and then the numbers [students available] will determine them going in batches. So, max we do 2 hours per session with each batch…Because of the tight scheduling, it will not be possible for students to just walk into the lab to say I am doing research or anything… So, it's not a walk in kind of service."* (ICT Administrator/Tutor 3). This regulatory approach limits students' ability to conduct research or engage in independent learning using ICT resources provided by the school.

One key finding identified is that even within scheduled class use times, students' use of ICT tools is largely limited, thereby restricting their hands-on experience and engagement with technology. A tutor highlighted the minimal ICT interaction among core and first-year students: *"Another thing that I will also talk about is the number of periods that we have. With the core, for instance, we have one hour in a week for every class, which is not enough to engage the student in ICT or to engage them"* (ICT Administrator/Tutor 4). This was validated by another tutor who expressed that: *"One of the things that I would say at the school level influences them [students' low usage]*

is the timetable [academic schedule and other required activities to do] as the first, and then the activities of the teacher." (ICT Administrator/Tutor 1).

Even elective ICT students, who might be expected to have more extensive access, face similar limitations in using existing ICT resources. As one tutor noted, *"On certain occasions, should the lab not be in use, because the core ICT course also has to do practical, then I have to move the [elective] class students to the classroom"* (ICT Administrator/Tutor 1). This underscores how limited ICT resources and scheduling pressures restrict students' ability to fully engage with ICT.

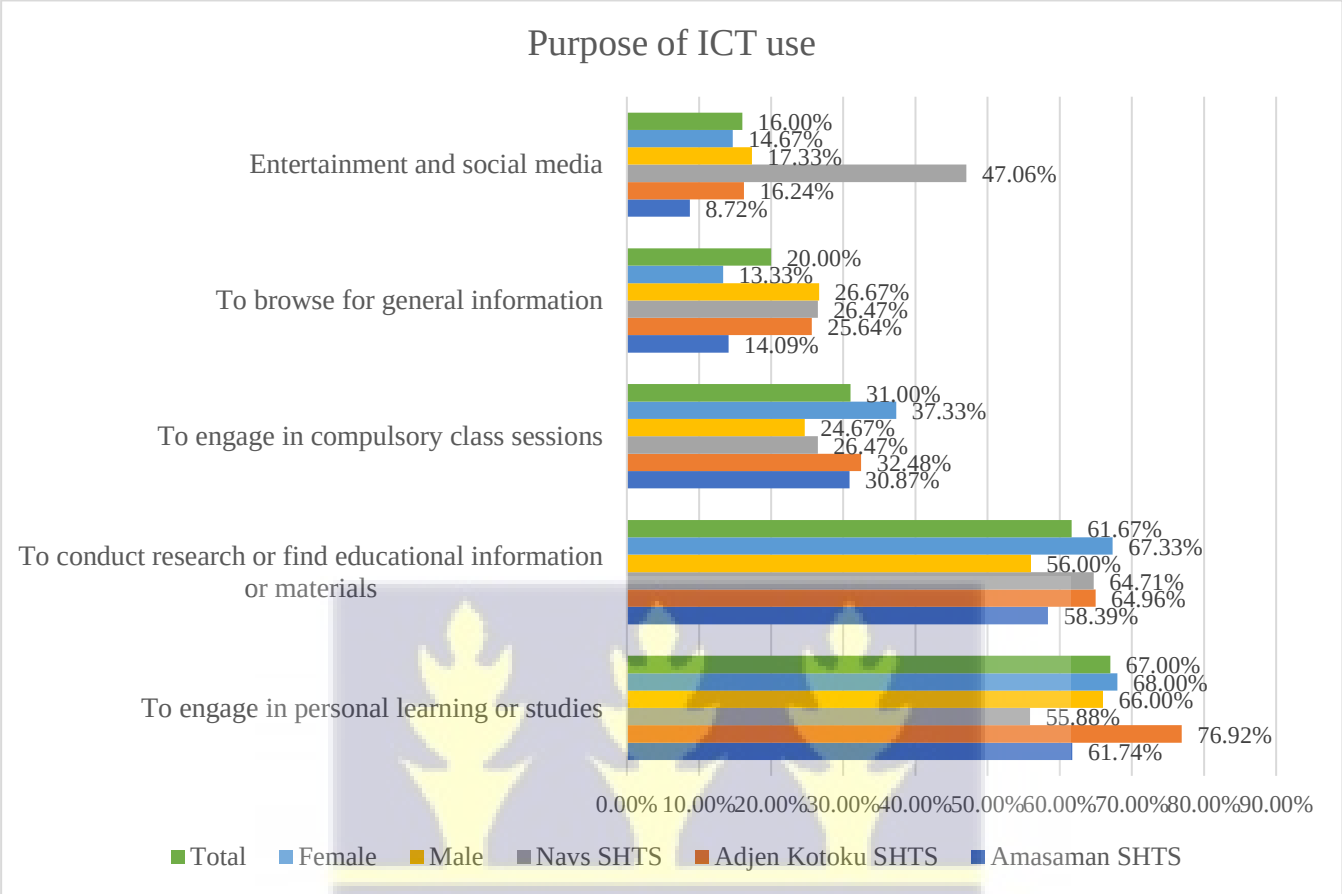
Several ICT administrators and tutors mentioned that usage of online resources was dependent on teacher's time and internet service. As one tutor remarked, *"...If there's Internet access, we do allow them to use [the ICT lab]. And we do tell them they are not supposed to go on social media. If you are there to do research, fine"* (ICT Administrator/Tutor 4). Another teacher remarked "*For example, some students come around and say they [their teachers] gave us a project…When we [ICT teachers or lab administrators] have time, we will allow them to use the ICT lab. If there's Internet, we normally get tutorial for them to watch and then they follow those tutorials"* (ICT Administrator/Tutor 2).

It is observed that the 41% of students expressing that they have accessed ICT resources in school libraries refer to using traditional library books and tutor personal devices in the school library.

4.3.3 Purpose of Use:

The quantitative show 67% of respondents using ICT for personal learning or studies. Additionally, 62% utilize ICT for research or accessing educational materials, and 31% of students use ICT during compulsory class sessions. These highlight the academic purpose of using ICT.

Figure 5: Purpose of Use by Gender and School



Source: Author's Field Survey, 2024.

Gender-specific data reveals similar trends, with both male and female students predominantly using ICT for academic purposes. 66% of males and 68% of females use ICT for personal learning. However, more female students (67%) report using ICT for research compared to 56% of males.

4.3.3.1 Qualitative Explanation of Purpose of Use

ICT tutors and administrators confirmed that the primary purposes for which ICT is used in the schools are academically centred. Nonetheless, there is a conflict between how majority of students use ICT and what the school allows. While majority of students prefer to use ICT for personal learning and research, the schools surveyed mostly allow access to ICT resources during scheduled

class hours. This is reflected in the sentiments of a tutor who expressed that "*...Because of the tight scheduling [to use ICT resources for academic purposes], it will not be possible for students to just walk into the lab to say I am doing research or anything... So, it's not a walk in kind of service.*" (ICT Administrator/Tutor 3).

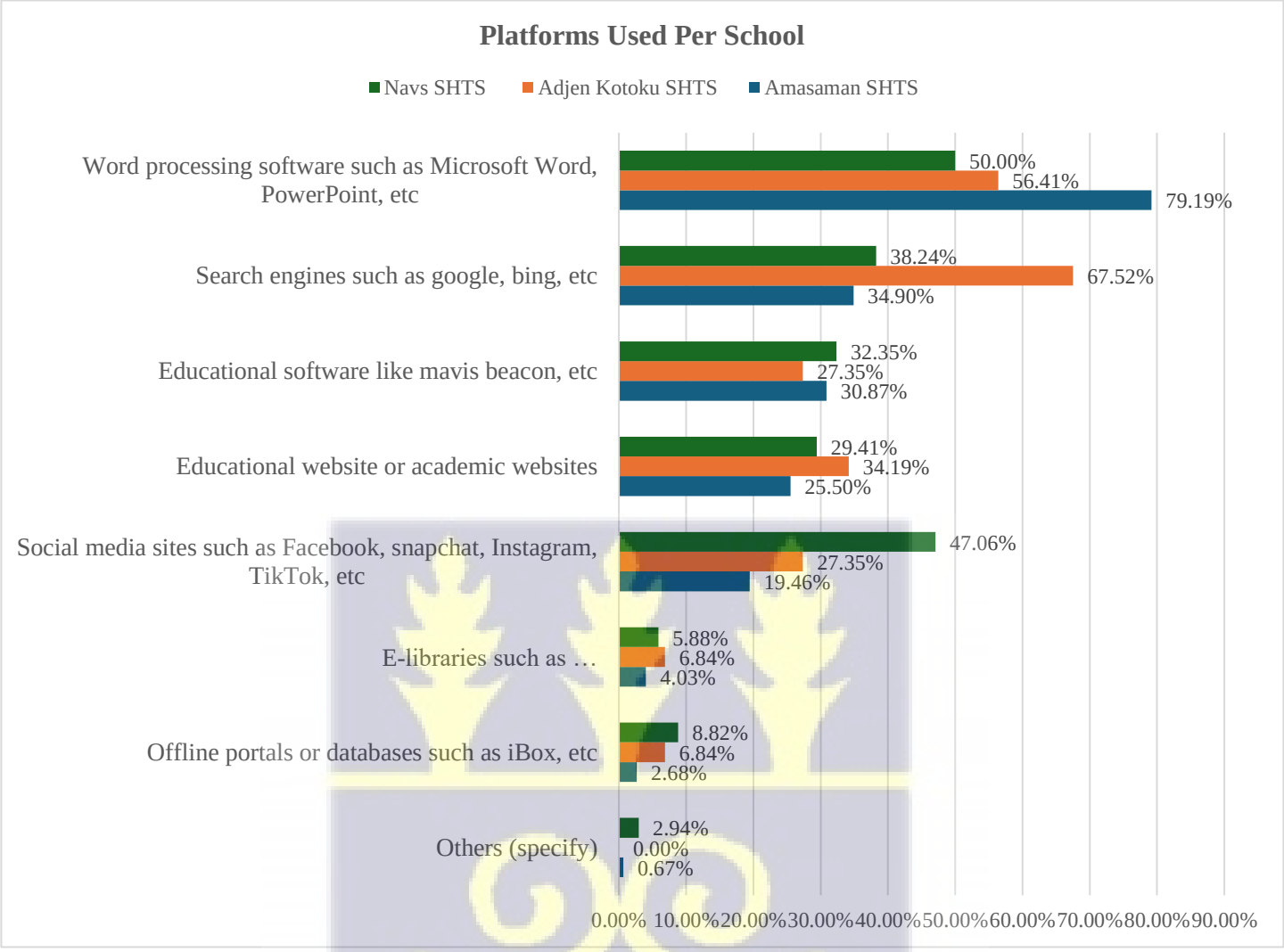
4.3.4 Activities Performed and Platforms or Tools Used

The survey results reveal that students primarily use ICT for academic activities, with 60% of respondents using it for conducting research and retrieving information, and 41% accessing educational materials such as digital textbooks and e-learning platforms. However, only 17% use ICT for writing and typing essays and reports.

ICT also supports skill development of a portion of students, with 31% using educational software to practice subjects like math and language, and 27% focusing on coding, software development, and other technical skills. Leisure activities are also notable, with 24% of students using ICT for social media and other online activities during breaks.

Regarding the ICT tools and platforms accessed by students, 67% use word processing software, making it the most frequently used tool across the sampled schools.

Figure 6:Platforms Used Per School



Source: Author's Field Survey, 2024.

Search engines are also used, with 48% of students relying on them for various academic purposes. Educational software and websites are accessed by 30% and 29%, respectively. Interestingly, 26% of students access social media platforms such as Facebook, Snapchat, Instagram, and TikTok, while offline portals and e-libraries are among the least accessed platforms, at approximately 5% each, respectively.

4.3.4.1 Platforms Used by School

At the school level, word processing software is the most accessed tool across all schools, with 79% of students at Amasaman SHTS, 56% at Adjen Kotoku Senior High, and 50% at Navs SHTS using it. Search engines are most popular at Adjen Kotoku Senior High (68%), while social media is more frequently accessed at Navs SHTS (47%).

4.3.4.2 Gender Breakdown of Platform Used

A gender breakdown of ICT platform usage shows that female students have a higher preference for both social media (28% of females vs. 23% of males) and search engines (53% of females vs. 43% of males). This suggests that female students are more engaged with these platforms compared to their male counterparts.

4.3.4.3 Qualitative Explanation of Activities Performed and Platforms Use

The qualitative discussions show that the activities performed using ICT are largely determined by the curriculum, and the availability of ICT resources. However, the activities vary significantly between elective and non-elective ICT students.

For elective ICT students, the activities are more advanced and include working on databases, designing websites, using Microsoft Excel, and watching educational videos to grasp complex concepts. As one tutor explained, *"For the elective students, if I should be curriculum specific, we do things that have to do with database projects; they do Microsoft Excel projects. They watch videos, especially with the smart TV, on YouTube videos that explain concepts before we introduce them to the concepts. Before we practically interact with those things on the machine [computers], they do [practice] typing, they are introduced to PowerPoint application, and then some*

programming basics, especially for those doing elective ICT" (ICT Administrator/Tutor 1). Another tutor explained, "… *so mostly some of them write elective ICT as a subject or as a course. So, we teach them work-related stuff or academic-related stuff. We teach them how to use Excel, PowerPoint, Word, and so on and so forth. That's on the academic side"* (ICT Administrator/Tutor 3). These activities are closely aligned with their academic goals and are designed to equip them with practical skills relevant to the job market.

In contrast, non-elective ICT students engage in more basic activities, primarily focused on research and typing. One tutor noted that, *"For the core ICT students, they use the ICT facilities for research and for typing, that is. In my school, that's basically what they use the ICT for, for research and typing. That is the only thing available. Even not for the whole school—a handful of them will come, not everyone comes"* (ICT Administrator/Tutor 3).

Similarly, another tutor mentioned, *"[For the core ICT students], when it comes to academic, for example, in our lesson in Excel, we normally use the questions they are given, where we are supposed to fill Excel sheets, find averages, and all the other stuff that it contains. Then something like preparing a CV—something you [teacher] just invite them and give them in their classes to go and try and then create their own CV"* (ICT Administrator/Tutor 2).

Tutors also observed that students sometimes use ICT for non-academic purposes, such as browsing social media or watching entertainment videos. Despite restrictions, this practice is common, especially among students using personal mobile phones. As one tutor remarked, *"On the entertainment side, you see them more often than not, surfing the net—either it's YouTube, TikTok, or Snapchat, if they're using their phones"* (ICT Administrator/Tutor 3).

Recognizing the pervasive use of social media, Navs SHTS is proactively educating students on how to harness it positively. One tutor shared, *"Last year we took the whole day, ... explaining some of the relevance of how to really learn social media to run a business, or to learn or enhance your personality. If you want to even be a celebrity or to ensure you are getting the most positive aspects of social media, we took our time explaining these things to the students"* (ICT Administrator/Tutor 3).

4.3.5 Frequency of ICT Use Among Students

Frequency of use was measured using use occasion, number of times used, and hours or minutes used to determine the extent of ICT usage among surveyed students.

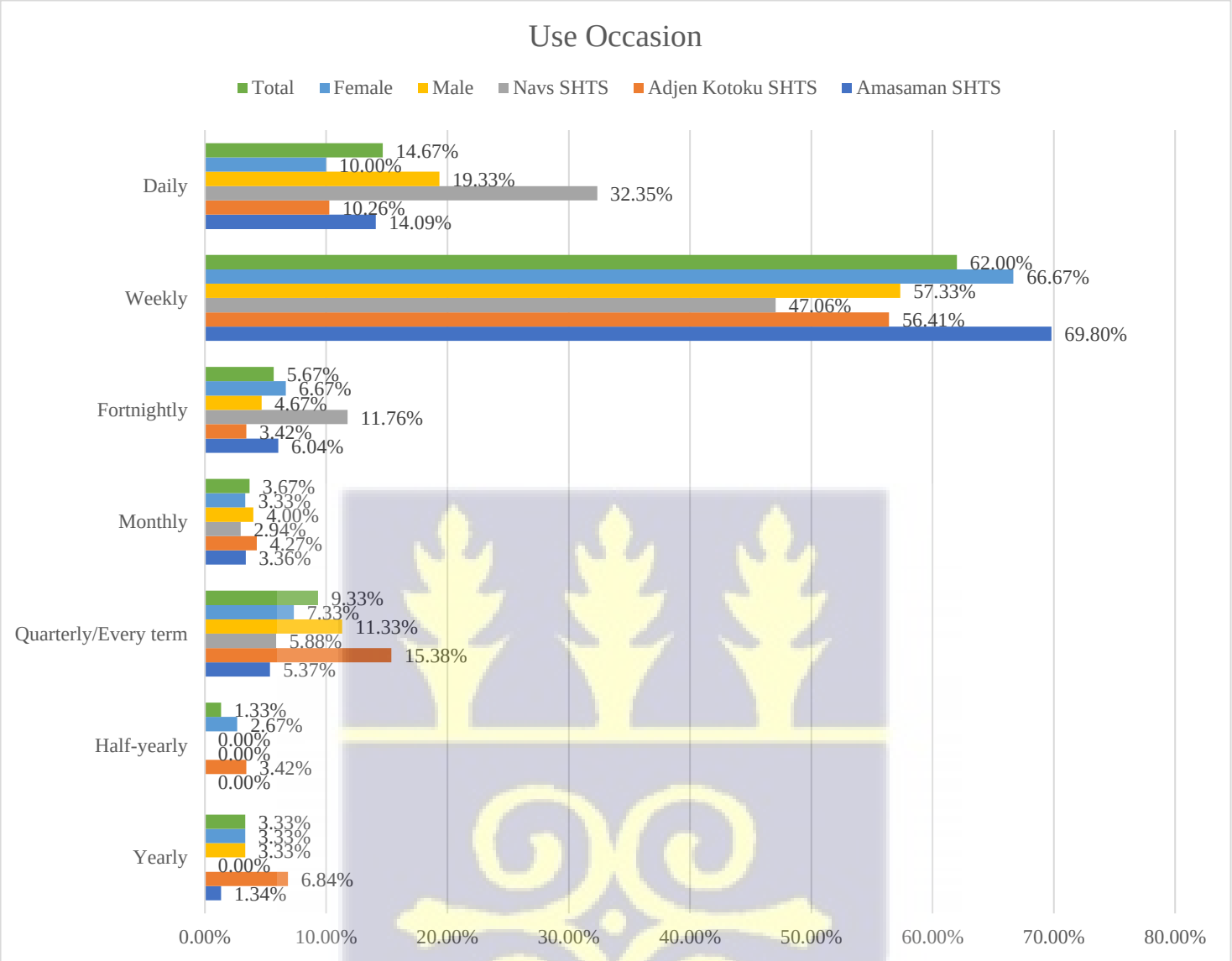
4.3.5.1 Use Occasion

Many students, 62% (186 students), use ICT on a weekly basis. However, only 15% (44 students) use ICT daily, indicating that while many students are consistent in their ICT use, fewer integrate it into their daily routine. See Figure 7 below.

A gender analysis reveals that male students are more likely to use ICT daily, with 19% of males reporting daily usage compared to 10% of females. Conversely, weekly usage is more common among females, with 67% of females compared to 57% of males. This indicates that females are more consistent in weekly ICT usage, while males show higher daily usage. See Figure 7 below.

Navs SHTS has the highest daily ICT use at 32%, followed by Amasaman SHTS at 14%, and Adjen Kotoku SHTS at 10%. Weekly usage is most common at Amasaman SHTS (70%), followed by Adjen Kotoku SHTS (56%), and Navs SHTS (47%). These patterns suggest that while Navs SHTS students are more inclined to use ICT daily, weekly use is predominant at Amasaman SHTS.

Figure 7:Use Occasion Segmented by Gender and School



Source: Author's Field Survey, 2024.

4.3.5.2 Number of Times Per Use Occasion

In terms of the number of times ICT is used per session, many students (48%) use ICT once per use occasion. About 27% use ICT twice per use occasion, while 13% report using it three times. A smaller group (12%) uses ICT four or more times per session, reflecting higher engagement during each use occasion.

4.3.5.3 Duration Per Use Occasion

The duration of ICT usage per session also varies. 43% of students spend around one hour per session on ICT activities. 24% use ICT for two hours, and 21% spend three hours per session, indicating that nearly one-fifth of students engage in more extended ICT usage. 12% of students spend only 30 minutes per session, showing limited interaction with ICT during each use.

Table 7: Crosstab of Use Occasion and Duration Per Use

Use Occasion	Duration per use occasion				
	30 minutes	1hour	2 hours	3+ hours	Total
Daily	3	17	15	9	44
Weekly	19	75	47	45	186
Fortnightly	1	10	4	2	17
Monthly	5	6	0	0	11
Quarterly/Every term	5	13	4	6	28
Half-yearly	0	3	1	0	4
Yearly	2	6	2	0	10
Total	**35**	**130**	**73**	**62**	**300**

Source: Author's Field Survey, 2024.

Among daily users, who constitute 44 students, the most prevalent session length is one hour, with 39% of students opting for this duration. Weekly users represent the largest group, comprising 186 students. Within this group, 40% dedicate one hour to ICT per session, while 25% engage for two hours, and 24% extend their sessions to three or more hours.

4.3.5.4 Qualitative Explanation of Frequency of Use

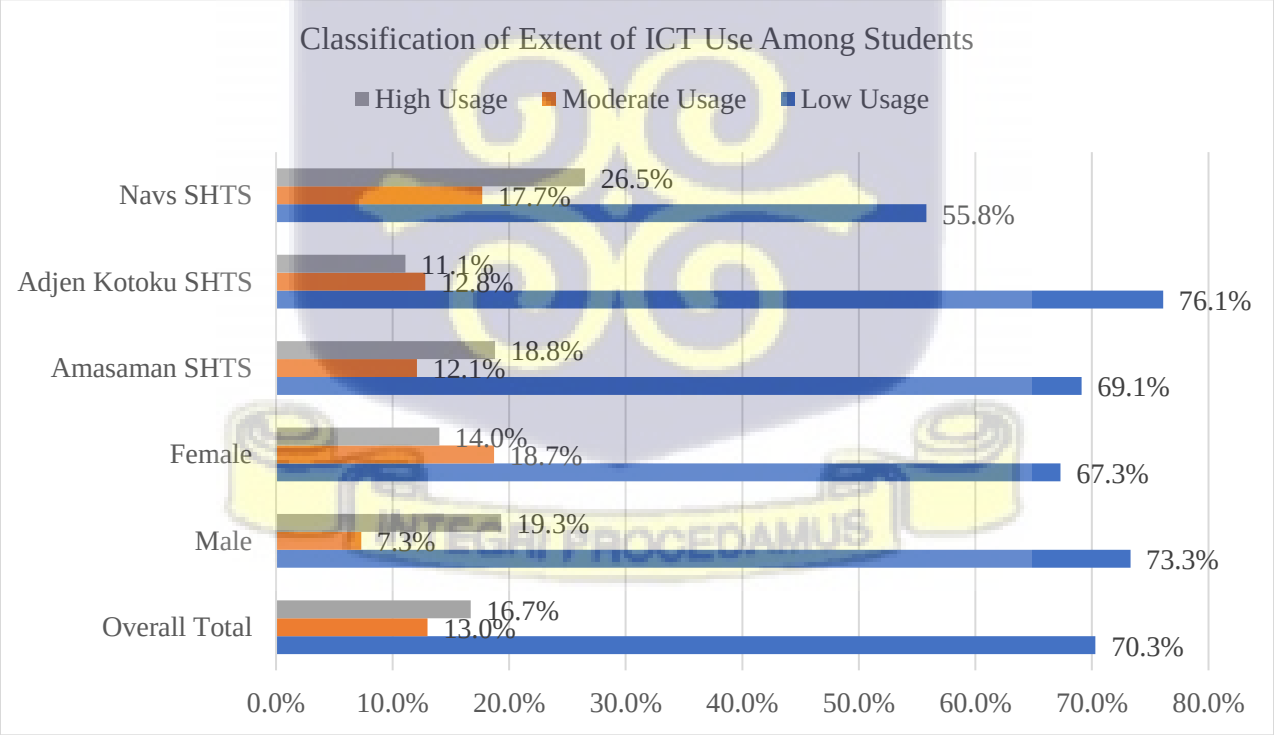
The frequency of ICT use among students is regulated by the academic timetable of the schools and depends on student groups. While elective ICT students have more frequent interactions with ICT resources, the core students, who constitute an overwhelming majority have very few opportunities to engage with ICT.

One tutor explained *that "For each [elective ICT] class, we meet four times in a week…For the core ICT students, I think they even come to the ICT lab only once in a week"* (ICT Administrator/Tutor 1). Another tutor added, *"[With the core ICT classes] for instance, we have one hour in a week for every class, which is not enough to engage the student in ICT or to engage them"* (ICT Administrator/Tutor 4). Explaining further, the tutor said that *"… Outside that, the core students, I can count the number of times they do (very few ICT sessions). A class like the Visual Arts students, for instance, their number cannot be contained in the ICT lab, so we don't go to the lab at all"*. This disparity in access affects the frequency of use among core ICT students.

4.3.6 Classification of Extent of ICT Use

The data on extent of ICT usage among students reveals that the majority fall into the low usage category, with 70% of students using ICT for less than 2 hours per week.

Figure 8: Classification of Extent of ICT Use Among Students by School and Gender



Only 13% of students are categorized under moderate usage (2.1 to 5 hours per week), while 17% fall into the high usage category, using ICT for more than 5 hours per week.

4.3.6.1 Gender Analysis of Extent of Usage:

The results indicate clear gender-based differences in how students engage with ICT within the school environment. Although male students are slightly more likely to be in the high usage category (19%) than female students (14%), a deeper look at the distribution reveals a more balanced engagement pattern among females. Notably, 19% of female students fall into the moderate usage category, compared to only 7% of males. This suggests that while male students tend to polarize towards either low or high ICT usage, female students demonstrate more moderate and consistent usage levels.

Table 8 Gender Analysis of ICT Usage

Level of ICT Usage	Male	Female
Low Usage	73%	67%
Moderate Usage	7%	19%
High Usage	19%	14%

Moreover, a larger proportion of male students (73%) fall into the low usage group compared to females (67%), further underscoring this polarized trend among males. The distribution suggests that although some males are high users, many others remain minimally engaged with ICT.

The Chi-square test results further support these observations, indicating a statistically significant difference in ICT usage between male and female students. The test results are as follows:

Table 9: Chi-square Test Results for Gender Analysis

Statistic	Value
Chi-square (χ^2)	9.07
Degrees of Freedom	2
p-value	0.0107

With a p-value of 0.0107, which is less than the common significance level of 0.05, the analysis confirms that gender plays a significant role in the variation of ICT usage among students when in school. This statistically significant difference suggests that gender-related factors may influence how students engage with ICT resources in their educational environment.

4.3.6.2 School-Specific Analysis of Extent of Usage:

A school-specific analysis reveals some variation in ICT usage among students across the three schools. Amasaman SHTS exhibits a relatively high proportion of low users (69%) but also a notable 19% of high users, suggesting some level of advanced engagement despite overall limited use. Adjen Kotoku SHTS has the largest proportion of low users (76%) and the lowest percentage of high users (11%), indicating relatively low ICT engagement. On the other hand, Navs SHTS presents the most favorable usage profile, with 27% of students categorized as high users—the highest among the three schools—although a majority (56%) remain in the low usage category.

Table 10: School-Specific Analysis of Extent of Usage

School	Low Usage (%)	Moderate Usage (%)	High Usage (%)
Amasaman SHTS	69	12	19
Adjen Kotoku SHTS	76	13	11
Navs SHTS	56	17	27

In contrast, Adjen Kotoku SHTS has the highest percentage of low users (76%) and the lowest percentage of high users (11%), indicating limited engagement with ICT resources. Navs SHTS stands out with 27% of its students in the high usage category, the highest among the schools. However, 56% of its students are still classified as low users. Despite these observed variations in ICT usage patterns, the Chi-square test results do not support a statistically significant difference among the schools. The test results are as follows:

Table 11:Chi-square Test Results for School-Specific Analysis of Extent of Usage

Statistic	Value
Chi-square	10.81
Degrees of Freedom	4
p-value	0.0288

With a p-value of 0.0288, which is less than the 0.05 significance level, the result suggests that the variation in ICT usage across the three schools is statistically significant and not due to random chance. This implies that school-level factors, such as infrastructure quality, accessibility, regulations, or support systems, may be influencing how students engage with ICT. The finding underscores the importance of contextual differences among schools and suggests that targeted interventions may be necessary to promote equitable ICT usage across schools.

4.3.6.3 Qualitative Classification of Extent of ICT Use Among Students

ICT administrators and tutors generally classified the extent of ICT use among students as low, with some variation in access and individual circumstances within the schools. A tutor provides a nuanced view, stating, *"Looking at the (ICT) facilities in the school, I would put them in the low category, but I would be a little bit more considerate because most of them have phones and you won't believe some things, some of them can use their phones for. That is why I'm saying I'll put them in the low to moderate usage category. Yeah, they are low to moderate users of ICT" (*ICT Administrator/Tutor 4).

Similarly, ICT Administrator/Tutor 1 observes, *"I will classify the majority of the students as low users. They do not use ICT often when they are in school because of the various challenges that restrict their use of ICT. Few are moderate to advanced users*." Likewise, ICT Administrator/Tutor 2 highlights a skills gap, noting, *"They have low skills and do not know how to use a lot of the ICT tools, so their usage is low."*

Finally, ICT Administrator/Tutor 3 notes, *"I would say it's in overall and taking into consideration the use of social media and all that, I will say their usage is low, the usage is low compared to previous batches and previous years."* These perspectives indicate that while a small number demonstrate moderate to advanced usage, most students engage minimally with ICT in school. Hence their ICT use is generally low.

ICT administrators and tutors explain that most students are low users, largely due to challenges such as limited access to resources, restrictions on personal devices, and insufficient ICT skills. For instance, a tutor acknowledges that while students are primarily low users, the use of personal mobile phones for ICT activities introduces some variation, placing them in the low to moderate

category. Another tutor emphasizes the skills gap, stating that many students lack the necessary skills to effectively use ICT tools, further constraining their usage when in school. This skill deficiency corroborates the quantitative finding that only a small fraction of students are high users. Additionally, another tutor notes a decline in ICT engagement compared to previous years, attributing this to broader trends such as reduced access.

In sum, the qualitative data supports the quantitative results, confirming that ICT usage among students within the school environment is generally low. It also highlights a deeper understanding of the underlying reasons, such as ICT resource limitations, skill deficits, and institutional constraints, which collectively hinder students' ability to fully engage with ICT resources.

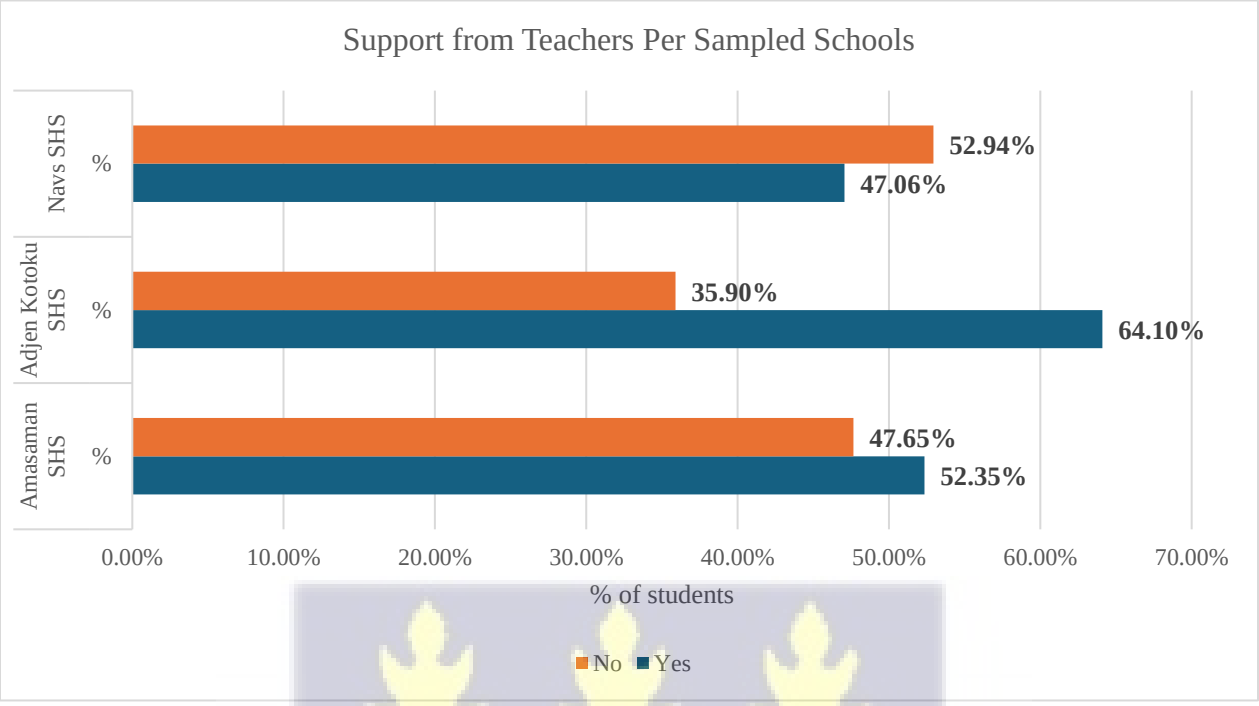
4.3.7 Teacher/Staff Support to Students for ICT Usage

The study explored the influence of teachers and staff in supporting students' use of ICT for learning. The findings indicate that about 56% of students (169) received support from their teachers in utilizing ICT. However, 44% (131 students) reported not receiving any support.

Gender and School Specific Breakdown of Teacher Support

There is a notable gender disparity in teacher support for ICT usage. Among male students, 45% reported receiving support, compared to 67% of female students. This suggests that female students are more likely to receive encouragement and assistance in integrating ICT into their learning compared to male students.

Figure 9: Support from Teachers Per Sampled Schools



Source: Author's Field Survey, 2024.

The level of teacher support for ICT usage varies across the sampled schools. At Amasaman SHTS, 52% of students reported receiving support, while Adjen Kotoku SHTS shows stronger teacher involvement, with 64% of students acknowledging teacher assistance and Navs SHTS demonstrates a less supportive environment, with only 47% of students affirming teacher support.

4.4 Objective 2: Challenges and Opportunities to ICT Usage Among Students

The investigation into the challenges and opportunities of ICT usage among students reveals significant barriers and potential enablers, validated through both quantitative and qualitative data.

4.4.1 Challenges Students Face When Using ICT in Schppl

The quantitative results indicate that the top challenges students face when using ICT in school include restricted access to ICT facilities (87%), slow and unreliable internet connections (34%),

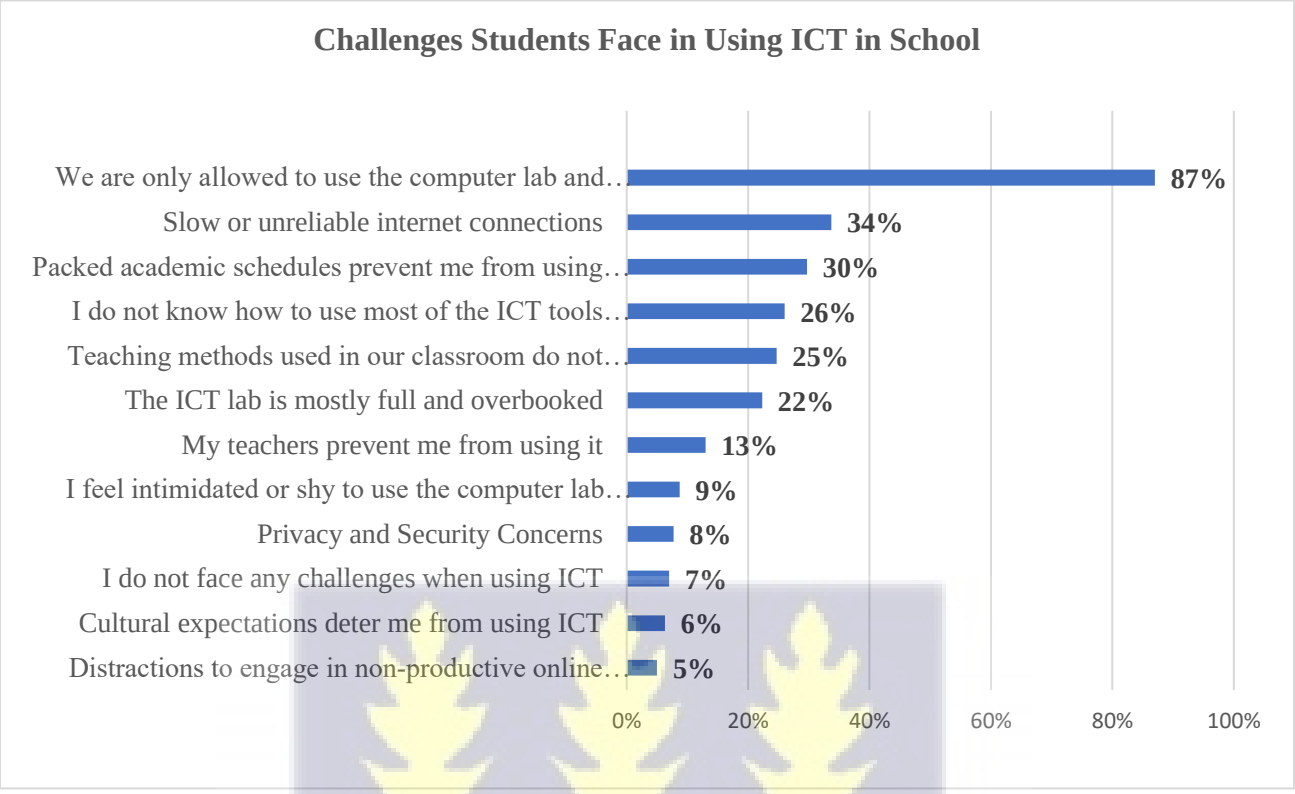
packed academic schedules (30%), limited digital skills (26%), minimal integration of ICT in teaching methods (25%), and overcrowded ICT labs (22%). See Figure 10 below.

4.4.1.1 Access Challenges

The primary access challenges inhibiting students' use of ICT in school include restricted availability, with 87% of students reporting they can only use computer labs during scheduled classes, limiting opportunities for independent study and exploration. Additionally, 29.7% of students indicate that packed academic schedules prevent them from using ICT resources, while 22.3% report that overcrowded labs make access difficult. A small portion (5%) of students also face the issue of their schools lacking ICT labs and digital tools altogether, further restricting their exposure to ICT.

Access restrictions on ICT usage are a prevalent issue across all the surveyed schools. In Amasaman Senior High Technical School (SHTS), 71% of students reported being restricted to using ICT resources only during formal class sessions. Similarly, in Adjen Kotoku SHTS, 70% of students face the same restriction, whereas Navs SHTS, while also facing access issues, reports a lower restriction rate, with 50% of students limited to using ICT resources only during scheduled class hours.

Figure 10: Challenges Students Face in Using ICT in School



Source: Author's Field Survey, 2024.

Qualitative Explanation of Access Challenges

The quantitative findings are corroborated by qualitative insights, where ICT administrators emphasized the scarcity of resources, such as a limited number of computers for a large student population, small ICT lab sizes, intermittent internet access, among others limiting students' access to use ICT resources.

Insufficient Computers, Number of ICT Labs and Lab Sizes Affecting Access

As one ICT administrator highlights, *"Limited [ICT] resources also deter them [students], where maybe, there are few computers to be used and then maybe they have to wait for their friends to finish before they will get a chance to use the same computers, it makes them sometimes get*

annoyed and then they leave.... We have only 40 functional computers to 1,000 students. That is not enough" (ICT Administrator/Tutor 2).

Additionally, the small sizes and number of the ICT labs exacerbate the access problem, as described in this case: *"The ICT lab space is also equally small. The current place that we have now is a bit bigger and can take about 40 students at a go... I think that the ICT lab itself, one isn't enough. I have been pushing the idea that at least we should get 2 ICT labs because most often the elective students are given precedence for the usage of the ICT lab and the resources there over the core class or students"* (ICT Administrator/Tutor 2). The tutor highlights the concerns about the limited space in the ICT lab creating unequal access. The current lab cannot accommodate all students, prompting a call for a second lab to reduce overcrowding and enhancing access.

Challenges with Access to Peripheral Devices and Multimedia Rooms:

The thematic analysis revealed that access to functional peripheral devices are major obstacles to effective ICT usage in the sampled schools. One ICT administrator/tutor emphasized the challenge by noting that *"The classrooms do not have projectors, and that doesn't motivate or encourage the use of ICT tools in the classroom."* (ICT Administrator/Tutor 1).

The inadequate number of projectors also leads to conflicts in accessing and using such ICT resources, as different teachers need them for their respective classes. The ICT tutor further articulated: *"So, what I mostly use in the teaching is the projector, that is sometimes. Because when you came to the school, I believe you've seen that we have only one projector, and the way the timetable is scattered, mostly when I am having a core class, an elective tutor or the person teaching elective also has a class [they will be using the projector]. So, there are somehow some clashes, so the core students don't have access to it"* (ICT Administrator/Tutor 1).

Moreover, the absence of a dedicated multimedia room further limits the students' exposure to essential ICT resources for teaching and learning. One ICT administrator/tutor stated that: *"We don't have [a] multimedia room as well"* (ICT Administrator/Tutor 4). Another expressed frustration, noting that *"You go to other schools, and they have a multimedia room. They have other ICT resources. In my school, we don't have anything like that. So, it is depriving them a lot"* (ICT Administrator/Tutor 1). Clearly the thematic analysis shows that peripheral and multimedia devices are limited in supply and cause challenges to effective use of ICT among students.

Challenges with Internet Access

ICT administrators and tutors highlighted the inconsistent and limited availability of internet access as a significant challenge to ICT usage in the sampled senior high schools. Although internet is available during specific periods like admissions, it is largely unavailable during crucial teaching, learning, and personal study hours. One ICT administrator/tutor pointed out that *"So, Internet instability is one of the major challenges because if the person is supposed to search for information online, you realise it takes quite some time* (ICT Administrator/Tutor 1).

Although the ICT labs have internet access, the service is not consistently provided, and there is often a lack of data for online access. These are highlighted in the following comments of ICT administrators/tutors interviewed: *"And we have access to Internet. However, they are not functional for now, just to put it across, but we have the access points… I got to know that the services have been terminated because there are no funds [from the government] for that purpose. And it is a service provider that is giving access to these things. So, it's not really specifically to this school, but almost all the schools under that [service] provider*" (ICT Administrator/Tutor 1).

Another tutor provided clarity on the matter: "*Yeah, we do have a Wi-Fi in the school, but is the government paid Wi-Fi. And it mostly comes on when we are doing admission. So maybe during the first semester or first term, we are privileged to have the Wi-Fi, after that it goes off and whatever research you are doing, you do with your own data…So it is only available for a restricted period for admissions. The ICT lab have Internet access, but if the (government) Internet goes off, that is the end. There's no continuous availability of internet."* (ICT Administrator/Tutor 4). The quotes above highlight the situation of internet access and usage in the schools, which affect research activities of students. This is expressed below by an ICT administrator: *"And then about the Wi-Fi, because it is not always available, sometimes they come [to the ICT lab] alright, they want to do things [like research], but the necessary thing [internet] they need to get online to use to do their work, they don't get it. So, they better go and use phones or other things at home"* ICT Administrator/Tutor 2.

In essence, inconsistent and limited internet access, often restricted to specific periods like admissions, poses a significant challenge in senior high schools, as ICT labs lack continuous service and data, impacting students' ability to conduct research and access online resources during crucial learning hours.

4.4.2 Technical and Operational Challenges

From the quantitative findings, technical challenges that inhibit students' use of ICT in school include slow or unreliable internet connections, which 33.7% of students report as a major issue, limiting their ability to access online resources and complete assignments efficiently. Furthermore, 24.7% of students note that classroom teaching methods rarely incorporate ICT interactive tools and multimedia, reducing opportunities for enhance engagement and interactivity. Additionally, 7.7% of students express concerns about privacy and security, discouraging them from fully engaging with digital tools.

In the qualitative, technical problems were identified to be less frequent. ICT administrator/tutor 1 report, *"To the best of my knowledge. We don't have technical problems that impedes the using of the ICT lab. The ICT resources that we have, as I said, with the exception of the access points, everything is functional."* However, the occasional technical issues still affect the smooth operation of some ICT facilities with a teacher stating that *"For example, the UPS, the batteries are dead, and they need to be replaced. Some of the monitors are also worn out, they need to be changed. For some, it's either the fan or the power supply"* (ICT Administrator/Tutor 2).

Operational funding is another critical challenge. According to one ICT administrator, *"For example, the UPS, the batteries are dead, and they need to be replaced. Some of the monitors are also worn out, they need to be changed. For some, it's either the fan or the power supply…But the ones that we need to replace, we actually report [to the administration or school management], and the normal feedback is when the funds are available, they'll get them done or replaced. So operational funding is also a challenge"* (ICT Administrator/Tutor 2). The lack of sufficient financial resources for maintenance and repair leads to frequent disruptions in ICT services.

Concerning consistent availability of internet services, another administrator notes, *"When I came, it [the internet] was functioning for about a month and some few weeks… but it stopped and per my questionings, I got to know that the services have been terminated because there are no funds [from the government] for that purpose"* (ICT Administrator/Tutor 1). This lack of funding impacts not only the availability of ICT resources but also their operational efficiency.

In essence, technical challenges such as unreliable internet connections, limited integration of ICT in teaching methods, privacy concerns, occasional equipment malfunctions, and insufficient funding for maintenance significantly hinder students' effective use of ICT in schools.

4.4.3 Digital Skills Challenges

Quantitative data reveals that 26% of students identified digital skills deficiencies as a challenge to their ICT usage. Moreover, nearly half of the students (45%) expressed low confidence in using ICT, despite 51% identifying as intermediate users.

ICT administrators and tutors acknowledge that students' digital skills are limited, and the lack of resources prevents them from providing continuous support for digital skills development. For example, an ICT Administrator expressed that: "*Some of the students have a little bit of challenge with their digital skills, but if you are to train them, what are you going to use to train them? That is why, for now, the only way we are towing is solely the curriculum stuff."* - ICT Administrator/Tutor 1. This assertion is further validated by another teacher who identifies multiple challenges that affects students' digital skills and ICT use. The tutor note:

> *"OK, it is a collection of all these foundational things or challenges - awareness, digital skills and interest) … So, if we have such a student coming from this environment [a village school without electricity] to let's say our school. It means*

this person has never used a computer before. I'm not sure he hasn't used a smart phone or has access to Internet. So, telling the person now that when you use a computer, it will bring you many benefits, there's a reluctance. It's a collective situation from the grassroots all the way to the top." - ICT Administrator/Tutor 3.

ICT administrator/tutor 1, expressing a similar sentiment throws more light on the effect of such a challenge on teaching and learning particularly students' skills development. *"So, we have a school population of about 1000 students, and all these students are supposed to do core ICT course, it means more like 20 computers for 1000 students...Yes, even if I'm picking only the elective students who are just a fraction of the entire [student] population,...even they don't have one to one access to laptops [one student to one laptop]. And since the idea of teaching ICT is to give the learners hand-on opportunity to get used to the advancement of technology that we have, it becomes difficult to really pay attention to each student to really get the skill that you [tutor] want them to get"* (ICT Administrator/Tutor 1). The statements show that the shortage of computers affect the development of digital skills among students.

4.4.4 Other Challenges

Additional challenges to ICT usage include socio-cultural factors, with 9% of students reporting feelings of intimidation or shyness when using ICT tools. Cultural expectations also play a role, particularly among female students, as about 6% indicated societal pressure to focus on traditional subjects, with ICT being perceived as a male-dominated field. Furthermore, 5% of students acknowledged being distracted by non-productive online activities. Notably, only 7% of students reported facing no challenges when using ICT in their schools.

4.4.5 Top 3 Challenges Faced Per School and Gender

The top three challenges faced by students at Amasaman SHTS include limited access to ICT resources, which is restricted to scheduled class times (71%), congested academic timetables that prevent effective ICT utilization (34%), and slow or unreliable internet connectivity (30%). Similarly, at Adjen Kotoku SHTS, the predominant challenges are restricted ICT usage due to scheduled classes (70%), unreliable internet connections (39%), and demanding academic schedules that hinder ICT usage (28%). In contrast, Navs SHTS reported slightly different issues, with half of the students indicating limited access to ICT resources confined to class times (50%), followed by slow or unreliable internet connectivity (32%), and a lack of knowledge and skills to effectively use ICT (26%).

From a gender perspective, female students identified the top three challenges as restricted access to ICT resources limited to scheduled class times (71%), insufficient knowledge and skills to use ICT effectively (37%), and packed academic schedules that inhibit ICT use (36%). On the other hand, male students highlighted limited access to ICT resources due to scheduled class times (66%), slow internet connectivity (32%), and overcrowding of the ICT lab, which is frequently full and overbooked (26%), as their primary obstacles to ICT utilization.

In conclusion, the challenges students face in using ICT in school are primarily due to restricted access to ICT resources, technical limitations such as slow and intermittent internet connection, as well as packed schedules, overcrowded labs, limited digital skills and minimal integration of ICT into teaching methods further constrain students' ICT use. Together, these challenges highlight the need for improved ICT infrastructure and funding to support effective digital learning in schools.

4.4.6 Opportunities for ICT Use Among Students

The study reveals significant opportunities for ICT use among students. Quantitatively, 98.7% of students acknowledged the presence of ICT or computer labs in their schools, and 92.7% expressed a desire to use these resources more frequently. This high level of awareness and enthusiasm highlights a strong potential for expanding ICT integration in the educational environment.

Qualitative insights validate these findings by emphasizing the critical role of infrastructure and student enthusiasm. ICT administrators noted that the availability of adequate computer labs provides essential hands-on experiences. When ICT administrators and tutors were asked to identify opportunities that that influence the extent to which students engage with ICT tools. At the school level, investments in resources such as computers and dedicated ICT labs were identified as critical in facilitating ICT use. As one ICT Administrator noted, *"the first one is the availability of the computers and even the space [ICT lab] in general. Once access is there, I think the burden on teachers will be reduced because they [students] will have a hands-on experience with the IT"* (ICT Administrator/Tutor 2). This statement underscores the importance of providing students with the necessary infrastructure to practice and refine their ICT skills.

According to the ICT administrators, there is an opportunity to leverage the influence of teachers in promoting ICT among students. The quantitative findings indicate that about 56% of overall students received support from their teachers, with a stronger focus (67%) among female students. The qualitative study suggest that teachers can be motivated to do more. For instance, one tutor said: *"When teachers assign students certain works [tasks] to do, especially when they need to use the computers, it gives them [students] the chance to come around [visit the ICT lab]"* (ICT Administrator/Tutor 2). This practice not only familiarizes students with digital tools but also helps them develop practical skills and confidence.

There is a recognition of the need for external support to enhance students' access to ICT resources. ICT Administrator/Tutor 3 suggests that partnerships with organizations or companies could provide discounted computers to students, making it easier for them to practice their skills at home. The tutor also advocates for the creation of incentives such as awards or workshops to encourage students' continued engagement with ICT. *"Perhaps if there could be an organisation or a company on standby who may discount computers or give students a discounted computer for parents to pay, maybe within a particular year of school, and then payments be done at regular intervals, I feel that may also enhance the usage of computers*" (ICT Administrator/Tutor 3). This approach would address the resource gap and encourage continuous learning.

The establishment of ICT clubs and exchange programs is proposed as a means of broadening students' exposure to ICT and fostering peer learning. ICT Administrator/Tutor 3 elaborates, *"we want to start a club so that at least they will have the opportunity to interact with other students from other schools so that they can share in their experiences."* This initiative aims to create a collaborative environment where students can learn from one another and stay motivated to pursue ICT-related activities.

Additionally, fostering a culture of ICT excellence through rewards and recognition can motivate students to improve their ICT skills. *"There could be workshops with facilitators or resource persons to sort of also encourage them to use computers and see what people have been able to do with computers"* (ICT Administrator/Tutor 3). Such initiatives could inspire students to pursue ICT-related careers and contribute to a more technologically adept student body.

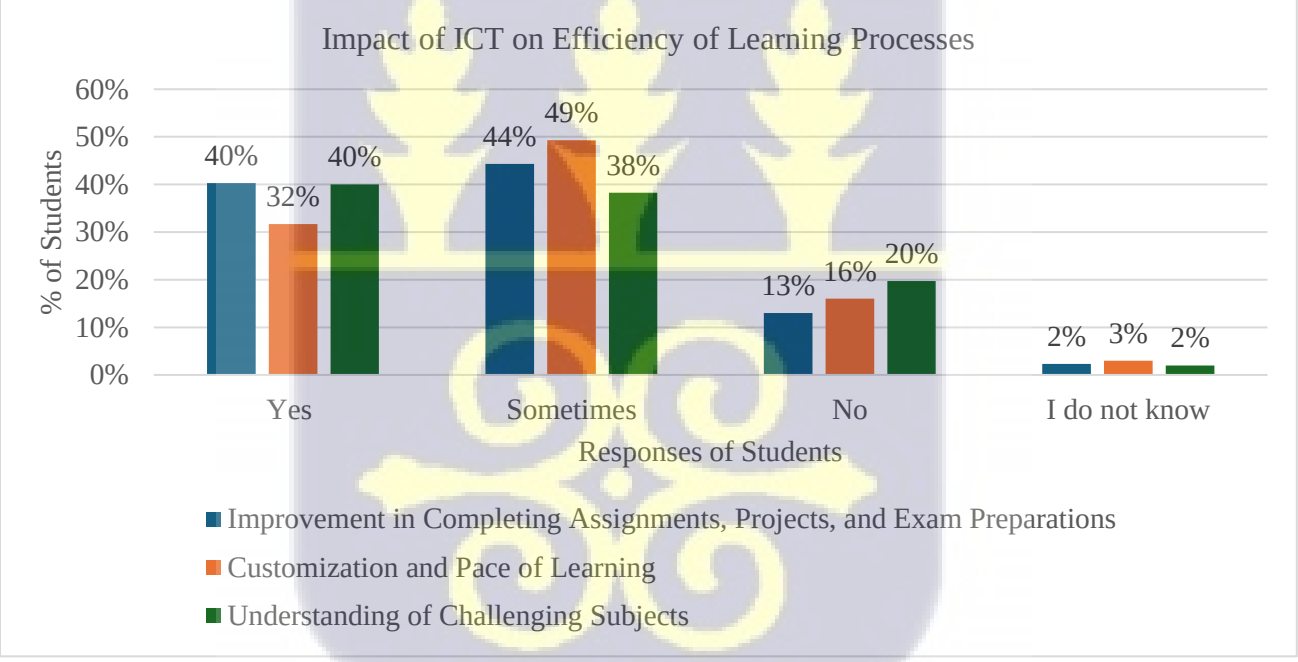
4.5 Objective 3: Impact of ICT Usage on Student Learning Experiences

Generally, the study establishes a positive impact of ICT on student learning experiences, but with only significant impact on the efficiency in the learning process of students.

4.5.1 Impact of ICT on Efficiency in Learning Processes

Quantitative data shows that 40% of students believe ICT improves their efficiency in completing assignments, projects, and exam preparation, while 44% report that ICT sometimes aids in these activities.

Figure 11: Impact of ICT on Efficiency of Learning Processes



Source: Author's Field Survey, 2024.

Improvement in Completing Assignments and Project:

A notable 40% of students affirmed that ICT has significantly improved their ability to complete academic tasks, including assignments, projects and exam preparations. 44% stated that ICT

"sometimes" aids in these activities, suggesting that the benefits of ICT may not be consistently realized across all tasks.

Navs SHTS has the highest percentage of students (56%) who believe ICT has enhanced their ability to complete academic tasks efficiently, indicating strong perceived benefits of ICT use. Adjen Kotoku SHTS follows with 48% of students recognizing ICT's positive impact on their academic work.

Table 12: Impact on Completing Assignments and Projects

Q21.While in school, has ICT usage helped you improve your ability to complete assignments and projects more effectively?	**Amasaman SHTS**	**Adjen Kotoku SHTS**	**Navs SHTS**	**Male**	**Female**
Yes	30.9%	47.9%	55.9%	39.3%	41.3%
Sometimes	45.6%	43.6%	41.2%	45.3%	43.3%
No	20.8%	6.8%	0.0%	12.7%	13.3%
I can’t say / I do not know	2.7%	1.7%	2.9%	2.7%	2.0%

Source: Author’s Field Survey, 2024.

The data shows that both male and female students generally perceive ICT as beneficial for improving their ability to complete academic tasks. There is no statistically significant difference between male and female students' perceptions of ICT's impact on their ability to complete academic tasks in this sample given that the Chi-square statistic is 0.31 with a p-value of 0.96 and 3 degrees of freedom.

Customization and Pace of Learning:

ICT’s ability to support personalized learning was recognized by about 32% (95 students), who stated that it enables them to study at their own pace. However, 49% (148 students) noted that ICT only "sometimes" allows for customized learning experiences, indicating variability in its effectiveness. See Figure 11 for further details.

Understanding of Challenging Subjects:

From Figure 11 above, ICT was found to clarify difficult subjects for 40%, aligning with expectations that technology can enhance comprehension in challenging areas. About 38% reported that ICT sometimes aids in understanding difficult subjects, suggesting that its effectiveness may be subject-specific or reliant on individual learning strategies. However, 20% did not find ICT useful for understanding challenging subjects, and 2% were undecided. These findings reveal that while ICT holds potential for enhancing academic efficiency, its impact is not uniformly realized.

4.5.2 Impact of ICT on Student Engagement and Interactivity

The quantitative data highlights some positive impact of ICT on student engagement and interactivity, with many students reporting enhanced engagement and increased motivation for active participation.

Engagement and Interactivity in the Classroom: A significant portion of students (45%) confirmed that ICT significantly enhanced their classroom engagement and interactivity, reflecting the perceived value of ICT in creating a dynamic learning environment. Additionally, 39% indicated that ICT "sometimes" improved their engagement, suggesting that its effectiveness can vary based on factors. However, 14% did not observe any improvement, and 2% were uncertain.

Motivation for Active Participation: Half of the students (51%) reported that ICT tools and platforms motivate them to engage more actively in classroom activities, discussions, and collaborative projects. Another 40% indicated that ICT "sometimes" motivates them. However, 8% did not find ICT motivating, and 2% were unsure.

4.5.3 Impact of ICT on Skills Development

The findings indicate that ICT usage in senior high schools has positively influenced students' digital skills development, with the majority reporting notable improvements. However, there is considerable variation in the extent of these improvements, underscoring the need for targeted strategies to ensure that all students fully benefit from ICT resources.

Improvement in ICT (Digital) Skills: Approximately 78% of students reported that their ICT skills improved due to using ICT facilities at school. However, 22% did not experience any improvement. Among those who reported improvement, 25% noted significant improvements in their digital skills, while 4% reported very significant improvements, together accounting for 29% of respondents. On the other hand, 40% experienced only minimal gains, with 27% indicating small improvements and 12% reporting very minor gains. Additionally, 31% expressed neutrality.

4.5.4 Overall Learning Experiences and Academic Performance

The study findings indicate that students have experienced improvement in their learning experiences and academic performance due to ICT usage within their schools. Nonetheless, there is no significant difference in overall learning experiences across different ICT usage levels.

4.5.4.1 Overall Student Learning Experiences

The findings reveal that a majority of students (60%) who use ICT at school perceive ICT as having a positive impact on their learning experiences through increased engagement, understanding, and overall educational quality. However, there are variations across gender and schools. A notable 27% of students feel that ICT has not positively influenced their learning, and 13% of students are uncertain about ICT's impact on their learning experiences.

Table 13: Breakdown of Impact on Overall Student Learning Experiences

Q26.While in school, has ICT usage positively impacted your overall learning experiences?	Gender Breakdown		School Breakdown			Total
	Male	Female	Amasaman SHTS	Adjen Kotoku SHTS	Navs SHTS	%
Yes	60.7%	59.3%	55.0%	64.1%	67.7%	60%
No	30.0%	24.0%	32.2%	23.1%	17.6%	27%
I can't say	9.3%	16.7%	12.8%	12.8%	14.7%	13%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100%

Source: Author's Field Survey, 2024.

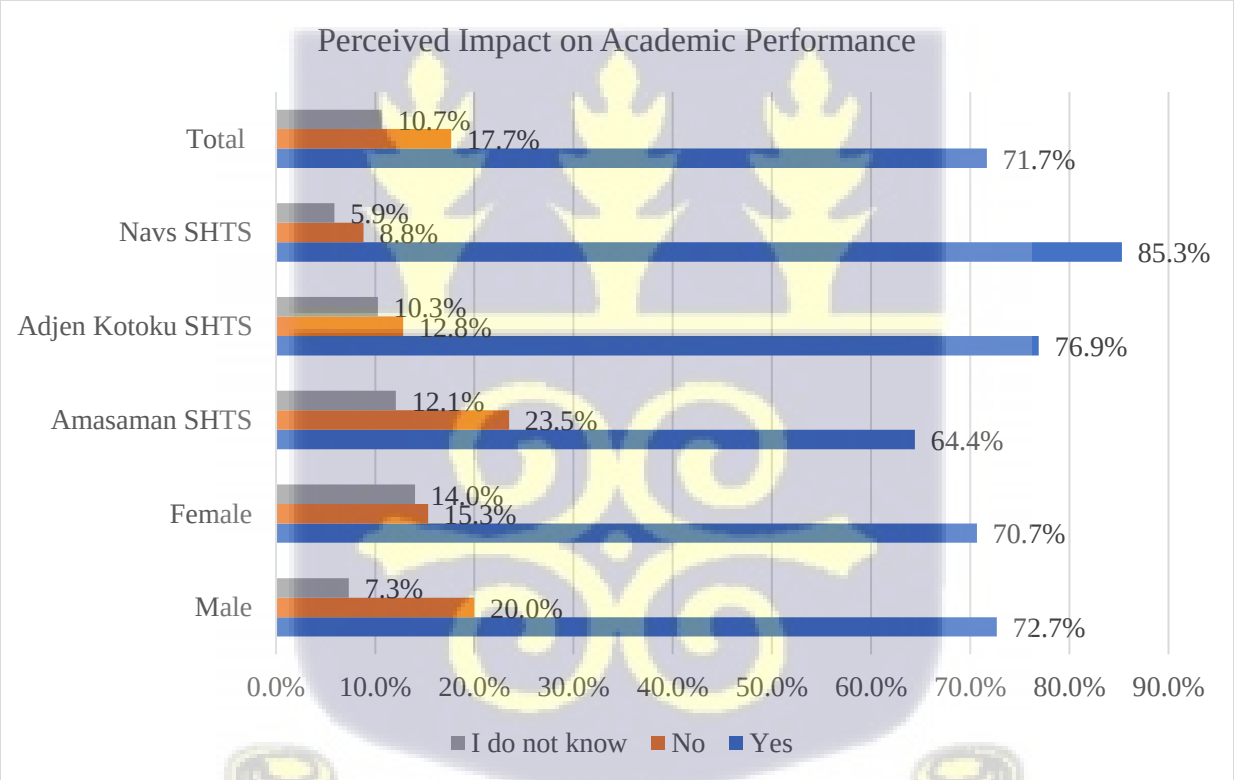
The findings indicate minimal differences between male and female students in their perception of ICT's impact on learning. A slightly higher proportion of male students (61%) reported a positive influence of ICT on their learning experiences compared to female students (59%). Conversely, 30% of male students indicated that ICT had no impact, compared to 24% of female students. However, the chi-square test results, with a p-value of 0.127, suggest that these differences are not statistically significant. This implies that both male and female students generally perceive the benefits of ICT in a similar manner.

At the school level, notable variations were observed in the reported impact of ICT on student learning experiences. Navs SHTS had the highest percentage of students (685%) who felt that ICT improved their learning, followed by Adjen Kotoku SHTS with 64% and Amasaman SHTS with 55%. Despite these variations, most students in all three schools reported benefiting from ICT in their learning. However, Amasaman SHTS had a higher percentage of students (32%) who reported that ICT had no positive effect on their learning, compared to 23% at Adjen Kotoku SHTS and 18% at Navs SHTS. This suggests that while ICT generally enhances learning, its effectiveness may vary depending on specific school environments or resources.

4.5.4.2 Overall Impact on Academic Performance

The data of ICT's overall impact on academic performance shows positive outcomes across gender and school demographics. 72% of all students who used ICT at school expressed that ICT use had positive impact on their academic performance, see Figure 11 below. Both male (73%) and female (71%), have noticed improvements in their academic performance due to ICT usage. Despite this slight variation, the study found no statistically significant difference between male and female students' perceptions of ICT's impact on academic performance.

Figure 12: Overall Impact on Academic Performance by School and Gender



Source: Author's Field Survey, 2024.

Navs SHTS reports the highest percentage of students (85%) experiencing academic improvement due to ICT use, followed by Adjen Kotoku SHTS (77%) and Amasaman SHTS (64%). Despite this overall positive trend, 18% of students who use ICT at school across all schools indicated no

improvement, with the highest percentage at Amasaman SHTS (24%). Additionally, 11% of students are uncertain about ICT's impact on their academic performance, with the greatest uncertainty observed among female students (14%).

Further analysis revealed no statistically significant difference in perceptions of ICT's impact on academic performance among students from different schools. Although there were variations in reported improvements across schools, the Chi-square test result ($\chi^2 = 9.37$, $p = 0.052$) suggests that these differences are not statistically significant. Therefore, most students across all schools perceive ICT as having a positive influence on their academic performance.

4.5.4.3 Results of the Kruskal-Wallis H Test

The Kruskal-Wallis H test was conducted to determine if there were statistically significant differences in students' learning experiences based on their ICT usage levels (Low, Moderate, High). Five learning experience indicators were analyzed: efficiency of learning processes, engagement and interactivity, skills development, overall learning experiences, and academic performance. The results are presented in the table below.

Table 14: Table of Kruskal-Wallis H Test Results

Learning Experience Indicator	Kruskal-Wallis Statistic (H)	p-value	Interpretation
Efficiency of Learning Processes	8.05	0.018	Significant difference across usage levels
Engagement and Interactivity	2.48	0.289	No significant difference
Skills Development	1.71	0.426	No significant difference
Overall Learning Experiences	4.1	0.129	No significant difference
Academic Performance	0.3	0.862	No significant difference

The analysis shows that only the efficiency of learning processes is significantly affected by ICT usage levels. The other indicators, including engagement, skills development, overall learning, and academic performance, do not show significant differences based on how often students use ICT.

4.5.4.4 Qualitative Explanation of Impact of ICT Use on Student Learning Experiences

The qualitative discussions with ICT administrators and tutors reveal the use of ICT have shown promise in enhancing student learning experiences, but issues such as inadequate resources and inconsistent application across subjects limit its effectiveness. One of the ICT administrators emphasized that even minimal access to ICT resources significantly enhances the learning experience: *"OK, so as I mentioned to some extent. It helps. To some extent with the small we have, I mean is better than none is better than none"* (ICT Administrator/Tutor 2). Another tutor highlighted the role of ICT in facilitating interactive and engaging learning experiences: *"So now, you can see that once a while, a teacher comes and say: I want to teach this particular concept, and I want the students to see it for themselves. So, they will ask me for the projector and the PA system... and it makes the teacher's work easier. And then the students also get their understanding more easily"* (ICT Administrator/Tutor 3). This sentiment underscores the value of ICT, even when resources are limited, as it provides students with essential hands-on experience and visual aids that contribute to a more tangible understanding of abstract concepts.

Moreover, the reliance on ICT for teaching specific subjects, particularly elective ICT, was noted as critical for improving the learning process, moving learning from abstract theory to concrete practice. One tutor stated, "*There is never a time I introduce any concept in class without making them [elective ICT students] watch a video of it, particularly using the machines to work*

[practice]" (ICT Administrator/Tutor 1). This approach not only aids in comprehension but also prepares students for practical application.

Furthermore, the occasional integration of ICT in teaching, as described by another tutor, demonstrates its potential to significantly enhance the learning process: *"With the little ICT devices that we have... when you are able to infuse a little bit of practicality and technology in your lessons, you can see that it makes it more easier for even your teaching and for the students to understand it a bit faster"* (ICT Administrator/Tutor 4). This reflects the importance of practical, technology-enhanced learning experiences in fostering a deeper understanding among students.

However, the discussions also pointed out the limitations caused by inadequate ICT infrastructure. As one administrator noted, *"I will not say unavailability, but inadequate ICT tools and infrastructure hasn't helped achieve the objectives of the curriculum that much... I think if those things were addressed, the results could be far better than they are"* (ICT Administrator/Tutor 1). This indicates that while ICT has a positive impact, its effectiveness is hampered by the lack of sufficient resources, which restricts the extent to which students can benefit from these tools.

4.6 Discussion of Findings in Relation to Literature

The findings of this study across all three objectives show a strong alignment with and extension of the literature reviewed in Chapter Two. Concerning the extent of ICT usage (Objective 1), the study addresses the gap identified regarding limited data on usage patterns among secondary school students (Section 2.3.8). Empirical evidence from this study indicates that 70% of students fall into the low usage category. The categorization of users based on usage frequency and duration, as adopted in earlier studies (Hsu et al., 2013; Wang et al., 2014), adds further nuance to the literature by incorporating both gender and school-specific variations for senior high schools

in Ghana. Furthermore, the statistically significant variation in ICT usage across schools ($p = 0.0288$) substantiates literature by Tondeur et al. (2008) and Gerick et al. (2017), who underscore the role of school-level factors—such as infrastructure, teacher competence, and institutional policies—in shaping ICT engagement.

In relation to the challenges and opportunities of ICT usage (Objective 2), the study's findings corroborate several recurring themes in the literature. As reviewed in Section 2.3.9, challenges such as restricted access to computer labs, inadequate peripheral devices, and unreliable internet connectivity are persistent barriers in Ghanaian SHSs (Shaibu & Abubakari, 2021; Yalley, 2022; Antwi et al., 2018). The findings from this study reinforce these assertions, with 87% of students reporting limited access to ICT resources outside class time, and qualitative data confirming overcrowded labs and insufficient technical support. Furthermore, challenges related to digital skill deficits and limited integration of ICT into classroom teaching echo insights from Goldhammer et al. (2016), OECD (2019), and Debrah and Arthur (2018), all of whom stress the importance of digital literacy and effective pedagogy in ICT use. Despite these challenges, the study identifies significant opportunities for improvement. The presence of ICT labs in nearly all schools and the high interest among students (92.7% expressing a desire to use ICT more frequently). These findings suggest that with targeted interventions—such as infrastructure upgrades, teacher capacity-building (Adomako et al., 2022), and partnerships to provide devices—ICT usage can be substantially improved, particularly in peri-urban and rural contexts like Ga West.

Regarding the impact of ICT usage on learning experiences (Objective 3), the findings affirm earlier literature that links ICT use with improved academic efficiency, engagement, and skill development. The data shows that 40% of students report enhanced efficiency in completing assignments due to ICT, a finding that aligns with Tamim et al. (2011) and Debrah and Quaenoo

(2018), who emphasized ICT's role in increasing productivity and enabling personalized learning. Although the Kruskal-Wallis H test indicates that only the "efficiency of learning processes" significantly differs across ICT usage levels ($p = 0.018$), qualitative evidence shows that even minimal integration of ICT tools—such as projectors and digital content—can enhance classroom interactivity and comprehension. This supports the work of Kirschner and van Merriënboer (2018) and Abdallah et al. (2021), who advocate for the pedagogical value of multimedia and smart technologies. However, the study also confirms the limitations noted in the literature: that the broader impact of ICT on academic performance and engagement remains inconsistent when integration is shallow or resources are inadequate (BECTA, 2004; Wuanka, 2017). Overall, this study not only validates key insights from the literature but also provides context-specific evidence that underscores the critical role of equitable infrastructure, teacher involvement, and institutional support in improving ICT use among students while maximizing the educational benefits of ICT at senior high schools in Ghana.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section provides a concise overview of the main results from the study. It highlights how the research objectives were addressed through the integration of the quantitative and qualitative data collected. Based on the findings the chapter draws conclusions and offer practical recommendations for policymakers, educators and diverse stakeholders to improve ICT among senior high students while ensuring full integration of ICT into education.

5.2 Summary of Findings

The study investigated the extent of ICT usage, challenges and opportunities associated with ICT usage, and impact of ICT usage on student learning experiences among senior high school students in Ga West Municipal. The integrated findings from the sequential mixed method design provided a thorough view of the research objectives with a unique focus on students, rather than the dominant focus on teacher use of ICT.

5.2.1 Extent of ICT Use

The study developed a classification of ICT usage for the SHS level which is not readily available in literature. The classification is based on hours used in a week for scheduled ICT classes activities, ICT usage restrictions in SHS, and other parameters unique to students at the SHS level. Most students (70%) fall into the low ICT usage category, using ICT for less than two hours per week, while only 13% engage at a moderate level and 17% at a high level. Qualitative data support these findings, revealing that limited access to ICT resources, restrictions on personal devices, and

insufficient ICT skills as well as technical and operational challenges contribute to the observed low usage. Educators noted that while some students use personal mobile phones for ICT activities, the lack of school resources and skills deficits significantly constrain overall ICT engagement.

5.2.2 Challenges

ICT resource insufficiency and access challenges were a significant barrier, with 87% of students indicating restricted access to ICT resources as the main challenges inhibiting their ICT usage. Overcrowded labs, insufficient ICT infrastructure, and the prioritization of elective ICT students over core students were notable constraints. All schools sampled are constrained by the limited number of ICT resources such as functional computers and peripheral devices, which are insufficient to meet the needs of the student population. Hence, inadequate ICT infrastructure, such as small and fewer ICT labs, forces schools to implement usage regulations, limiting the full potential of ICT for both students and teachers. Qualitative insights highlighted the scarcity of computers and peripheral devices, leading to frustration and disinterest among students and teachers. These findings are consistent with that of Shaibu and Abubakari (2021), who found that the limited infrastructural challenges impede the use of ICT.

Technical challenges, such as unreliable internet connections and outdated equipment, further limited ICT usage. Another key challenge identified by the study is the limited operational funding, which affects the number of functional computers, the availability of internet connectivity, and the overall use of ICT resources. The study found that financial constraints limit the capacity of schools to maintain and upgrade their ICT infrastructure, thereby affecting both access and quality of ICT usage.

In addition to resource-related issues, packed school schedules and restrictions on personal ICT devices limit the opportunities for students to engage with ICT outside of structured class times. Furthermore, the integration of ICT into broader educational activities remains challenging, as schools struggle to incorporate technology into the classroom, which negatively affects both teaching and learning outcomes.

Gender disparities in digital skills also emerged as a prominent challenge. While female students receive more support from teachers, they face greater difficulties in digital literacy compared to male students. This highlights the need for targeted interventions to bridge the digital skills gap among students, particularly for female students.

The challenges identified by the study are consistent with the findings of Edefiogho's (2005) who identified limited equipment, insufficient skills, minimal support, and a lack of interest or knowledge among teachers and administrators. Collectively, these hinder the effective utilization of ICT, reducing its potential to enhance educational experiences.

5.2.3 Opportunities for ICT Use

Despite the challenges identified, the study uncovered key opportunities for enhancing ICT usage within schools. First, students exhibited a high level of awareness regarding the availability of ICT resources and demonstrated strong interest in integrating these tools into their learning experiences. Notably, 91% of students expressed positive interest in utilizing ICT at school, with all three senior high schools reporting over 90% of their student population keen on increasing ICT engagement. This high level of motivation stresses the potential for expanding ICT use, given the strong willingness among students to adopt technology as part of their educational routine.

In terms of skills, most students possess basic to intermediate ICT proficiency, presenting an opportunity for further development. Schools can empower students to make more advanced use of ICT for educational purposes by enhancing these foundational skills. Opportunities for female students lie in the strong support they receive from teachers, which can be leveraged to further enhance their ICT skills and usage. These, in turn, could lead to improved learning outcomes as students become more adept at leveraging digital tools.

At the institutional level, opportunities exist to address resource and infrastructure limitations. Increasing investment in ICT resources would significantly improve accessibility. Increasing the number of computers, multimedia devices, and dedicated ICT labs, and incorporating ICT resources directly into classrooms would also enable broader and more effective use of technology in daily lessons. Furthermore, ensuring adequate operational funding for the maintenance of these resources and continuous availability of internet services are essential for sustaining their functionality.

Teachers are positioned to play a critical role in promoting ICT usage and engagement among students. Encouraging and motivating teachers to integrate technology into their teaching methods can further enhance the learning environment, creating a culture of continuous ICT engagement for students. Hence, teachers can promote ICT use of students by giving assignments or projects that require the use of ICT resources. Also, they can help mitigate gender disparities in ICT use by continuously providing tailored support for female students. These opportunities collectively present a path for schools to optimize ICT usage, ultimately contributing to more dynamic and enriched learning experiences of students.

5.2.4 Impact on Student Learning Experiences

The study found that ICT positively impacts student learning experiences and academic performance, even with limited resources and restricted access. 60% of students reported enhanced learning experiences, and 72% noted improvements in academic performance due to ICT usage. Additionally, approximately 40% of students noted improved efficiency in the learning process, and 45% of students believing ICT significantly enhances classroom engagement.

While male and female students had similar perceptions of ICT's benefits, variations were observed at the school level, with Navs SHTS showing the highest perceived improvement in learning. Tutors validated these findings, highlighting that even minimal ICT resources make learning more effective and engaging when used. However, infrastructural limitations, school regulations and digital skills gaps prevent the full realization of ICT's transformative potential for enhancing learning experiences and academic performance of students.

5.3 Conclusions

The study concludes that ICT usage among students is generally low, primarily due to inadequate ICT resources, access constraints and skill deficiencies. While there is a high level of awareness and enthusiasm for ICT use among students, significant challenges impede its effective use. Despite these barriers, ICT positively influences student learning experiences and academic performance, with students and educators acknowledging its value in making learning efficient, more interactive and engaging. The variations observed between schools suggest that specific institutional contexts and resource availability play a crucial role in determining the effectiveness of ICT. Nonetheless, there was no observed difference between gender.

The study also highlights the potential for improving existing infrastructure, leveraging student interest and providing operational funding to enhance ICT engagement. Forming ICT clubs and establishing partnerships with external organizations are opportunities to provide students with discounted devices offer new opportunities. However, the current implementation is insufficient to fully harness ICT's benefits, as demonstrated by the mixed impact on skill development and the varied perceptions of its influence on learning.

5.4 Recommendations

The following recommendations are made based on the findings of the study.

i. **Enhance ICT Infrastructure:** Schools should prioritize investment in ICT infrastructure, including expanding computer labs, increasing the availability of peripheral devices, and ensuring reliable internet access to support ICT integration across all subjects.

ii. **Expand Access to ICT Resources:** Schools should provide flexible access to ICT resources beyond scheduled class times, enabling students to use the facilities for independent study and personal learning. This may include increasing the number of functional computers and considering alternative arrangements, such as extended lab hours.

iii. **Strengthen Teacher Support and Professional Development:** Teachers should be equipped with the necessary skills and resources to effectively integrate ICT into their teaching practices. Professional development programs focusing on the use of ICT in pedagogy and the creation of ICT-based assignments can enhance student engagement and learning outcomes. Moreover, such programs can be leveraged to equip teachers with

knowledge and skills address the gender disparities in digital literacy, providing female students with targeted assistance to improve their ICT confidence.

iv. **Develop Digital Skills Training Programs:** Implement targeted programs to address digital skills gaps among students. This includes practical training sessions and workshops to build confidence and competence in using ICT tools, particularly for low users' category.

Schools and their educational stakeholders can create an enabling environment that maximizes the benefits of ICT by addressing these recommendations, ensuring that all students can fully participate in and benefit from digital learning opportunities.

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APPENDIX

1. Approval Letter from Ethical Clearance of Humanities, University of Ghana.
2. Introductory Letter from ISSER to Study Area's Assembly
3. Approval Letter for Study Area – Ga West Municipal Education Office
4. Consent Forms
5. Questionnaire for Survey
6. In-depth Interview Guides
7. Observation Protocol & Checklist

Appendix 1: Approval Letter from Ethical Clearance of Humanities, University of Ghana

UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)
P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No: ECH 126/ 23-24

February 13, 2024

Daniel Amewuda
Institute of Statistical Social and Economic Research
University of Ghana
Legon

ETHICAL CLEARANCE
(ECH 126/ 23-24)

The Ethics Committee for the Humanities (ECH) conducted a full-board review and approved your protocol titled:

A STUDY OF ICT USAGE AMONG SENIOR HIGH SCHOOL STUDENTS IN THE GA WEST MUNICIPAL DISTRICT IN GHANA

PRINCIPAL INVESTIGATOR: **DANIEL AMEWUDA**

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid until February 12, 2025. You are required to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

AKDarkwah

Professor Akosua K. Darkwah
ECH Vice-Chair

Cc: Professor Peter Quartey, Institute of Statistical Social and Economic Research, UG
Dr. Fred Dzanku, Institute of Statistical Social and Economic Research, UG

Tel: +233-303933866 Email: ech@ug.edu.gh

Appendix 2: Introductory Letter from ISSER to Study Area's Assembly

UNIVERSITY OF GHANA

INSTITUTE OF STATISTICAL, SOCIAL AND ECONOMIC RESEARCH

OFFICE OF THE DIRECTOR

Ref. No.: ISSER-AC 5/6

October 27, 2023

The Director
Ga West Municipal Education Directorate
Amasaman - Accra

Dear Sir/Madam,

LETTER OF INTRODUCTION: DANIEL AMEWUDA (10937981)

The Institute of Statistical, Social and Economic Research (ISSER), wishes to introduce to you Daniel Amewuda, an MA student in Development Studies with ID number **10937981**.

Mr. Amewuda's research topic is **'A study of ICT usage among senior high school students in the Ga West Municipal District.'** He will therefore need the assistance of your establishment to collect data for the research work. All data collected will be used solely for academic purposes and treated with the strictest confidentiality.

All correspondence should be made directly to Mr. Amewuda [redacted] or ame23dacy@gmail.com. If you have any queries about this, please do not hesitate to contact the MA Coordinator via mail ktasante@ug.edu.gh.

We hope we can count on your kind co-operation.

Yours faithfully,

Prof. Peter Quartey
Director

Cc: MA/MPhil Coordinator, ISSER
Municipal Chief Executive, Ga West District Assembly

P. O. Box LG 74, Legon, Accra, Ghana | Tel: +233 (0) 577 699 900/1 Fax: +233 (0) 577 699 902
Email: isser@ug.edu.gh | info@isser.edu.gh | www.isser.ug.edu.gh

Appendix 3: Approval Letter from Study Area – Ga West Municipal Education Office

GHANA EDUCATION SERVICE

Email: gawestmunicipal@ges.gov.gh
www.facebook.com/gawestmeo
WhatsApp: 030-395 8584
GhanaPost GPS: GW-0007-9161

Ref: GES/GWM/IL/2023/VOL.1/020

REPUBLIC OF GHANA

MUNICIPAL EDUCATION OFFICE
GA WEST MUNICIPAL ASSEMBLY
P. O. BOX AM 80, AMASAMAN
Tel: 034-229 2681/030-395 8584

14TH NOVEMBER, 2023

DISTRIBUTION:
THE HEADTEACHER
-AMASAMAN SENIOR HIGH SCHOOL
-ADJEN KOTOKU SENIOR HIGH SCHOOL
-AKRAMAMAN SENIOR HIGH SCHOOL
-NAVS SENIOR HIGH SCHOOL

INTRODUCTORY LETTER

We write to introduce to you **Daniel Amewuda** an MA student in Development Studies from the University of Ghana.

Mr. Amewuda's research topic is '**A study of ICT usage among Senior High School Students in the Ga West Municipality.**'

All data collected will be used solely for academic purposes and treated with the strictest confidentiality.

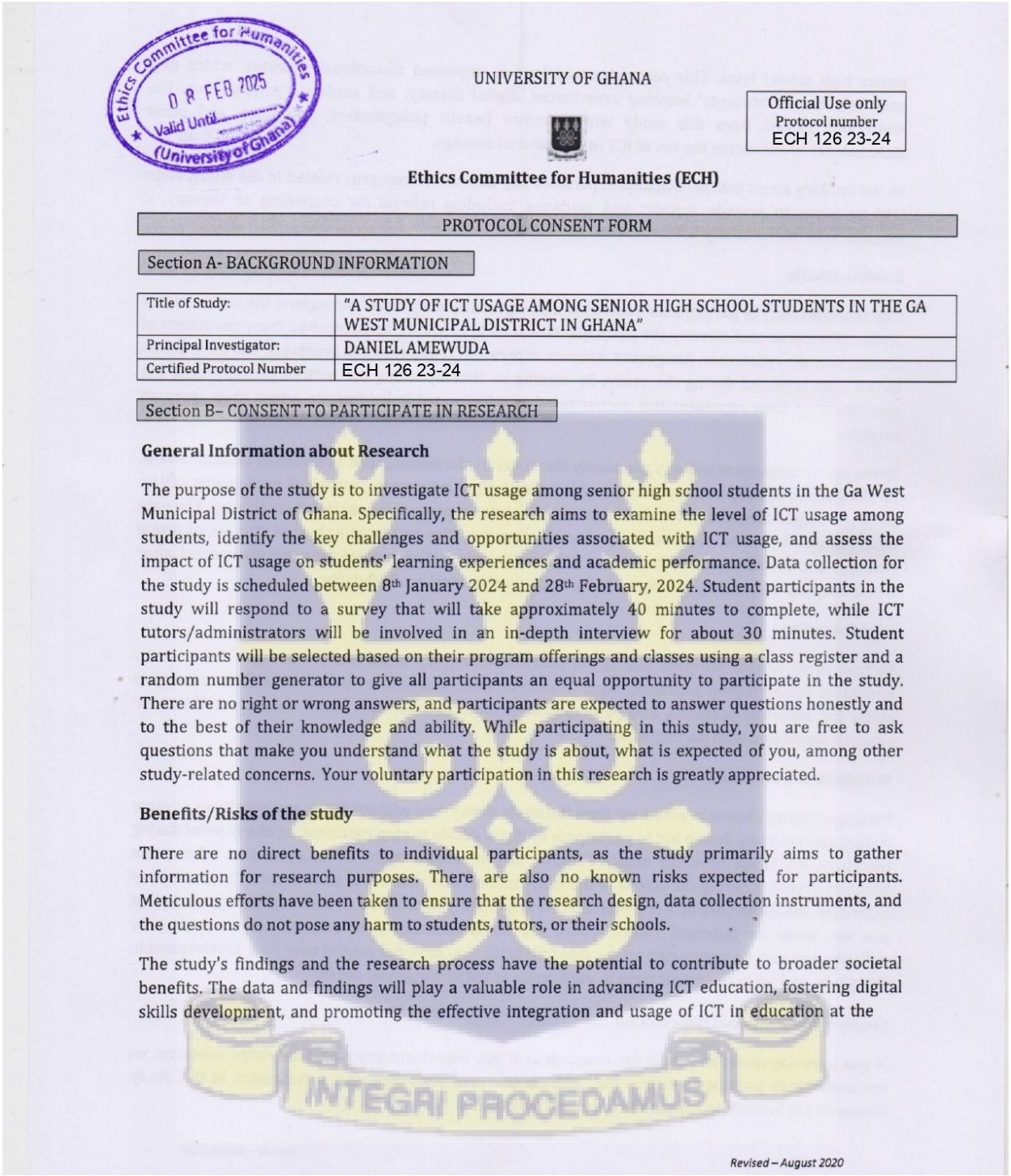
Kindly offer him the necessary assistance to enable him conduct the research and ensure that his interactions with learners and teachers do not interfere with instructional time.

Counting on your co-operation.

Thank you.

VICTOR N. TAWIAH (MR)
DIRECTOR OF EDUCATION
GA WEST MUNICIPALITY
AMASAMAN

Appendix 4: Approved ECH Consent Forms



Ethics Committee for Humanities
08 FEB 2025
Valid Until
(University of Ghana)

UNIVERSITY OF GHANA

Official Use only
Protocol number
ECH 126 23-24

Ethics Committee for Humanities (ECH)

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	"A STUDY OF ICT USAGE AMONG SENIOR HIGH SCHOOL STUDENTS IN THE GA WEST MUNICIPAL DISTRICT IN GHANA"
Principal Investigator:	DANIEL AMEWUDA
Certified Protocol Number	ECH 126 23-24

Section B– CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

The purpose of the study is to investigate ICT usage among senior high school students in the Ga West Municipal District of Ghana. Specifically, the research aims to examine the level of ICT usage among students, identify the key challenges and opportunities associated with ICT usage, and assess the impact of ICT usage on students' learning experiences and academic performance. Data collection for the study is scheduled between 8th January 2024 and 28th February, 2024. Student participants in the study will respond to a survey that will take approximately 40 minutes to complete, while ICT tutors/administrators will be involved in an in-depth interview for about 30 minutes. Student participants will be selected based on their program offerings and classes using a class register and a random number generator to give all participants an equal opportunity to participate in the study. There are no right or wrong answers, and participants are expected to answer questions honestly and to the best of their knowledge and ability. While participating in this study, you are free to ask questions that make you understand what the study is about, what is expected of you, among other study-related concerns. Your voluntary participation in this research is greatly appreciated.

Benefits/Risks of the study

There are no direct benefits to individual participants, as the study primarily aims to gather information for research purposes. There are also no known risks expected for participants. Meticulous efforts have been taken to ensure that the research design, data collection instruments, and the questions do not pose any harm to students, tutors, or their schools.

The study's findings and the research process have the potential to contribute to broader societal benefits. The data and findings will play a valuable role in advancing ICT education, fostering digital skills development, and promoting the effective integration and usage of ICT in education at the

INTEGRI PROCEDAMUS

Revised – August 2020

senior high school level. This research could lead to improved educational practices, which may positively impact students' learning experiences, digital literacy, and academic performance. The knowledge gained from this study will therefore benefit policymakers, educators, and other stakeholders in enhancing the use of ICT in educational settings.

In the unlikely event that participants experience any distress or concerns related to the study, steps will be taken to provide support and guidance, including referral for counseling or therapy, if necessary, to minimize any potential risks.

Confidentiality

The confidentiality of participants' records will be rigorously maintained throughout the course of this study. All records that identify the participants will be kept secure and protected from unauthorized access. Only the researcher, designated research supervisor(s) and research assistants, will have access to the data collected during the study. By signing or thumbprinting the written consent form, the participant or their representative authorizes these designated individuals to access their research records.

Under no circumstances will any personally identifiable information, such as names or contact details, be disclosed in any reports or publications resulting from this research. Instead, all participants will be assigned unique identifiers or codes to anonymize their responses and protect their privacy. The data collected will be stored in password-protected electronic files and locked physical storage, ensuring that only authorized personnel can access it. These records will be retained for a specified period, after which they will be securely destroyed to maintain participants' confidentiality.

Compensation

Refreshments will be provided during the study; however, it's important to note that there are no additional compensation packages, either in cash or kind, available for participants. This research is solely for academic purposes, and participation is entirely voluntary. There are no conditions or rewards associated with participation.

Withdrawal from Study

Participants may choose to withdraw from the study at any time without facing any penalty or adverse consequences. If you decide not to participate or if you decide to stop participating at any point during the study, it will not have any negative impact on you. Furthermore, in the event that information becomes available during the course of the study that may be relevant to your decision to continue or withdraw, the researcher or a representative will promptly inform you or your representative so that you can make an informed choice. There are no circumstances or reasons under which your participation may be terminated by the research team. You have full control over your involvement in this study, and we respect your right to participate or withdraw as you see fit.

Contact for Additional Information

If you have any questions about the research or if you experience any research-related concerns, we are available to provide assistance and address concerns regarding your participation in this study. Please do not hesitate to contact the following individuals:

For General Inquiries and Questions:

Daniel Amewuda
ISSER Graduate Programs
Institute of Statistical, Social and Economic Research (ISSER)
University of Ghana
Email: damewuda003@st.ug.edu.gh
Mobile: +233 240 858 453

ISSER Graduate Programs
Institute of Statistical, Social and Economic Research (ISSER)
University of Ghana
Telephone: +233(0)577 699 900
Email: isser-graduate@ug.edu.gh

For Questions About Your Rights as a Research Participant:

The Administrator of the Ethics Committee for Humanities
ISSER, University of Ghana
Email: ech@ug.edu.gh
Phone: +233 303 933 866

Section C- PARTICIPANT AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

_____

Name of Participant

_____ _____

Signature or mark of Participant Date

Revised – August 2020

If participant cannot read and or understand the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____

Name of witness

_____ _____

Signature of witness / Mark Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____

Name of Person who Obtained Consent

_____ _____

Signature of Person Who Obtained Consent Date

UNIVERSITY OF GHANA

Official Use only
Protocol number
ECH 126 23-24

Ethics Committee for Humanities (ECH)

GUARDIAN /PARENTAL PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	"A STUDY OF ICT USAGE AMONG SENIOR HIGH SCHOOL STUDENTS IN THE GA WEST MUNICIPAL DISTRICT IN GHANA"
Principal Investigator:	DANIEL AMEWUDA
Certified Protocol Number	ECH 126 23-24

Section B– CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

The purpose of the study is to investigate ICT usage among senior high school students in the Ga West Municipal District of Ghana. Specifically, the research aims to examine the level of ICT usage among students, identify the key challenges and opportunities associated with ICT usage, and assess the impact of ICT usage on students' learning experiences and academic performance. Data collection for the study is scheduled between 8th January 2024 and 28th February, 2024. Student participants in the study will respond to a survey that will take approximately 40 minutes to complete, while ICT tutors/administrators will be involved in an in-depth interview for about 30 minutes. Student participants will be selected based on their program offerings and classes using a class register and a random number generator to give all participants an equal opportunity to participate in the study. There are no right or wrong answers, and participants are expected to answer questions honestly and to the best of their knowledge and ability. While participating in this study, you are free to ask questions that make you understand what the study is about, what is expected of you, among other study-related concerns. Your voluntary participation in this research is greatly appreciated. Permission would be sought from the Heads of institutions and/or parents or guardians of students under 18 years to participate in the research.

Benefits/Risks of the study

There are no direct benefits to individual participants, as the study primarily aims to gather information for research purposes. There are also no known risks expected for participants. Meticulous efforts have been taken to ensure that the research design, data collection instruments, and the questions do not pose any harm to students, tutors, or their schools.

The study's findings and the research process have the potential to contribute to broader societal benefits. The data and findings will play a valuable role in advancing ICT education, fostering digital skills development, and promoting the effective integration and usage of ICT in education at the

senior high school level. This research could lead to improved educational practices, which may positively impact students' learning experiences, digital literacy, and academic performance. The knowledge gained from this study will therefore benefit policymakers, educators, and other stakeholders in enhancing the use of ICT in educational settings.

In the unlikely event that participants experience any distress or concerns related to the study, steps will be taken to provide support and guidance, including referral for counseling or therapy, if necessary, to minimize any potential risks.

Confidentiality

The confidentiality of participants' records will be rigorously maintained throughout the course of this study. All records that identify the participants will be kept secure and protected from unauthorized access. Only the researcher, designated research supervisor(s) and research assistants, will have access to the data collected during the study. By signing or thumbprinting the written consent form, the participant or their representative authorizes these designated individuals to access their research records.

Under no circumstances will any personally identifiable information, such as names or contact details, be disclosed in any reports or publications resulting from this research. Instead, all participants will be assigned unique identifiers or codes to anonymize their responses and protect their privacy. The data collected will be stored in password-protected electronic files and locked physical storage, ensuring that only authorized personnel can access it. These records will be retained for a specified period, after which they will be securely destroyed to maintain participants' confidentiality.

Compensation

Refreshments will be provided during the study; however, it's important to note that there are no additional compensation packages, either in cash or kind, available for participants. This research is solely for academic purposes, and participation is entirely voluntary. There are no conditions or rewards associated with participation.

Withdrawal from Study

Participants may choose to withdraw from the study at any time without facing any penalty or adverse consequences. If you decide not to participate or if you decide to stop participating at any point during the study, it will not have any negative impact on you. Furthermore, in the event that information becomes available during the course of the study that may be relevant to your decision to continue or withdraw, the researcher or a representative will promptly inform you or your representative so that you can make an informed choice. There are no circumstances or reasons under which your participation may be terminated by the research team. You have full control over your involvement in this study, and we respect your right to participate or withdraw as you see fit.

Contact for Additional Information

If you have any questions about the research or if you experience any research-related concerns, we are available to provide assistance and address concerns regarding your participation in this study. Please do not hesitate to contact the following individuals:

For General Inquiries and Questions:

Daniel Amewuda
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For Questions About Your Rights as a Research Participant:

The Administrator of the Ethics Committee for Humanities
ISSER, University of Ghana
Email: ech@ug.edu.gh
Phone: +233 303 933 866

Section C- PARTICIPANT AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding my child's participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

_____

Name of Participant

_____ _____

Signature or mark of Participant Date

If participant cannot read and or understand the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____

Name of witness

_____ _____

Signature of witness / Mark Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____

Name of Person who Obtained Consent

_____ _____

Signature of Person Who Obtained Consent Date

Revised – August 2020

Appendix 5: Questionnaire For Survey

A Study of ICT Usage Among Senior High School Students in Ga West Municipal District

Student Questionnaire

Demographics

D0	Name of school	
D1	Name of student	
D2	Gender of student	[ ] Male [ ] Female
D3	Age of student	
D4	Programme offering:	
D5	Class	
D6	Locality of residence	
D7	Region of residence	

SECTION A: ICT USAGE AT SCHOOL SETTING

Note: Circle the number that corresponds to the answer that apples to you.

1. Which of the following ICT infrastructure or devices or tools are available in your school?

ICT or Computer lab	1
School library or reading room computers	2
Multimedia devices such as projector in classrooms	3
Personal Laptop/computer	4
Personal Smartphone/tablets	5
TV/Radio for students	6
TV/Radio for teachers/staff	7
Others	8

2. Which of the ICT facilities or devices do you use when you are at school? (MR/MA)

School ICT or Computer lab	1
School library or reading room computers	2
Multimedia devices such as projector in classrooms	3
Tutor/Staff mobile devices/tablets	4
Tutor/Staff laptop/computer	5
Personal phone/tablet/laptop	6
TV/Radio for students	7
TV/Radio for teachers/staff	8
Not applicable//None of the above	9
Others (specify)	10

3. Which of the ICT facilities or devices do you use **most often** when you are at school? (SR/SA)

School ICT or Computer lab	1
School library or reading room computers	2

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Multimedia devices such as projector in classrooms	3
Tutor/Staff mobile devices/tablets	4
Tutor/Staff laptop/computer	5
Personal phone/tablet/laptop	6
TV/Radio for students	7
TV/Radio for teachers/staff	8
Not applicable/None of the above	9
Others (specify)	10

4. Which of the following ICT tools and platforms do you access when you are in school?

Word processing software such as Microsoft Word, PowerPoint, etc	1
Search engines such as google, bing, etc	2
Social media sites such as Facebook, snapchat, Instagram, TikTok, etc	3
Educational website or academic websites	4
Offline portals or databases such as iBox, etc	5
E-libraries such as …	6
Educational software like mavis beacon, encyclopedia, etc	7
Not applicable/None of the above	8
Others (specify).....	9

5. What is the purpose for which you use the available ICT infrastructure, devices and platforms in school?

Entertainment and social media such as Facebook, TikTok, Snapchat, etc	1
To engage in personal learning or studies	2
To conduct research or find educational information or materials	3
To engage in compulsory class sessions	4
To browse for general information	5
Not applicable	6
Others (specify).....	7

6. How often do you use ICT for any purpose when you are in school (That is use occasion)? **(SR)**

Daily	1
Weekly	2
Fortnightly	3
Monthly	4
Quarterly	5
Half-yearly	6
Yearly	7
Never used before	8

7. How many times do you use ICT per use occasion for any purpose when you are in school? Write number of times here: .....

8. On average, how many hours per use occasion do you spend using ICT in school (including both educational and non-educational activities)?
.....

9. What activities do you perform when using ICT in school?

Access social media, and engage in other leisure activities during breaks.	1
Conduct research and retrieve information	2
Access educational materials such as digital textbooks, educational websites, e-learning platforms	3
Download course materials, subject notes, and study guides.	4
I use educational software and online tools to practice math, language, or other subjects.	5
I use ICT to learn and practice coding, software development, and other technical skills.	6
I access language learning apps and websites to improve my language skills or learn new languages.	7
I use ICT to collaborate and share with my peers on group projects and assignments.	8
I engage in online courses and tutorials to supplement my learning.	9
I access educational video platforms such as YouTube and Google to learn about topics.	10
Type/write essays and reports to complete assignments.	11
Create multimedia presentations, graphics and videos	12
Others (specify).....	13

10. Which of these ICT devices, tools and platforms are used for teaching and learning purposes in classrooms, in addition to any available computer lab in your school?

Classroom computers	1
Projectors	2
smartboards	3
Wifi on campus/internet	4
Multimedia room	5
Others (specify).....	6

Conditions for ICT Usage

11. Which of these conditions or situation apply to the use of school ICT facilities? (SR)

Students are only allowed to use the computer lab when we have a class	1
Students can go to the ICT lab or use library computers for their personal studies	2
The school computer lab is always unavailable or closed for personal learning	3

12. Which of these situations apply to your observation and use of ICT facilities when in school?

When I am in school, I only use ICT when we go for ICT class or multimedia lessons at the lab	1
The school computer lab is always unavailable for my personal learning	2
I can access any ICT facility including ICT labs, multimedia room and smart classroom at any time to learn	3

13. Which of these situations apply to your personal interest and use of ICT when in school?

I like to use ICT when I am at school	1
I do not like to use ICT in school	2

14. How often would you like to use ICT to help with your personal studies when you are in school?

Very Frequently	1
Frequently	2
Occasionally	3
Rarely	4
Never	5

15. Do you receive support from your teachers to use ICT to for your personal learning when you are in school?

Yes	1
No	2

16. What challenges to you face when using **ICT in school?**

My school does not have ICT labs and digital tools that I can use	1
Packed academic schedules prevent me from using ICT	2
The ICT lab is mostly full and overbooked	3
We are only allowed to use the computer lab and other ICT facilities when we have a class	4
I feel intimidate or shy to use the computer lab and other ICT devices	5
I do not know how to use most of the ICT tools and platforms available to me at school	6
Cultural expectations that girls should focus on more traditional subjects or ICT is for boys deter me from using ICT or pursuing technology-related interests.	7
Teaching methods used in our classroom does not often use ICT interactive tools and multimedia	8
Slow or unreliable internet connections	9
My teachers prevent me from using it because it is considered a distraction.	10
Distractions to engage in non-productive online activities	11
Privacy and Security Concerns: Worries about online privacy, data breaches, and cyber threats	12
I do not face any challenges when using ICT	13
Others (specify)	14

SECTION B: ICT USAGE AT HOME

17. Which of the following ICT infrastructure or devices or tools are available to you at home or within your immediate environment?

Personal mobile devices/tablets	1
Personal laptop/computer	2
Parents/Guardian mobile devices/tablets/laptop	3
TV/Radio	4
Community ICT lab	5
Community Library computers	6
Multimedia devices such as projector at home	7
Community Information Center (CIC)	8
None / Not applicable	9
Others (specify).....	10

18. Which of the ICT facilities or devices do you use for ICT activities when at home?

Personal mobile devices/tablets	1
Personal laptop/computer	2
Parents/Guardian mobile devices/tablets/laptop	3
TV/Radio	4
Community ICT lab	5
Community Library computers	6
Multimedia devices such as projector at home	7
None / Not applicable	8
Others (specify).....	9

19. Which of the ICT facilities or devices do you use **most often** when at home? (SR/SA)

Personal mobile devices/tablets	1
Personal laptop/computer	2
Parents/Guardian mobile devices/tablets/laptop	3
TV/Radio	4
Community ICT lab	5
Community Library computers	6
Multimedia devices such as projector at home	7
None / Not applicable	8
Others (specify).....	9

20. Which of the following ICT tools and platforms do you access when at home?

Word processing software such as Microsoft Word, PowerPoint, etc	1
Search engines such as google, bing, etc	2
Social media sites such as Facebook, snapchat, Instagram, TikTok, etc	3
Educational website or academic websites	4

Offline portals or databases such as iBox, etc	5
E-libraries such as	6
Educational software like mavis beacon, encyclopedia, etc	7
Others (specify).....	8

21. What is the purpose for which you use the available ICT infrastructure, devices and platforms at home?

Entertainment and social media such as Facebook, TikTok, Snapchat, etc	1
To engage in personal learning or studies	2
To conduct research or find educational information or materials	3
To engage in compulsory class sessions	4
To browse for general information	5
Not applicable	6
Others (specify).....	7

22. How often do you use ICT for any purpose when you are home (That is use occasion)? **(SR)**

Daily	1
Weekly	2
Fortnightly	3
Monthly	4
Quarterly	5
Half-yearly	6
Yearly	7
Never used before	8

23. How many times do you use ICT per use occasion for any purpose when you are home? Write number of times here: .....

24. On average, how many hours per use occasion do you spend using ICT at home (including both educational and non-educational activities)?
.....

25. What activities do you engage in when using ICT at home?

Access social media, and engage in other leisure activities during breaks.	1
Conduct research and retrieve information	2
Access educational materials such as digital textbooks, educational websites, e-learning platforms	3
Download course materials, subject notes, and study guides.	4
I use educational software and online tools to practice math, language, or other subjects.	5
I use ICT to learn and practice coding, software development, and other technical skills.	6
I access language learning apps and websites to improve my language skills or learn new languages.	7
I use ICT to collaborate and share with my peers on group projects and assignments.	8

I engage in online courses and tutorials to supplement my learning.	9
I access educational video platforms such as YouTube and Google to learn about topics.	10
Type/write essays and reports to complete assignments.	11
Create multimedia presentations, graphics and videos	12
Others (specify).....	13

26. Which of these conditions or situation apply to your use of ICT facilities at home?

My parents/guardian allow me to use ICT devices and platforms by myself	1
My parents/guardian only allow me to use ICT devices and platforms under supervision	2
My parents do not allow me to use any ICT devices or platform	3

27. Which of these situations apply to your personal interest and use of ICT at home?

I like to use ICT when I am at home	1
I do not like to use ICT at home	2

28. How often would you like to use ICT to help with your academic studies when at home?

Very Frequently	1
Frequently	2
Occasionally	3
Rarely	4
Never	5

29. Do you receive support from your parent/guardian/siblings to use ICT to for your personal learning at home?

Yes	1
No	2

30. What challenges do you face when using ICT at home?

I do not have access to ICT device such as computers/laptop, internet, or even smartphones at home	1
My parents consider technology as a distraction, and therefore prevent me from using it at home	2
I do not know how to use most of the ICT tools and platforms available at home	3
Slow or unreliable internet connections	4
I feel intimidate or shy to use the computer lab and other ICT devices at home	5
Cultural expectations that girls should focus on more traditional subjects or ICT is for boys deter me from using ICT or pursuing technology-related interests.	6
Distractions to engage in non-productive online activities	7
Privacy and Security Concerns: Worries about online privacy, data breaches, and cyber threats	8
Others (specify)	9

General Level of Usage

31. How confident do you feel in your ability to use ICT devices, tools and software effectively whether at school or home?

Not confident at all	1
Not very confident	2
Neutral	3
Confident	4
Very confident	5

Preamble

Proficiency assessments help educators, institutions, and employers understand the digital capabilities of students and tailor their support and resources accordingly.

- **Basic ICT Proficiency:** At the basic level, students possess fundamental digital literacy skills. They can perform essential tasks such as navigating computer interfaces, using word processing software, sending emails, conducting basic internet searches, and managing files and folders. Basic ICT users have a foundational understanding of common software applications and can use them for basic purposes.

- **Intermediate ICT Proficiency:** Intermediate-level students have a more advanced skill set. They are proficient in using a wider range of software applications, including spreadsheet and presentation software. They can engage in more complex tasks such as creating multimedia content, conducting research online, and troubleshooting common technical issues. Intermediate users are more comfortable with a variety of digital tools and can apply them in educational and professional contexts.

- **Advanced ICT Proficiency:** Advanced-level students have a high level of digital literacy and competence. They can perform advanced tasks that may include programming, data analysis, graphic design, and software development. They have in-depth knowledge of specific software applications and can adapt to new technologies and tools quickly. Advanced ICT users are often sought after for their ability to leverage technology for complex projects, research, and innovation.

32. Which of the following best describes your level of proficiency in ICT usage?

Basic user	1
Intermediate user	2
Advanced user	3

SECTION C: IMPACT ON PERSONAL LEARNING AND ACADEMIC PERFORMANCE

32. Have your ICT (digital) skills improved or developed as a result of using ICT or ICT facilities within your senior high school?

Yes	1	Continue
No	2	Go to Q34

33. To what extent have your digital skills improved as a result of using ICT or ICT facilities in your school?

Very small extent	1
Small extent	2
Neutral	3
Large extent	4
Very large extent	5

34. While in school, has ICT usage helped you improve your ability to complete assignments, projects, and exams preparations more effectively?

Yes	1
Sometimes	2
No	3
I can't say / I do not know	4

35. While in school, has ICT enabled you to study at your own pace and helped tailor your learning experience to your needs?

Yes	1
Sometimes	2
No	3
I can't say / I do not know	4

36. While in school, has ICT helped you improved your understanding of challenging subjects?

Yes	1
Sometimes	2
No	3
I can't say / I do not know	4

37. Has the use of ICT in the classroom made your learning experience more engaging and interactive?

Yes	1
Sometimes	2
No	3
I can't say / I do not know	4
We do not use ICT in the classroom	5

38. Do ICT tools and platforms motivate you to participate actively in classroom activities, discussions, or collaborative projects?

Yes	1
Sometimes	2
No	3
I can't say / I do not know	4

39. While in school, has ICT usage positively impacted your overall learning experiences?

Yes	1
No	3
I can't say / I do not know	4

40. Have you noticed improvements in your academic performance as a result of using ICT for learning in school?

Yes	1
No	3
I can't say / I do not know	4

41. What benefits do you derive from using ICT to support your education, both at school and home?

ICT helps me access more educational materials	1
ICT helps me search for information or conduct research	2
ICT helps me to understand subject/course content or concepts more	3
I save time when I use a computer for learning.	4
I focus on learning more if I use ICT tools.	5
I remember what I've learnt better if I use ICT tools.	6
ICT make learning faster for me.	7
ICT help improve my grades or get better results in my subjects	8
ICT allows me to collaborate with others to learn easily	9

Opportunities and Recommendations

42. Which of the following statements best apply to you?

I would want to use more of ICT for my personal learning in school	1
I would want to use less of ICT for my personal learning in school	2
I do not want any changes to the current ICT usage in my school	3

43. What can be done for you to improve your ICT usage at school?

.....

44. What can be done for you to improve your ICT usage at home?

.....

-The End –

Thank you for completing our questionnaire.

Appendix 6: In-depth Interview Guides

Study of ICT Usage Among Senior High School Students in Ga West Municipal District

In-depth Interview - Discussion Guide (ICT/Lab Administrator Only)

Demographics

D0	Name of school	
D1	Name of ICT tutor / administrator	
D2	Gender of tutor	[ ] Male [ ] Female
D3	Locality of residence	
D4	Region of residence	

1. What ICT infrastructure or devices or tools are available in your school? **Probe for:**
   - ICT lab
   - Classroom computers / multimedia devices
   - Library computers / devices
   - Availability of internet
2. What devices or ICT facilities do students use for ICT activities when they are in school? **Probe**:
   - School ICT or Computer lab
   - School library or reading room computers
   - Multimedia devices such as projector in classrooms
   - TV/Radio for students
   - TV/Radio for teachers/staff
   - Tutor/Staff mobile devices/tablets
   - Tutor/Staff laptop/computer
   - Personal phone/tablet/laptop
   - Others (specify) .....
3. Which ICT facilities do students **use most often** when in school?
4. What kind of activities do students engage in when they use ICT facilities within the school?
5. What are the state and adequacy of available ICT infrastructure in your school?
6. What are the key weaknesses or challenges associated with ICT usage among your students. **Probe:**
   - ICT infrastructure and devices
   - ICT tools and platforms
   - School environment and conditions for use
   - Student attitude and interest; Digital skills
   - Academic schedule and availability of time (packed?)
7. What are the opportunities associated with ICT usage for your students.
8. What threatens ICT usage among your students for learning and academic improvement?
9. How has the integration of ICT tools and resources or otherwise affected the quality of teaching and learning in your educational institution?
10. How has the availability/unavailability and (non)usage of ICT impacted students' personal learning and academic performance?

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Modified IDI Guide After Quantitative Analysis:

IN-DEPTH INTERVIEW - DISCUSSION GUIDE

A study of ICT Usage Among Senior High School Students in Ga West Municipal Assembly.

Demographics

D0	Name of school	
D1	Name of ICT tutor / administrator	

ICT Resources:

1. What ICT infrastructure or devices or tools are available in your school? Which ones do students use often and why?
2. What is the state of available ICT infrastructure in your school?
    - Functional vs non-functional devices
3. How frequently do students use available ICT infrastructure? ICT labs, internet, multimedia rooms, etc.
    - *Scheduled Class (group) use vs personal use.*

School Regulations of Student ICT Use

4. What regulations exist for student usage of available ICT devices?
5. What are the specific usage regulation challenges or issues that are affecting students' use of ICT within the educational setting?

Actual Usage

6. What kind of activities do students engage in when they use ICT facilities within the school?
7. What school level factors influence ICT usage among students in your school?
    - *Only 16.7% of students use ICT for writing and typing essays and reports? Why?*
8. Overall, how would you rate the extent of ICT use among students in your school? (1) low use or users (2) moderate use or users (3) high use or users

Key Challenges:

9. What are the key challenges associated with ICT usage among your students.

Key Opportunities:

10. What opportunities are available to increase students' ICT usage within the educational setting.

Impact on Student Learning Experiences

11. How has the availability/unavailability and (non)usage of ICT impacted students' learning and academic performance?
    - Perceived student engagement and interactivity
    - Perceived improvement in learning processes
    - Perceived improvement in digital skills
    - Perceived improvement in overall learning experiences

Appendix 7: Observation Protocol & Checklist

Observation Guidelines:

This observation protocol provides a structured framework for systematically observing and documenting various aspects of ICT usage among senior high school students in the Ga West Municipal District.

Data Collection Method:

- Direct observation by researcher or designated observers
- Use of observation checklist or log to record observations in real-time

Duration and Frequency:

- Observations conducted over multiple sessions across different times of the school day
- Duration of observations varies based on availability and schedule constraints

Setting:

- Various locations within Senior High Schools (SHTS) in Ga West Municipal District including ICT labs, classrooms, libraries, common areas

Participants:

- Senior High School students (Form 3)
- ICT tutors or facility managers

OBSERVATION CHECKLIST:

A study of ICT Usage Among Senior High School Students in Ga West Municipal Assembly.

This checklist is designed to record observations in real-time during the study of ICT usage among senior high school students. Observers should fill out the checklist based on their observations and note any significant findings or insights.

Date: _____ Name of Observer: _____

School Name: _____ Grade/Class: _____

1. Availability and Functionality of ICT Facilities:
    - Number of functional computers: …….
    - Number of non-functional computers: …….
    - Number of ICT labs: …….
    - Number of school library computers: ……
    - Number of multimedia rooms: ……...
    - Availability of functional internet access in ICT labs……..
    - Availability functional internet access in the libraries……
    - Availability of functional internet access in classrooms……..

Notes on ICT resources:

……
……
……
……
……

2. Frequency of ICT Usage: How often students access ICT facilities during school hours

……
……
……
……
……

3. Types of ICT Activities: Specify activities students engage in using ICT (e.g., research, assignments, gaming, social media)

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……
……

……
……

4. Variety of software and applications utilized for academic and non-academic purposes

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……
……
……
……

5. Challenges and Barriers: Observe obstacles hindering effective ICT usage (e.g., technical issues, lack of resources, connectivity issues)

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……
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……

6. Observations on how students and tutors address or overcome these challenges

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……
……
……
……

Additional Comments/Notes on Overall Observations:

……
……
……
……
……
……
……
……

Name of Observer: ……..

Signature of Observer: ……