

UNIVERSITY OF EDUCATION, WINNEBA



**TECHNOLOGY-DRIVEN EDUCATIONAL INNOVATION IN SEMI-URBAN
GHANA: A CASE STUDY OF ATWIMA-NWABIAGYA DISTRICT**

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GHANA: A CASE STUDY OF ATWIMA-NWABIAGYA DISTRICT**

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DECLARATION

Student's Declaration

I, RUTH AMA SARPONG, declare that this dissertation, except for quotations and references contained in the published works, which have all been identified and duly acknowledged, is entirely my original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature:.....

Date:.....

Supervisor's Declaration

I hereby declare that the preparation and presentation of this work were supervised in accordance with the guidelines for supervision of dissertations as laid down by the University of Education, Winneba.

Name: **Mr. Eric Ofosu-Dwamena (Supervisor)**

Signature:.....

Date:.....

DEDICATION

To my parents, Pastor and Mrs. Sarpong, whose unwavering belief in me and immense sacrifices made it possible for me to attain this certification.

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I am deeply grateful to my supervisor, Mr. Eric Ofofu-Dwamena of the University of Education, Winneba, for his constructive criticisms and insightful suggestions, which greatly contributed to the successful completion of this work.

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LIST OF ACRONYMS

COVID	Corona Virus Disease
GKSB	Ghana Knowledge and Skills Bank
ICT	Information Communication and Technology
NGO	Non-governmental Organisation
STEM	Science, Technology, Engineering and Mathematics
SEIP	Secondary School Improvement Project
SMS	Short Message Service
MOOC	Massive Open Online Course
UNESCO	United Nations Educational, Scientific and Cultural Organisation
OERs	Open Educational Resources
PLCs	Programmable Logic Controllers

ABSTRACT

The study examines the role of technology as a catalyst for educational innovation in semi-urban communities, with a specific focus on the Atwima Nwabiagya District of Ghana. It investigates the accessibility and availability of educational technology, the obstacles hindering effective technology integration, and the ways in which technology can help bridge educational gaps in these communities. To capture real-world experiences with educational technology, the study employs qualitative research methods, incorporating observations and interviews with students and educators. Findings indicate that although digital devices and resources are present in schools, their utilisation is often limited by infrastructural deficits, insufficient teacher capacity, insecure facilities, and restrictive administrative policies. Despite these challenges, the study reveals that when effectively integrated, technology enhances learning outcomes, particularly when it supports innovative teaching practices in comparable semi-urban contexts in Ghana and beyond. The study underscores the urgent need for targeted interventions in leadership, infrastructure, and professional training to fully harness the transformative potential of technology in semi-urban education. These insights are intended to inform policy development and guide practical strategies aimed at promoting inclusive, technology-driven educational innovation in similar settings across Ghana and elsewhere.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

In recent years, the rapid improvement of technology has fundamentally transformed various sectors all around the world, with education being one of the most significantly impacted domains. In both developed and developing countries, technology has become a vital tool for enhancing teaching and learning, improving the easy accessibility of education, and advancing innovation (Costache & Enachescu, 2025; Southern Voice, 2023). In the quest to bridge the gaps in quality, equity, and inclusiveness, the integration of technology in education is seen as a catalyst, particularly in contexts where traditional educational resources are limited.

Interestingly, the use of technology in education has evolved from the mere provision of computers in schools to the integration of sophisticated digital learning environments, online resources, and artificial intelligence-driven adaptive learning systems globally (World Bank, 2022). What further accelerated the adoption of digital learning platforms, remote instruction, and blended learning models, compelling educators and policymakers to rethink traditional pedagogical approaches, is the havoc that hit the world: the COVID-19 pandemic (UNESCO, 2023). In developed countries, educational technology has been leveraged to personalise learning, offer differentiated teaching methods and facilitate teamwork irrespective of one's location.

In Africa, the adoption of educational technology has been uneven, with significant disparities between urban, semi-urban, and rural areas (Southern Voice, 2023). While urban centres often benefit from better infrastructure and investment, semi-urban and

rural communities face persistent challenges such as limited access to digital devices, unreliable electricity, insufficient internet connectivity, and inadequately trained teachers (Ibrahim et al., 2022). Despite these challenges, there have been notable efforts by governments, non-governmental organisations, and private sector actors to promote digital inclusion and innovation in education.

Ghana, in particular, has demonstrated a strong commitment to digital transformation in education. The government's 'One Teacher, One Laptop' initiative, launched in 2021, seeks to provide digital infrastructure, distribute laptops to teachers, and integrate digital content and management systems into schools nationwide. Teachers in kindergarten to senior High school were all-inclusive (Sarpong, 2023). These efforts aim to prepare teachers for the demands of the 21st-century digital economy and to foster a culture of innovation and lifelong learning.

To give students in under-performing senior high schools access to additional educational resources, the Secondary Education Improvement Programme (SEIP) funds the development and deployment of the i-box (a local file server that doesn't require internet access) and i-campus (a web-based server that does require internet access). It is anticipated that the program will help 2,000 senior high school instructors and headmasters, 30,000 new secondary school students, 150,000 students in under-performing schools, and other education officials (Sarpong, 2023).

Semi-urban communities occupy a unique position in the educational landscape. As the name suggests, they are often characterised by a blend of urban and rural features, with moderate access to infrastructure and services. However, they frequently fall through the cracks of policy interventions that target either urban or rural extremes (Yeboah & Agyekum, 2024). In Ghana, districts like Atwima Nwabiagya illustrate the

challenges faced by semi-urban areas. Though not as undeserved as rural communities, they mostly lack the full range of resources available in urban centres.

The digital divide in semi-urban communities manifests in several ways. Schools may have limited or outdated ICT equipment, infrequent internet access, and teachers who lack training in using digital tools (Ibrahim et al., 2022). Students from low-income households may not have access to devices at home, further exacerbating educational inequalities. Social enterprises and public-private partnerships, such as Bluetown's AccessSTEM initiative, have begun to address these gaps by providing affordable, off-grid digital solutions and open educational resources to semi-urban and rural schools (Bluetown, 2022).

Technology holds immense potential as a catalyst for educational innovation in semi-urban communities. It can facilitate access to high-quality learning materials, enable interactive and personalised instruction, support teacher professional development, and foster collaboration among students and educators (Costache & Enachescu, 2025). Moreover, technology can help bridge the divide between urban and semi-urban schools by providing opportunities for remote learning, virtual exchanges, and access to global knowledge networks.

However, realising this potential requires a nuanced understanding of the specific barriers and enablers in semi-urban contexts. Factors such as infrastructure, teacher readiness, policy support, community engagement, and cultural attitudes towards technology all play a critical role in shaping the effectiveness of educational technology interventions (Southern Voice, 2023).

The Atwima Nwabiagya District, located in the Ashanti Region of Ghana, is a semi-urban area with a diverse population and a mix of public and private educational

institutions. The district has been a beneficiary of several governments and donor-supported educational initiatives, yet disparities in technology access and integration persist. By focusing on this district, the study seeks to provide a nuanced analysis of the factors influencing technology adoption in semi-urban settings and to generate insights that can inform policy and practice at both local and national levels.

1.1 Conceptual Framework

The study's conceptual framework is grounded in the interaction of three core components:

1.1.1 The Accessibility and availability of educational technology

Accessibility (the ease with which teachers and learners can use technologies) and availability (the physical presence of hardware, software, and connectivity) are foundational to whether schools in semi-urban Ghana can adopt and sustain educational technology. Where either is weak, pedagogical integration stalls and equity gaps widen. Many semi-urban and deprived basic schools lack reliable electricity and functioning ICT facilities. Analyses of basic-school infrastructure in Ghana show that a substantial share of primary and JHS institutions are not connected to reliable power, which directly limits the use of computers, projectors, and other devices. Empirical work demonstrates the close relationship between electricity access and the ability to use ICT for teaching and learning.

Monitoring by civil-society groups and the press highlights severe shortages of functioning ICT labs in deprived districts: recent EduWatch monitoring reported that only about 2% of deprived basic schools had functional ICT labs, indicating that many semi-urban schools (which are often classified as deprived) do not have the basic hardware needed to teach Computing as a practical subject. This lack of

equipment means that computing curricula are frequently taught without hands-on access to computers (EduWatch, 2025). Internet penetration in basic and junior-high schools is low: national reviews and sector briefs document that only a minority of schools have reliable internet access suitable for rich, cloud-based learning. Low or absent connectivity in semi-urban schools constrains the adoption of online platforms, virtual classrooms, and up-to-date digital resources (Sarpong, 2023).

Sarpong (2023) states that here technology exists in semi-urban settings, it is often limited in type and quantity (few computers, many old machines), and teachers frequently rely on mobile phones or low-bandwidth tools rather than full ICT labs. Consequently, many classrooms use offline or SMS-based solutions and local servers (e.g., i-Box / Raspberry Pi solutions) as pragmatic workarounds when internet and power are unreliable. National statistics reveal that millions of school-age children had not used an ICT device in the months prior to recent surveys, underscoring the scale of digital exclusion that will affect semi-urban pupils as well as rural ones. These large numbers point to systemic inequities in access that extend beyond single schools to household and community levels.

Government and non-government initiatives aim to expand access (e.g., tablet distribution projects, teacher competency frameworks, and offline server deployments). However, evidence and monitoring suggest the gap between policy and practice remains: distribution of devices or policy frameworks alone is insufficient without reliable power, maintenance plans, connectivity, and teacher support. Locally appropriate solutions (offline servers, SMS/MOOC designs for low bandwidth, solar power) show promise where they are matched to the infrastructural realities of semi-urban schools (Sarpong, 2023)

1.1.2 Barriers to Technology Integration in Semi-Urban Educational Settings

Technology integration in education offers significant potential for improving teaching and learning; however, its implementation in semi-urban communities is often hindered by a range of contextual barriers. These challenges limit the effective use of digital tools and reduce opportunities for innovative teaching practices. A major barrier is inadequate infrastructure, including unreliable electricity supply, poor internet connectivity, and insufficient ICT facilities. Many semi-urban schools struggle with inconsistent power supply and limited broadband access, which undermines the routine use of digital tools in teaching and learning (Bervell & Umar, 2020). According to Asante and Acheampong (2022), infrastructure gaps remain the single most significant impediment to widespread ICT adoption in Ghanaian schools.

Even where schools have some ICT infrastructure, access to functional digital devices like computers, tablets, projectors, and printers remains limited. In semi-urban areas, schools often rely on a small number of outdated devices, making it difficult to integrate technology meaningfully into classroom lessons (Boateng, 2023). Students also face personal device limitations because many households cannot afford laptops or smartphones. Educators' competency in using technology effectively is critical. Lack of adequate ICT training and professional development continues to inhibit technology integration. Studies show that teachers in semi-urban schools feel underprepared to use digital tools for instruction due to limited training opportunities and insufficient pedagogical support (Agyei & Voogt, 2019). Without digital literacy, even available technologies are underutilised or used solely for administrative tasks rather than instructional innovation.

Technical assistance is essential for maintaining devices, troubleshooting software issues, and ensuring the ongoing use of ICT tools. Semi-urban schools frequently lack trained ICT support personnel, leading to long downtimes when devices malfunction (Bervell & Umar, 2017). Lack of maintenance culture further compounds the issue, resulting in broken devices that remain unrepaired for long periods. Socioeconomic constraints also play a significant role. Families in semi-urban areas may face financial limitations that prevent students from accessing digital tools at home, widening the digital divide (Owusu-Agyeman, 2020). Household income levels influence students' exposure to technology, affecting their readiness to engage with digital learning platforms. Resistance to change, fear of technology, and traditional pedagogical preferences can hinder integration. Some teachers prefer conventional teaching methods and may view technology as burdensome rather than beneficial (Tondeur et al., 2017). Moreover, school leaders may lack the vision or commitment needed to champion ICT adoption.

1.1.3 Technology as a Bridging Tool in Semi-Urban Communities

Technology serves as a crucial bridging tool in education by reducing disparities in access to information, improving teaching and learning processes, and expanding opportunities for learners in underserved contexts such as semi-urban communities. When integrated effectively, digital tools help connect learners to global knowledge resources, enhance instructional delivery, and mitigate inequities rooted in geography, socioeconomic status, and institutional limitations. Technology offers opportunities to bridge gaps between resource-rich and resource-poor schools. Through digital platforms, learners in semi-urban areas can gain access to high-quality educational content that may not be available locally (UNESCO, 2020). Learning management

systems, e-libraries, and open educational resources (OERs) provide students with materials that supplement traditional textbooks, thereby improving learning outcomes.

ICT tools such as interactive software, virtual laboratories, and multimedia resources improve instructional quality and learner engagement. According to Anderson and Dron (2012), technology-enabled learning environments foster active and collaborative learning, making it easier for teachers to differentiate instruction to meet diverse student needs. In semi-urban schools, where teacher shortages and large class sizes are common, technology supports more effective curriculum delivery. Technology bridges geographic boundaries by connecting students and teachers in semi-urban communities with global educational networks. Digital communication tools including; video conferencing, email, and online forums facilitate peer collaboration and exposure to global best practices (Redecker, 2020). This connectivity fosters digital citizenship and prepares students for participation in a globalised knowledge economy.

For teachers, technology serves as a bridge to continuous professional learning. Online training platforms, webinars, and virtual professional learning communities (PLCs) offer innovative ways for educators to build ICT competencies and share teaching strategies. Tondeur et al. (2019) note that technology-enabled professional development enhances teachers' pedagogical, technological, and content knowledge (TPACK), enabling them to integrate ICT more effectively in the classroom. Technology has the potential to mitigate socioeconomic inequities by providing low-cost or free learning solutions. Mobile learning, in particular, is expanding access for students who may not own laptops but have access to mobile phones. Research shows that mobile-based learning improves access to digital content for learners in low-

resource communities (Traxler, 2018). This makes mobile technology a powerful equaliser in semi-urban educational contexts. Assistive technologies, such as screen readers, speech-to-text tools, and digital audio materials, help bridge gaps for students with disabilities. ICT supports differentiated learning pathways, ensuring that students with diverse needs can participate fully in classroom activities (WHO & UNICEF, 2022). This aligns with inclusive education goals and helps semi-urban schools address learning disparities.

Technology functions as an essential bridging tool by equalising access to learning resources, connecting semi-urban learners to global knowledge networks, supporting teacher development, and mitigating socioeconomic and infrastructural limitations. Its strategic use can significantly transform educational systems and promote more equitable learning outcomes in semi-urban Ghanaian communities.

1.2 Conceptual Framework

The framework conceptualises technology-driven educational innovation as a dynamic process relying on accessibility, overcoming barriers, and strategic use of technology to foster educational equity in semi-urban Ghana. The framework views technology as a potential means to overcome the educational divide caused by geographic and socioeconomic disparities, enhancing learning opportunities and inclusion.

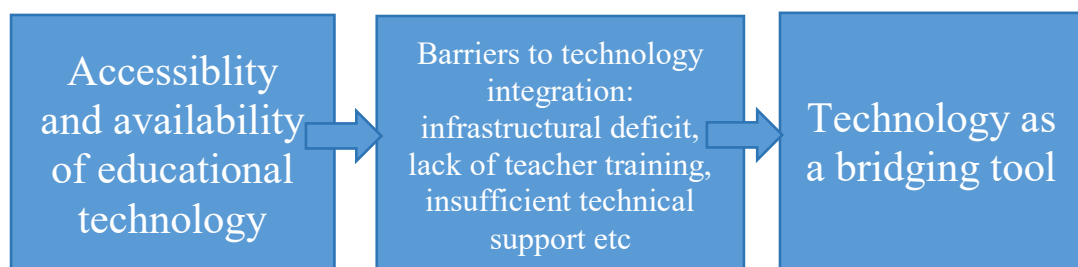


Figure 1: A conceptual framework of the availability and barriers to technology integration in semi-urban Ghana.

1.3 Statement of the Problem

There are continuous educational disparities between Semi-urban centres and urban communities, as the former are faced with limited access to advanced resources and pedagogical tools (Akom et al., 2016). While urban schools benefit from cutting-edge resources, semi-urban institutions often struggle with outdated methods, widening the digital divide. For instance, only 34% of semi-urban Indian schools have access to advanced learning technologies, compared to 68% in urban areas (India Today, 2024). This disparity underscores the urgent need for technology-driven interventions tailored to semi-urban contexts.

To close these gaps and provide adaptable, equitable learning solutions, technology emerges as a force altering the landscape of education. With an emphasis on their ability to equalise access and enhance results, this study examines how interactive tools, hybrid learning models, and participatory technologies propel educational innovation in semi-urban environments.

Educational inequities in semi-urban regions are exacerbated by infrastructural deficits and a lack of localised pedagogical strategies (Akom et al., 2016). Despite Ghana's ambitious efforts to promote digital education, significant disparities remain in the accessibility and effective use of educational technology in semi-urban districts like Atwima Nwabiagya. While initiatives such as the "Ghana Smart Schools project" have increased the availability of digital devices and infrastructure, many schools in semi-urban areas continue to face critical challenges: One such challenge is Inadequate Infrastructure. Many schools lack reliable electricity, sufficient internet connectivity, and up-to-date ICT equipment, limiting the effective use of technology in teaching and learning (Ibrahim et al., 2022; Southern Voice, 2023). Another

challenge is Limited Teacher Capacity. Teachers often lack the necessary training, confidence, and ongoing support to integrate technology into their pedagogical practices (Yeboah & Agyekum, 2024).

Again, there is the issue of Socioeconomic Barriers. Students from low-income families and teachers who are not financially fit may not have access to digital devices or internet connectivity at home, exacerbating educational inequalities (Costache & Enachescu, 2025). Policy and Implementation Gaps cannot be left out, as they pose a challenge faced by schools in semi-urban communities. While national policies support digital education, there are gaps in implementation at the district and school levels, particularly in semi-urban contexts (Resilient Digital Africa, 2024).

These challenges hinder the full realisation of technology's potential to enhance learning outcomes, promote educational innovation, and bridge the divide between urban and semi-urban communities. Without targeted interventions and sustainable support, the digital divide may persist or even widen, leaving students in semi-urban areas at a disadvantage compared to their urban counterparts.

1.4 Purpose of the Study

The main purpose of this study is to examine the role of technology as a catalyst for educational innovation in semi-urban communities, with a specific focus on the Atwima-Nwabiagya District of Ghana. The study seeks to explore how digital tools, resources, and practices are shaping teaching and learning processes in this context, and the extent to which technology contributes to improving educational access, equity, and instructional quality.

More specifically, the study aims to investigate the availability and accessibility of educational technologies in selected schools, identify the barriers that hinder effective technology integration, and examine how teachers and students utilise digital tools to enhance learning. By analysing these dimensions, the study intends to generate a nuanced understanding of the transformative potential of technology in semi-urban educational settings and how it can drive innovative pedagogical practices.

Ultimately, the purpose of the study is to provide evidence-based insights that can inform policy formulation, leadership decisions, and practical interventions aimed at strengthening technology-enabled education in semi-urban Ghana. Through a qualitative case study approach, the research contributes to broader discussions on digital inclusion and the role of technology in promoting equitable and innovative learning environments.

1.5 Objectives of the Study

For the purpose of achieving the main objectives of this study, further specific objectives were derived as follows:

- 1 Examine the accessibility and availability of educational technology in semi-urban communities
- 2 Identify the barriers to effective technology integration in semi-urban educational communities.
- 3 Examine how technology can help to bridge the divide in semi-urban communities

1.6 Research Questions

In an attempt to achieve the set research objectives, the following research questions were posed.

- 1 Are educational technologies accessible and available in Atwima Nwabiagya District?
- 2 What are the barriers to effective technology integration in Atwima Nwabiagya District?
- 3 What are some of the ways to bridge the digital divide in Atwima Nwabiagya District?

1.7 Significance of the Study

This study provides a focused analysis of the state of educational technology in semi-urban Ghana, an area often overlooked in favour of urban or rural extremes. By identifying specific barriers to technology integration in the Atwima Nwabiagya District, the study offers evidence-based recommendations for policymakers, educators, and development partners.

The research highlights the potential of technology to bridge educational divides, promote equity, and foster innovation, with implications for national strategies and local implementation. Insights from this study can inform the design of targeted interventions, such as professional development for teachers, community-driven digital hubs, and affordable connectivity solutions, ultimately contributing to the achievement of Sustainable Development Goal 4: Quality Education for All.

The research will contribute to the growing body of literature on educational technology adoption in developing countries, particularly in semi-urban contexts that are often overlooked in favour of urban or rural extremes. By providing empirical

evidence from the Atwima Nwabiagya District, the study will enhance understanding of the unique challenges and opportunities associated with technology integration in semi-urban schools.

Findings from the study will inform policymakers at the national, regional, and district levels about the specific needs and barriers faced by semi-urban schools. This will support the design of targeted interventions, resource allocation, and capacity-building initiatives aimed at promoting digital inclusion and educational innovation.

The study will offer practical recommendations for school administrators, teachers, and development partners on how to effectively integrate technology into teaching and learning. Insights from the research can inform the development of professional development programs, community-driven digital hubs, and affordable connectivity solutions.

1.8 Delimitation of the Study

The study focuses on the Atwima Nwabiagya District, a semi-urban area in the Ashanti Region of Ghana. It examines public secondary schools within the district. The research covers the period from 2020 to 2025, reflecting the recent acceleration of digital education initiatives in Ghana. The study primarily investigates issues related to the accessibility, availability, and integration of educational technology, as well as the barriers and opportunities for innovation in semi-urban educational settings.

1.9 Limitations of the Study

While the study aims to provide a comprehensive analysis, several limitations should be acknowledged. The focus on a single district limited the generalisation of findings to other semi-urban areas in Ghana or sub-Saharan Africa. Access to up-to-date,

reliable data on technology use and educational outcomes was constrained by institutional or logistical challenges. The fast-paced evolution of educational technology rendered some findings or recommendations obsolete over time. COVID-19 Impact: The ongoing COVID-19 pandemic may have influenced technology adoption patterns not fully captured in the study.

1.10 Organisation of the Study

The study is organised into five chapters. Chapter One provides an Introduction presenting the background, statement of the problem, objectives, research questions, significance, delimitation and limitations of the study. Chapter Two, that is, Literature Review, reviews relevant literature on educational technology adoption, barriers to integration, and case studies from Ghana and other sub-Saharan African contexts. Chapter Three details the research methodology, including the research design, data collection methods, sampling techniques, and analytical approaches used in the study. Chapter Four presents the results and Discussion based on the data collected. It presents findings on the availability, accessibility, and barriers to educational technology in the Atwima Nwabiagya District, followed by an analysis of how technology can bridge educational divides. Finally, Chapter Five concludes the study by summarising key findings, discussing policy and practical implications, and offering recommendations for stakeholders.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Technological advancement has become a cornerstone of educational innovation globally, offering informative opportunities for teaching and learning. In Ghana, particularly in semi-urban communities such as Atwima Nwabiagya, the integration of technology into education is positioned as a lever for bridging educational divides, enhancing learning outcomes, and preparing students for participation in the global economy. This review synthesises current literature on the accessibility and availability of educational technology, identifies barriers to effective technology integration, and evaluates how technology can bridge educational divides in semi-urban Ghana.

2.1 Accessibility and Availability of Educational Technology in Semi-Urban Communities

2.1.1 National and local policy context

Ghana's government has prioritised digital education as part of its broader digitisation agenda. The launch of the Ghana Knowledge and Skills Bank (GKSB) portal in 2024 exemplifies this commitment, providing free access to educational materials and tutoring services for students nationwide, including those in semi-urban and rural areas. The GKSB is designed to work offline, addressing connectivity challenges and ensuring that students in areas with limited internet access can still benefit from digital resources (We Are Tech Africa, 2024).

Ghana has several initiatives aimed at bridging the technology gap, including the Ghana Investment Fund for Electronic Communications (GIFEC), which works on

school connectivity and ICT infrastructure (Sarpong, 2023). Some innovative projects help improve access in underserved areas: for instance, *Ghana Reads* uses low-cost tablets and offline digital libraries (via Raspberry Pi) to deliver learning content in areas without reliable internet (Sarpong). The Eneza Education platform (mobile-phone-based) has been targeted at students and teachers in rural and underserved regions, allowing access to lesson plans and teacher support via SMS (Sarpong).

2.1.2 Infrastructure and resource deployment

Despite policy efforts, significant disparities remain in the distribution and quality of technological infrastructure. In the Atwima Nwabiagya District, research reveals a “worrisome situation” regarding the implementation of ICT policy in basic schools. Access to computers and computer laboratories is limited, and internet connectivity is virtually absent in most schools. This lack of infrastructure restricts students’ ability to engage in practical ICT learning, leaving many behind in digital literacy (Opoku et al., 2016)

However, targeted interventions such as the AccessSTEM pilot project have begun to address these gaps. This initiative, implemented in semi-urban Ghana, provides solar-powered digital learning tools and affordable internet to underserved communities. The project supports both teachers and students, facilitating access to globally recognised open educational resources (OERs) and improving digital infrastructure (Bluetown, 2022; Times of India, 2022).

In a comparative study of junior high schools in the Ga South Municipality, Sey (2013) reports that access to ICT infrastructure is limited. Computers are the most common tool, but other technologies such as projectors, interactive whiteboards, and

digital cameras are “virtually unavailable.” The same study found a disparity in access between urban and non-urban schools: urban students and teachers had more access to computers compared to their rural counterparts. In semi-urban areas, similar limitations contribute to a digital divide; even when infrastructure is present, the quantity and quality may be insufficient for meaningful pedagogical use.

2.1.3 Teacher capacity and professional development

Teacher training is a vital part of integrating technology effectively in education. The AccessSTEM project, for example, offers extensive training for 5,000 teachers in the use of digital learning materials, focusing on Science, Technology, Engineering, and Mathematics (STEM) subjects. This initiative ensures teachers are equipped with the necessary skills to utilise technology effectively in their classrooms, enhancing educational quality (Times of India, 2022). However, in semi-urban districts like Atwima Nwabiagya, challenges persist. Peprah (2016) highlights a lack of computers, limited internet access, and unqualified teachers as key obstacles to ICT integration. Even where technology exists, teacher readiness is often inadequate, with many educators lacking sufficient training to effectively use digital tools, undermining the technology's practical benefits.

Further compounding this, Appianing (2025) notes that some teachers in semi-urban Junior High Schools largely rely on mobile phones due to the unavailability of more advanced ICT devices. Mobile-based platforms such as SMS-based learning are more accessible in underserved or semi-urban areas, but restrictive school policies, including bans on phone use in classrooms, limit the potential of these devices for educational purposes.

A broader analysis reveals that Ghana's teacher training system faces structural challenges. Despite reforms like the 2018 Common Core Program aimed at modernising teaching methods, many teachers struggle to implement competency-based, student-centred approaches due to limited ICT training and professional support (Ministry of Education, 2018; Modern Ghana, 2025). Many teacher training colleges still lack modern digital resources, which results in trainee teachers graduating without adequate experience in technology-integrated teaching (UNESCO, 2021). Efforts such as the UNESCO Emergency Remote Teaching (ERT) training program have begun to address these gaps by equipping teachers with practical digital skills, enabling them to enhance their teaching both in normal and crisis contexts (UNESCO, 2024).

Building teachers' digital literacy and competencies for successful ICT integration requires extensive professional development through collaborative learning networks, individualised coaching, and capacity-building workshops (GSET, 2024). Furthermore, initiatives aimed at female educators and teachers in isolated regions are essential for inclusive transformation and equitable digital education (Ministry of Education, Ghana, 2025). Without sustained and context-sensitive teacher training programs, the ambition of leveraging technology to improve learning outcomes and educational equity will remain elusive.

2.2 Barriers to Effective Technology Integration in Semi-Urban Communities

2.2.1 Infrastructure Deficits

The most significant barrier to technology integration in semi-urban communities like Atwima Nwabiagya is inadequate infrastructure. Schools often lack basic ICT facilities, including computers, reliable electricity, and internet connectivity. These

deficits are compounded by insufficient government investment and maintenance, resulting in sporadic or non-existent access to digital tools (Opoku et al., 2016).

One of the major barriers to technology access in basic schools in Ghana is unreliable or limited access to electricity. Baako et al.(2023) found that many basic schools—especially outside major urban centres struggle with consistent electricity supply, which undermines the integration of ICT in classrooms. Without stable electricity, even if a school has devices, their use is severely constrained. This infrastructure gap highlights a fundamental constraint on the availability of technology in semi-urban (and more rural) settings.

Further compounding this issue, only about half of Ghana’s junior high schools have reliable electricity access, limiting ICT integration opportunities (Africa Education Watch, 2025). The lack of electricity affects critical elements of ICT use, such as computer operation, internet connectivity, and the ability to power projectors or other teaching aids, thereby weakening educational innovation efforts in semi-urban and rural schools (Wathi, 2025). Many schools also lack the physical infrastructure necessary to deploy ICT, including secure classrooms, sufficient furniture, and protection for devices from environmental damage (Eduwatch, 2025). These infrastructure challenges are entrenched, partly due to constrained national education budgets and competing demands on resources, which limit systematic investment in ICT facilities and maintenance (Managing Ghana, 2025). To address these challenges, targeted interventions such as solar-powered ICT centres and community learning hubs have started to emerge, proving vital to extend technology access in electricity-deprived regions (Appianing, 2025). Overall, until stable and comprehensive

infrastructure systems are established, efforts to leverage technology for education quality and equity in semi-urban Ghana will be severely limited.

2.2.2 Financial Constraints

High costs associated with acquiring, maintaining, and upgrading technology present another major challenge. Many schools in semi-urban areas operate with limited budgets, making it difficult to prioritise investment in ICT over other pressing needs. Additionally, the cost of internet access remains prohibitive for many families and schools, further limiting the reach of digital education initiatives (Internet Society Ghana, 2021)

Furthermore, the cost of internet access remains prohibitively expensive for most schools and families, limiting learners' exposure to digital content and resources. According to recent sector analyses, Ghana faces a substantial financial shortfall in education infrastructure investment, with an estimated need for \$2.5 billion between 2025 and 2028 to bridge deficits in school buildings, ICT facilities, and related learning resources (Managing Ghana, 2025). This gap is exacerbated by the allocation of funds to recurrent expenditures like the Free Senior High School policy, leaving minimal resources for technology upgrades (The BFT Online, 2025). Schools also encounter ongoing expenses such as software licensing, device repairs, and training, which strain limited operational budgets and threaten the sustainability of digital initiatives. Additionally, the lack of dedicated funding streams for maintenance leads to rapid deterioration and obsolescence of ICT equipment in many institutions (Africa Education Watch, 2025). Without innovative financing models, including public-Schools will find it difficult to fully utilize the advantages of ICT for educational innovation through private partnerships, concessional loans, and grant mechanisms.

Financial barriers can be reduced and equitable digital inclusion can be encouraged by ensuring dependable, reasonably priced access to digital technologies and internet connectivity through community-based solutions and subsidised tariffs.

2.2.3 Digital Literacy and Capacity Gaps

Both teachers and students in semi-urban communities often lack the requisite digital literacy skills to fully utilise available technology. While government and NGO-led workshops and seminars have made some progress, there remains a significant skills gap, particularly among older teachers who may be less familiar with digital tools (Internet Society Ghana, 2021).

For teachers, insufficient training translates into limited confidence and competence in using digital pedagogies, which restricts digital literacy development among students. Students, especially in under-resourced schools, often lack basic digital skills because of inadequate exposure and practice opportunities at earlier education levels (UKFIET, 2023). The situation is worsened by outdated curricula and a lack of comprehensive digital literacy strategies at the national level, which results in a widespread deficiency of 21st-century skills that are vital for modern employment and socio-economic participation (Ndibalema, 2025). Efforts to address this gap include targeted teacher training programs, capacity-building initiatives in digital content creation, and inclusive curricula reforms. Strengthening digital literacy among educators and learners is crucial for harnessing the full potential of technological innovations in education, fostering lifelong learning, and bridging disparities in access and skills across Ghana's diverse regions (Seetal et al., 2021; Ntiamoah & Antwi, 2023).

2.2.4 Socio-Cultural and Language Barriers

Socio-cultural factors, including resistance to change and language barriers, can hinder the adoption of educational technology. Educational content that is not localised or presented in indigenous languages may be less accessible to students and teachers in semi-urban communities, reducing its effectiveness (Opoku et al., 2016).

Research indicates that despite positive attitudes toward digital tools, teachers and students often encounter challenges arising from entrenched cultural norms and hesitation to adopt unfamiliar technology-driven pedagogies (The BFT Online, 2025). Language barriers further complicate engagement, as much e-learning content is primarily available in English, limiting comprehension and inclusion for learners who are more proficient in local languages like Twi or Ewe (Ghana Education Service, 2024). Additionally, socio-cultural expectations around teaching and learning styles influence the willingness of educators to shift away from traditional lecture methods toward interactive digital approaches (Asante & Frempong, 2025). Gender norms and economic realities also affect access and participation, with girls and economically disadvantaged students frequently facing greater obstacles to digital inclusion (Gender and Digital Portal, 2024). Overcoming these socio-cultural barriers requires the localisation of educational content, culturally sensitive teacher training, and community engagement initiatives that promote the benefits and relevance of educational technology in diverse contexts (Wathi, 2025). Without these targeted efforts, socio-cultural and linguistic factors will continue to limit full ICT integration and equity in semi-urban education settings.

This comprehensive analysis draws on recent empirical studies and policy critiques to underscore the complex interplay of culture, language, and technology adoption in

Ghana's educational landscape (Opoku et al., 2016; The BFT Online, 2025; Ghana Education Service, 2024; Asante & Frempong, 2025).

2.3 Technology as a Bridge for Educational Divide in Semi-Urban Communities

2.3.1 Enhancing Access to Quality Education

Technology has the potential to democratise access to high-quality educational resources. Initiatives like the GKSB portal and AccessSTEM provide students in semi-urban areas with access to up-to-date learning materials, interactive content, and virtual tutoring, which would otherwise be unavailable. These platforms are designed to function offline, making them particularly valuable in areas with unreliable connectivity (We Are Tech Africa, 2024)

2.3.2 Supporting STEM Education and Workforce Development

The construction of STEM-focused schools in Atwima Nwabiagya, equipped with advanced laboratories and digital resources, is a strategic move to prepare students for the demands of the 21st-century economy. The government's investment in such institutions is expected to increase the number of students pursuing science-related courses, ultimately boosting Ghana's capacity to produce skilled engineers and technologists (MyJoyOnline, 2023).

2.3.3 Promoting Equity and Inclusion

By making educational resources accessible to a wider population, technology helps to level the playing field between urban, semi-urban, and rural students. Solar-powered digital tools and locally hosted content ensure that even students in off-grid communities can participate in digital learning, addressing both economic and infrastructural barriers (Bluetown, 2022).

Initiatives such as the Sua IT project target rural Ghanaian youth by providing hands-on ICT training, bridging the gap caused by the lack of computer labs and internet in many rural schools (Mastercard Foundation, 2024). These efforts empower students in underserved areas to develop critical digital skills, fostering social inclusion and reducing disparities in educational outcomes (ActionAid Ghana, 2025). Additionally, government policies emphasize equitable distribution of ICT infrastructure, aiming to close the rural-urban divide by ensuring all children have access to quality ICT education regardless of location (UNESCO, 2015). Despite these advances, challenges remain due to limited funding and logistical difficulties in reaching remote areas, underscoring the need for sustained multi-stakeholder collaboration to achieve true digital equity (Ghana Education Service, 2024). Through these concerted efforts, digital inclusion becomes a catalyst for social and economic empowerment in Ghana's diverse educational landscape.

2.3.4 Building Digital Literacy and Lifelong Learning Skills

Digital education initiatives often include components aimed at building digital literacy not only for students but also for teachers and community members. This focus on capacity building is essential for fostering a culture of lifelong learning and adaptability, critical skills in a rapidly changing technological landscape (Internet Society Ghana, 2021).

Recent initiatives like the Digital Literacy Initiative (DLI) Coding Club pilot have demonstrated success in providing students with foundational coding skills while simultaneously training teachers to facilitate digital learning effectively (Institute of ICT Professionals Ghana, 2024). Government programs are committed to upskilling one million youth with digital proficiencies, helping them thrive in the Fourth

Industrial Revolution (National Youth Authority, 2024). Additionally, partnerships between universities and NGOs are expanding digital skills training, emphasizing not only technical competencies but also digital citizenship and safe online behavior (University of Education Winneba, 2025). These efforts collectively enhance digital inclusion, empower communities, and embed lifelong learning as a core educational value in Ghana's evolving education system.

2.4 Case Study: Atwima Nwabiagya District

2.4.1 Current State of Educational Technology

A study in the Atwima Nwabiagya District highlights the limited availability of ICT resources in basic schools. While some progress has been made through government and NGO initiatives, the majority of schools still lack adequate computer labs and internet access. This situation underscores the need for sustained investment and policy support to ensure that all students benefit from technological advancements (Opoku et al., 2016).

Supporting these findings, more recent government initiatives under Ghana's 2018-2030 Education Strategic Plan emphasize the integration of ICT to enhance educational quality and management across all levels (Ghana Ministry of Education, 2024). Despite these policy efforts, there remains an implementation gap at the district level, with many basic schools still struggling to meet ICT infrastructure standards and access to digital learning platforms (Ghana Ministry of Education, 2024).

NGOs and private sector partners contribute to addressing some of these challenges by establishing ICT centers and donating equipment, but these efforts are often limited in scope and concentrated in only a few schools, leaving disparities unaddressed (Graphic Online, 2023; USAID, 2025). The lack of consistent internet

connectivity and technical support further undermines these investments' sustainability, calling for more coordinated and well-funded efforts to enhance ICT education effectively in these underserved rural areas (Opoku et al., 2016; Ghana Ministry of Education, 2024).

2.4.2 Ongoing Innovations and Interventions

The establishment of a STEM school in Daabaa, Atwima Nwabiagya North, represents a significant step forward. With 12 laboratories and the capacity to admit 2,500 students, this institution is poised to become a centre of excellence for STEM education in the region. The school is expected to operate differently, with teachers having greater autonomy and access to modern facilities, setting a new standard for educational innovation in Ghana (MyJoyOnline, 2023).

The Daabaa school represents a broader shift in Ghana's educational strategy, where the aim is to create centers of excellence that match global standards in science and technology education. According to Ghana's Ministry of Education and advocates for STEM, such initiatives are intended to make the nation competitive in the global knowledge economy by providing learners with state-of-the-art facilities and opportunities for advanced practical experimentation (MyJoyOnline, 2023; Ghana News Agency, 2023; Ghana Ministry of Education, 2024).

The sustained commitment of the Ghanaian government and stakeholders, demonstrated by programs like the Yamoransa Model Labs, further builds the capacity of schools to offer critical STEAM (Science, Technology, Engineering, Arts, and Mathematics) skills and digital competencies to Ghana's youth (GBC Ghana Online, 2025; Ghana Ministry of Education, 2024).

Finally, centers like Daabaa are anticipated not only to improve STEM outcomes at the regional level but also set benchmarks for pedagogical innovation and curriculum delivery that can be replicated nationwide, ensuring that the next generation of Ghanaian students is better equipped for future academic pursuits and the demands of the 21st-century workforce (MyJoyOnline, 2023; GBC Ghana Online, 2025; Ghana News Agency, 2023).

2.4.3 Impact and Future Prospects

The integration of technology in Atwima Nwabiagya's educational system is gradually bridging the digital divide and enhancing learning outcomes. However, the full potential of technology as a catalyst for educational innovation can only be realised through continued investment in infrastructure, teacher training, and localised content development. The success of current initiatives will depend on the ability of stakeholders to address existing barriers and scale up best practices across the district and beyond.

Despite promising efforts, significant challenges remain. Many schools in the district face limited access to computers, unreliable internet connectivity, and inconsistent electricity supply, which hamper digital learning opportunities (De Keersmaecker, 2012; ExploreAnthro, 2024). Additionally, there is a shortage of qualified teachers skilled in ICT integration, highlighting the need for comprehensive professional development and capacity-building programs (Bluetown, 2022). These infrastructural and human resource gaps risk perpetuating inequalities, particularly between urban and more rural or peri-urban areas within the district (India Today, 2024).

Nevertheless, innovative solutions such as solar-powered and satellite-enabled distance learning platforms have begun to mitigate some of these challenges by

offering interactive and accessible educational content. Public-private partnerships and social entrepreneurship models focused on scalable STEM education interventions are also proving effective in narrowing the learning gap (MyJoyOnline, 2023; Britannica, 2025). Looking forward, the prospects of technology-driven educational innovation in Atwima Nwabiagya depend on a multi-stakeholder approach involving government policy support, community engagement, and sustainable financing mechanisms. Integration of artificial intelligence and adaptive learning technologies could further personalise instruction and address diverse learner needs if infrastructural barriers are overcome (Dictionary.com, 2023).

2.5 Conclusion

Technology holds immense promise as a catalyst for educational innovation in semi-urban communities such as Atwima Nwabiagya, Ghana. While significant challenges remain, particularly in terms of infrastructure, funding, and digital literacy, ongoing initiatives demonstrate that targeted interventions can make a meaningful difference. If access to digital resources, supporting STEM education, and building local capacity are expanded, technology can help bridge educational divides and prepare Ghanaian students for success in the global knowledge economy.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

Chapter three of this paper covers the methods that were employed for the collection of data for the study. Methodology is the description of the approaches and kinds of research paradigms used in particular research (Kaplan,1973). The chapter outlines the research design, rationale for the research design, the researcher's role, site and setting characteristics, data sources, study area, target population, sampling methods, data collection methods and instruments, as well as measures taken to ensure validity, reliability and procedures for data analysis. The aim is to provide a transparent and reproducible approach to understanding how technology integration is transforming education in this district.

3.1 Rationale and Assumptions for Qualitative Design

The rationale for qualitative research design centres on its unique capability to explore complex social phenomena by capturing rich, subjective human experiences and perspectives. It addresses aspects that quantitative methods cannot, such as understanding depth, context, and meaning within social contexts. Qualitative research leverages subjectivity as a strength, using systematic and rigorous methods to gather detailed, contextually grounded insights. This approach is essential when the research aims to uncover motivations, behaviours, and interpretations that shape human experiences. The rationale also includes the necessity of qualitative methods for studies requiring a human-centred understanding of real-world issues, especially where rapid social changes and complex environments are involved (Lim, 2025).

The assumptions underlying qualitative research typically include ontological, epistemological, axiological, and methodological premises. Ontologically, qualitative research assumes multiple realities exist, as different participants may interpret experiences uniquely. Epistemologically, it assumes that knowledge is co-constructed through the interaction between researchers and participants, emphasising proximity to participants' lived experiences. Axiologically, it recognises the researcher's values and biases as part of the interpretive process rather than threats to objectivity. Methodologically, qualitative research assumes that inductive reasoning and flexible, iterative approaches are appropriate for exploring meanings and patterns within data rather than testing hypotheses (Creswell & Poth, 2018; Walters, 2001; Compita Consulting, 2023).

3.2 Type of Design

The study employed a qualitative case study design, which facilitated an in-depth exploration of the phenomenon of technology-driven educational innovation within its real-life context (Yin, 2018). This approach allowed for detailed examination of the experiences, perceptions, and interactions of key stakeholders: teachers and students, with educational technologies (Creswell & Poth, 2018).

Qualitative case study methodology is particularly suited for answering “how” and “why” questions in situations where the boundaries between the phenomenon and its context are not clearly evident (Yin, 2018). This method also enables researchers to gather rich, contextualized data through multiple sources such as interviews, observations, and document analysis, providing comprehensive insights into the complexities of integrating technology in education (Bao, 2023; Dintoe, 2018). Furthermore, the immersive nature of case studies supports adaptability throughout

the research process, allowing for responsiveness to emerging themes and stakeholders' needs (EdTech Books, 2003).

3.3 Researcher's Role

A central element of qualitative inquiry is the researcher's role, as the researcher functions as the primary instrument for data collection and interpretation. In this study, the researcher brought both disciplinary knowledge and contextual understanding to the semi-urban Ghanaian setting, enabling the collection of rich, nuanced, and meaningful data on educational innovations. This role required sensitivity to social and cultural subtleties, including awareness of local norms, practices, and educational dynamics that could influence participant responses.

As qualitative research is inherently interpretive, the researcher engaged in reflexivity, maintaining continuous self-awareness and critically reflecting on personal beliefs, assumptions, and potential biases that could shape interactions, data interpretation, and conclusions (Lim, 2025). The researcher also managed ethical considerations, including safeguarding participant rights, maintaining confidentiality, and obtaining informed consent, which are particularly critical in educational settings with diverse stakeholders (Li, Furlong, & Lester, 2025).

In addition, the researcher established trust and rapport with participants, fostering an environment where students and teachers felt comfortable sharing authentic perspectives on technology-driven educational innovations. By adopting a participatory stance, the researcher facilitated the co-construction of meaning, consistent with the Constructivist paradigm guiding this qualitative case study (Goundar, 2025). This dynamic, reflexive, and ethically grounded role enhanced the depth, richness, and credibility of the inquiry, allowing for a nuanced understanding

of how educational technology is implemented and experienced in the Atwima Nwabiagya District.

3.4 Site and Setting Characteristics

The study was situated in Atwima-Nwabiagya District, a semi-urban district located in the Ashanti Region of Ghana. This area presents a unique setting where emerging technological infrastructure intersects with traditional educational practices, making it ideal to study technology-driven innovation in education (Gyamfi et al., 2022). The target population consists of a public secondary school within the district. Participants include school administrators, teachers, and students who are actively involved in teaching and learning processes where technology is deployed (Atuahene, 2019).

This study employed purposive sampling to recruit 12 participants, in line with the recommendations of Creswell (1997) and Denzin and Lincoln (2011) for qualitative research. Purposive sampling was used to select individuals who had direct experience with educational technology in semi-urban schools, ensuring that the data collected would be rich, relevant, and insightful. The sample included ten students, evenly divided by gender (five males and five females), and two teachers from Toase Senior High School, one male and one female. This composition provided a balanced perspective of both learners and educators, capturing diverse experiences and viewpoints necessary for a comprehensive understanding of the research problem.

Data were collected through semi-structured interviews, which allowed participants to express their experiences, perceptions, and challenges regarding the use of educational technology in their own words. Semi-structured interviews are particularly suited to qualitative research because they provide flexibility for

participants to elaborate on issues they consider important while enabling the researcher to probe for deeper insights.

Qualitative research typically requires 5 to 25 participants to reach data saturation, the point at which additional interviews no longer yield new information (Creswell, 1997; Denzin & Lincoln, 2011). The sample of 12 participants was therefore sufficient to obtain in-depth, meaningful data. This approach facilitated a nuanced exploration of participants' lived experiences, enabling the identification of themes and patterns regarding accessibility, use, and challenges of educational technology in semi-urban educational contexts.

3.5 Data Collection Methods and Instruments

This study employed semi-structured interviews as the primary data collection method to gather in-depth insights from students and teachers regarding their experiences with and challenges in using educational technology (Kvale & Brinkmann, 2009). Semi-structured interviews were chosen because they offer a flexible approach that allows participants to articulate their perspectives freely while enabling the researcher to probe for clarification and a deeper understanding of specific issues.

Before data collection, ethical clearance was obtained from the relevant institutional review board to ensure compliance with ethical research standards. Initial contact was made with school authorities to secure permission and schedule interviews at times convenient for both students and teachers, minimising disruption to teaching and learning activities.

The data collection process was phased to ensure comprehensive coverage and triangulation. It began with a review of relevant documents and school records to understand the existing infrastructure and policies related to educational technology.

This was followed by semi-structured interviews with the 12 purposively sampled participants. In addition, focus group discussions were conducted with students to capture shared experiences and generate dialogue on common challenges and solutions.

To complement interviews and focus groups, observations were carried out during regular class sessions, allowing the researcher to witness the actual use of technology in teaching and learning contexts. Observations were conducted unobtrusively to minimise interference with classroom activities (Yin, 2018). This combination of interviews, focus groups, document reviews, and observations provided a rich, triangulated dataset, enhancing the credibility and depth of the study's findings on the role of educational technology in semi-urban schools.

3.6 Methods of Verification and Trustworthiness

The study adhered to ethical research standards by obtaining informed consent from all participants, ensuring confidentiality and anonymity, and allowing participants to withdraw at any stage without penalty (Creswell & Poth, 2018). These measures protected participants' rights and fostered an environment conducive to open and honest sharing of experiences. To enhance validity, the study employed a pilot test of the data collection instruments with a small group of educators outside the main study sample. Feedback from the pilot was used to refine interview questions and observation protocols, ensuring clarity, relevance, and the ability to elicit rich, meaningful data.

The study also implemented triangulation to strengthen trustworthiness, credibility, and dependability. Data were collected from multiple sources, including students, teachers, documents, interviews, focus groups, and classroom observations- and

analyzed using varied methods. This approach allowed for cross-verification of information, reducing the risk of bias and enhancing confidence in the findings (Braun & Clarke, 2006). Collectively, these strategies ensured that the study produced robust, reliable, and credible insights into the experiences, perceptions, and challenges associated with educational technology in semi-urban schools.

3.7 Data Analysis Procedures

The study adhered to ethical research standards by obtaining informed consent from all participants, ensuring confidentiality and anonymity, and allowing participants to withdraw from the study at any stage without penalty (Creswell & Poth, 2018). These measures safeguarded participants' rights and promoted openness in sharing their experiences.

To ensure validity and accuracy of the data collection instruments, a pilot test was conducted with a small group of educators outside the main study sample. Feedback from this pilot was used to refine interview questions and observation protocols, ensuring that the instruments effectively captured the intended information and were understandable to participants.

The study also employed triangulation as a strategy to enhance the trustworthiness of the findings. Data were collected from multiple sources including students, teachers, documents, observations, and focus groups using interviews. This multi-faceted approach allowed cross-verification of information, reducing potential biases and increasing the credibility, dependability, and confirmability of the results (Braun & Clarke, 2006). Together, these measures ensured that the study produced reliable and meaningful insights into the experiences, challenges, and perceptions of students and teachers regarding educational technology in semi-urban schools.

CHAPTER FOUR

RESULTS/FINDINGS

4.0 Introduction

This chapter presents the entire results and discussions from the study in sections. Findings of this study have been grouped into three main sections under the specific objectives: examining the accessibility and availability of educational technology in semi-urban communities, identifying the barriers to effective technology integration in semi-urban educational communities and evaluating how technology can help to bridge the divide in semi-urban communities. Lastly, the findings were discussed in relation to the objectives of the study.

4.1 Demographic Characteristics of Respondents

The socio-demographic characteristics of respondents were investigated in the study and so presented in this section. This was done to offer crucial data about the respondents from which a more accurate conclusion might be reached. Twelve(12) participants were sampled from Toase Senior High School in the Atwima Nwabiagya District for the study.

The demographic profile of the respondents in this study comprises the critical variables of age, gender, school name, role/status within the school (whether student or teacher), and the nature of the school (private or public). These characteristics provide a foundational context to understand the perspectives and experiences shared by respondents regarding the integration of educational technology in semi-urban communities, specifically in the Atwima Nwabiagya District.

4.1.1 Age of Respondents

The age of the respondents ranged predominantly between 17 and 18 years. This reflects the typical age bracket of senior high school students in Ghana, affirming that the participants represent the intended target group for understanding technology integration impacts on learners within this context. The exact ages reported by participants were: 18 years (Participant A, F, G, H, I, J,), 17 years (Participants B, C, D, E). While the age of the teachers ranges from 25 to 30 (Participants K and L). This age range is crucial in qualitative educational technology research as it captures the experiences of adolescents who are formative technology users in education and teachers old enough to know the trends as far as technology use is concerned and how they are to adopt it in their daily instructions in the classroom.

According to Ghana's 6-3-3 educational system, which requires students to complete three years of senior secondary school after graduating junior high school at the age of 15, senior high school students in Ghana usually range in age from 15 to 18 (Ghana Ministry of Education, 2025). Although studies show some variation, the official age ranges for SHS students typically fall between 15 and 18 years old. Many students are older than this range because of things like grade repetition or late school entry (Ghana Statistical Service, 2025).

Therefore, the ages of 17 and 18 in this study fall within the normative range but also represent an important developmental stage where students can critically engage with digital technologies and apply them in their academic work. This adolescent group is particularly valuable for examining technology's role in learning, as they combine cognitive readiness with increasing autonomy in study practices. Additionally, focusing on this age group ensures that findings from the study have direct

implications for secondary education policy and practice, especially as these learners transition to higher education or employment where technological competence is essential.

Furthermore, by comprehending this age group's technological experiences, one can identify particular obstacles and enablers influenced by their developmental stage, socioeconomic background, and academic requirements. In semi-urban Ghanaian communities, this nuanced understanding aids in customising interventions to enhance technology integration that speaks to students' actual needs and learning styles.

4.1.2 Gender of the Respondents

To guarantee gender-inclusive viewpoints in the results, both male and female participants took part in this research interview. Males (Participants A, C, D, E, J, K) and females (Participants B, F, G, H, I, L) made up the gender distribution. Examining any gender-specific experiences or obstacles pertaining to educational technology access and usage in the semiurban setting, including both genders, deepens the study.

Gender inclusion is critical because existing research in Ghana has documented that while males often have higher enrolment and engagement with technological subjects, females face distinct challenges shaped by Socio-cultural norms, self-efficacy beliefs, and access constraints (Boadu, 2024). For example, cultural perceptions often stereotype technology fields as male domains, which may influence female students' confidence and participation in ICT-related activities. However, studies also show that female students' performance and interest can improve significantly when supported by female role models and inclusive teaching practices (Ayite, 2022; Mensah, 2023).

By capturing perspectives from both male and female students, this study is positioned to provide a holistic understanding of how gender dynamics influence technology adoption and educational innovation in semiurban Ghanaian schools. It also enables identification of gender-responsive strategies that can address specific barriers faced by female learners, fostering equitable access and use of educational technology for all students in the Atwima Nwabiagya District.

4.1.3 Name of School of the Respondents

All respondents were students of the same institution, Toase Senior High School, located within the semi-urban community under investigation. Toase Senior High School, established in 1971, is situated in the Toase Township of the Ashanti Region along the Abukwa-Bibiani main road, close to the Nkawie Government Hospital. This consistent school establishment establishes a focused and stable context for understanding how educational technology is integrated and accessed within the district. The semi-urban setting of the school reflects the typical characteristics and infrastructural realities of communities undergoing gradual urbanisation, making it an apt example for the study.

Furthermore, the uniform school setting allows for comparability of experiences across respondents, reducing variability that might arise from different institutional policies or resource availabilities in multiple schools. This increases the reliability of findings by ensuring that observed patterns in technology use and barriers are context-specific and not confounded by cross-school differences. The location within a semi-urban community also highlights unique challenges and opportunities that differ from both purely rural and fully urban educational environments, such as partial but inconsistent access to electricity, internet connectivity, and modern ICT infrastructure.

Additionally, Toase Senior High School's mission to provide quality education to students from its catchment area aligns with the study's focus on educational equity and innovation in semi-urban Ghana. The historical establishment of the school and its long-standing position in the community afford a deep-rooted perspective on how educational technology adoption has evolved locally over time, further enriching the contextual grounding of the study. This solid institutional foundation supports a nuanced exploration of technology's role as a catalyst for educational innovation pertinent to similar semi-urban settings in Ghana and beyond.

4.1.4 Role of Respondents

All participants identified themselves as “students,” and some as teachers. This participant selection aligns well with the research objective of assessing the accessibility and availability of educational technologies, the barriers to their use, and the role of technology as a bridge to the digital divide in semi-urban and urban communities. Including both students and teachers provides a comprehensive range of perspectives. While students offer firsthand experience with daily interaction and challenges related to using educational technology, teachers contribute insights on pedagogical integration, infrastructural constraints, and institutional factors affecting technology adoption. Together, these perspectives illuminate both the practical realities learners face and the systemic factors shaping technology use in semi-urban schools. This dual perspective enriches the findings and supports more nuanced, actionable recommendations to improve educational technology integration and promote equity in access and outcomes within the community.

4.1.5 Nature of School (Public or Private)

Participants unanimously indicated that Toase Senior High School is a public school. Public schools in Ghana typically face distinct resource allocation, infrastructural, and management challenges compared to private schools, and this is why the status of the school matters significantly in this study. Understanding technology integration in a public semi-urban school offers important insights related to national educational policies, funding, and systemic constraints impacting technology access and innovation.

Public schools such as Toase Senior High often operate under tighter budgetary constraints, which can limit procurement of modern educational technologies and necessary infrastructure like reliable internet and electricity. These limitations affect both the quantity and quality of technological resources available to learners and teachers. Infrastructural deficiencies, such as erratic power supply and limited connectivity, compound the difficulty of fully integrating technology into teaching and learning processes. Additionally, management challenges, including less autonomous decision-making and bureaucratic delays in resource mobilisation, can hinder rapid adaptation or innovation in technology use.

Furthermore, public schools are the primary educational providers for a majority of Ghanaian students, particularly in semi-urban and rural areas. Thus, the challenges they face reflect broader systemic realities and directly affect educational equity and inclusion. Investigating technology integration in public schools like Toase SHS thus aligns with national priorities underscored in policies such as Ghana's National ICT for Education Policy (2015) and the Digital Transformation Strategy (2020–2024),

which recognise the need for addressing infrastructural and funding disparities across educational institutions to ensure inclusive digital learning environments.

The contextual grounding in a public semi-urban school enables the study to highlight how policy intentions translate into practice, reveal existing gaps, and propose specific strategies that can enhance effective technology adoption. This focus offers transferable lessons for other public schools in similar semi-urban Ghanaian contexts and informs policymakers, educational leaders, and development partners committed to bridging the digital divide through targeted investments and systemic reforms.

4.2 Examine the Accessibility and Availability of Educational Technology in Semi-Urban Communities

One of the key research project objectives is to examine the accessibility and availability of educational technology in semi-urban communities. Though educational technologies like computers, laptops, mobile phones, and projectors are reportedly present at the school, access is constrained by subject and time.

In the interview conducted, a respondent from the school stressed:

"You can have access to it only when you have that subject before you can have access to those educational technologies." - (Male Participant E, Student)

Another highlighted limited access outside ICT periods:

"Sometimes, we only use them when it's the period for that lesson." - (Male Participant A, student)

Yet students can physically visit the ICT lab outside lesson times, but cannot freely use the equipment, as described by one:

"You can have access to it only when you have the subject- (Female Participant B, student)."

These findings are in coherent with a research by Sey (2013) which reports that, access to ICT infrastructure is limited. Computers are the most common tool, but other technologies such as projectors, interactive whiteboards, and digital cameras are –virtually unavailable. This clearly illustrates that availability exists, but meaningful day-to-day accessibility remains limited, confirming a partial but underutilised technology infrastructure in this particular school in question.

4.2.1 Barriers to Effective Technology Integration

In the quest to know if the respondents knew about the barriers to effective technology integration, some research questions were asked to gain respondents’ understanding in that regard. Respondents were asked to share an experience of themselves or someone who has experienced a barrier or any barriers they have encountered.

4.2.2 Institutional Constraints and Leadership

One respondent emphatically indicated that leadership plays a major role in restricting access beyond financial issues:

"It's because of the leaders. They are stopping us from using it. It isn't any financial constraints."-(Male participant D, student)

Another also stated:

"Lack of finances is not part"-(Male participant A, student)

The interviewer, however, underscored scepticism about finances, rhetorically asking: *"Do you have plenty of money like that?"*. This is trying to probe further if indeed there is something beyond just financial constraint in their school. The response emphasised administrative reluctance.

Another stated, *"I don't think it is financial resources. Even if the resources are there, there will not use the money for those technological devices. They will use it for other things"*.- (Male Participant D, student)

4.2.3 Infrastructure: Electricity and Internet

The impact of unstable infrastructure is vividly portrayed with statements like:

"Electricity is not stable here. You will be there and the power will go off unless you resort to sleeping." - (Male Participant E, student) and

"We have to stay in darkness for almost a week"(Male Participant D, student)

"Our electricity is very poor." (Male Participant A, student)

Another student noted,

"We students don't use the internet connection at school,"- (Male Participant C, student)

4.2.4 Security and Equipment Maintenance

The finding suggested that the attitude of some students may be the reason they are not fully allowed to use the ICT labs without any supervision, as concerns about theft were raised:

"Sometimes when they allow us to use the LAB, some people do steal accessories,"- (Male Participant A, Student), resulting in limited lab availability for personal use.

4.2.5 Limited and Inconsistent Teacher Use

It was found out that, though mostly confined to ICT lessons, some teachers integrate technology to enrich learning; one student described:

"For the biology aspect, we normally use a laptop. Our teacher shows us videos." (Participant B, Female).

Another participant added,

"When the Biology teacher comes to class, it is not always that he uses the Biology textbook to teach or copy notes. So, because he wants us to understand better, he brings the laptop and uses the video to explain better on the subject topic. So, this helps us to understand better. For example, if you take the circulatory system, he shows us the video so that we can understand" (Female Participant B, student).

One of the respondents stated *" I sometimes use my phone as a technological tool for my students to grasp concepts, and truly they get everything speedily"* -(Female Participant, Teacher).

4.3 Technology as a Bridging Tool

Students recognise technology's academic benefits when accessible:

"It has helped me to know how to use software and other things," -(Male Participant A, student) and

"It has really helped me a lot because it helps me get more understanding about the topic or subject at hand."-(Male Participant D, student)

However, restrictions hamper its bridging potential:

"We don't use phones in school, so we don't use them to search for answers on our assignments,"-(Participant exacerbating urban-semiurban divides in self-directed learning opportunities.

From the finding, it was realised that that, the usage patterns at home vary: one student says,

"I use my phone and tablet daily to learn,"- while others report,

"I use it to learn, but not always," and some *"rarely"* use technology outside school.

This variance reflects socioeconomic disparities typical of semi-urban contexts.

4.4 Discussion

4.4.1 Introduction

This section of the chapter discusses the findings based on the study objectives. Also, the framework and its relevant literature will shed insight into the findings. This study investigated the following objectives: a) Examine the accessibility and availability of educational technology, b) Identify the barriers to effective technology integration in semi-urban educational communities, and c) Evaluate how technology can help to bridge the divide in semi-urban communities.

4.4.2 Qualitative Insights and Implications

The direct quotes from students at Toase SHS further reveal that the impact of educational technology is shaped by a dynamic combination of physical, institutional, and personal factors. While physical access to devices and digital resources is present, it is often constrained by inconsistent availability, maintenance issues, and limited reach beyond the classroom. This limited access underscores the importance of your project's focus on not only mapping where technology is available but also understanding how and when it is actually used by students and teachers.

How technology is viewed and used in schools is greatly influenced by institutional culture. Innovation can be facilitated or hindered by leadership attitudes and policy choices, which can occasionally present more challenges than budgetary constraints. For instance, strict administrative guidelines or a lack of backing from the administration of the school can stifle creativity and restrict the use of technology integration, even when resources are available. This highlights the need for your research to critically examine the influence of leadership and institutional norms on technology use.

Infrastructure remains a persistent challenge, with unreliable electricity and poor internet connectivity frequently disrupting learning activities. These infrastructural gaps not only hinder the effective use of technology but also create disparities in access, especially for students who rely on school-based resources. Your project's attention to these foundational issues is vital, as sustainable technology integration cannot be achieved without addressing these basic requirements. Security concerns, including data privacy and safe online practices, are also emerging as important considerations. Students and teachers express apprehension about the risks associated with digital tools, which can deter confident and widespread adoption. Your research should therefore consider how security measures and digital literacy training can be integrated into broader technology initiatives.

Teacher capacity is another critical factor. Even when technology is available, its educational value is maximised only when teachers are equipped with the skills and confidence to use it effectively. Professional development and ongoing support are essential for empowering educators to leverage technology in ways that enhance learning outcomes. The unequal use of technology between school and home further exacerbates educational divides. Students from more privileged backgrounds may have greater access to devices and the internet at home, while others rely solely on school resources. This disparity underscores the need for policies that promote equitable access and support for all learners, regardless of their socio-economic status.

4.4.3 Accessibility and Availability of Educational Technology

The interviews consistently reveal that students in Toase Senior High School have access to basic educational technologies such as mobile phones, laptops, computers, and projectors. However, access is not universal or equitable. Most students reported having mobile phones at home, but access to laptops and computers is limited and

often restricted to specific subjects or ICT labs. For example, one student stated, "We only use them when it's the period for that lesson," indicating that technology is not integrated into daily learning but is confined to scheduled ICT classes.

This finding aligns with broader research on semi-urban educational settings in Ghana, where infrastructure and resources are often insufficient to support widespread technology integration (Ibrahim et al., 2022; Southern Voice, 2023). The limited availability of devices and the lack of access outside scheduled lessons suggest that technology is not yet a seamless part of the educational experience for most students.

This suggests sporadic, but impactful use of Educational Technology within non-ICT subjects. This finding is similar to that of the study by Peprah (2016) who noted that a lack of unqualified teachers as major obstacles. Even where technology is available, teacher readiness is poor: in some contexts, teachers lack the training to utilise digital tools effectively, which diminishes the practical usability of the technology.

It is also in accordance with the research by Appianing (2025) which highlighted that, some teachers in semi-urban JHS rely heavily on mobile phones, rather than more advanced ICT tools, because of the unavailability of more sophisticated devices. Mobile-based platforms (e.g., SMS-based learning) are often more accessible in underserved or semi-urban communities, but restrictive school policies (such as bans on phone use in class) limit how these devices are used for learning.

Another literature by Agyei and Voogt (2019) pointed out that, lack of adequate ICT training and professional development continues to inhibit technology integration. Studies show that teachers in semi-urban schools feel underprepared to use digital tools for instruction due to limited training opportunities and insufficient pedagogical

support. Without digital literacy, even available technologies are underutilised or used solely for administrative tasks rather than instructional innovation.

4.4.4 Barriers to Effective Technology Integration

Several barriers to effective technology integration emerged from the interviews, and these are:

- **Infrastructure Limitations:** Students frequently cited unreliable electricity and poor internet connectivity as major obstacles. One student noted, *"Sometimes, we have to stay in darkness for almost a week,"* highlighting the impact of infrastructural challenges on technology use.
- **Policy and Administrative Constraints:** Access to ICT labs and devices is often restricted by school policies. Students reported that they cannot use the lab for personal assignments or outside scheduled lessons, and some mentioned that school leaders are not prioritising ICT. For instance, one student said, *"The leaders are stopping us from using it. It isn't any financial constraints,"* suggesting that administrative attitudes and policies are significant barriers.
- **Financial Constraints:** While some students denied financial constraints as a barrier, others pointed to a lack of funds for new technologies and maintenance. This discrepancy may reflect differing perceptions or the prioritisation of other school needs over technology investment.
- **Teacher Practices:** Technology use is largely confined to specific subjects and is not consistently integrated across the curriculum. Teachers use laptops and projectors for certain topics, such as biology, but this is not the norm for all subjects.

These findings are consistent with the literature on educational technology in semi-urban and rural Ghana, where infrastructure, policy, and teacher readiness are key challenges (Yeboah & Agyekum, 2024; Southern Voice, 2023).

It somehow opposes but also supports research by Internet Society Ghana (2021), which suggested that high costs associated with acquiring, maintaining, and upgrading technology present another major challenge. Many schools in semi-urban areas operate with limited budgets, making it difficult to prioritise investment in ICT over other pressing needs. Additionally, the cost of internet access remains prohibitive for many families and schools, further limiting the reach of digital education initiatives.

Also, it is consistent with the study by Bervell and Umar (2020), which highlighted that technology integration in education offers significant potential for improving teaching and learning; however, its implementation in semi-urban communities is often hindered by a range of contextual barriers. These challenges limit the effective use of digital tools and reduce opportunities for innovative teaching practices. A major barrier is inadequate infrastructure, including unreliable electricity supply, poor internet connectivity, and insufficient ICT facilities.

Many semi-urban schools struggle with inconsistent power supply and limited broadband access, which undermines the routine use of digital tools in teaching and learning, highlighting severe connectivity issues obstructing technology use. These findings are also in accordance with a study by Opoku et al. (2016), which stated that internet connectivity is virtually absent in most schools. This lack of infrastructure restricts students' ability to engage in practical ICT learning, leaving many behind in digital literacy.

4.4.5 Technology as a catalyst for bridging the educational divide

The interviews provide mixed evidence on the role of technology in bridging the educational divide. On one hand, students acknowledged that technology has helped them gain a clearer understanding of topics and improve their academic performance. For example, one student said, "It has really helped me a lot because it helps me get more understanding about the topic or subject at hand." The use of videos and digital resources in biology classes was particularly valued for enhancing comprehension.

On the other hand, students also highlighted significant limitations. The lack of access to digital learning platforms, unreliable internet, and restricted use of devices at school mean that technology is not fully leveraging its potential to bridge the divide. Students noted that they cannot use phones or laptops for assignments at school and that textbooks do not provide sufficient information. This suggests that while technology has the potential to enhance learning, its impact is currently limited by contextual factors.

The findings of the study on technology as a bridging tool are supported by other relevant literature. For instance, We Are Tech Africa (2024) noted that technology has the potential to democratise access to high-quality educational resources. Initiatives like the GKSB portal and AccessSTEM provide students in semi-urban areas with access to up-to-date learning materials, interactive content, and virtual tutoring, which would otherwise be unavailable. These platforms are designed to function offline, making them particularly valuable in areas with unreliable connectivity.

In a comparative study of junior high schools in the Ga South Municipality, Sey (2013) reports that access to ICT infrastructure is limited. Computers are the most common tool, but other technologies such as projectors, interactive whiteboards, and

digital cameras are “virtually unavailable.” The same study found a disparity in access between urban and non-urban schools: urban students and teachers had more access to computers compared to their rural counterparts. In semi-urban areas, similar limitations contribute to a digital divide; even when infrastructure is present, the quantity and quality may be insufficient for meaningful pedagogical use.

4.5 Qualitative Insights and Methodological Considerations

The interviews are a valuable source of qualitative data, providing nuanced insights into students' experiences and perceptions. The use of open-ended questions allowed students to express their views in their own words, capturing the complexity of technology integration in semi-urban schools. The data reveals both the opportunities and challenges of educational technology, highlighting the need for context-specific solutions.

From a methodological perspective, the interviews demonstrate the importance of thematic analysis in qualitative research. Common themes such as infrastructure limitations, policy constraints, and the impact of technology on learning emerged across multiple transcripts. These themes can be further explored and validated through additional data collection and analysis.

4.6 Implications for Policy and Practice

The findings from these interviews have several implications for policy and practice:

- **Infrastructure Investment:** Addressing infrastructural challenges, such as unreliable electricity and internet connectivity, is essential for effective technology integration.

- **Policy Reform:** School policies should be revised to allow greater access to ICT labs and devices for students, particularly for personal assignments and self-directed learning.
- **Teacher Training:** Teachers need ongoing professional development to integrate technology across the curriculum and to use digital resources effectively.
- **Community Engagement:** Engaging stakeholders, including school leaders and community members, is crucial for fostering a culture of innovation and supporting technology adoption.

4.7 Conclusion

The interview transcripts provide a rich and detailed account of the accessibility, barriers, and impact of educational technology in a semi-urban Ghanaian context. The data highlights both the potential of technology to enhance learning and the significant challenges that must be addressed to realise this potential. These insights are highly relevant to your research and can inform both academic analysis and practical interventions aimed at promoting educational innovation in semi-urban communities.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a comprehensive synthesis of the research findings drawn from chapters one through four, along with conclusions and practical recommendations based on the study's objectives and analysis. The study explored the use of Information and Communication Technology (ICT) in teaching and learning in Ghanaian second-cycle institutions, the significance of semi-urban contexts in educational settings, and approaches to digital education innovation within resource-constrained environments like rural Ghana.

5.1 Summary of Findings

The study revealed that while there is a growing positive attitude toward ICT integration in Ghanaian secondary schools, significant infrastructural challenges remain. Asamoah et al. (2022) highlighted that schools in semi-urban and urban areas tend to have better ICT facilities compared to rural counterparts but face issues such as inconsistent power supply and limited internet access. These challenges directly impact effective ICT adoption for teaching and learning. Moreover, the semi-urban context carries unique Socio-cultural and resource dynamics, positioning it between rural and urban educational ecosystems, thus requiring tailored interventions (South African Family Practice, 2025).

The launch of the Ghana Knowledge and Skills Bank platform (We Are Tech Africa, 2024) demonstrates governmental efforts to bridge digital divides by providing free, accessible educational content digitally, including offline options for rural learners.

This initiative aligns with findings from Yeboah and Agyekum (2024), who advocated for practical ICT teaching frameworks that cater to rural teachers lacking access to computer hardware or reliable internet, emphasising adaptive pedagogical strategies grounded in literature review principles.

5.2 Conclusions of the Study

The integration of ICT in Ghanaian education hinges on addressing infrastructural inadequacies, enhancing teacher capacity in ICT pedagogical skills, and ensuring context-appropriate digital resources. The semi-urban setting requires particular focus as it embodies both opportunity and challenge in educational technology deployment. National digital platforms such as the Ghana Knowledge and Skills Bank signify that the integration of ICT in Ghanaian education hinges on addressing infrastructural inadequacies, enhancing teacher capacity in ICT pedagogical skills, and ensuring context-appropriate digital resources. The semi-urban setting requires particular focus as it embodies both opportunity and challenge in educational technology deployment. National digital platforms such as the Ghana Knowledge and Skills Bank signify progressive steps toward inclusivity and resource democratisation.

However, despite policy efforts and investments, significant challenges persist, particularly in semi-urban and rural areas. Many schools suffer from inadequate ICT infrastructure, unreliable electricity, poor internet connectivity, and insufficient computer labs, which severely limit effective technology use in teaching and learning (Amenyedzi, Lartey, & Dzomeku, 2011; Eduwatch, 2025). Additionally, teacher preparedness remains a critical barrier, with many educators lacking sufficient training and confidence to integrate ICT pedagogically (Enu et al., 2018; Appiah & Abdul-Rahim, 2021). This creates a digital divide, where access and usage disparities

between urban and semi-urban or rural schools affect equity and quality in education (Ghana Education Watch, 2025; Gender & Digital, 2024).

Sustained governmental and stakeholder commitment is therefore essential to expand ICT infrastructure, increase teacher professional development programs, and tailor digital resources to the local education context. With focused efforts, educational technology in semi-urban Ghana can realise its transformative potential, supporting improved learner engagement, skills development, and alignment with the demands of the 21st-century economy.

5.3 Recommendations

- 1 **Infrastructure Development:** There should be a prioritisation of electricity and internet stability in second-cycle institutions, especially in semi-urban and rural zones, to help foster an environment fit enough for ICT in education (Asamoah et al., 2022). Public-private partnerships could be leveraged to accelerate infrastructure expansion, including solar-powered ICT hubs, to ensure sustainable and resilient access in off-grid areas (Africa Education Watch, 2025). This will reduce disparities in digital access that currently limit learning opportunities in rural and deprived districts.
- 2 **Teacher Training:** Continuous professional development programs should focus on innovative, context-sensitive ICT teaching techniques that consider local constraints, as highlighted by Yeboah and Agyekum (2024). Training should include digital pedagogical skills, cybersecurity awareness, and adaptive use of available technology, empowering educators to integrate ICT meaningfully in classrooms (Institute of ICT Professionals, Ghana, 2024).

- 3 **Resource Accessibility:** Expand digital platform offerings with offline capabilities and mobile-friendly interfaces to accommodate students in areas with limited connectivity (We Are Tech Africa, 2024). The development of localised and culturally relevant digital content will enhance engagement and learning outcomes, ensuring inclusivity. Simultaneously, investment in digital device accessibility programs will mitigate hardware limitations.
- 4 **Policy and Funding:** Encourage policy frameworks and targeted budgets that support school ICT infrastructure growth and integration initiatives tailored for distinct geographical and socioeconomic contexts (South African Family Practice, 2025). A multisectoral approach involving government, private sector, NGOs, and communities could help mobilise sustainable financing and governance for technology-driven education innovation (Ministry of Education, Ghana, 2025).
- 5 **Stakeholder Collaboration:** Foster stronger partnerships among schools, local governments, communities, and technology providers to ensure coordinated implementation, monitoring, and continuous improvement of ICT initiatives (Eduwatch, 2025). Such collaboration would enhance accountability and ensure initiatives align with local educational needs.

5.4 Areas for Further Research

Only the viewpoints of students and teachers in a single district were included in this study. Future studies could;

- 1 Conduct comparative analyses between rural and urban areas or across multiple semi-urban districts to identify differentiated barriers, best practices, and scalable models for ICT integration.

- 2 Examine the attitudes, preparedness, and professional development needs of educators, administrators, and policymakers regarding educational technology adoption and integration.
- 3 Quantitatively assess how technology influences specific learning objectives, academic performance, and digital competency acquisition across subjects and student populations.
- 4 Investigate the long-term effects of policy reforms and infrastructure improvements on educational innovation, equity, and digital inclusion in diverse contexts.
- 5 Explore gender and socioeconomic disparities in ICT use and access, developing strategies to ensure inclusive digital education opportunities for all learners.

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APPENDIX A

INTERVIEW GUIDE

Demographic Information of Participants (Students/Teachers)

Please provide the following information:

A) Personal information of the participants

1. What is your age?
2. What gender do you associate yourself with?
3. What is the name of your school?
4. What is your role in the School? (Example: Teacher, student)
5. What are your years of Experience (if applicable)
6. Is your school a Public or Private school?
7. What is your highest educational qualification? (for teachers)
8. Do you have access to Technology at Home (Yes/No): if no, why don't you have?
9. How often do you use Technology for teaching/Learning? Why?
(Daily/Weekly/Rarely/Never):

APPENDIX B

Interview Guide for Students/ Teachers

SECTION A: Accessibility and availability of educational technology in semi-urban communities

- 1 What type(s) of educational technologies are currently available in your school?
(e.g., mobile phone, computers, tablets, projectors, internet access)
- 2 How accessible are these technologies to teachers and students daily?
- 3 Can you describe how frequently and effectively these technologies are used in teaching and learning processes?
- 4 What digital learning resources or platforms are you familiar with or use regularly?
- 5 Are there any recent initiatives or projects in your school or district that have improved access to educational technology? Please describe.
- 6 How does the availability of these technologies compare to what you believe is needed for effective learning?

SECTION B: Barriers to effective technology integration in semi-urban educational settings

- 1 What are the main challenges your school faces regarding the use of educational technology?
- 2 How do issues like internet connectivity, electricity supply, or availability of devices affect technology use?
- 3 Have teachers received any training on integrating technology into teaching? If yes, how adequate was it?
- 4 Do financial constraints limit technology acquisition or maintenance in your school? Please explain.

- 5 Are there cultural, language, or socio-economic factors that impact the adoption of technology among teachers or students?
- 6 How supportive is the school administration and local education authorities in addressing these challenges?
- 7 Can you provide examples of situations where technology integration was hindered by these barriers?

SECTION C: How technology can help to bridge the divide in semi-urban communities

1. In what ways has educational technology improved teaching and learning outcomes in your school or district?
2. How has technology helped to address educational inequalities between urban and semi-urban or rural students?
3. Can you provide examples of how technology has enabled students to access resources or learning opportunities that were previously unavailable?
4. How do students and teachers perceive the impact of digital tools on motivation, engagement, and academic performance?
5. What role do government initiatives, NGOs, or private sector partnerships play in supporting technology access and use in your community?
6. What additional technological tools or infrastructure would you recommend to further bridge the educational divide in semi-urban communities?