UNIVERSITY OF EDUCATION, WINNEBA

THE USE OF INTERNET RESOURCES TO IMPROVE LEARNING OF ICT

THE CASE OF BODWESANGO SENIOR HIGH SCHOOL.

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THE USE OF WIRELESS INTERNET AND DIGITAL NETWORKED DEVICES AS A LEARNING TOOL TO IMPROVE THE LEARNING OF ICT IN GHANA. A CASE STUDY OF BODWESANGO SENIOR HIGH SCHOOL IN THE ASHANTI REGION OF ADANSI ASOKWA DISTRICT.

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A dissertation in the Department of Information Technology Education, Faculty of Applied Sciences and Mathematics Education, submitted to the School of Graduate Studies in partial fulfilment of the requirements for the award of the degree of Master of Science (Information Technology Education) in the University of Education, Winneba

MAY, 2021

DECLARATION

STUDENT DECLARATION

I, **ALBERT DAKURAH**, declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own 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 dissertation was supervised in accordance with the guidelines for supervision of dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: **DR. KWAME ANSONG-GYIMAH**

SIGNATURE…….……

DATE…….

DEDICATION

This dissertation is dedicated to my family for being the source of inspiration and my conscience, thereby inspiring in me confidence courage, determination, hard work to pursue my dreams and instilling in me a sense of passion for success by their unwavering and relentless spirit in their belief in the power of education.

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ABSTRACT

ICTs are rapidly changing the ways of exchanging and receiving information and provide positive ways of learning and teaching. The sensational growth of wireless internet usage is moving fast and has changed the lives of millions of people around the world. For

learners, the usage of wireless internet is a crucial tool for educational progression. The study is based on wireless internet and digital device usage at Bodwesango Senior High School, undertaken to obtain teachers and learners' views regarding their use of wireless internet and digital devices, their reasons for using wireless internet and the impact of wireless internet use on educational activities. The study wanted to find out what learners used wireless internet and digital devices for; what internet services were found to be most useful and relevant to teachers and learners and how often they used wireless internet and digital device. The study further investigated whether teachers and learners had the necessary skills to utilize the internet and also identified challenges that learners experienced when using the internet. The sample was drawn from Bodwesango Senior High School in the Adansi Asokwa where 253 learners and teachers were surveyed and results were analyzed using SPSS. In the assessment process, frequency and percentage graphs were drawn to summarize the results. The most common problems of all were the slow speed of the internet and network problems. Recommendations included the need for Ghana government to fund secondary schools in order to provide quality education. Provision of more funds by the Ministry of Education and Ghana Education Service to assist in providing resources needed such as internet connectivity and better facilities (such as school library) in the schools. Internet access will enable teachers and learners to access online information sources for educational purposes since most teachers and learners use their smart-phones to access the internet in the absence of school library, public library and information centre in their community.

CHAPTER ONE

INTRODUCTION

Learning, communication and computing has become much easier due to the introduction of wireless internet and digital devices. Unlike before, people including students have to learn, communicate and do their research through the hard way by reading through many books to come out with their results. They have to travel long distances to search for information from one library to the other and from one place to another. All this have come to pass due to the technological inventions of wireless internet and digital devices which makes it possible for students and people all over the world to improve their knowledge in ICT, to communicate and to do research with the aid of a wireless internet and digital devices. The study will be looking at the title (topic), introduction, background of the study, statement of the problem, the purpose and significance of the study, limitations of the study, delimitation of the study and the organization of the research study, review of related literature.

1.1 Background to the Study

A wireless internet network or data network is a telecommunications network, which allows computers to exchange data. In wireless computer networks, networked computing devices pass data to each other along network links (data connections). The connections between nodes are established using either cable media or wireless media. The best-known computer network is the Internet (Wikipedia, 2015).

The deployment of Wireless broadband services is done by weighing the geographical population density against the bandwidth limitation. Wireless technologies are designed to reduce the time and different types of obstacles created by cables and more

convenient than wired networking. In 1997,'Wireless fidelity-popularly known as Wi-Fi technology was developed by IEEE 802.11 standards, which provided users the liberty to connect to the internet from any place (Tambe, 2015).

Network computer devices that originate, route and terminate the data are called network nodes. Nodes can include hosts such as personal computers, routers, switches, iPad phones, servers as well as networking hardware's. Two such devices can be said to be networked together when one device is able to exchange information with the other device, whether or not they have a direct connection to each other (Geier, 2001).

Computer networks differ in the transmission media used to carry their signals, the communications protocols to organize network traffic, the network's size, topology and organizational intent. In most cases, communications protocols are layered on (i.e. work using) other more specific or more general communications protocols, except for the physical layer that directly deals with the transmission media. Computer networks support applications such as access to the World Wide Web, shared use of application and storage servers, printers, and fax machines, and use of email and instant messaging applications (Wikipedia, 2015).

A wireless network is any type of computer network that uses wireless data connections for connecting network nodes. Wireless networking is a method by which homes, hospitals, telecommunications networks and enterprise (business) do installations by avoiding the costly process of introducing cables into a building, or as a connection between various equipment at distance locations. Wireless telecommunications networks are generally implemented and administered using radio communication. This

implementation takes place at the physical level (layer) of the OSI model network structure. Examples of wireless networks include cell phone networks, Wi-Fi local networks and terrestrial microwave networks.

Wi-Fi or Wireless Fidelity is Freedom it allows you to connect to the internet from your couch at home, in a hotel room or a conference room at work without wires. Wi-Fi is the wireless technology like a cell phone. Wi-Fi enabled computers send and receive data indoors and out; anywhere within the range of a base station. In addition, the best thing of all is fast.

However, you only have true freedom to be connected anywhere if your computer is configured with a Wi-Fi CERTIFIED radio (a pc card or similar device). Wi-Fi certification means that you will be able to connect there are other Wi-Fi CERTIFIED products, whether you are at home, office, airport, coffee shops and any other public areas equipped with a Wi-Fi access availability. Wi-Fi is the major face behind hotspots, to a much greater extent (Seminarsonly, 2015).

In 1997,'Wireless fidelity-popularly known as Wi-Fi technology was developed by IEEE 802.11 standards, which provided users the liberty to connect to the internet from any place. But this service was pretty expensive till 2002, however the new 802.11g standards in 2003 has led to creation of Wi-Fi enabled devices to the masses as a result today a Wi-Fi router has become a household commodity in most modern homes in India (Tambe, 2015).

Wireless radio frequency (RF) technology is well suited for personal area networks (PANs). The short-range (approximately 10 meters) requirements of PAN allow the use of low-power high-bandwidth (upto1Mbps) data connections created by proximity. The greatest limitations of radio PANs are international emission regulations and standardization of the physical and data-link layers. Once standards are established, volume production and improvements in design and process will allow the cost and power of PAN radios to drop (Hewlett-Packar, 1970).

A wireless sensor network (WSN) digital devices (nodes), which form a distributed autonomous network for computation and communication, must react to real world phenomena, process and fuse data, and eventually create new knowledge. This knowledge must be presented to an end-user or analyzed to create value added end-user services (Akyildiz, 2012).

Wireless media uses the antennas for sending and receiving the electromagnetic waves without using any physical conductors. Antennas that propagate the waves into the air generate radio frequencies (RF). Antennas for wireless transmission can be put into two different categories (Molisch, 2005).

1. Directional antennas: Directional antennas are commonly used in point-to-point configurations connecting two distant buildings LANs, and sometimes point-to-multipoint (connecting two WLANs). In this, sending and receiving antenna must be properly aligned for proper transmission. An example of a directional antenna is a Yagi antenna: this antenna allows you to adjust the direction and focus of the signal to strengthen the range/reach.

2. Omni-directional antennas: Omni-directional antennas are used in point-to multi-point configurations, where they distribute the wireless signal to other computers or devices in WLAN. An access point would use an Omni-directional antenna. These antennas can also be used for point-to-point connections. In this, signal is spread in all directions and can be received by any antenna, which is compatible to receive the signals.

However, this study is aimed at providing an overview on computer networking with specific emphasis on wireless networked digital devices the technology for computing, communication and enhancing the economy in Ghana.

1.2 Statement of the Problem

Wireless internet networking and digital devices is a technology through which data signals flow through portable communicating devices into the air. It is useful for people to communicate browse and access applications software's and information without wires (Rappaport, 2002). It allows people to interact with e-mail or browse the Internet connect to wireless devices from a location that they prefer. Wireless networks are not bound to a channel to follow like wired networks. Wireless networking is less expensive and much easier to install than more traditional wired networking. Wireless networking is used at the airport, or in hotel lobbies, in the bus and a small office or home network etc. The transmitted distance can be anywhere between a few meters as a television's remote control and thousands of kilometers as radio frequency (RF) communication. Wireless network uses the antennas for sending and receiving the electromagnetic waves without using any physical conductors. Antennas that propagate the waves into the air generate radio frequencies (RF) (Rhoton, 2001). A detailed overview of wireless internet and digital devices, the technology for computing, communication, enhancing

the teaching and learning of ICT and to enhance the economy in Ghana will be highlighted in this study.

1.3 Objectives of the Study

1. To provide an overview on wireless internet network and digital devices as a learning tool to enhance the teaching and learning of ICT.
2. To examine the different types of wireless internet network.
3. To determine the structure and components of a wireless network and digital networked devices.

1.4 Research Questions

1. What student learning improvements are linked to the use of wireless internet and digital services?
2. What are the challenges for accessing wireless internet and digital devices?
3. What are the advantages of using wireless internet and digital technology as a learning tool to enhance teaching and learning?

1.5 Significance of the Study

This study on the use of wireless internet and digital network devices to improve the learning of ICT in Ghana, a case study in Bodwesango Senior High School Ghana has the following significance:

1. It will educate the general public on the details about computer networking with more emphasis on wireless networking and digital network devices. It will also familiarize students and the general public about the structure and components of wireless networking and digital network devices and most importantly the various types of wireless networks that exists.

2. This research will be a contribution to the body of literature in the area of the relationship between performance assessment and investment decision, thereby constituting the empirical literature for future research in the subject area.

1.6 Scope of the Study

This study on computer networking using wireless network and digital networked devices will provide an overview of computer networking with more emphasis on wireless networks and devices. It will also cover all the types of wireless network that exists, structure and components of the wireless network and devices.

1.7 Specific Objectives

1. The advantages of using wireless internet and digital devices as a learning tool to enhance the learning of ICT in Senior High Schools
2. How wireless internet network and digital devices operates
3. The strengths of wireless internet and the various digital devices

1.8 Limitations of the Study

Even though the research carried out was successful, some limitations hindered the progress of the research. The limitations included the following:

- The research has been undertaken in an area where internet connectivity is a challenge.
- Combining work with the research has not been an easy task.
- Stable power has been a challenge as is on and off.

1.9 Delimitation of the Study

The research was not concerned with educational background of users or the social class people, gender and age who make use of wireless internet and digital devices.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this research is to know how teachers students of Bodwesango Senior High and the community of Adansi Asokwa District uses wireless internet and digital devices to improve the learning of ICT and computing in their society and in Ghana at large.

This chapter focuses on the review of already existing wireless internet technology what others have researched on wireless internet network and digital devices, what is already known, what is yet to be known and relevant literature essential to this research. The review of literature purposely encompasses the use of various wireless technologies to cornet, browse and communicate to one another. It will contain the theoretical framework and the technology behind wireless internet connectivity and digital devices.

The past 15 years have brought an unprecedented increase in access to telephone services. This growth has been driven primarily by wireless internet technologies and the liberalization of digital devices and telecommunications markets, which allowed for faster and cheaper rollout of mobile networks.

The total number of mobile phones in the world surpassed the number of fixed-line telephones in 2002; by the end of 2008, there were an estimated four billion mobile phones globally (Intelligence, 2008). The proportion of mobile phone subscriptions in developing countries increased from about 30% of the world total in the year 2000 to

more than 50% in the year 2004 and to almost 70% in the year 2007. No technology has ever spread faster around the world than wireless technology (Economist, 2008).

2.2 The Theoretical Framework and the Technology of the Research

This segment is to find out what others have said about the topic under consideration. It shall therefore cover areas such as definitions, technologies, wireless network communication, wireless sensor fidelity, wireless data services, digital devices, the motivation for the usage of wireless network and digital devices.

The past 15 years have brought an unprecedented increase in access to telephone services. This growth has been driven primarily by wireless technologies and the liberalization of telecommunications markets, which allowed for faster and cheaper rollout of mobile networks. The total number of mobile phones in the world surpassed the number of fixed-line telephones in 2002; by the end of 2008, there were an estimated four billion mobile phones globally (Intelligence, 2008). The proportion of mobile phone subscriptions in developing countries increased from about 30% of the world total in 2000 to more than 50% in 2004 - and to almost 70% in 2007. No technology has ever spread faster around the world (Economist, 2008).

2.3 Existing Technologies and Problems

The basic existing technology for implementation of Wireless networks (WLAN) in residential and enterprise setups has been discussed in similar research work.

However, the major concern in this research work is that there are several issues associated with the deployment and management of WLAN. These include scalability, provisioning, real-time and non-real time data flow, accessibility range, power

management interference from other systems operating in the same spectrum such as Bluetooth. Major problems that need to be address are;

1. Security Management

2. Quality of Service and centralized Management of WLANs.

2.4 Recommendations for Secure Wireless Internet

- Maintain a full understanding of the topology of the wireless network.
- Label and keep inventories of the fielded wireless and handheld devices.
- Create backups of data frequently.
- Perform periodic security testing, audits and assessment of the wireless network.
- Perform a risk assessment, develop a security policy, and determine security requirements before purchasing wireless technologies.
- Apply security management practices and controls to maintain and operate secure wireless networks after careful installation
- The information system security policy should directly address the use of 802.11, Bluetooth, and other wireless technologies.
- Configuration/change control and management practices should ensure that all equipment has the latest software release, including security feature enhancements and patches for discovered vulnerabilities. • Standardized configurations should be employed to reflect the security policy, and to ensure change of default values and consistency of operations.
- Security training is essential to raise awareness about the threats and vulnerabilities inherent in the use of wireless technologies.

Robust cryptography is essential to protect data transmitted over the radio channel, and theft of equipment is a major concern

2.5 Wireless Internet in Senior High Schools

Wireless internet is an invented technology, which holds the greatest promise humanity has known for learning and universal access to quality education (Tella, 2007:11). The internet is a network of hundreds and thousands of computers across the world, connected in a way that lets other computers access information from them. It is also a computer mediated communication tool, providing the individual with access to a broad spectrum of information and unique communication technologies which allows learners to broaden their learning experiences, access important information and communicate to others within learning community (Odede, 2013:57). Internet use has great potential to revolutionize the process of learning in schools by enhancing the skills of learners because the internet has become a current requirement in the present academic order (Ali, 2014:222). The use of the internet allows a wide range of resources to be accessed by learners across the globe irrespective of their location and age (Otunla, 2013:116). The use of the internet has had a profound influence on the educational sector as it is being used for diversifying activities in schools (Bankole, 2012:16). For example, it has modernized information techniques used by teachers and their learners. It improves methodology used for learning and teaching purposes; the internet provides information and knowledge resources that allow access to a varied range of materials from around the globe to a local community. It is also used as a publishing medium which allows access to a vast amount of information which was not possible in the past, by so doing it reduces the information gap between the learners in underdeveloped and developing regions (Otunla, 2013: 1). Ukpebor and Emwanta (2012: 17) argued that internet use

has become an efficient resource for school assignments in that learners and teachers trust and have confidence that the use of the internet is a good educational tool. As a result teachers need to incorporate the use of internet sites in classroom activities because the use of internet has the ability to supplement, reinforce and to upgrade the educational process. There is increasing research output on how the internet can be a vital component that will significantly expand student learning (Ukpebor, 2012:18). Odede (2013: 58) is of the view that the use of the internet is spreading rapidly into education particularly in high schools, with a huge impact in many areas and covering all the subjects that are taught. Learners are using it to support the attainment of learning outcomes. Outside school's daily activities, learners may use the internet to access and complete assignments and other school related tasks given by their teachers. Devi (2013: 139) suggests that since the internet is a multipurpose tool with numerous potentials, it enables learners to communicate, exchange and share ideas, knowledge and experiences with other learners thereby enhancing learners' skills and capabilities in relation to their studies. This makes the internet a very popular and effective tool used by learners for education as well as a variety of other activities including entertainment. The internet provides an interactive environment for sharing information on a wide variety of subjects; and it can also be used to support learners in their studies. The internet is a valuable source of information which is frequently used by learners to supplement the traditional educational methods. For example, to complete a given task, teachers may ask learners to find specific web sites to gain more in-depth knowledge about a particular topic which in turn highlights more information to the learners. Internet resources provide the flexibility to approach a concept from various angles. The use of the internet in schools gives learners' opportunity to find information on almost anything in an efficient and effective way, and it also gives learners the

advantage of connecting and interacting with their teachers quickly and cheaply. The use of the internet provides a vast amount of educational benefits to learners and it offers a host of ideas, a broad array of information and engaging, interactive opportunities to teachers and learners. (Shezi, 2005 : 1) Pointed out that the internetenables people from all areas around the world to exchange information and also disseminate it. Internet offers students a golden opportunity of networking with others globally because the internet is the knowledge centre of the world (Shezy, 2005: 1).

2.6 Wireless Data Networks

Each type of wireless data network operates on a specific set of radio frequencies. For example, most Wi-Fi networks operate in a special band of radio frequencies around 2.4 GHz that have been reserved in most parts of the world for unlicensed point-to-point spread spectrum radio services. Other Wi-Fi systems use a different unlicensed band around 5 GHz. Google scholar (2005).

The 802.11b, 802.11g, and 802.11n Wi-Fi services all operate in a frequency range at or slightly above 2.4 GHz. The 802.11a signal uses a band close to 5.3 GHz. The specific center frequencies of each Wi-Fi channel are listed in Table 2-3. Unless you are a radio engineer, the important things to know about the different Wi-Fi services are the maximum data transmission rate and the signal range. Table 2-3 shows the important characteristics of each Wi-Fi specification. The differences between the maximum data speeds and the typical speeds are caused by the handshaking and other nondata information that must attach itself to each data packet. Obviously, there is a tremendous amount of overhead involved in moving information through any kind of Wi-Fi network (IEEE, 1997).

2.7 Wireless Data Services

Because radio signals move through the air, you can set up a network connection from any place within range of the network base station's transmitter; it is not necessary to use a telephone line, television cable, or some other dedicated wiring to connect your computer to the network. Just turn on the radio connected to the computer and it will find the network signal. Therefore, a radio (or wireless) network connection is often a lot more convenient than a wired one. This is not to say that wireless is always the best choice (Google, 2015).

A wired network is usually more secure than a wireless system because it's a lot more difficult for unauthorized eavesdroppers and other snoops to monitor data as it moves through the network, and a wired link doesn't require as many complex negotiations between the sender and receiver on protocols and so forth. In an environment where your computer never moves away from your desk and there are no physical obstacles between the computer and the network access point, it is often easier to install a data cable between the computer and a modem (Surabhi, 2015).

2.8 Wireless Communication

Personal area networks connect mobile devices carried by users to other mobile and stationary devices. Their communicating range is scaled to the spatial interaction volume of humans (e.g., the reach of a hand or the audible distance of a voice), typically under ten meters. This distance coincides well with the limited battery capacity of small portable devices, and allows communication bandwidth (Pico cells) to be reused spatially. Wireless PAN Communication can occur over optical, magnetic, electric, and electromagnetic channels (Gershenfeld, 2015).

Since its inception, the Wi-Fi technology has come a long way in providing quicker wireless access to Internet applications and data across a radio network thereby making the access process faster than conventional modem. Radio bands such as 2.4GHz and 5GHz depend on wireless hardware such as Ethernet protocol and CSMA for the Wi-Fi Technology to work. Like every communication network, this method also involves transmitter (Wireless Router/Hotspot) and receiver that can be any Wi-Fi enabled device like laptop, mobile, tablet etc. (Tambe, 2015).

Many organizations and users have found that wireless communications and devices are convenient, flexible, and easy to use. Users of wireless local area network (WLAN) devices have flexibility to move their laptop computers from one place to another within their offices while maintaining connectivity with the network. Wireless personal networks allow users to share data and applications with network systems and other users with compatible devices, without being tied to printer cables and other peripheral device connections. Users of handheld devices such as personal digital assistants (PDAs) and cell phones can synchronize data between PDAs and personal computers and can use network services such as wireless email, web browsing (Gast, 2005).

2.9 How Wireless Network Works

Moving data through a wireless network involves three separate elements: the radio signals, the data format, and the network structure. Each of these elements is independent of the other two, so you must define all three when you invent a new network. In terms of the OSI reference model, the radio signal operates at the physical layer, and the data format controls several of the higher layers. The network structure includes the wireless network interface adapters and base stations that send and receive

the radio signals. In a wireless network, the network interface adapters in each computer and base station convert digital data to radio signals, which they transmit to other devices on the same network, and they receive and convert incoming radio signals from other network elements back to digital data. Each of the broadband wireless data services use a different combination of radio signals, data formats, and network structure. We will describe each type of wireless data network in more detail later in this chapter, but first, it is valuable to understand some general principles.

2.10 Benefits of Wireless

Wireless broadband provides Internet access to mobile devices in addition to allowing network operators to extend their networks beyond the range of their wired connections. For our purposes, two-way radio is the most sensible approach to wireless broadband, but other methods (such as infrared light or visible signaling) are also possible. Connecting your computer to the Internet (or a local network) by radio offers several advantages over connecting the same computer through a wired connection.

First, wireless provides convenient access for portable computers; it is not necessary to find a cable or network data outlet.

Second, it allows a user to make a connection from more than one location and to maintain a connection as the user moves from place to place.

For network managers, a wireless connection makes it possible to distribute access to a network without the need to string wires or cut holes through walls. In practice, access without cables means that the owner of a laptop or other portable computer can walk into a classroom, a coffee shop, or a library and connect to the Internet by simply turning on the computer and running a communication program. Depending on the type of wireless network you are using, you might also be able to maintain the same connection in a moving vehicle.

When you are installing your own network, it is often easier to use Wi-Fi links to extend your network and your Internet connection to other rooms because a wired system requires a physical path for the cables between the network router or switch and each computer. Unless you can route those cables through a false ceiling or some other existing channel, this usually means that you must cut holes in your walls for data connectors and feed wires inside the walls and under the floors. A radio signal that passes through those same walls is often a lot neater and easier.

2.11 Digital Networked Devices

A physical unit of equipment that contains a computer or microcontroller. Today, myriad devices are digital including a smartphone, tablet and smartwatch. In contrast, there are numerous non-digital (analog) devices, such as a thermometer, electric fan and bicycle. Automobiles, washing machines and many other products are both digital and analog.

The proliferation of mobile computing devices including laptops, personal digital assistants (PDAs), phones, router, switch and wearable computers has created a demand for wireless personal area networks (PANs). PANs allow proximal devices to share information and resources. The mobile nature of these devices places unique requirements on PANs, such as low power consumption, frequent make-and-break connections, resource discovery and utilization, and international regulations. This paper examines wireless technologies appropriate for PANs and reviews promising research in resource discovery and service utilization (Zimmerman, 1999). Cellular phone technology provides mobile voice communication, but mobile workers also need immediate access to digital information. The Internet provides a wealth of digital

information, but the interfaces and data links are typically not portable. The fusion of cell phones and personal digital assistants (PDAs) can deliver the communication and information required by mobile users (Jean-Paul, 1993).

The concept of a pen-based pocket computer an electronic version of a day planner, address book, and memo pad. However, the device could not fit in a pocket and was slow and complex. The pocket organizers in the early 1990s provided the needed functions, speed, and size, but their small keyboard and inability to exchange data with personal computers (PCs) made them undesirable (Newton, 1993).

The most common networking devices are HUB, Switch, Router, Bridge, Brouter, Network Interface Cards (NICs), Wireless access points, Modems and Gateway function in computer network. A computer network is basically a group of multiple networking devices connected together for data sharing. Collectively networking devices have single purpose securely transfer data as fast as they can. To achieve this goal every networking device has its own functionality.

2.11.1 Switch

A switch is a multi-port bridge with a buffer and a design that can boost its efficiency (large number of ports imply less traffic) and performance. Switch is data link layer device. Switch can perform error checking before forwarding data that makes it very efficient, as it does not forward packets that have errors and forward good packets selectively to correct port only. In other words, switch divides collision domain of hosts, but broadcast domain remains same.

2.11.2 Router

A router is a device like a switch that routes data packets based on their IP addresses. Router is mainly a Network Layer device. Routers normally connect LANs and WANs together and have a based, on which they make decisions on routing the data packets. Router divide broadcast domains of hosts connected through it. Router forwards packets on the bases of their destination address. For this, router keeps record of the path that packets can use as they move across the network. These records are maintained in a database table known as routing table. Routing table can be built statically or dynamically.

2.11.3 Bridge

A bridge operates at data link layer. A bridge is a repeater, with add on functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device.

2.11.4 Wireless Access Point (WAP)

A wireless access point (WAP) is a hardware device or configured node on a local area network (LAN) that allows wireless capable devices and wired networks to connect through a wireless standard, including Wi-Fi or Bluetooth. WAPs feature radio transmitters and antennae, which facilitate connectivity between devices and the Internet or a network. A WAP is also known as a hotspot.

2.11.5 Modem

Modulator-demodulator is a hardware electronic device that allows computers to communicate by sending and receiving data over telephone lines, wires or cable-TV and satellite connection. One computer's modem converts its digital signals (which cannot be sent efficiently over phone lines) into analog signals (which can be). The other computer's modem reconverts the analog signals (that the computer cannot understand) into digital signals (that it can). Conversion of one type of signals to another is called modulation, their reconversion to the original type is called demodulation. Modern modems work at 56 thousand bits per second (Kbps) or higher data transfer speeds, perform automatic error correction, and allow voice and fax communications. In the case of transmission over an analog telephone line, which was once the most popular way to access the internet, the modem converts data between analog and digital formats in real time for two-way network communication. In the case of the high-speed digital modems popular today, the signal is much simpler and doesn't require the analog-to-digital conversion.

2.11.6 Gateway

A gateway, as the name suggests, is a hardware device that acts as a “gate” or passage to connect two networks together that may work upon different networking models. It may be a router, firewall, server, or other device that enables traffic to flow in and out of the network. They basically works as the messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switch or router.

2.12 Conclusion

The widely use of wireless network and digital devices is not a surprise, but the research points to the fact that more conscious effort must be made to extend the coverage area of wireless networking and the use of digital devices to improve the lives of the users.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In this chapter, the main focus is on the research design and methodology underpinning the investigation into the use of wireless internet and digital devices by teachers and learners of Bodwesango Senior High School and the Bodwesango community as a whole. The chapter outlines the research paradigm, research approach, research design, population of the study, data collection methods, data analysis procedure and ethical issues that guided the study.

The study is also to look at the economic, social and the motivational benefits of the use of wireless internet and digital devices. A variety of interactive, experimental and observational methods of the effective use of wireless networking and digital devices to develop and improve the live style of the people. This chapter focuses on the methods the researcher used for the study. It includes the research design, the research method, research participants, sampling and the method of collecting the data.

3.2 Research Paradigm

According to Killam (2013: 5) a research paradigm is a "way of thinking about or viewing the world and is a set of beliefs or worldview that used to guide a research or inquiry". Lucienne, Blessing and Chkakrabarti (2009: 240) argue that paradigms express the fundamental assumptions whereupon the research is assembled and ought to be known when applying the related approach or its methods. Neuman (1997: 62), on the other hand, notes that a paradigm is an idea that is made to mean the basic assumptions of the research, the main questions to be answered, and the research

techniques to be used. This paradigm enables the researcher to unpack some of the assumptions that are associated with the use of the internet by learners which were taken for granted such as using the internet for assignments and research activities. The following are the main paradigm classifications which the researcher used and a brief overview of each is provided.

3.3 Quantitative Research

For any study carried out, there is a need for the study to satisfy the two research approaches mentioned above by identifying the appropriate research methods to be used for it. This study was carried out using a quantitative research method, namely a survey (see below). The researcher adopted the quantitative approach because of its value of making it possible to obtain numerical data on the use of internet by grade 11 learners. Fox and Bayat (2007:7) describe quantitative research as concerning things that can be counted. For example, the use of statistics to process and explain data and to summarize findings. In general, quantitative research is concerned with systematic measurement, statistical analysis and methods of experimentation. Quantitative methods collect quantifiable data. As noted, a quantitative method, namely the survey was employed in the present study.

With regard to internet usage, the quantitative research method was applied to determine how many learners were using internet, how many were aware of internet services, what was their motives behind using the internet and what was their views regarding internet use. Shiweda (2013) outlined that this approach was chosen for her study to ensure a more representative population which allows for a better generalization of the findings.

This approach was achieved through the use of a questionnaire comprising of open questions that generated qualitative data and closed questions which provided quantitative data. Open ended questions invited the expression of feelings and views, and opinions of the respondents with regard to the use of internet. While both types of questions were used the vast majority were closed in nature thereby underpinning the quantitative nature of the study.

3.4 Research Approach

Research approaches involve quantitative and qualitative research. Holliday (2002: 5) outlines the difference between the two approaches: In quantitative research, the reality can be measured by the right research instruments which maintain that there is a normality that researchers can fathom and understand and be mastered by statistics and experiments while in qualitative research the reality of the research approach is that the research results are descriptive and people can be touched by the research that makes sense and interpret bits of reality. Quantitative research counts occurrences across a large population and uses statistics and replicability to validate generalization from survey samples and experiments and qualitative research locates the study within particular settings which provide opportunities for exploring all possible social variables and more informed exploration as themes and focuses emerge.

3.5 Research Design

The researcher used qualitative research method, which is a type of research that collects and works with non-numerical data and that seeks to interpret meaning from these data that help us understand social life through the study of targeted populations or places. Qualitative research is typically focused on the micro-level of social interaction that composes everyday life. From the above explanation, one will agree

with me that the study undertaken was a qualitative research (Crossman, 2019). This is because the research was used to improve the learning of ICT and the living standard of the students of Bodwesango SHS and the people of Adansi Asokwa District.

3.6 Population

According to (Welman, 2005:552), the population in a study refers to the object which could consist of individuals, groups, organizations, human products and events, or the conditions to which they are exposed. The population upon which this study was based on is 253 both students and teachers of Bodwesango Senior High School in the Adansi Asokwa District. Wallen and Fraenkel (Fraenkel, 2013:380) describe the target population as the group of persons (objects and institutions) that the study focuses on, and also considered as the entire group of people which the researcher is interested in to make conclusions.

3.6.1 Size of the Population

The population of 253 both teachers and students is reflected in Table 1 below.

Table 1: Population of study (Teachers and form two students)

Population	Size
Science Class	43
General Agric Class	46
Home Economics 'A' Class	47
Home Economics 'B' Class	49
Teachers	68
Total	**253**

3.7 Participants and Sampling

3.7.1 Participants

The researcher targeted form two students and teachers of Bodwesango SHS of Adansi Asokwa District, that is having a population of about thousand six hundred and fifty four (1654) where the researcher conducted the study. The targeted group was all users of wireless networking and digital devices.

3.7.2 Sampling

The researcher used simple random sampling technique to get the sample from the population. Simple random sampling is a sample, which is chosen so that every member of the population is equally likely to be a member for the sample, independently of which the other members of the population are chosen (Cook, 1992). The sample technique is motivation

The researcher used the simple random sampling technique for the following reasons:

- It is simple to design
- It gives greater accuracy of results
- It helps to avoid bias in selection

It is often not feasible to survey the entire target population and a sample that is representative of the population is therefore selected. Based on the large number of learners in the present study it was concluded that there was a need for sampling. Fox and Bayat (2007:54) pointed out that sampling is the process by which elements are drawn from the population and sampling in survey research allows the researcher to generalize findings across the population from which the sample was taken.

3.7.3 Sample Unit

Surveying the entire population can consume a large amount of time, money and effort so it is sometimes in the researcher's interest to survey only a sample, which is a subset of the population. The selected sample of 115 form two students and teachers is shown in Table 2 below.

Table 2: Sample Size of Form Two Students and Teachers

Population	Sample size	Percentage (%)
Science Class	29	25.2
General Agric Class	27	23.5
Home Economics 'A' Class	24	20.9
Home Economics 'B' Class	25	21.7
Teachers	10	8.7
Total	**115**	**100**

Probability sampling was used for this study and in probability sampling, the size of the population under investigation is known to the researcher. Characteristics of probability sampling are, for example, every individual or unit has an equal chance of being sampled and the researcher can make generalizations to the larger population.

3.8 Data Collection Technique

According to Bless, (Bless, 2008:111) data collection is the precise, systematic gathering of information relevant to the research sub-problems, using methods such as conducting a survey. As noted, the survey method was employed to collect data as it was the most cost effective way to reach the sample required. Hence the study adopted a quantitative approach, which lead to the questionnaire tool being used for the collection of data.

3.8.1 Motivation

Motivation is an internal state that arouses us to action, pushes us in a particular direction, and keeps us engaging in certain activities. The researcher used one of the numerous motivational skills to arouse and sustain the people interest on the use of wireless internet and digital devices (Elliot, 2000). The researcher advocate that there should be a wide area coverage and less cost for the use of wireless internet and digital devices to motivate the interest of the people to patronize the usage of it.

3.9 Data Collection Instruments

3.9.1 Questionnaire

Fox and Bayat (Bayat, 2007:88) define a questionnaire "as a list of questions on a specific topic compiled by a researcher and to which answers and information are required. With questionnaires it is easy to reduce some bias" since there is uniform question presentation and no middleman bias. Questionnaires can be distributed to a large number of people at the same time. This has an advantage of saving time when collecting data. Leedy and Ormarod (Ormarod, 2010:189) argued that the questionnaire method does not require that the participants include their names, therefore this may increase the likelihood of the respondents being more truthful, especially when addressing the topic such as the use of wireless internet and digital devices.

Wallen and Fraenkel (Fraenkel, 2013:84)describe a questionnaire as a group of written questions used to gather information from respondents and it is regarded as one of the commonest tools for gathering data in research. Bawden and Robinson (Robinson, 2012:308) stated that "questionnaires are regarded as being in the positivist style of research, since they assume that the researcher and those surveyed share a common

perspective of the situation". The questionnaire technique was chosen as the most appropriate tool for data collection as it is a rich and reliable source of research data. The present study wanted to collect quantifiable data and participants' opinions and perceptions towards internet usage.

Pedhazur and Schmelkin (Schmelkin, 2013:132) emphasised the advantages of questionnaires:

1. Questionnaires are generally cheaper and quicker to administer
2. Questionnaires are less time consuming to complete
3. Questionnaires are less demanding with respect to matters such as selection and supervision
4. Questionnaires provide for wider coverage of the population of interest
5. Questionnaires are able to reach respondents in remote locations or special populations.

The questions used were mainly closed with some open questions. The questionnaire used to collect the data was divided into two categories:

Section one sought to determine demographical information on the respondents, such as gender and age.

Section two dealt with internet use in general and tried to discover the details and perceptions from their learners regarding the internet use.

3.9.2 Questionnaire Design

For questionnaire it involves the researcher creating questions that accurately measure the opinions, experiences, and behaviors or actions of the sampling of the public the survey will ask to respond. Questionnaire design includes question development, wording, organization, and testing.

3.9.3 Forms of Questions

A disadvantage of the questionnaire is that since they are structured instruments, they allow little flexibility for the respondents in respect of providing in-depth information. To overcome this disadvantage, the researcher used a combination of both open and closed questions but as noted the latter were in the majority. The structured format of the questionnaire is important for obtaining valuable and quality results. Terre-Blanche and Durrheim (Durrheim, 2002:294) asserted that open questions allow respondents to communicate their experiences or opinions about a specific issue in their own words, without any restriction. Respondents are expected to give a short written responses relating to the matter at hand. Open questions are thus flexible.

Terre-Blanche and Durrheim (Durrheim T.-B. a., 2002:295)argued that closed questions do not allow the respondents to provide answers in their own words, but force the respondent to select one or more choices from a fixed list of answers provided. Closed questions have the advantage of eliciting a standardized set of responses from all the respondents and therefore allowing for easier comparative data analysis. The most frequently used is the dichotomous item which offers two alternative answers only.

3.9.4 Pre-testing the questionnaires

McCormack and Hill (Hill, 1997:97) stated that pre-testing is a standardized step in questionnaire formation, where the goal is to check how well the questionnaire is working before beginning with the fieldwork and to make any required improvements for clarity of questions. In agreement with the above statement, Babbie and Mouton (Mouton, 2001:244) elucidated that pretesting is the most vital part in survey research design. When a researcher is developing a questionnaire there is always a likelihood of

error. Therefore, pre-testing the questionnaire is important to reveal and correct any flaws in questions.

The purpose of a pre-test is to test the adequacy of a questionnaire on a predetermined number of people from the population of interest before the costs of a full-scale survey are incurred. This means that no survey should be conducted without the questionnaire first having been tested. As a result of this procedure, defects in the questionnaire will be discovered and these can be corrected before it is administered to the chosen sample. Pre-testing enables the researcher to revise the methods of a research and logistics of data collection before starting the actual fieldwork. As a result a good deal of time, effort and money can be saved in the long run. In this study the questionnaires were pre-tested with ten (10).

Participants, before the actual study was conducted. The researcher distributed 10 questionnaires to teachers and learners. The results provided that there were no unclear, imprecise and irrelevant questions that the learners identified and only minor changes were made to the questionnaire and were reviewed and incorporated into the final version of the research instrument. This allowed the researcher to conclude that all instructions and questions in the questionnaire were understood.

The nature of the comments from the pretest

In pre-testing these problems are eliminated

- Unclear instructions
- Excessive length
- Ambiguity or lack of clarity in the question wording
- Leading questions

- Poor continuity
- Alternative answers to closed questions

3.10 Data Analysis

Since the purpose of data gathering is to solve a research problem, data collected should therefore be analyzed. Khumalo (2006:46) outlined that after data has been obtained from the questionnaire it should be checked for completeness, comprehensiveness, consistency and reliability and this process is called data cleaning. Muhambe (2012:42) opines that quantitative data, sometimes called numerical data, is the data measured or identified on a numerical scale. Quantitative data is essentially analyzed using statistical methods, and results can be displayed using tables, charts, and graphs.

For this study, the data from the questionnaire was coded as a data file for analysis, using the programme called Statistical Package for Social Sciences (SPSS). Content analysis was used to interpret the responses of open questions. Weber (Weber, 1990:5) stressed that content analysis classifies textual material, reducing it to more relevant, manageable bits of data. A coding key was drawn up in which numerical values were assigned to all closed answer options in the questionnaire. The respondents to the open question were not coded but were reported on in subsequent chapter. The data were entered on a data matrix design using SPSS and subsequent presentation of the data was in the form of ratios, tables, percentages and other forms of graphic presentations such as charts.

3.11 Validity and Reliability

Briggs and Coleman (Coleman, 2007:96) regard reliability, along with validity and relevance, as one of the key tests in judging the adequacy of research. Oliver (Oliver, 2010:73)argued that the validity of research is the extent to which the data collection instruments actually measure what they purport to measure.

According to Hudson (Hudson, 1981:113), cited in De Vos et al (1998:85) reliability is "the accuracy or precision of an instrument; as the degree of consistency or agreement between two independently derived sets of scores, and as the extent to which independent administrations of the same instrument yield the same results under comparable conditions."

For the purpose of this study, to enhance reliability, the researcher recorded every step that was taken during data collection. This ensured that if other researchers wanted to replicate the study, they could do so and possibly to the same conclusions. Generally, to ensure validity and reliability, pre-testing of the data collection instruments is done.

3.12 Ethical Considerations

Ethical issues describe the system of ethical protections that the contemporary social research establishment have created to try to protect better the rights of the research participants. Ethical issues are very sensitive matters as one embarks on social research. De Vos et al (al, 2005:58) underline the pertinence of ethical responsibility in social sciences as unique by the fact that the objects of study are human beings. Ethical problems facing a social researcher are complex, as expressed in the following definitions:

Ethics is a set of moral principles which is subsequently widely accepted and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, other researchers, assistants and students (al, 2005:57). Ethics is the inquiry into the nature and grounds of morality where morality means moral judgements, standards and rules of conduct (Taylor, 1975:12).

George (2005: 252) saw ethics as the study or discipline which concerns itself with judgements of approval and disapproval, judgement as to the rightness or wrongness, goodness or badness, virtue or vice of actions, dispositions or objects. For Martin (2011: 41) it is concerned with principles, which are universal and which are more than a fixed, a blind set of rules of behavior, so it entails reasoning about behavior and choices.

Ethics definition outlines the morally accepted principles between the researcher and people involved including other researchers and participants. The researcher is therefore accountable not only to respondents but to other researchers as well since ethics includes not only respecting and protecting the lives of the respondents but respecting and acknowledging the work of other researchers. Ethics is fundamentally characterized as principles or standards for representing the relations between people to benefit all concerned, with respect for the needs of all people involved in the experiment.

Bodwesango Senior High School requires an ethical agreement between the institution and the respondents before engaging in the research as it involves human beings. Hence, in conducting this study, the researcher was bound by the ethical agreement signed with Bodwesango Senior High School at the beginning of this study.

One of the principles that was agreed upon was that the participation of each respondent was voluntary, no participant should feel obliged to participate if she/he is not willing. Before the respondents engaged with the questionnaire, the researcher explained precisely what the purpose of the study was before the participants filled in the questionnaires. It is with their consent that they gave their time to participate in the study and it was made clear that they could withdraw at any time during the process if necessary.

The respondents were also told that participating did not result in any rewards and no one would be coerced into participating in the study. Once this was done the participants signed a consent form agreeing to participate in the study. The ethical values require the researchers not to put participants in a situation where they might be at risk of harm as a result of their participation.

In ensuring the privacy of the participants it was noted from the researcher's perspective that the rights and privacy issues relating to the participants would not be compromised in any way. The names were not asked for in the questionnaire and no names were mentioned in the reporting and discussion of the results. Therefore, privacy and confidentiality were ensured. The researcher told the participants that this collection of data was for educational purposes and any type of misleading information will be avoided.

It was also agreed to respect the personal privacy and confidentiality of the information gathered from the respondents, to avoid any harm. When the researcher started analysing and interpreting data, the researcher resolved to maintain the anonymity of all the respondents as a sign of cooperation with confidentiality agreed upon in the ethical clearance.

CHAPTER FOUR

PRESENTATION OF RESULTS OF THE STUDY

4.1 Introduction

This chapter presents the research findings. The research results were drawn from the self-administered questionnaire given to the teachers and students of Bodwesango Senior High School. The findings are presented in the form of frequency tables, bar-charts and pie charts.

4.2 Response Rate

Two hundred and fifty three questionnaires (253) were delivered to teachers and students of Bodwesango High School. Two hundred and fifty three questionnaires (253) were returned, yielding an excellent response rate of 100%. This good response rate can be attributed to the fact that the questionnaires were hand delivered to the teachers and students as the researcher waited for participants to complete them. The questionnaires were distributed on 15 April 2019. The questionnaire had 22 questions (20 close ended questions and 2 open ended questions for clarification purposes). According to Babbie and Mouton (2001), the consensus is that a response rate of 50% is adequate, 60% is considered good and 70% or more response rate is considered very good.

4.3 Presentation of Results

The questionnaire was designed to elicit a range of information. The questionnaire results are presented according to the sections covered in the questionnaire. These include demographics, background or general questions. The results of the questionnaire are presented by means of frequency tables and pie and bar-charts. Cross-

tabulation of some variables was also done to check if age and level of information literacy have any effect on the level of their internet use.

Note:

- Percentages were rounded off to one decimal point
- Questions 5, 7, 12, 13, 16 and 18 allowed respondents to indicate more than one response and hence the percentages exceeded 100%
- N means number of respondents that answered a picular question.

4.4 Part A: Background Information

This part on background information required the respondents to provide information related to their gender and age.

4.4.1 Gender of Respondents

The respondents were asked to specify their gender (question 1). The results are illustrated in Table 3 below. Out of 253 there were 63% (160) female and 37% (93) male respondents. From the results it is evident that there were more female respondents than male respondents and it must be borne in mind that female participants outnumbered male participants in the school.

Table 3: Gender of respondents N=253.

Gender	Frequency	Percent (%)
Female	160	63
Male	93	37
Total	**253**	**100**

4.4.2 Age categories

In Question two respondents were asked to indicate their age. Table 4 below shows that out of the 253 learners and teachers the highest number of respondents (54.5%) were between the age ranges of 21 – 30 years old. Three respondents were between the ranges of 41 – 50 years of age (1.2%) and two respondents were between the age ranges of 51 – 60 years of age (0.8%). Hence, the most common age group was 12-30 (54.5%) and the least common was 51-60 (0.8%).

Table 4: Age of respondents **N=253**

Age Range (Years)	Frequency	Percentage (%)
10 – 20	105	41.5
21 – 30	138	54.5
31 – 40	5	2.0
41 – 50	3	1.2
51 – 60	2	0.8
Total	**253**	**100**

4.5 Part B: What Student Learning Improvements are linked to the use of Wireless Internet and Digital Devices?

This part of the research report assessed the respondents' general learning improvements to the use of wireless internet and digital devices. Respondents were asked various questions relating to the learning improvements of wireless internet and digital devices. The findings are listed below.

4.5.1 Learning Improvements as a Result of the use of Wireless Internet and Digital Devices

What is the learning improvement for you using wireless Internet and digital devices?

This part of the research determines the learner's perception about the improvements using wireless internet and digital devices. Table below clearly illustrates that all the 253 teachers and learners, have had some major improvement in the used of wireless internet and digital devices in their day to day activities.

Table 5: The improvement of learners' for using wireless internet and digital devices N=253

Improvement	Frequency	Percentage (%)
Been able to learning by doing research	194	77
Easily communicate with family and friends	120	47
Update of knowledge	105	42
Entertainment	45	18
Access the news and social media	25	10
Total	**489**	**194**

***Multiple response received**

4.5.2 Learning to use the Internet

Respondents were asked to find out how they learnt to use wireless internet. Table 6 below indicates that out of 253, a majority of 146 (57.7%) taught themselves how to use wireless internet, 48 (19.0%) learnt from reading books, 44 (17.3%) were taught by friends, 15 (6.0%) learnt from schools and 0 (0%) no other respond was given.

Table 6: Learning to use wireless internet N=253

How learnt	Frequency	Percentage (%)
Self-taught	146	57.7
Reading from books	48	19.0
Taught by friends	44	17.3
School	15	6.0
Total	**253**	**100**

4.5.3 Advantages or benefits of using wireless internet and digital devices for academic purposes

This question is a multiple response question, asked learners were asked about the benefits or advantages of using wireless internet for academic purposes. Here the learners were allowed to tick more than one option that applied to them. Most learners indicated that the greatest benefit of using wireless internet was reliability of information 34% (139), followed by accuracy of information 33% (134) and the lowest being time saving 19% (76) and user friendly 14% (55).

Table 7: Benefits of using internet for academic purposes N=253

Benefits	Frequency	Percentage (%)
Reliability of information	139	53
Accuracy of information	134	51
Time-saving	76	29
User-friendly	55	21
Other	0	0
Total	**404**	**154**
***Multiple response received**		

4.5.4 Challenges Encountered when Surfing the Internet by using Wireless Internet and Digital Devices

Learners were asked to problems and challenges encountered when surfing the internet. Table below indicates that all 253 learners reported having had problems. Table 8 below indicates that a majority of 139 (54.9%) had problems with the cost of internet expenses, 120 (47.4%) learners reported to have had problems with slow access speed, 93 (36.8%) respondents had problems with network signals, 65 (25.7%) respondents encountered virus problems, 24(9.9%) respondents had difficulties in locating information, 18 (7.1%) respondents had problems with inaccurate information, 17 (6.7%) respondents had problems with unreliable sources and 16 (6.3%) had problems logging in.

Table 8: Challenges encountered when surfing the internet using wireless internet N=253

Challenges	Frequency	Percentage (%)
Cost of internet expenses	139	54.9
Slow access speed/Slow network connection	120	47.4
Network signals	93	36.8
Viruses	65	25.7
Difficulty in locating info	25	9.9
Inaccurate information	18	7.1
Unreliability of sources	17	6.7
Logging in	16	6.3
Total	**493**	**194.8**
***Multiple response received**		

4.5.5 Main method used to access wireless internet

The researcher wanted to find out what were the respondents' main method used to access the internet. Table 9 below indicates that the most common main method used was smart-phones by 184 (74%) respondents, 30 (11.3%) used a tablet as their main method to access the internet, followed by 25 (9.4%) respondents who used laptops as their main method to access the internet. The lowest was a desktop computer with 13 (4.9%) respondents using it to have access to the internet and 1 (0.4%) didn't respond. Therefore, this indicates that the use of smart phones is predominant amongst the respondents.

Table 9: The main methods of accessing wireless internet N=253

Method	Frequency	Percentage (%)
Smart-phone	184	72.7
Tablet	30	11.9
Laptop	25	9.9
Desktop computer	13	5.1
No response	1	0.4
Total	**253**	**100**

4.5.6 Where do you usually access your wireless internet?

Respondents were asked to indicate from where they usually access the internet wireless (question eight). Table 10 below shows that 233 (92%) respondents usually access the internet at home, followed by 20 (8%) who usually access the internet at an internet café.

Table 10: Site of wireless internet access N=253

Where access	Frequency	Percentage (%)
Home	233	92
Internet café	20	8
Total	**253**	**100**

4.5.7 Wireless Internet access at home

Learners were asked the main method they use to access the internet at home. There were two hundred and fifty (253) responses. The majority of learners used data bundles at home to access the internet: 231 (91.3%), followed by 12 (4.7%) learners using Wi-Fi and the lowest being 7 (2.8%) respondents using a modem and 3 (1.2%) who presumably did not have wireless internet access at home.

Table 11: Type of wireless internet access at home **N=253**

	Frequency	**Percentage (%)**
Data bundles	231	91.3
Wi-Fi	12	4.7
Modem	7	2.8
None	3	1.2
Total	**253**	**100**

4.5.8 Frequency of wireless internet use per week

The frequency of the use of wireless internet for academic purposes by learners were given as: Out of the 264 learners, 124 (49%) respondents used the internet daily. This is probably the results of the majority of the respondents having access to smart-phones. They were followed by 95 (37%) who used the internet once a week and 22 (9%) who used the internet once a month. Only 11 (4%) used the internet once every two weeks and 1 (1%) never used the internet.

Table 12: Accessing wireless internet for academic purposes weekly N=253

Frequency of use	Frequency	Percentage (%)
Daily	124	49
Once a Week	95	37
Once a Month	22	9
Once every two weeks	11	4
Never	1	1
Total	**253**	**100**

4.5.9 Wireless Internet Services Students' use

It was discovered from the results that a good number of respondents uses the search engine. Google 205 (81%), Social networks 145 (57%) and 25 (10%) respondents used Email. The lowest being 15 (6%) respondents who used Microsoft networks.

Table 13: Wireless Internet Service Learners Frequently use N=253

Services	Frequency	Percentage (%)
Google	205	81
Social Networks	145	57
E-mail	25	10
Microsoft Networks (MSN)	15	6
Total	**390**	**154**
***Multiple response received**		

4.5.10 Duration of internet use

The researcher asked respondents how long they had used wireless internet. From Table 13 below it is noted that out of 253 learners who were using the internet, a majority of 134 (53%) had used wireless internet for more than 18 months followed by 44 (17%) respondents who had used it for between 13 to 18 months, 40 (16%) respondents had used the internet for less than 6 months and just 35 (14%) had used the internet for between 7 and 12 months.

Table 14: Duration of the internet use **N=253**

Duration	Frequency	Percentage (%)
More than 18 months	134	53
13 to 18 months	44	17
Less than 6 months	40	16
7 to 12 months	35	14
Total	**253**	**100**

4.5.11 Amount of time spend on the internet per-browsing session

This part of the report established the amount of time spend on the internet by the respondents. Table 15 below indicates that out of 253 learners, a majority of 88 (34.8%) reported to have been using the internet from 2-4 hours a week, 87 (34.4%) learners had used the internet for less than 1 hour a week, 40 (15.8%) learners had used the internet for about 5-6 hours a week, 22(8.7%) learners had used the internet for 10-20 hours a week and only 14 (5.5%) respondents had used it for 7-9 hours a week and 2 (0.8%) did not respond to the question.

Table 15: Time spent on the internet per-browsing session **N=253**

Time spent	Frequency	Percentage (%)
2-4 hours a week	88	34.8
Less than 1 hour a week	87	34.4
5-6 hours a week	40	15.8
10-20 hours a week	22	8.7
7-9 hours a week	14	5.5
No response	2	0.8
Total	**253**	**100**

4.5.12 Social networking sites learners use

A multiple response were given as to what social networking sites the learners used. Table 16 below indicates that all 253 learners responded to having used social networking and it indicates that a majority of 177 (69%) and 172 (67%) learners had used Facebook and WhatsApp respectively, followed by 35 (13%) respondents who had used Twitter, 15 (5.0%) respondents reported having used LinkedIn and the lowest being 10 (3%) learners who reported that they had used MySpace.

Table 16: Social networking sites learners use N=253

Social networking sites	Frequency	Percentage (%)
Facebook	177	69
WhatsApp	172	67
Twitter	35	13
LinkedIn	15	5
MySpace	10	3
Total	**409**	**157**
***Multiple response received**		

4.5.13 Sufficient skills to use wireless internet

To find out whether the learners had sufficient skills to browse through the internet. The results from Table 17 below indicate that the majority 195 (77.1%) of respondents considered themselves as having the skills to browse through the internet and 58 (22.9%) respondents reported that they did not have the necessary skills.

Table 17: Skills to use the internet N=253

Skills	Frequency	Percentage (%)
Yes	195	77.1
No	58	22.9
Total	**253**	**100**

4.5.14 Solutions to the internet problems as perceived by learners

Learners' views were sorted regarding solutions to the above mentioned problems. The results showed that out of 253 only 171 (67.6%) respondents provided their views. 51 (20.2%) respondents provided their views regarding network signals outlining that there should be a strong connection of networks by increasing the number of network poles and 33 (13.0%) respondents addressed the issue of internet expenses with the view of having Wi-Fi hotspots in each of their schools and Wi-Fi routers. The whole results are summarised in the table below stating their views.

Solutions to the internet problems as perceived by learners with regard to cost of internet expenses

- By getting free data bundles or using internet for free to research our project and assignment for free to get more information.
- By having Wi-Fi hotspots in each and every schools.
- By installing Wi-Fi routers at schools so that underprivileged students can get access to the internet.
- By trying to reduce the amount of data and to also offer Wi-Fi serials to most communities
- Cancel the use of internet, I know is important but we have to do something about this Decrease cost of internet expenses
- Lower internet expenses and implement the nearby internet cafes with WI fi connections.
- The government can produce sim card that can browse the internet free for only school learners to get more information they need even if they don't air time or data bundles.

- There should be intentions of giving each and every individual bonus airtime, free data bundles, when he/she is recharging with a certain amount and they should expand the connection of network to a higher phase.

Solutions to the slow access speed of network

- Antiviruses should be provided for people faster network connections should be established
- Buy another phone like smartphone, tablet or maybe a laptop to reduce network signals and slow network connections
- By increasing the network poles so the internet can run fast.
- By making sure that there is no problems regarding to use internet, because when having problems when browsing an internet we cannot do school works or connect with friends
- By providing good network signals because it takes time
- By using the new phone which has 4G internet speed access.
- By using Wi-Fi as it's not slow to access speed and as it doesn't cost any airtime or data bundles
- Come up with a network which is not slow when browsing
- Faster network connections, for faster access and less charges for data bundles.

Solutions to the network signals

- Government must ensure that it provides internet cafe for free Wi-Fi
- We should access internet for free locate Wi-Fi network
- Wi-Fi routers should be installed
- Wi-Fi should be located.

- They must increase the high level of network poles in the rural areas.
- Use a computer to remove all viruses and make the sim card connected to check the settings
- To put some networks ariels close to people who are lacking on GPRS

Viruses

- Activation of anti-virus, install some security and save airtime by using data bundles
- Antiviruses should be provided for people faster network connections should be established
- By making anti-virus for all smart phones
- By producing an anti-virus for the smart-phones
- Updating powerful anti-virus and lowering data bundles price
- Downloading antiviruses.
- To have knowledge of how to solve the problem when it start to have virus
- They must be network signals, and create strong software that can protect computer from infection of the viruses.
- To redeem this virus problem by having anti-virus. For the viruses there must be anti-viruses to stop this plague and for the slow networking there must be 3G employment of service providers, so that our network can be upgraded.
- Use a computer to remove all viruses and make the sim card connected to check the settings.

Inaccurate information

- To update any information in the world and the job experiences, handwork, skills and trained jobs.
- To receive training on using internet.
- Those who upload the information should be accurate and antivirus programmes that are advanced should be introduced
- They must publish more peer reviewed sources so they can be reliable
- The internet CEO must double check if the information is reliable and relevant before it goes to public.
- The internet cafe workers must come to our school and teach us more about internet and the access of it.
- People should be instructed not to drop any information which is not reliable on the internet, e.g. Wikipedia for example.

4.5.15 Received training on searching for information using wireless internet

On training of how to search for information using the internet, it was discovered learners had received training on searching for information on the internet. Table 18 below shows that majority of 216 (85.4%) respondents indicated that they had not received any training on searching for information on the internet while 37 (14.6%) indicated that they did receive such training.

Table 18: Training on searching for information on the internet N=253

Training	Frequency	Percentage (%)
No	216	85.4
Yes	37	14.6
Total	**253**	**100**

4.5.16 Rating the level of information literacy

In rating learners in terms of level of information literacy. Table 19 below it is indicated that the highest percentage rated their level of information literacy as being 'good' (102 (40%), followed by 'average' for 74 (29%) respondents and 62 (25%) rated themselves as 'very good'. The lowest number of respondents indicated 'poor', 10 (4%) and just 1 (2%) respondent indicated 'very poor'

Table 19: Level of information literacy **N=253**

Rating	Frequency	Percentage (%)
Good	102	40
Average	74	29
Very good	62	25
Poor	10	4
Very poor	5	2
Total	**253**	**100**

4.5.17 Respondents' comments and suggestions on the use of internet.

Respondents commented and suggested what they felt about the use of wireless internet and digital devices. Out of 253 respondents, 80 (32%) respondents did not have comments and suggestions. However, 173 (68%) responded to this question.

Of these, the vast majority of respondents 230 (90.9%) stated that the internet is "good for them since they source information as learners" and 23 (9.1%) respondents viewed the internet as a bad thing as some learners use it to download pornographic videos.

4.6 Summary of the Chapter

This chapter presented the findings of the survey, a total of 253 questionnaires were distributed and all were completed and returned giving a 100% response rate. Findings were, presented in the form of tables.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter conclusions and recommendations will be provided. The recommendations will be made based on the information presented in the previous chapters. A brief summary of the study is also provided. The research questions underpinning the study are presented and the summary of the results are provided.

5.2 Summary of the Study

In Chapter One the background to the study was provided. The statement of the problem, purpose of the study, the research questions, justification of the study and conceptual framework were discussed. Other issues discussed included a brief history of Adansi Asokwa District. Definitions of terms used in the study were also provided. The focus of Chapter Two was the literature review. The review traced the history of the development of wireless internet and digital devices. Other areas included in the chapter were: key internet milestones, access to wireless internet, wireless internet in education, wireless internet in high schools, the use of wireless internet in higher institutions of learning, and challenges faced by learners in the use of wireless internet. User studies from other parts of the world and from within Africa were reviewed.

The focus of Chapter Three was on the research methodology adopted in the study. Survey design was adopted and the instrument used to collect data was the questionnaire comprising of both closed and open questions. The validity and reliability of the study were established by the use of pre-testing the questionnaire with a sample population of teachers and students of Bodwesango Senior High School. SPSS was

used in analysing the quantitative data while thematic content was employed in analysing the qualitative results.

In Chapter Four the results of the survey of 253 students and teachers of Bodwesango SHS in the Asokwa District were presented and analysed. The results were mainly presented using tables and were deemed to have adequately answered the research questions of the study.

Findings of the study were discussed in Chapter Five in the light of the relevant literature. The study found that a majority of students and teachers of Bodwesango SHS used wireless internet and digital devices in order to have access to their academic information for their studies.

5.3 Conclusions

There were significant results from the survey of 253 students and teachers of Bodwesango SHS. The analyses of data revealed the following: the majority of the learners 233 (92%) were users of wireless internet and digital devices, with usage ranging from 1 hour to 20 hours weekly. The majority of the learners, 233 (92%) accessed the internet at home, followed by 20 (8%) at internet cafes. Most, 197 (78%) of these students and teachers used wireless internet and digital devices for learning purposes, 119 (46.5%) for communication with friends and 103 (41%) to update knowledge, followed by a smaller percentage of (18%) using wireless internet for entertainment and (11%) for news. This shows that the youth are always excited and full of enthusiasm to explore whatever is new in the advancement of technology. The students and teachers faced various problems while searching with wireless internet.

The most widely faced problem was the cost of internet access, followed by slow network connection.

The findings revealed that a large proportion of students and teachers had been using wireless internet and digital devices in their everyday lives for quite some time and 129 (51%) of the population used wireless internet daily. However, findings from this study revealed that the majority of respondents, 139 (54.9%), had used wireless internet for more than 1 year and 6 months and 91 (35.6%) have been using the internet from 2-4 hours a week.

The study found that students and teachers were using various internet facilities, such as social networks 144 (57.1%), followed by students and teachers using the search engine Google 207 (82%) and 23 (9.4%) respondents used email and 13 (4.9%) respondents using Microsoft networks. It was also discovered that all 253 students and teachers were familiar with the various social networks and all of them used them. The results indicate that a majority of 180 (71%) of students and teachers had used Facebook and WhatsApp, followed by 31 (12%) respondents had used Twitter, 13 (5%) respondents reported having used LinkedIn and the lowest being 8 (3.4%) learners reporting that they had used MySpace.

Some respondents (28%) were of the view regarding network signals that there should be a strong connection of networks. This can be achieved by increasing the number of network poles and 46 (18%) pointed out the issue of internet expenses with the view of having Wi-Fi hotspots in the schools and Wi-Fi routers. All of the mentioned challenges can be dealt with if government can equip schools with relevant infrastructure such as

buildings and providing computers to the needy schools. Since the internet has come to the fore front in education, it could be of use to engage the teachers, students and headmasters/headmistress in the technological environment through enhancement of their ICT skills so that they can move on the same path with digital learners. The government in power must engage in partnership programmes with the private sector and other useful stakeholders to work hand in hand in implementing the ICTs in schools especially senior high schools.

Most respondents were of the opinion that they had sufficient skills to enable them to effectively browse, search and retrieve information on the internet. 197 (78%) of the respondents rated themselves as having the skill to browse through the internet. However, a fairly large number 56 (22%) of students and teachers said they did not have the skill to browse the internet. Concerning the level of information literacy, most 106 (42%) respondents rated themselves as 'good' followed by 'average' 76 (30%) and 62 (24%) 'very good'. The lowest respondents indicated poor with only 10 (4%) and just 1 (0%) respondent indicating 'very poor'.

Based on the outcomes of the respondents' views, it can be agreed that we are now in the world of technology where the use of wireless internet and digital devices is growing exceptionally fast. Hence the use of wireless internet is a global phenomenon that is changing the face of schools and higher educational institutions in remarkable and lucrative ways. Currently, South Africa is one of many countries that continues to enjoy much productivity with efficient wireless internet usage. In the past five years, the use of the wireless internet has become widespread in Ghana. It is estimated that mobile internet penetration is forecast to reach 71% by 2020. This is confirmed in the

study report by Internet society global (2019) report which states that 4.39 billion internet users in 2019 globally, an increase of 366 million (9%). Ghana has reached 15 million internet users and the number is expected to increase come 2020.

In addition to the above conclusion, the use of wireless internet and digital devices by students and teachers of Bodwesango SHS showed a positive contribution to their lives. An analysis of the comments indicated that students and teachers viewed wireless internet in a positive manner as a useful tool to be used towards their academic works. It appears from the responses that students and teachers used wireless internet mostly for educational tasks. It can be concluded that the use of wireless internet and digital devices amongst these students and teachers was popular and they pointed out that wireless internet is a source of all information for them and is more convenient and reachable. This was evidently due to many of the respondents having enhanced access to the internet in their homes via their smart phones.

The results reveal that the majority of students and teachers use wireless internet via their cell phones. Lack of infrastructure is the major obstacle in wireless internet access which needs immediate attention and the government needs to look at establishing browsing centres or computer labs in schools with wireless internet connectivity because lack of access to wireless internet is a major problem hindering internet usage amongst the students and teachers as the internet is the most essential educational tool for students and teachers at all schools. Internet illiteracy is another area of concern among high school students.

Given the above conclusion, the following recommendations are made.

5.4 Recommendations

Based on the findings of this study it is recommended that students and teachers ought to look for alternative means of gaining access to internet such as going to internet cafes instead of being wholly depended on their smart phones.

The Ghana government should better fund the public Senior High Schools with a view to providing quality education and the resources needed such as internet connectivity and better funding will provide better facilities in the schools including internet access because this will assist learners in more reliable and stable access to the internet for educational activities since most learners use their smart-phones to access the internet. The government should embark on the creation of telecentres and build public or school libraries with full internet access because this will increase the use of internet among learners and thus school teachers ought to refer their learners to websites on the internet for additional information that will help them with their educational endeavours because the additional information will complement and widen the learners understanding of the topics they have learnt.

Encourage learners to visit some websites prior to their lessons to learn more about what they are going to be taught. Learners should be well equipped with information searching skills for them to make effective use of the internet services in order to enhance learning. Efforts ought to be made to upgrade the infrastructure to improve internet access speed. The authorities should take immediate steps to establish telecentres in all rural areas with fast internet connectivity. The adequate facilities in terms of space, staff and technology should be available for maximum utilization of internet sources and services.

The rural schools shouldn't be ignored in any plans regarding the supply and usage of the internet as this can narrow the gap of the digital divide. The internet connectivity should be extended in schools as to increase access and usage The teachers should take steps to make learners aware about the proper use of the internet and make their use focused and purposeful Internet illiteracy is one of the major problems amongst the learners that needs immediate attention and the training programmes should be conducted to increase the internet skills of the learners. These programmes should focus on all aspects of the internet literacy.

5.5 Future Research

The following related studies should be conducted.

1. A comparative study on the use of internet focusing on learners from other provinces should be carried out as to determine the level of internet usage among other schools.
2. A similar study on the use of internet by grade 12 learners to check their viability regarding the internet usage. This will help to prepare them before they go to universities with required skills.
3. The principals and teachers could be surveyed to obtain their opinions on how the lack of public libraries around schools affects the performance of learners. This will determine the possible need to check viability of implementing public libraries.
4. The study need to be conducted assessing the learners' ability to locate the relevant information on the internet.
5. A similar study on the use of the internet by the school staff.

6. A similar study should be carried out amongst the same learners over a period of years to establish if there would be any developments in the use of internet over these years.

5.6 Summary of the Chapter

In this chapter major research findings and conclusions were presented. The original intentions of investigating the use of wireless internet and digital devices by learners and staff of Bodwesango SHS achieved. The problems related to the use of wireless internet and digital devices were identified. Based on the findings of the study the researcher has made recommendations which will benefit secondary schools which don't have school libraries and public libraries within where the schools are situated to promote and encourage the use of internet among high school learners. It can be summarized that the internet provides a vast amount of information to the learners, however it requires them to be captivated with skills and knowledge to be able to vet the information and its validity. Learners saw that the frequent utilization of the internet will empower and enable them with intelligence skills to browse. Therefore, learners will have more access to information and this will help them to utilize the information as well as by questioning it and giving input as to enhance the basic information with their own thoughts.

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UNIVERSITY OF EDUCAITON, WINNEBA

DEPARTMENT OF INFORMATION TECHNOLOGY EDUCATION

APPENDIX

SURVEY QUESTIONNAIRE FOR COLLECTING DATA ON THE USE OF WIRELESS INTERNET AND DIGITAL DEVICES BY TEACHERS AND STUDENTS OF BODWESANGO SENIOR HIGH SCHOOL IN THE ADANSI ASOKWA DISTRICT

Please note: All the information collected in this study will be used strictly for writing an academic thesis. Individual identification of participants is not important in this study.

Instructions

Please indicate your appropriate response by means of a tick [√]. Where possible please elaborate in the space provided.

Section A: Demographic information

1. What is your gender?

Male ◯ Female ◯

2. What is your age?

☐ 15-24 ☐ 25-34 ☐ 35-44 ☐ 45 and up

Section B: Wireless Internet and Digital Device usage

3. Do you use the Internet? ◯Yes ◯No

4. If No, please explain why not

5. What are the benefits of using wireless internet and digital devices for academic purposes? (Choose one or more)

◯ User friendly

◯ Time saving

◯ Accuracy of information

◯ Reliability of information

◯ Other (Specify…)

6. How did you learn to use wireless internet and digital device? (Choose one)

◇ Reading from books

◇ Self-taught

◇ Taught by friends

◇ School

◇ Other (Specify…)…….

7. What is your main method to access wireless internet? (Choose one)

◯ Desktop computer

◯ Laptop

◯ Smart phone

◯ Tablet

◯ Other (Specify…) …….

8. Where do you usually access wireless internet? (Choose one)

◇ School

◇ Home

◇ Internet café

◇ Other (Specify…)……..

9. What kind of internet access do you use at home? (Choose one)

☐ Wi-Fi

☐ Data bundles

☐ Modem

☐ None

☐ Other (Specify…)

10. How often do you access the internet for academic purposes using wireless internet? (Choose one)

☐Daily ☐ weekly ☐Once every two weeks ☐Once a month ☐ Never

11. What internet services do you normally use? (Choose one or more)

◯ E-mail

◯ Google

◯ Microsoft network (MSN)

◯ Social networks (Facebook, Instagram, WhatsApp, Mxit, Twitter)

◯ Other (Specify…) ……

12. What is the purpose of your wireless Internet use? (Choose one or more)

◇ For the news (i.e. Sowetanlive, Media24, Supersport, etc…)

◇ To update knowledge

◇ For learning purpose (i.e. to prepare for assignments, class, research, etc…)

◇ To communicate with family and friends (i.e. Social networking)

◇ For entertainment

◇ For other reasons (Specify…) ……..

13. For how long have you been using wireless and digital devices internet?

☐ Less than 6 months ☐ 7 6 to 12 months ☐ 13 to 18 months

☐ More than 18 months

14. What amount of time do you spend using wireles internet per-browsing session?

◯ Less than 1 hour a week ◯ 2-4 hours a week ◯ 5-6 hours a week

◯ Other (Specify)……

15. Which of the following social networking sites do you use wireless internet for (Choose one or more)?

◇ Facebook ◇ Twitter ◇ MySpace ◇ LinkedIn ◇ WhatsApp

◇ Other (specify)……..

16. Do you have sufficient skills to browse through the use of wireless internet?

◯ Yes ◯ No

17. What problems do you encounter when surfing the internet by using wireless internet and digital devices? (Choose one or more)

- ◯ Viruses
- ◯ Inaccurate information
- ◯ Unreliability of sources
- ◯ Slow access speed/slow network connections
- ◯ Network signals
- ◯ Difficulty in locating relevant information
- ◯ Cost of internet expenses (air time or Data bundles)
- ◯ Logging in
- ◯ Other (Specify…) ……

18. What solutions can be employed to overcome these challenges?

19. Did you receive any training on searching for information using wireless internet?

☐ Yes ☐ No

20. If Yes, where? ……

21. How do you rate your level of information literacy? (Information literacy is the ability to access, evaluate, and use information from a variety of information sources)

☐ Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor

22. Any comment, suggestion regarding the use of wireless internet and digital devices?

Thank you for your time and participation!!!!