UNIVERSITY OF CAPE COAST

THE AVAILABILITY AND UTILISATION OF LOCAL AREA NETWORK IN

SENIOR HIGH SCHOOLS IN THE CENTRAL REGION OF GHANA

NANA YAW DUODU

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Dissertation submitted to the College of Distance Education, University of Cape Coast, in partial fulfilment of the requirements for award of Master of Education Degree in Information Technology.

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature:……………………… Date:…………………………..

Name: Nana Yaw Duodu

Supervisor's Declaration

I hereby declare that the preparation and presentation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast.

Supervisor's Signature: ……………….................. Date:……............................

Name: Dr. Paul Nyagomeh

ABSTRACT

The aim of the study was to ascertain the availability and utilisation of local area network in Senior High School in the Central Region of Ghana. The purposive sampling was used to select three hundred and eighty students, ICT teachers and assistant headmasters of selected schools. Data were collected from students, ICT teachers and assistant headmasters for analysis.

The study revealed that students, ICT teachers and school administration were dissatisfied with the availability of LAN and LAN tools as well as the utilisation level of the LAN tools available. The schools also express concerns on poor or no extension of LAN to other part of the school such as headmasters office, account office, library etc.. The school administration admitted that, it is responsible for the provision of LAN tools in their schools but was constrained by inadequate funds.

Based on the outcome of the study, it was recommended that senior high schools should be provided with LAN tools to facilitate data communication. Also, the G.E.S., PTAs and corporate bodies should assist schools to acquire LAN tools regularly to areas such as the headmaster's office, assistant headmasters' offices, science Laboratories, classrooms and staff common room to promote digital data communication. Finally, networking experts should be employed permanently to help configure and educate the entire school population about the uses of LAN tools such as printing, sharing DBMS, etc. and more importantly record keeping to help enrich the technological knowledge of students, teachers and administrators to promote teaching and learning.

ACKNOWLEDGEMENTS

DEDICATION

This dissertation is dedicated to my lovely daughter, Nana Akosua Nyamedo Akyia Duodu.

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LIST OF ACRONYMS

ARPANET - Advanced Research Projects Agency Network

DHCP - Dynamic Host Configurator Protocol

E-education - Electronic Education

EMIS - Education Management Information System

GPRS - The Ghana Poverty Reduction Strategy Paper

HTLM - Hypertext Markup Language

I.C.T – Information and Communication Technology

IPTO - Information Processing Technology Office

ISO - International Organisation for Standardisation

IST-Africa - Information Sciences and Technology (Africa)

LAN - Local Area Network

MAN – Metropolitans Area Network

MoE - The Ministry of Education

NIC - Network Interface Card

NS - Networking Systems

PAN - Personal Area Network

PCs - Personal computers

SHS – Senior High School

WAN – Wide Area Network

WLAN - Wireless Local Area Network

Wi-Fi - Wireless Internet for Frequent Interface

CHAPTER ONE

INTRODUCTION

Background to the Study

The basic importance of Information and Communication Technology (ICT) and ICT tools such as desktop computers, laptops, mobile phones and iPods, is to help the user to communicate with others and share resources. According to Lammle (2009), "our society has become highly dependent on these resources and sharing them with each other" (p. 2). Lammle further argues that the ability to communicate and share resource with those we need to, whether we are in the same building or in some far away land, completely hinges on our capacity to create and maintain solid and dependable network.

Computer network involves the integration of computer system in order to help them share resources. Asante (2012) defines "computer networking as a set of technologies consisting of hardware, software and cabling or some other means that can be used to connect computers together, enabling them to communicate, exchange information and share resources" (p. 98). These resources include hardware (printer, plotter, scanner, et cetera) and software (word processing, desktop publisher, database, et cetera), components which turn to make communication between the individual users very easy and secured. For example, in the universities, computer networks are used for storing and retrieving information such as students' records, staff and administration information, reducing the need for paper traffic and manual record keeping data format, hence rationalising the time students, staff and administrators spend in producing results.

Local Area Network (LAN) and Wide Area Network (WAN) are the two main categories of network (Pedro, Enrique, Ernesto & Lucio, 2004). "Though, other intermediaries such as Campus Area Network (CAN), Metropolitan Area Network (MAN) do exit" (Asante, 2012, p. 100).

Networks are named based on their geographical coverage. The biggest form of network is the WAN which consists of millions of private, public, academic, business and government networks of local to globe scope, that are linked by a broad array of electronic, wireless and optical networking technologies (Castells, 2003).

On the other hand, the smallest form of network that is mainly found within the same building is called LAN. Greg (2007) describes LAN as a small network, limited to a single collection of machines and one or more cables and other peripheral equipment. LAN is the basic form of network, consisting of two or more computers and also serves as the foundation on which all other complex networks are built.

With the evolution of technology in processing and storing data, many institutions had begun researching for a better opportunity to simplify data communication. Forester (1985) indicates that the idea of LAN began during the evolution of modern telephone network from 1876 to 1951, when science and technology began to interconnect machine as well as people and to carry pictures and data as well as voice.

On May 31, 1961, Leonard Kleinrock, came out with the publication "Information Flow in Large Communication Nets" (p 162- 163). A year later, Licklider, the then Director of Information Processing Technology Office (IPTO), also gave his version of a galactic network in 1962, which brought to

light, the notion of sharing computer resources (called host computers or simply hosts) over an entire network. Host-to-host interactions were envisioned, along with access to specialised resources (such as supercomputers and mass storage systems) and interactive access by remote users to the computational powers of time-sharing systems located elsewhere.

These ideas were first realised in Advanced Research Projects Agency Network (ARPANET), which established the first host-to-host network connection on October 29, 1969, with Robert Taylor spearheading the movement. In 1969, the University of California at Los Angeles, the Stanford Research Institute, the University of California at Santa Barbara, and the University of Utah were connected as the beginning of the ARPANET network using 50 Kbit/s circuits.

The desire by most manufacturing companies and stakeholders to continue research into computer network must follow a standard known as modular design, with separation of concerns. In this approach, the system is split into modules and each module is assigned separate responsibilities (concerns). Network designers usually adopt a restricted version of modular design, known as layered design (Ivan, 2013). This responsibility is being monitored worldwide by the International Organisation for Standardisation (ISO) to guide in networking system manufactures in producing a standard device. The devices that are used for network connectivity has gone through a great development with a constant change in earlier concept to a well improved ones with a typical example hubs, which is now being replaced by switches.

It is very important to learn that networks have a very poor history in Africa with no precise information on the first company which created the LAN. According to IST-Africa (2012), the available network infrastructure to support the Internet is relatively inadequate and inappropriate for ensuring real expansion of Internet services (p. 30). The continent also lacks literature and traces its networks history to the networking of individual organisations. Maclay, Hawkins and Kirkman (2005) concludes that most schools had low levels of ICT use and integration with no significant differences between private and state schools. Maclay *et al.* further contends that "indeed most students and their teachers do not access a network in schools, and use computers only on a weekly basis" (p. 5).

Sub-Saharan Africa continues to suffer from a relatively poor ICT infrastructure, which remains costly to access, although some notable exceptions exist. Even though there has been some boost in the emergence of telecommunication networks in the 21st century in some countries in Africa, including South Africa, Kenya, Uganda and Ghana, IST-Africa (2012) argues that the overall performance of networking among the individual African states is below expectation.

In Ghana, network and for that matter, LAN became common to many people during the last decade. Malcolm and Godwyll (2005) maintains that ICT in Ghanaian schools and African countries is generally increasing and dramatically growing (p. 1). Most governments and private organisations have had a little encounter with such network devices which had resulted in the poor exchange of information or data electronically, hence, the use of paper to transfer data even within the same office. For instance, within the school

setting, the administrator will have to print a hard-copy of a particular class list which has to be sent to the office of the head of the school instead of just transferring the information on the network, which will be more secured, easy and help reduce the wasting of resources.

In 2006. the Ministry of Education and Sports assessed ICT use in Ghana's educational institutions and intimated that there was the need to promote its use in order to enable every Ghanaian to be able to use the ICT tools and resources confidently and creatively to develop their skills and knowledge needed to achieve personal goals and be full participants in the global economy by 2015.

It is, therefore, very disheartening to see a whole school with no network connectivity or sometimes, no ICT laboratory or computers. It is also disturbing to hear politicians mount political platforms and promise to provide schools and communities with ICT infrastructure but only end up providing some few personal computers with a very little effort to connect them locally on a Local Area Network (peer-to-peer, intranet) or on the Wide Area Network (such as the internet, extranet, et cetera).

Even though Mangesi (2007) describes Ghana "as one of the first African countries to liberalise its telecommunication sector, and has made tremendous progress in ICT infrastructure deployment" (p. 5). He points out that, ICT revolution in Ghana has not promoted the use of the networks and computing. However, Mangesi contends that, this liberalisation of the telecommunication has contributed to the awareness of LAN within today's institutions.

"The Ghana Poverty Reduction Strategy Paper (GPRS I & II) and the Education Strategic Plan 2003-2015, all suggest the use of ICT (network) as a means of reaching out to the poor in Ghana" (Mangesi, 2007, p. 3), but on the contrary, the situation is different since most schools and institutions rely on the old and primitive way of sharing information on a network referred to as sneakenet as a result of limited networking facilities. Greg (2007) defined sneakenet as an old, well-known alternative to networking which involves passing a disk from machine to machine (p. 8). This ancestral type of network is primarily unproductive, outmoded and inefficient. The following are some key disadvantages of a sneakenet:

(i)   There is insecurity in data transfer process.

(ii)   There is an element of time wasting because the device has to be transported to the intended location.

(iii)   There is a breakdown of the system since viruses and other treats are easily transferred from one computer to the others.

(iv)   Data are usually lost among others during data storage and transfer.

The Ministry of Education (MoE) as part of its promise to promote effective education to Ghanaians should have a more effective monitoring system as well as checks with a nationwide or regional level dependable network such as the Metropolitan Area Network (MAN), Wide Area Network (WAN), intranet and the extranet.

Networking involves connecting computers and other electronic devices for the purpose of sharing information and resources and for communication (Greg, 2007). The primary motivation for networking and networking systems in education is the need for administrators, teaching and

non-teaching staff, parents and learners to share data, and to communicate quickly and efficiently.

Personal computers (PCs) are valuable business tools, but without a network, they are isolated and can neither share data with other computers nor access network-attached peripheral devices, such as printers, scanner and fax machines.

Networking Systems (NS) which is also referred to as networking devices include all the devices and ICT tools that can connect to other devices on a particular network. According to Janssen *(2012)*, networking systems or networking device is a widely-used term for any hardware within networks that connect different network resources. These tools may include hardware (computers, printer, scanner, et cetera), software (Network Operating Systems, Network Adaptor Card software, et cetera.) and connectivity devices (routers, bridges, repeaters and gateways).

The Central Regional Schools' census saw poor data gathering process where schools had to travel to Cape Coast to populate to the Education Management Information System (EMIS) with their schools data. At the Regional Census Centre the researcher observed a very poor LAN connectivity and felt that the rationale behind networking (LAN) has not been utilized. For example, the Central Regional Secretariat which organized the census lacked a simple platform to aid them in multi digital assimilation and dissemination of relevant information (The Central Regional Annual School Census, 2014).

The circulation of memos, letters and any other data for that matter, can be confidently and reliably sent successfully to end terminals if

dependable networks are established in our schools and in our educational offices. It is therefore, necessary to find out the availability and utilisation of networking systems in the senior high schools in the Central Region of Ghana.

Statement of the Problem

The availability of LAN and LAN systems in the school could influence their utilisation and enhance students, teachers as well as the school administrations in general to adapting to digital data communication in order to reduce the extent by which papers are used to store and keep records. LANs usage in schools will further aid assessment of students, administration monitoring teachers as well as district administrators supervising the work of schools bring to halt the traditional ways of data storage, transfer, and in a large share data communication, et cetera.

However, a discussion with administrators, teachers and students in most schools in some parts of the Central Region revealed the lack of LAN to facilitate data communication. The situation demands redress because the institutions that are supposed to create the awareness and educate people about the importance of technology such as LAN at this stage of our development still resort to primitive practices in the transfer of data such as sneakenet and paper document storage. This does not only delay communication processes but also affect the financial status of institutions and even affect all stakeholders of education.

Purpose of the Study

The main purpose of this study was to examine the availability and utilisation of LAN in Senior High Schools in the Central Region of Ghana. The study further addressed the utilisation of the available LAN systems,

geographical and the extension of LAN facilities, and the effect of cost on LAN systems, maintenance of LAN in school as well as the availability of standard of LAN systems.

This research, therefore, sought to investigate the availability and utilisation of LAN in the Senior High Schools in teaching and learning as well as the administration of schools in the Central Region of Ghana.

Objectives of the Study

The objectives for the study were to:

(i) determine the availability of LAN and LAN devices in senior high school in the central region.

(ii) determine the utilisation of LAN and LAN devices in senior high school in the central region.

(iii) examine the level of knowledge and understanding possessed by the students, teachers and the school administrators in the use of LAN.

(iv) identify the body responsible for the provision of ICT tools in senior high schools.

(v) examine the cost effect on installation, expanding and maintenance of LAN systems and how it influences the availability and utilisation of networking systems in schools.

(vi) make recommendations to improve the availability and use of the LAN in Senior High Schools.

Research Hypotheses

The following were the hypothesis for the study:

(i)   There is no statistical significant different between schools in their satisfaction level of the availability of LAN tools.

(ii)   The utilisation of LAN has no statistically significant effect on schools data communication.

(iii) The geographical extension of LAN to other part of the school has no effect on data communication in school setting.

(iv)   The installation and maintenance cost has no statistical significant effect in the availability of networking systems regarding data communication.

Significance of the Study

Many public and private institutions spend a lot of money in purchasing stationery materials such as pens, rulers, books and foolscaps to transfer pieces of information within a working environment of which senior high schools are of no exception. For this reason, investigation into the availability and utilisation of LAN in senior high school is very important.

Schools administrators, bursars and porters of schools sometimes have to go to the head's office several times in order to provide a piece of information either for approval or acceptance. The teachers of various departments, in order to communicate with the school administration, have to stop whatever work they are doing and walk to the school administration. This is because the computers in our schools mostly seem not to be in "talking terms". In effect, the study will create the awareness on the urgent need for the migration into digital data communication in the schools.

This study intends to encourage and motivate computer user within the school setting by eradicating the congestion and human traffic natures at the various offices and hence, educate network users on the numerous benefits regarding the utilisation of LAN in the schools and offices. The study will also help the school administration and the other stakeholders to take steps to acquire ICT gadgets into their labs to support the creation of LAN in the schools.

Finally, the study will add to the existing knowledge on how LAN will contribute to the accomplishment of a virtual or paperless school system in order to enhance communication among the various units of the school for improved academic work.

Delimitation of the Study

The study examined the availability and utilisation of the LAN in ten Senior High Schools in the Central Region of Ghana. I restricted the scope of the research mainly because of time and other constraints. The study was confined to finding out the availability and utilisation of LAN in Senior High Schools, its effect on teaching and learning, availability of expects, effect of cost on LAN systems, maintenance of LAN, standard of LAN systems and the knowledge in-depth of LAN users as well as the effective LAN tools usage by the school administrators in attainment of educational goals.

Limitations of the Study

In spite of the strenuous efforts by the researcher to conduct the study thoroughly, the main limitation was lack of academic literature. The researcher faced a great challenge and difficulties regarding the availability of local materials in relation to the LAN.

Scheduling appropriate times to meet the school administrators, technicians, ICT teachers and sometimes, students was difficult because it sometimes distorted the schools' academic calendar. Hence, appointments were cancelled if schools had something else doing. Also the unavailability of funds at the appropriate time affected the research process.

Organisation of the Study

The study is organised into five chapters. Chapter One concentrates on the introduction and provides a background to the study, a statement of the problem, purpose of the study, research objectives, significance of the study, delimitations and limitations of the study. Chapter Two reviews the literature related to the study. The chapter specifically discussed: the concept and history of network, Local Area Network (LAN) and its importance, the availability of LAN in senior high school, the utilisation of LAN in senior high schools, the cost Involved in Setting up the Local Area Network (LAN) and the skills and knowledge of students, teachers and school administration in LAN. Chapter Three deals with the methodology for the study and covers issues such as the research design, population, sample and sampling methods, research instruments, data collection procedure and the data analysis methods. Chapter Four focuses on the analysis and findings of the study. Finally, Chapter Five provides a summary of the methods and findings of the study. It also presents conclusions of the study and makes recommendations. Also included in this chapter are suggestions for further research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter concentrates on a review of related literature related to the study on the availability and utilisation of LAN in Senior High School. The review is based on the following: the concept of and the history of network, local area network, importance of local area network, availability of local area network, the utilisation of local area network and skills and knowledge of students, teachers and school administrators in local area network.

The Concept and History of Network

Network is the generic term used to describe the interconnection of two or more computerised devices purposively for sharing of resources and communication. According to Pathways (2007), computer networks, is also known as "datacom" or "data-transmission networks", since its primary rational is data sharing. He further states that, computer networks represent a particular case of distributed computer systems in which a group of computers operate in a coordinated manner to perform a set of interrelated tasks by exchanging data in an automated mode.

Marsic (2013), in line with the same network description defines network as a "set of devices (often referred to as nodes) connected by communication links that are built using different physical media" (p. 1). He further explains that nodes can be a computer, telephone, or any other device capable of sending and receiving messages in the form of data.

According to the Education Management Information System (EMIS) (1994), networking is best described as a set of software services accomplishing. Computers linked to communicate and exchange information constitute a network. Here, the software component of a network involves the Network Operating System (NOS), Hypertext Markup Language (HTML), Network Protocols et cetera that resides on the hardware such as computers (desktop, laptop, PDA, et cetera.) to transmit frame of data across some telecommunication devices (nodes).

Asante (2012) agrees with the International Technical Support Organisation (ITSO)(1994) definition of networking and contends that computer networking is a set of technologies consisting of hardware, software and cabling or some other means that can be used to connect computers together, enabling them to communicate, exchange information and share resources. Thus Asante thinks in line with the ITSO that network always involves some devices. The devices are referred to us telecommunication devices (ITSO, 1994). According to Doms (2001), "LAN equipment routes information between computers and plays a part in every message sent and received over the Internet (Network)" (p.1).

Todd (2009) stresses that network means two or more connected computers that can share resources like data and application, office machines, an internet connection, or a combination of the above. Network can be described as the coming together of Information and Communication Technology (ICT) tools to assemble and disseminate data.

On the other hand, a computer network consists of a collection of computers, printers and other equipment that is connected together so that they

can communicate with each other. In effect, network does not consist of only computers but other peripherals such as printer, plotter, scanner et cetera.

In all the explanations of networking by the scholars, one thing runs across all their arguments and definitions and this is sharing of a resource. This is to say that the primary rational for any resources is to aid the sharing of resources which could be a hardware or a software whether they are in the same building or in some far away land (Lammle, 2009). According to Marsic (2013), assertion on component characteristics, reliability and performance of individual hardware components (nodes and links) is responsible for a dependable network. Therefore, people within the same room, house, office, school, town, district, region, state, country and for that matter the world at large can share. But, Blake (2012), insists that computer networks do not exist in a perfect world and commented:

Machines crash and later are rebooted, fibers are cut, electrical interference corrupts bits in the data being transmitted, switches run out of buffer space, and, as if these sorts of physical problems aren't enough to worry about, the software that manages the hardware may contain bugs and sometimes forwards packets into oblivion (p. 21).

Maclay, Hawkins and Kirkman (2005) in support with Blake, add that inputs and conditions that are important for ICTs in schools include reliable electricity supply, physical security, and number of telephones per person (teledensity) as a proxy for external communications infrastructure. In effect, it can be argued that, effective and reliable network. Information and communication technologies (ICTs) consist of hardware, software, networks, and media for the collection, storage, processing, transmission, and

presentation of information (voice, data, text, images), as well as related services. Communication technologies consist of a range of communication media and devices, including print, telephone, fax, radio, television, video, audio, computer, and the internet.

According to Adam, Butcher, Tusubira and Sibthorpe (2011), experience suggests that several infrastructural preconditions are required before a school is able to integrate ICT effectively into its day-to-day operations. He further argued that, access to reliable power, secure and appropriate school buildings, and good road access to the school are critical to effective integration of ICT into schools (p. 18).

When the first computers were built during the Second World War, they were expensive and isolated, since then, there have been efforts from various individuals to connect computers together (Bonaventure, 2011, p. 5). According to Forester (1985), the idea to connect computers locally "LAN" began during the evolution of modern telephone network from 1876 to 1951, when science and technology began to interconnect machine as well as people and to carry pictures and data as well as voice. On May 31, 1961, Leonard Kleinrock, made the publication "Information Flow in Large Communication Nets" (Kleinrock, 1961, p 162- 163).

A year later, J. C. R. Licklider, the then director of Information Processing Technology Office (IPTO) in the United State of America also gave his version of a galactic network in 1962, which brought to light, the notion of sharing computer resources (called host computers or simply hosts) over an entire network. According to Bonaventure (2011), computer network emerged relatively recently, in the late 1960s. Host-to-host interactions were

envisioned, along with access to specialised resources (supercomputers and mass storage systems) and interactive access by remote users to the computational powers of time-sharing systems located elsewhere.

The above ideas were first realised in the Advanced Research Projects Agency Network (ARPANET) which started in "1969 and continued until the mid-1980s" (Bonaventure, 2011, p. 5). The organisation went on to establish the first host-to-host network connection on October 29, 1969 with Robert Taylor spearheading the movement. In 1969, the University of California in Los Angeles, the Stanford Research Institute, University of California in Santa Barbara, and the University of Utah were connected as the beginning of the ARPANET network using 50 Kbit/s circuits (Brown, 2015).

A network can be as small as a distance between your mobile phone and its Bluetooth headphone and as large as the Internet itself, covering the whole geographical world, i.e. the Earth (tutorialspoint.com). Broadly speaking, there are two types of network configuration, peer-to-peer networks and client/server networks (Bakardjieva, 2011). Lodd (2009) supports this differentiation when he states that there are two main types of network and they are peer-to-peer and client/server. Tanenbaum and Wetherall (2011) also state that there are two types of transmission technology that have widespread use and they are broadcast links and point-to-point links. In the case of Tanenbaum and Wetherall, they replace the client/server with broadcast because of the distribution nature of data.

The IST Africa (2012) states that developing peer-to-peer networking and knowledge sharing at grassroots level, every member of node on the

network is a client and this gives all users the equal right of use. Therefore, there is no need for Network Operating System (NOS).

On the other hand, peer-to-peer is very porous with security since there is no centralised control. According to Lodd (2009), client/server is more secure to control since, it provides a centralised resource control. It involves using a centralised computer called server to deploy or distribute data over a network. A central computer, or 'server', acts as the storage location for files and applications shared on the network

Client/server networks, according to Lodd (2009), are pretty much the polar opposite of the peer-to-peer network. It involves the central computer or 'server', acting as the storage location for files and applications shared on the network. The server also controls the network access of the other computers which are referred to as the 'client' computers. According to Hepp, Hinostroza, Laval and Rehbein (2004), computer serves as a central server, providing a client/server configuration. Typically, teachers and students in a school will use the client computers for their work and only the network administrator (usually a designated staff member) will have access rights to the server.

Bakardjieva (2000) gives a summary between peer-to-peer and client/server network and is shown in Table 1.

Table 1: A Summary of Peer-to-Peer and Client/Server Network

Peer-to-peer networks	Client/server networks
Easy to set up	More difficult to set up
Less expensive to install	More expensive to install
Can be implemented on a wide range of operating systems	The server needs to run an operating system that supports networking
It is time consuming to maintain the software being used as computers must be managed individually.	Less time consuming to maintain the software being used (as most of the maintenance is managed from the server)
Demands a moderate level of skill to administer the network	Demands that the network administrator has a high level of IT skills with a good working knowledge of a server operating system
Does not require a server	Requires a server running a server operating system
Ideal for networks with less than 10 computers	No limit to the number of computers that can be supported by the network
Very low levels of security supported or none at all. These can be very cumbersome to set up, depending on the operating system being used	High levels of security are supported, all of which are controlled from the server. Such measures prevent the deletion of essential system files or the changing of Settings

Pathways (2007) argues that organisations of different sizes, structures, and budgets need different types of networks, and that a local newspaper company has needs for a network that would be different from the needs of a multinational company. This can be concluded that the school, just like an organisation, will require a type of network based on the number of students as well as the size. Pathways contends that network can be divided into one of two categories: peer-to-peer or server-based networks.

Peer-to-peer networks are more commonly implemented where less than ten computers are involved and where strict security is not necessary (Bakardjieva, 2000). Bakardjieva maintains that all computers have the same status, hence the term 'peer', and they communicate with each other on an equal footing. File, such as word processing or spreadsheet documents, can be shared across the network and all the computers on the network can share devices, such as printers or scanners, which are connected to any one computer. According to Lodd (2009), computers connected together in peer-to-peer do not have any central, or special authority.

Different categories of network can be distinguished based on the distance it covers. According to Kaur and Sharma (2011), depending upon the geographical area covered by a network, it is classified as Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Personal Area Network (PAN)

Networks are named based on their geographical coverage. The biggest form of network is the WAN and it consists of millions of private, public, academic, business and government networks of local to globe scope, that are

linked by a broad array of electronic, wireless and optical networking technologies (Castells, 2003).

"Fault tolerance and cost effectiveness are important characteristics of networks" (Marsic, 2013, p. 2). Marsic states that a network "should be able to deliver messages even if some links experience outages" (p. 2). But frequent faults and cost inefficient has contributed to a big failure because, vital component in Information and Communication Technology such as local area network or computer networks, especially for schools comes with a price tag. And since "most African countries still lack a specific policy relating to the ICT use in education despite the growing presence of computers in many schools in other part of the world" (Trucano, 2012, p. 94). Trucano (2010) contends:

The mobile market has taken off in developing countries, and there are many indications that mobile Internet is soon to follow. This is predicted to be the easiest, most accessible and cost-efficient way to provide Internet access in areas where the information environment is often underdeveloped because of a barriers like lack of infrastructure for fixed-line broadband, lack of accessible computers and electricity, competition, literacy requirements, regulations, and high costs (p. 123)

In conclusion, the review on the definition and history of network will concentrate on the meaning, historical background, and the types of network and history of LAN in the selected Senior High Schools for generalisations.

Local Area Network and its Importance

Just as the name implies, "a Local Area Network (LAN) is usually restricted to spanning a particular geographically location like an office building, a single department within a corporate office, or even a home office" (Lammle, 2009, p. 3). Sheldon (1997) contends that computer networks are defined by their scale. This is to say that, before naming a network the size and the area its covers are very important.

Greg *et al*. (2007) describe LAN as a small network, limited to a single collection of machines and one or more cables and other peripheral equipment. Greg added that, LAN is the basic form of network consisting two or more computers and it also serves as the foundation on which all other complex networks are built. Thus the essence of sharing resources are considered at home before considering what is out there to be shared.

Contrarily to (Lammle, 2009; Greg, 2007; and Sheldon 1997), Bonaventure (2011) explained LAN as a set of communicating devices such that any two devices can directly exchange frames through the data link layer". Lammle *et al*. added that some LANs only connect few devices, but there are LANs that can connect hundreds or even thousands of devices.

Castells (1996) states that in the LAN environments, each computer on the network may access and use hardware resources on the network, such as printing a document on a shared network printer, sharing files, data, and information. According to Clark, Pogran and Reed (1978), a local area network is a data communication network, typically, a packet communication network, limited in geographic scope.

According to Clark (1978) components of a Local Area Network like any other data communication network, a local area network is composed of three basic hardware element namely, a transmission medium, often twisted pair, coaxial cable, or fiber optics; a mechanism for control of transmission over the medium such as wired or wireless and an interface to the network for the host computers or the devices which serve as the nodes of the network to aid the connectivity to other network interfaces. Each node rebroadcasts the request, which continues to reach nodes (Tanenbaum, *et al*. 2007).

Bakardjieva (2000) lists the following as the components of a computer LAN:

- A minimum of at least two computers

- Cables that connect the computers to each other, although wireless communication is becoming more common

- A network interface device on each computer (this is called a network interface card or NIC)

- A 'Switch' used to switch the data from one point to another. Hubs are outdated and are little used for new installations

- Network operating system software

Tanenbaum *et al*. (2007) states that each cabling type comes in a variety of forms, and each has a unique design and usage characteristics with associated cost, performance, and installation criteria. Other transmission medias are wireless, Bluetooth etc. and this makes it possible to network a room without necessary connecting cables. In wireless transmission mediums, no cables are used, but a wireless transmitter is usually mounted on the customer's building (Greg *et al*., 2007), Greg *et al*. contend that the

availability of wireless equipment at a good price with reasonable performance makes going unwired an attractive option, especially for new installations with a fairly small number of computers

To expand or extend a LAN, Greg *et al*. (2007) recommend the need to have devices such as repeaters, bridges, switches, routers and gateways. This is because, Kee (2010) confirms that Local Area Network (LAN) may connect an intranet, extranet, or internet based on the resources that the user prefers to use.

Examples of Local Area Network

According to Kaur and Sharma (2011), LAN within an institution can be wired or remain a wireless network. The wired network requires the use of cable and switch or hub to network the said area. The term 'wireless network' refers to two or more computers communicating using standard network rules or protocols, but without the use of cabling to connect the computers together instead, the computers use wireless radio signals to send information from one to the other. A Wireless Local Area Network (WLAN) consists of two key components: an access point (also called a base station) and a wireless card. Marsic (2013) maintains that "a device that uses Wi-Fi (such as a personal computer, video-game console, smartphone, digital camera, tablet computer, or digital audio player) can connect to the Internet via a wireless network access point" (115).

The Availability of LAN Equipments

Ferranti, Perry, Gill, Guasch, Maloney, Sdnchez-Pdramo and Schady (2003) considers providing ICT equipment and connectivity to schools, as the first and foremost priority in e-education plan. To them, nations that are ready to achieve technology standard must make sure, the physical structures are in place.

According to Mariscal, Botelhoy and Gutiérrez (2008), ICT equipment include telephones and computers. Telephones include all the telecommunication gargets that aid in the transmitting of the data. On the other hand, the computers involve all programmable electronic devices that process data and following a set of instructions to produce information which it can output or store for future use (Appiah, Birbal & Taylor, 2008).

Doms (2001) contends that "LAN equipment are the devices that direct traffic between computers, making possible email transmission, Internet browsing, and file sharing with co-workers" (p. 4). Ferranti *et al*. (2003) cautions that there is the need to "pay special attention to importation of computer equipment, as they are likely to be particularly intensive in high technology" (p. 33).

Doms (2001) states that the four of the most important types in "LAN equipment are routers, switches, LAN cards, and hubs" (p. 1). Lammle (2009) was of the view that the devices are also connectivity devices because, and they connect network entities. The device as listed by Lammle include hub, repeater, modem, Network Interface Card (NIC), switch, wireless access point router, Dynamic Host Configurator Protocol (DHCP) server et cetera.

Again, drawing down on other devices, the Ministry of Education (MOE) Survey (2009) cited in Cudjoe (2013) revealed ICT situation in senior high schools in Ghana. According to the survey, 13% of senior high schools did not have computers or LAN accommodation. Only 231 representing 46. 1% of schools had computers that met minimum standards. Student/Computer ratio was 33:1 in the Volta Region. This means that 33 students used or shared 1 computer. Also students/computer ratio in the Northern Region was 50:1 and the Ashanti region was 40:1. At the school level, it ranged from a low of 3:1 to a high of 650:1, even though students paid a computer levy of GH¢3.00 (USD$1.0) (Mangesi, 2007). Mangesi stated categorically that, there is a great disparity between public and private urban and rural area schools in their access to ICTs tools.

The MOE Survey (2009) further revealed that only 89(17.7%) of schools had some sort of network (internet) and these were mostly in the urban or the metropolitan areas. Only 8.3% computers in the school system were connected to the internet nationwide. Moreover 93.4% of the schools used unlicensed software while majority of the schools did not have ideas about Networking Operating Systems (NOS). According to Semenov (2005), this low and unreliable access to technology means that students do not get enough experience to master complex software tools, and teachers cannot assign tasks that assume ready computer availability.

Even though the survey states that, the Government of Ghana was committed to the transformation of the agro-based economy of Ghana into an information rich and knowledge-based economy and society using the tools of Information and Communication Technology (ICT), the MOE survey (2009)

revealed that among the 1858 senior high schools in Ghana as at 2009, 473 (25.5%) had printers, 304 (16.4%) had photocopiers, 259 (13.9%) had scanners, 267 (14.4%) had TV, 165 (8.9%) had tape recorders, 84 schools had digital cameras, 26 (1.4%) had LCD projectors and 26 (1.4%) had overhead projectors. Semenov (2005) stresses that for the best utilisation of ICT in education, a teacher needs a wide range of devices connectable to a computer, and these are referred to as peripherals which are vital resources that can be shared on a network.

According to Adam, Butcher, Tusubira and Sibthorpe (2011), strong government support is important for advancing ICT availability and usage in education as a broad social and economic development enterprise, a challenge faced by many educational institutions in Africa. Adam *et al*. argue that, "lack of financing and prioritisation of ICT investments as a barrier to effective ICT use. Hence, ICT and for that matter, networking in education or school may not be possible in many African countries" (p. 24). IST-Africa (2012) supports Adam *et al*. point of view and assert that the available network infrastructure to support the Internet is relatively inadequate and inappropriate.

The Utilisation of LAN

The primary motivation for networking and networking systems in education, according to Greg (2007), is the need for administrators, teaching and non-teaching staff, parents and students or pupils to share data and to communicate quickly and efficiently. Maclay *et al* (2005), in their publication of "Global Networked Readiness for Education." state that data

communication is defined as "the ability of a community to realise the benefits of the networked world" (p. 13).

Asanti (2012) stresses that distance is no barrier to the new technology (network) which affords communication of all sorts. Asanti posits that communication has tremendously extended the powers of computers and has also afforded users of computers a lot services. This is to support the point made earlier that LAN has a great attribute of two computerised devices to communicate without the user going through stress.

The applications on network offers unprecedented opportunities for data collection and sharing resources on Local Area Networks can also be used to provide a central fide system for a group of small computers which do not have their own secondary storage. Thus network serve many purposes.

The Importance of LAN in Senior High Schools

The importance of LAN in our senior high school include the following.

(i) LAN enables data sharing among a group of users to exchange information and transfer data from one user to another as workflow demands. Data sharing also usually means that master copies of data files reside in a specific place on another computer elsewhere on the LAN, and users can access the master copy to do their work. A typical example is the sharing of the school database software by the entire school. The software (SMS) is installed on the main server where the database is kept to merge updates to keep a single master copy consistent and correct for the whole school to share.

(ii) LANs enable users to share data hence, makes it possible to circulate voice messages, documents, and other files among users. It can also improve human communication substantially. Example in the school is the scenario where documents are sent through a network to various offices in the school.

(iii) The LAN also promotes the sharing of peripheral devices such as printers, scanners, fax machines, and other devices attached directly to a network or to an ICT tools on the network among users. In a school, fewer peripherals can be bought to undertake the work of many peripherals.

Ferranti *et al*. (2003), contend that "countries that neither increase education levels nor ductility outcomes face a difficult approach of the technological transition in a sequenced challenge of increasing private sector participation in manner suffer poor productivity outcomes" (p. 8): they added that, using more advanced technologies and hiring more educated workers are a way to respond to this pressure to become more productive.

The Government will strive to reduce the ICT access gap between rural and urban areas by activating the Rural Telecommunication Development Fund, offering special incentives to investors in rural ICT provisions, supporting construction of rural telecentres and involving local government authorities in ICT utilisation and promotion.

In Africa and other developing regions, educational applications that favour wider integration of computers into the curriculum will be harder to implement because of lack or resource and poor management.

However, there are a number of interesting applications of computers in African secondary schools. In 1997, Ghana's Ministry of Education began to supply microcomputer-based science labs to secondary schools in 110 districts (Murphy, Anzalone, Bosch & Moulton, 2002).

In conclusion, the School Connectivity Initiative aims to achieve universal school connectivity (IST Africa, 2012). Key challenges in the development of human resource include a limited supply of well qualified ICT professionals, poor quality of available national ICT training, no hardware or software industry to stimulate training and specialisation in these areas and the absence of certified ICT training and evaluation. Marsic (2013) concludes that, on average, network resources are poorly utilised

The Cost involved in Setting up the Local Area Network (LAN)

Technology costs depend on a number of factors, such as the quality and quantity of purchases of hardware such as computers, local area networks (LANs), servers, routers and other connections (Coley, Cradler, & Engel, 2005). The Australian Council for Computers in the Classroom (1999) states that modern teaching could not be accomplished without computers. For senior high schools and for that matter institution levels equivalent, the Ministry of Education (2009) contends that ICT includes any communication device or application encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems, as well as the various services and applications associated with them, such as video-conferencing and distance learning. The organisation, therefore, spells out the following standardised set of minimum requirements for setting up a Standard school ICT laboratory and the cost involved as in 2005 (see Table 2.)

Table 2: Pro-forma for Local Area Network (LAN) Hardware

Hardware Equipment for LAN	Cost (in GH₵)
100 piece @ 20ft of Cat5e 350MHz UTP Ethernet	500.00
150 pieces of RJ 45 connectors	30.00
1 of 9U fixed wall mount cabinet	400.00
180 meters PVC Cat5e Patch panel (with a Rack, patch cords)	600.00
Battler boxes/13A Sockets/Plugs	50.00
1 scanner (flatbed)	1265.00
1 Network printer (Black & white – toner fill) which print up	1976.77
To 55ppm and has duplex printing on both sides of paper	1400.00
A 3 colour printer at 30 pages per minutes	5000.00
1 Photocopier machine (IR 4570-print version)	1850.00
1 LCD Projector with screen (2500 ANSI lumen	1349.00
Storage Media (500 GB external drives/16GB pen drive/DVD)	350.00
1 Server computer (Internal Pentium Dual core with RAID	900.00
50 Work Station Computers (Pentium IV – refurbished)	15000.00
50 of D-Link DGS 10/100 PCI Network Card	1275.00
2 of 24 ports D-Link DGS 10/100 switches for LAN connections	765.00
1 Wireless Router (4 ports) for Internet connectivity	1188.30
1 D-Link WAP (high speed 2.4 GHz. 11g with 108 MPS)	198.00

Source: (MOE ICT Report, 2006)

The report further explained that webcam, facsimile machine (fax), video camera, television, video recorder, radio/wireless, telephone, et cetera, are regarded optional ICT laboratory requirement that need to be networked to aid data communication or enable the sharing of resource. The report also stressed that the cables should not be exposed nor crossed each other. The report emphasised the need for truncking pipes, cable organiser, routers cabinets to be on the network.

The National Centre for Technology in Education (2009) indicates that, computer networking in first level and second level schools should fall within the following estimations shown in Table 3.

Table 3: Estimate for Networking One Classroom with 5 Network Points.

Networking one classroom (with 5 network points)	Qty	Guideline Cost	Totals (inc VAT)
Cabling per network point	5	720	1320
Wall Cabinet	1	1080	1186
Switch (24 port)	1	400	1800
Computers with network cards	5	9400	10340
Totals			**14646**

Source: National Centre for Technology in Education, 2009

Table 3 gives an indication of what it costs to network just one classroom, with 5 network points, with 1 for the teacher and 4 distributed around the classroom. The total cost is GH₵ 14,646. The example is provided so that schools can use it as a guide.

Table 4: Networking additional Classrooms, and the School Library

Network 11 classrooms and the school library.	Qty	Guideline Cost	Totals(inc VAT)
Cabling per network point	60	€150	€9,000
Wall Cabinet	1	€240	€240
Switch (24 port)	3	€400	€1,200
Totals			**€10,440**

Source: National Centre for Technology in Education, 2009

Table 5: Estimate for Networking a New Computer Room with 30 New Computers

Networking a computer room with 30 points	Qty	Guideline Cost	Totals (inc VAT)
Cabling per network point	30	€150	€4,500
Wall Cabinet	1	€240	€240
Switch (24 port)	2	€400	€800
Totals			**€5,540**

Source: National Centre for Technology in Education, 2009

For a school to network the ICT lab with 30 computers, it needs an estimated amount of GH¢ 19,390.00 will be needed.

Table 6: Estimated Cost of a wireless network to link 24 computers in the Science Lab.

Add a wireless network of 24 computers/laptops to the Science Lab	Qty	Guideline Cost	Totals (inc VAT)
Cabling per network point	3	€150	€450
Wall Cabinet	1	€240	€240
Wireless network card	24	€75	€1,800
Wireless router (these link to a switch),	3	€600	€1,800
Switch (24 port)	1	€400	€400
Totals			**€4,690**

Source: National Centre for Technology in Education, 2009

The various tables show the Pro-forma invoice from TBS Limited, for Local Area Network (LAN) installations. The estimates are based on forming a local network with internet connectivity, using 50 computers with peripherals. TBS Ghana Limited prepared the pro-forma invoice for schools which would like to network their system (Sampana, 2010). The invoice lists are all items required to set up a Local Area Network for 50 users in one senior high school.

Software is an ingredient for the operation of any vibrant local area network (Stallings, 2005). The software for the local area network according to Table 7 all are necessary.

Table 7: Pro-foma Invoice for Local Area Network Software

Software for LAN	Cost (Gh ₵)
Operating System (Windows NT Server-Enterprise Edition)	169.00
Operating System (Window NT Workstation with service pack)	152.00
Microsoft Office 2007	272.00
Antivirus software (AVG or Kasperky – for 2yearrs	68.00
Host Based Firewalls	170.00
Internet Content filtering Software (for 1 year)	1474.00
Software that support Remote Instruction	330.00
Software that support Remote Lab- Administration	179.00
Software that support Audio and Video	50.00

Source: (MOE Report, 2006)

Skills and knowledge of students, teachers and school administration on LAN is very important for the development of technological institutions and for that matter "paperless or virtual educational system" in Ghana. According to Alexey (2005), computer is never autonomous, but rather, connected to a growing number of electronic digital devices, aggregation and networks for data and information acquisition, storage, processing, distribution and multimedia delivery. This implies that, administrators, teachers and students learning ICT in the senior high schools are expected to possess basic knowledge in the their usage.

The lack of perfect knowledge of the network state can lead to a poor behaviour of the protocol or degraded performance of the applications leaving

the entire network becoming underutilised entail network becomes under utilised when the LAN system are to put to use (Marsic, 2013).

Summary

Computer networks emerged relatively recently, in the late 1960s. They have inherited many useful properties from their predecessors, namely, older and more widely adopted telephone networks (Forester, 1985). Specifically, the two well-known examples are local area networks (LANs) and wide area networks (WANs) (Blake, 2012). LAN is the smallest as well as the cheapest type of network which forms the basis for all other network and usually restricted to spanning a particular geographical location like an office building, a single department within a corporate office, home or school. Computer network primarily are design to aid in data communication and storage. Clark *et al*. (1978) maintained that, LAN is a data communication network, typically, a packet communication network, limited in geographic scope. Tanenbaum *et al*. (2007) states that each LAN tools (Cables) comes in a variety of forms, and each has a unique design and usage characteristics with associated cost, performance, and installation criteria.

Ferranti *et al*. (2003) considers providing ICT equipment and connectivity to schools, as the first and foremost priority in e-education plan. This is because computer network in the school settings will linked together computers and other telecommunication devices to allow them to share resources such as hardware, software and data.

The School Connectivity Initiative aims to achieve universal school connectivity (IST Africa, 2012). Key challenges in the development of human resources include a limited supply of well qualified ICT professionals, poor

quality of available national ICT training, no hardware or software industry to stimulate training and specialisation in these areas and the absence of certified ICT training and evaluation. Stakeholders are therefore, advise to invest hugely to make this tools accessible to the school populates. Marsic (2013) concluded that, on average, network resources are poorly utilized. The entail network becomes underutilised when the LAN system are to put to use.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter describes the methodology that was used for the study. The chapter focused on the research design, population, sample and sampling procedure, research instruments, data collection and data analysis procedures.

Research Design

A non-experimental (descriptive survey) research design was considered to be appropriate for the study. This type of design does not involve the manipulation or control of factors that may influence the subjects' behaviour or performance. Specifically, the non-experimental design adopted was the descriptive survey design. Descriptive survey examine a phenomenon that is occurring at a specific place(s) and time. It is concerned with conditions, practices, structures, differences or relationships that exist, opinions held, processes that are going on or trends that are evident.

The researcher employed questionnaires for data collection. Amedahe and Asamoah-Gyimah (2003) describe descriptive survey design as research design that makes use of various data collection techniques involving observation, interview, questionnaire, attitude scale and examination of teaching documents. The researcher used quantitative research methods to collect, interpret and analyse data because according to Knupfer and Mclellan (2001), descriptive research does not fit neatly into the definition of either quantitative research methodologies, but it can utilise elements of both, often within the same study. With the in-depth, narrative descriptions of situations, I

used description as a tool to organise data into patterns that will emerge during analysis.

Fraenkle and Norman (2006) list the following as advantages of descriptive research:

(i) It provides a good numbers of responses from numerous people.

(ii) It provides a meaningful picture of events and seeks to explain people's perception and behaviour on the basis of information obtained at a point in time.

(iii) It can be used with greater confidence with regard to particular questions which are of special interest and values to a researcher.

(iv) In- depth follow- up questions can be asked and items that are not clear can be explained.

(v) It is very easy to analyse the responses obtained from the respondents.

One major weakness of descriptive research is that answers to descriptive research do not enable us to understand why people feel, think or behave in a certain manner, why programmes pose certain characteristics, why a particular strategy is used at a certain time and so forth. As a result, our understanding of situation, group of occurrence is limited.

In spite of these couple of disadvantages, the rationale for this design chosen was to enable more respondents to be questioned fairly, quickly and observed at less cost and also since questions were structured, there would be less influence from dynamics of interpersonal variables such as personality influences. Also it allows for greater degree of accuracy, reliability, standardisations of measurement and the uniqueness of the study; much information can be obtained from individual respondent of the population.

Population

For the purpose of the study, the target population was all ICT teachers, all students and school administrators from all the 64 senior high schools in the Central Region of Ghana (Central Region Statistical Department, 2014)

The accessible population was 24,000 people which consisted of students, teachers and Assistant Headmasters of the schools in the Central Region.

Sample and Sampling Procedure

The sample for the research was chosen from the selected senior high schools in the Central Region. Out of the 64 Senior High Schools in the Central Region, 10 schools were selected for the study. The selection was based on the argument by Amedahe and Asamoah-Gyimah (2003) that in most quantitative studies, a sample size of 5% to 20% of the population size is sufficient for generalisation purposes. The 10 schools represented 15.64% which is ideal to represent the population. The sample of 24,000 was made up of 23,838 students, 98 ICT teachers and 64 Assistant Headmasters in charge of Academic.

The sample size selected for the study was based on Krejcie & Morgan's (1970), recommendation for determining a sample size from a given population. This is shown in Table 8.

Table 8: Krejcie and Morgan's Table for determining sample size for a given population

Table for Determining Sample Size for a Given Population

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

Note: "N" is population size
        "S" is sample size.

Source: Krejcie & Morgan, 1970

Based on Krejcie and Morgan's assertion, the sample size considered for the study was 380. The sample size consisted of 340 students, 30 ICT teachers and 10 administrators. Probability and non-probability sampling were employed to select respondents for the study. The sample thus comprised 34 students, 3 ICT teachers and 1 Assistant Headmaster (Academics) from each of the selected schools.

I employed purposive sampling method which is a non-probability sampling technique to select respondents for ICT teachers and assistant headmasters. This sampling technique was used to select the respondents from the various schools because of their knowledge and association in ICT. In purposive sampling, the researcher handpicks the cases to be included in the sample on the basis of judgment of their typicality and uniqueness or their

particular knowledge about the issues under study. Thus, in purposive sampling, also known as, judgmental sampling, the researchers purposely choose subjects whose opinions are thought to be relevant to the research topic (Amedahe & Asamoah-Gyimah, 2003).

On the other hand, lottery method, a simple random sampling which is a probability sample technique were also employed to select the students' respondents for the study. Amedahe and Asamoah-Gyimah (2003) indicated that, simple random sampling is the most basic of the probability designs. This type of sampling gives all units of the target population an equal chance of being selected. The simple random sampling is appropriate when a population of study is similar in characteristics of interest. The lottery method used involved these steps:

- Constructing a sampling frame: constructing a sampling frame is preparing a list of the units of the target population, that is, the list of all elements in the population (students') records and include names and if possible addresses of sample units in alphabetical order and numbered accordingly.

- Write numbers of listed names on slips of paper and put in a container.

- Mix well and remove one slip or paper at a time from the container without looking into it

- Register or record the number or name on the slip. When a slip is selected and recorded, it is thrown back into the container before the next one is picked. The process is continued until the required number of respondents is recorded. If an already drawn number is

selected for a second or third time it is ignored, that is, it is thrown

back into the container.

Research Instrument

Questionnaires (Appendix A and B) containing both open and close-

ended questions were used to collect the data from the respondents.

Questionnaires are doubtless one of the primary sources of obtaining data in

any research endeavor. According to Kothari (2004), questionnaire is an ideal

instrument to gather descriptive information from a large sample in a fairly

short time. The questionnaires had three sections: Section A, Section B, and

Section C. Section A sought information on personal and demographic

characteristics such as respondents' institution, age, sex, and status in school.

Section B elicited respondents' opinions on the availability, utilisation of the

LAN within the school setting and the effects on users' perception and

knowledge on LANs. Section C sought information on the administrative

details concerning the building, purchasing, maintenance and extension of

LAN in the Senior High School. The four-point Likert-type questions were

also employed in the Section B of questionnaire to solicit further information

from respondents.

Questionnaire was suitable because they are operative in collecting

large data within relative short time than other methods such as interviews and

observations. (Brown, 2001; Fraenkel & Wallen, 2003; Gillham, 2000; Muijs,

2004; Nunan, 1999; Seliger & Shohamy, 1989) recommended the use of

questionnaires by stating that; questionnaires are one of the efficient means of

collecting data on a large-scale basis; it takes less time to administer them and

also ensures the anonymity of respondents. Additionally, the researcher used

questionnaire because it was less expensive and also took a little time to administer. Questionnaire again has the advantage of taking it to a wider audience as compared to interviews, but has a disadvantage of not being possible to customize it to individuals as it is possible with other methods of data collection instruments.

In general, there are different ways of administering questionnaires. Gillham (2000), identified the ways as; by post, over the internet, through the telephone, and by face-to-face. The face-to-face approach of administering questionnaire was employed in this study. Though, no single approach is impeccable, yet some are identified to have many flaws than the others. For instance, whenever the respondents are contacted by post or through the internet, the return rate is low and the researcher has no idea as to how the questions were answered. On the contrarily, with face-to-face method of administering the questionnaire, the return rate associated with it is high, the researcher is present to monitor affairs, any ambiguous question can be clarified on the spot by the researcher, and the researcher knows the conditions under which the questionnaires were filled out (Brown, 2001; Gillham, 2000).

However, Richards and Schmidt (2002) cautioned that when designing a questionnaire, the researcher should ensure that it is valid, reliable, and unambiguous. To ensure external and internal validity, the respondents responded to the questionnaire at sight and they were collected on the spot. But the respondents were encouraged to give their independent and impartial responses to the items.

Pilot Testing of Instrument

Teijlingen and Hundley (2002), defined pilot study as experimental, exploratory, test, preliminary, trial, or try out of a research instrument. They emphasised that a pilot study is not a feasibility or hypothesis-testing study but rather it pre-tests or tries out the research instruments. McIsaac and Gunawardena (1996) shared in the view of Teijlingen and Hundley (2002) and added that it can be used in qualitative, quantitative, or mixed methods studies.

Pilot testing of instrument or a pilot study is "a small-scale trial run of all the procedures planned for use in the main study" (Monette et el., 2002). Students, ICT teachers and assistant headmasters from Nsaba Presbyterian Senior High School and Nyarkrom Senior High/Technical School the same context where the study was to be conducted were chosen because they represented the targeted respondents of the study. Thirty-four (34) students, five (5) ICT teachers, and two (2) assistant heads were used in the pilot study. According to Monette, Sullivan and DeJong (2002), an important component in the data collection process is that of the pilot study, in light of these assertion, the instrument was pilot-tested to help the modification and editing of the original questionnaire to suite response from the respondents (Polit, Beck & Hungler, 2001).

The feedback of the respondents helped to improve the quality of the survey in terms of content coverage, content validity, and reliability. The teachers' questionnaire yielded a reliability coefficient of 0.926; the students' questionnaire had 0.829 and the assistants heads' questionnaire also had a reliability coefficient of 0.829. All questionnaires were highly reliable since the reliability coefficients of all questionnaires were above 0.5. The reliability

statistics of the students and ICT teachers/assistant heads' questionnaire are presented in appendix C and D respectively.

Data Collection Procedure

A letter of introduction was obtained from the Head, Department of Information Technology (Centre for Continue Education, University of Cape Coast), and was presented to all the Headmasters after a brief self-introduction. The heads usually referred the researcher to the Assistant Heads (Academic) to facilitate the exercise. Through the Assistant Heads, various respondents were contacted and the questionnaires given to them to answer the various items. The students were usually organised into the classroom and the questionnaires were given to them to answer after which they were collected. In the same way, the questionnaires were given to the ICT teachers and the Assistant Heads in their offices and immediately they finished answering the questions, they were collected. Out of the 340 students, 30 ICT teachers and 10 assistants heads of academics, returning rate of 100% was recorded respectively. I believe the 100% returning rate was recorded because I always waited until I retrieve each questionnaire given out. After the exercise, the researcher went back to the Head to thank and express his appreciation to them.

Data Analysis Methods

The data collected were analysed quantitatively, the research hypothesis one, two, three and four was analysed using both descriptive and inferential statistics. Descriptive statistics involves the use of frequencies and percentages to compute responses. In testing for the hypothesis one, the one way anova

analysis was to test for the relationship of the availability of LAN and LAN tools among the schools. Regression analysis of the utilisation, geographical extension and the effect of Cost on the availability and utilisation of LAN were been done.

Computer software, the Statistical Product for Service Solutions (SPSS) version 21.0 was used for the analysis. Appropriate tables were generated for detailed explanation of the issues that emerged.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

In this chapter, all data gathered for the study have been organised and analysed and this is followed by discussion of key issues relating to the findings of the study. Frequency tables have been provided to give statistical reflections on key issues in terms of the research hypothesis. One way anova and regression analysis of the availability, geographical extension and the utilisation of LAN has been done to help test the research hypotheses.

Demographic Characteristics of the Respondents

The demographic characteristics considered in the study are sex and age distribution of respondents and the schools they were selected from.

School Distribution of Respondents

Respondents who were selected from various schools for the study are presented in Table 9.

Table 9: Distribution of Students, Teachers and Administrator by their represented school

School	Students		Teach/Admin		Total Percentage	
	No.	%	No.	%	No.	%
Nsaba Presby. SHS	34	10	6	15.0	40	10.5
Swedru Business SHS	34	10	3	7.5	37	9.7
National SHS	34	10	5	12.5	39	10.3
Mozano SHS	34	10	4	10.0	38	10.0
Mankesem SHS	34	10	5	12.5	39	10.3
Adisadel College SHS	34	10	3	7.5	37	9.7
Nyarkrom SHS	34	10	3	7.5	37	9.7
Winneba SHS	34	10	3	7.5	37	9.7
Dawurampong SHS	34	10	4	10.0	38	10.0
Aggrey Mem. A.M.E Zion	34	10	4	10.0	38	10.0
Total	**340**	**100.0**	**40**	**100.0**	**380**	**100.0**

Source: Field survey, 2014

In Table 9, 340 (89.5%) of the respondents were students, while 40 (10.5%) of them where teachers and administrators. Out of the 340 students selected for the study, 34 (10%) were selected from each of the schools. With respect to the teachers and administrators selected for the study, 6 (15.0%) were from the Nsaba Presbyterian, 5 (12.5%) were from Ghana National SHS,

4 (10.0%) each were from Mozano SHS, Dawurampong SHS and Aggrey Memorial A.M.E SHS and 3 (7.5%) each were from Swedru Business SHS, Adisadel College SHS, Nyarkrom SHS and Winneba SHS.

Distribution of Respondents by Sex

Out of the total students and teachers/administrators sampled for the study, 271 (79.71.0%) were males and 109 (28.68%) were females. This number comprised of 234 (68.8%) male students and 106 (31.2%) female students. The teachers and the administrators were 37 (92.5%) males and three (7.5%) female teachers and administrator. (See Table 10)

Table 10: Distribution of respondents by sex

Sex	Student		Teac/Admin		Total Percentage	
	No.	%	No.	%	No.	%
Male	234	68.8	37	92.5	271	71.3
Female	106	31.2	3	7.5	109	28.7
Total	**340.0**	**100.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

Table 10 shows that the schools are male-dominated. This is because 71.3% of respondents are males whiles 28.7% of them are females. Even though "most study disclosed that the male students had positive perception of computers and the web technologies than the female students (Liaw, 2002). The study attitudes toward gender difference in the accessibility of LAN and its utilisation have been mixed.

Age Distribution of the Respondents

It was necessary for the researcher to determine the age distribution of the respondents to determine their maturity or youthfulness. The age distribution of the students, teachers and administrators is presented in Table 11.

Table 11: Age Distribution of Respondents

Age	Students		Teach/Admin		Total Percentage	
	No.	%	No.	%	No	%
Below – 15	12	3.53	-	-	12	3.2
15 – 20	217	63.28	-	-	217	57.1
21 – 25	111	32.65	-	-	111	29.2
26 – 30	-	-	6	15.0	6	1.6
31 – 35	-	-	19	47.5	19	5.0
36 – 40	-	-	3	7.5	3	0.8
41 – 45	-	-	2	5.0	2	0.5
45 and above	-	-	10	25.0	10	2.6
Total	**340**	**100.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

Table 11 shows that 12 (3.16%) of the respondents were below age 15. Also 217 (52.110%) were between 15 to 20 and 111 (29.21%) were between 21-25 age group. The respondents between 26 to 30 years were 6 representing (1.6%), 19 (5.0%) were between the ages 31 to 35, 3 (0.8%) and 2 (0.5%) of them respectively were also between 36 – 40 and 41 – 45 age brackets respectively while the remaining 10 (2.6%) fell between the 46 and above age bracket.

Thus the majority of the students' populations were between 15 – 25 years, which makes them youthful. In the case of the administrators and ICT teachers, it was relised that the age distribution was evenly spread.

Average Number of Computers in the Schools

Table 12 shows the teachers and administrators' responses on the number of computers that was available in the selected schools.

Table 12: Average number of computers in schools

Average number of computers	Frequency	%
Below – 20	3	7.5
20-30	27	67.5
31- 40	6	15.0
Above 40	4	10.0
Total	**40**	**100.0**

Source: Field Survey, 2014

In Table 12, 27 (67.5%) of the administrators and teachers admitted that, the average number of computers in their schools was between 20 and 30, 6 (15%) indicated that the average number of computers was between 31-40, four (10%) indicated that the number of computers were above 40, while the remaining three (7.5%) said that the number of computers in their schools was below 20. This means that all the schools had a number computers which is a major network node in the networking. This is in line with (MOE) Survey (2009) which reported that, only 231 (13%) of Senior High Schools had computer or LAN accommodation that meet minimum standards. This is

consistent with Semenov (2005) that the low and unreliable access to technology means that students did not get enough experience to master complex software tools, and teachers could not assign tasks that assumed ready computer availability.

The number of computers to students' ratio was needed to determine how effective and successful the LAN can function as terminals which serve as a node on the network. This meets the explanation by Marsic (2013) that, a node can be a computer, telephone, or any other device capable of sending and receiving messages in the form of data. The table 13 shows the ratio of computers to students since the computers is the main nodes on school networks.

Table 13: Ratio of computers to students

Age	Teach/Admin No.	Percentage %
Below – 3	3	7.5
3 – 4	15	37.5
5 – 6	21	52.5
Above 6	1	2.5
Total	**40**	**100.0**

Source: Field Survey, 2014

In the table, 21(52.5%) of the respondents indicated that, the ratio of computers to students was 1:5 to 1:6 and 15(37.5%) responded that the ratio was between 1:3 and 1:4. In addition, 1:3 and above 1:6 computer-student ratio was given by 3(7.5%) and 1(2.5%) respondents respectively. This

.indicates that, students did not have access their own LAN node. Therefore, since most of the schools had student population of 1500-2000 with an average number of computers of 20-30, then the MOE (2009) finding has been confirmed because it was stated in the survey that, every 33 students used or shared 1 computer in SHS in Ghana. This rate was not even since student/computer ratio in the Northern Region was 50:1 and the Ashanti Region was 40:1. The above student/computer ratios affirm Trucano, (2012) assertion that, "most African countries still lack a specific policy relating to the ICT use in education despite the growing presence of computers in many schools in other part of the world"(p. 94). Ferranti *et al*. (2003) concluded that, nations that are ready to achieve technology standard must make sure that the physical in structures are in place by providing ICT equipment and connectivity to schools, as the first and foremost priority in e-education plan.

Do you have ICT Lab in your School?

It is an undisputed fact that, the ICT laboratories house most of the ICT tools that are available in our educational institutions. It was, therefore, very relevant to determine the accessibilities of ICT laboratories (lab) in the various schools, and Table 14 shown the availability of ICT labs in the schools.

Table 14: Availability of ICT Labs in the schools

Availability of	Student		Teach/Admin		Total Percentage	
ICT Babs	No.	%	No.	%	No.	%
Yes	339.7	99.7	40	100	379	99.73
No	1	0.3	0	0	1	0.03
Total	**340**	**100.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

Table 14 indicates that there were computer laboratories in various schools. This is because 379(99.73%) of the respondents indicated that there were ICT lab in their schools with 1(0.03%) student claiming that there was no ICT lab in his school. While the entire teachers and administrators (respondents) admitted having computer labs in their schools, only 1 (0.3%) student said that there was no ICT Lab. This could be that, the student had not been attending ICT classes and the consequently was not aware of the availability of the ICT facility. As showed in Table 14, the finding are in support with Malcolm and Godwyll (2005) assertion on availability of ICT. Which reports that, in Ghanaian schools, there is generally increasing and dramatically growing of ICT. But Maclay *et al*. (2005) further argue that, the problem with developing countries with respect to ICT is "the low levels of ICT use in schools and integration with no significant differences between private and state schools. And further contends that "indeed most students and their teachers do not access a network in schools, and use computers only on a weekly basis" (p. 5).

Table 15: Availability of LAN in the ICT labs

LAN in ICT	Student		Teach/Admin		Total Percentage	
LAB	No.	%	No.	%	No.	%
Yes	122	35.9	16	40.0	138	36.32
No	218	64.1	24	60.0	242	63.68
Total	**340.0**	**40.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

Table 15 shows that 242 representing 63.68% of the respondents indicated that, even though they had ICT Labs with some computers, they did not have access to a Local Area Network in their schools while 138 representing 36.32% maintained that they had LAN in their schools. This supports IST-Africa's (2012) assertion that the available network infrastructure to support the Internet is relatively inadequate and inappropriate. From the table, it can be concluded that, since LANs are not most common in most of the schools because, the set of communicating devices such that any two devices can directly exchange frames through the data link layer as explain by Bonaventure (2011) are not visible in the schools. Therefore, the internet which is a worldwide connection of LANs are not accessible, since Kee (2010) asserted that Local Area Network (LAN) may connect an intranet, extranet, or internet based on the resources that the user prefers to use.

Table 16: Availability of Local Area Network in other part of the school

LAN extension	Student		Teach/Admin		Total Percentage	
in schools	No.	%	No.	%		
Yes	67	19.7	5	12.5	72	18.94
No	272	80.0	34	80.5	306	80.53
None	1	0.3	1	2.5	2	0.53
Total	**340.0**	**40.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

In Table 15, 306 (80.53%) respondents said that there was no extension of LAN to other parts of the school with 72 (18.94%) saying that there were some extension of LAN in the school ecology while the remaining 2 (0.53%) had no knowledge on the expansion or extension of LAN to other parts of the school to help in data communication. Poor extension of LAN is the major reason for the sharing of resources with primitive approaches even though The Ghana Poverty Reduction Strategy Paper (GPRS I & II) and the Education Strategic Plan 2003-2015 all suggest the use of ICT (network) as a means of reaching out to the poor in Ghana. Mangesi (2007) also explains that the continuous use of paper for almost every activity in the school is due to the limited networking facilities. This supports the point made by Clark, Pogran. & Reed (1978) that a local area network is a data communication network, typically a packet communication network, limited in geographic scope Ferranti *et al* (2003) contend that nations should considered providing ICT equipment and connectivity to schools, as the first and foremost priority in e-

education plan. To them, nations that are ready to achieve technology standard must make sure, the physical in structures (Telecommunications) are in place.

The study found out the number of the administrators and ICT heads of department and ICT subject teachers had LAN in their offices to help in data communication. The findings are presented in Table 16.

Table 17: Availability of Local Area Network in your office

LAN extension	Teach/Admin	Total Percentage
	No.	%
Yes	10	25.0
No	30	75.0
Total	**40**	**100.0**

Source: Field Survey, 2014

In the table, 30(75%) out of the 40 respondents had no LAN access in their respective labs, 10 representing 25% had LAN in their offices. This shows a very poor accessibility of LAN in the "Mater Users" of LAN in our educational institutions. This buttresses IST-Africa (2012) that the available network infrastructure to support network (LAN, Internet) is relatively inadequate and inappropriate in our school.

Medium of LAN Connectivity in schools

Having responded to the availability of LAN in the lab and other parts of the schools by the respondents, the researcher posed a question on whether or not the network medium was LAN or wireless and the responses are provided in Table 18.

Table 18: Medium of LAN connection in schools

Medium of LAN	Students No.	Students %	Teach/Admin No.	Teach/Admin %	Total Percentage No.	Total Percentage %
Wired	36	10.6	10	25.0	46	10.11
Wireless	0	0.0	0	0	0	0.00
None	304	89.4	30	75.0	334	87.89
Total	**340.0**	**40.0**	**40**	**100.0**	**380**	**100.0**

Source: Field Survey, 2014

Table 18 shows that 10 (25%) of the administrators admitted that the network available in their institutions was wired while 30 (75%) said that their schools neither had wired nor had wireless network. In the case of the students, 36 (10.6%) said they had a wired network in their schools while 304 (89.4%) said that they neither had wired nor had wireless network. Thus, 46 (10.11%) said they had access to wired network while 334 (87.89%) said that they neither had wired nor wireless network. The above means that, none of the schools had access to a wireless network. In wireless transmission mediums, no cables are used, but a wireless transmitter is usually mounted on the customer's building (Greg *et al*., 2007).

Does your School uses Network Operating System

The Network Operating System (NOS) a school uses go a long way to determine whether the school is on peer-to-peer network or server-client network. Respondents were, therefore, asked about the existence of NOS concept in their schools. Table 19 shows the responses.

Table 19: Availability of Network Operating System (NOS)

LAN extension	Teach/Admin	Total Percentage
	No.	%
Yes	2	5.0
No	38	95.0
Total	**40**	**100.0**

Source: Field Survey, 2014

In the Table, 38 (95.0%) of the administrators and teachers said that their school did not have NOS while the remaining 2 (5.0%) respondents said that their schools did not have any NOS. But a further question which demanded the type of NOS used by the school, 2 (5.0%) posited that their schools used NOS.

NOS is basically an operating system used in server-client environment. Even though The IST Africa (2012) indicated that, developing peer-to-peer networking and knowledge sharing at grassroots level and that, each member on electronic node on the network is a client with equal right over the other. The facts still remain that, a server base network is more secure and safer with respect to data communication, storage, integrity etc.

Table 20: The Use of Networking Operating System in Schools

Type of NOS	Teach/Admin No.	Total Percentage %
Windows	0	0.0
Linus	0	0.0
Unix	0	0.0
Others	0	0.0
None	40	100
Total	**40**	**100.0**

Source: Field Survey, 2014

In the table, it can be concluded that respondents who answered that there were NOS in their schools had no idea about NOS. In fact, all 40 (100%) respondents had none of the NOS in their schools. This supports the MOE (2009) that a lot of people did not have any idea about NOS. Even though Bakardjieva (2000) named Networking Operating System as one of the key components of the LAN, it was discovered that none of the schools had NOS, which also that, none of the schools has a dedicated server to monitor and deploy server services. But like Lodd (2009) stated, computers connected together in peer-to-peer do not have any central or special authority.

The one or the body responsible for the purchasing of LAN tools for the school was looked at and the responses are presented in Table 20.

Table 21: The body Responsible for the Purchasing of LAN Tools in School

LAN extension	Teach/Admin No.	Total Percentage %
School administration	36	90.0
GES	4	10.0
NGO	0	0.0
Individual	0	0.0
Total	**40**	**100.0**

Source: Field Survey, 2014

As shown in Table 21, 36 (90%) of the administrators admitted that school administration is responsible for the provision of LAN tools while four (10%) said their schools' LAN tools were provided by the Ghana Education Service. With reference to Table 2, 3, 4, 5, 6 and 7, the cost of ICT tools are very expensive and since most institution has very little or no help from other stakeholders, it was established that, schools go through a lot of difficulties to acquire this very important LAN tools. The findings is in line with Adam *et al*. (2011) argument that, lack of financing and prioritisation of ICT investments have a great impact on networking in education or school in many African countries. This therefore strongly agrees to Adam et al. (2011) that, "strong government support is important for advancing ICT availability and usage in education as a broad social and economic development enterprise, a challenge faced by many educational institutions in Africa" (p. 24).

Test for the Research Hypotheses

     Hypothesis 1: The satisfaction level of LAN availability has no statistical significant effect among the schools with regards to the existence of LAN tools such as computers, servers, switches, et cetera, in the senior high schools.

Table 22 shows anova comparison of the satisfaction level of the availability of LAN facilities and equipment for the teaching and learning among students of senior high schools.

Table 22: Anova showing Availability of LAN among Student in the Schools

		Sum of Squares	Df	Mean Square	F	Sig.
What is the satisfaction level of the availability of computers in the schools?	Between Groups	8.297	9	.922	2.220	.021
	Within Groups	137.029	330	.415		
	Total	145.326	339			
What is the satisfaction level of the availability of servers in the schools?	Between Groups	13.944	9	1.549	5.980	.000
	Within Groups	85.500	330	.259		
	Total	99.444	339			
What is the satisfaction level of the availability of switchs in the schools?	Between Groups	1.591	9	.177	2.790	.004
	Within Groups	20.912	330	.063		
	Total	22.503	339			
What is the satisfaction level of the availability of access point in the schools?	Between Groups	13.897	9	1.544	4.448	.000
	Within Groups	114.559	330	.347		
	Total	128.456	339			

Table 22 Continued

What is the satisfaction level of the availability of trucking pipes in the schools?	Between Groups	.471	9	.052	1.304	.234
	Within Groups	13.235	330	.040		
	Total	13.706	339			
What is the satisfaction level of the availability of printers in the schools?	Between Groups	22.365	9	2.485	5.519	.000
	Within Groups	148.588	330	.450		
	Total	170.953	339			
What is the satisfaction level of the availability of scanners in the school?	Between Groups	15.956	9	1.773	6.953	.000
	Within Groups	84.147	330	.255		
	Total	100.103	339			

Significant at $P > 0.05$ level

In Table 22, there is statistically significant difference among the schools with regard to the students' perception on the availability of computers, servers, switches, trucking pipes, printers and scanners among the individual schools.

The results of a one-way anova indicated that computers have the $F_{(2, 338)} = 2.220$ and $P = 0.021$ which shows that satisfaction level of the availability of LAN tools among the schools is statistically significant. The results of a one-way anova show that, servers have the $F_{(2, 338)} = 5.980$ and $P = 0.000$ which show the satisfaction level of the availability of computers was statistically significant. Again, the results of a one-way anova indicated that switche devices in schools have the $F_{(2, 338)} = 2.790$ and $P = 0.004$ which show the satisfaction level of the availability of switches was statistically significant. In addition, the test statistic indicated that there was statistically significant difference among schools concerning the availability of

access point because F of (2, 338) = 4.448 and a P= 0.000. Also the results of a one-way anova point to the fact that printers have the F (2, 338) = 5.519 and P = 0.000 which show the satisfaction level of the availability among the schools is statistically significant. Finally, the results of a one-way anova indicated that scanners have the F (2, 338) = 6.953 and P = 0.000 which show that the satisfaction level of the availability of scanners was statistically significant.

However, the statistical test results of a one way anova indicated that, the cost of three (3) routers (access point) has the F (2, 358) = 1.304 and P = 0.234 which shows the satisfaction level of the availability of trucking pipes among the schools is not statically significant.

In Table 22, there is significant difference among Senior High Schools students' satisfaction level in the availability of LAN tools, facilities and equipment for data communication and resource sharing. The significant values are less than the 0.05 level of significant among all the tools with the exception of trucking pipes. Therefore, the research hypothesis was rejected, because the null hypothesis states that: There is no statistical significant different between schools in their satisfaction level of the availability of LAN tools must be rejected. Hence there is a significant different between the schools with respect of LAN availability.

A post-hock conducted on the satisfaction level with the availability show the direction indicated that, see appendix C.

Again the responses given by the teachers and the administrator are shown in Table 23.

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Table 23: Anova showing Availability of LAN among Teachers and Administrators

		Sum of Squares	Df	Mean Square	F	Sig.
What is the satisfaction level of the availability of computers in the schools?	Between Groups	8.297	9	.922	2.420	.041
	Within Groups	137.029	30	.415		
	Total	145.326	39			
What is the satisfaction level of the availability of servers in the schools?	Between Groups	13.944	9	1.549	3.980	.006
	Within Groups	85.500	30	.259		
	Total	99.444	39			
What is the satisfaction level of the availability of access point in the schools?	Between Groups	13.897	9	1.544	2.148	.001
	Within Groups	114.559	30	.347		
	Total	128.456	39			
What is the satisfaction level of the availability of trucking pipes in the schools?	Between Groups	.471	9	.052	2.304	.024
	Within Groups	13.235	30	.040		
	Total	13.7706	39			
What is the satisfaction level of the availability of printers in the schools?	Between Groups	22.365	9	2.485	4.351	.009
	Within Groups	148.588	30	.450		
	Total	170.953	39			
What is the satisfaction level of the availability of scanners in the schools?	Between Groups	15.956	9	1.773	5.711	.019
	Within Groups	84.147	30	.255		
	Total	100.103	39			

ns- not significant at P>0.05 level

Table 23 shows that there is a significant difference between senior high schools teachers and administrators, the satisfaction level in the availability of LAN facilities. The significance value is 0.05 level of significance. Therefore the research hypothesis is rejected.

The results of a one-way anova indicated that computers have the F (2, 38) = 2.420 and P = 0.041 which show that the satisfaction level of the availability among the schools is statistically significant. The results of a one-way anova show that servers have the F (2, 38) = 3.980 and P = 0.006 which show the satisfaction level of the availability statistically significant. Again, the results of a one way anova indicated that switches have the F (2, 38) = 2.790 and P = 0.014 which show the satisfaction level of the availability was statistically significant. In the same respect, the test statistic indicated that there was statistical significant among school concerning the availability of routers because F of (2, 338) = 2.148 and a P= 0.001. The statistical test results of a one-way anova also indicated that there access point has the F (2, 38) = 2.304 and P = 0.024 which shows the satisfaction level of the availability of trucking pipes among the schools is statistically significant. Again the results of a one-way anova point to the fact that printers has the F (2, 38) = 4.351 and P = 0.009 which shows the satisfaction level of the availability among the schools is statistically significant. Finally, the results of a one-way anova indicated that scanners have the F (2, 338) = 5.711 and P = 0.019 which show the satisfaction level of the availability not significant.

Table 23 reveals that there is a significant difference among senior high schools students' satisfaction level in the availability of LAN tools, facilities and equipment for data communication and resource sharing. The

significance values were less than the 0.05 level of significance among all the tools with the exception of trucking pipes. Therefore the research hypothesis was rejected. And because the null hypothesis states that: The availability of LAN has no statistical significant effect on schools data communication must be rejected. Hence, LAN availability has a great impact on schools data communication and resource sharing.

From the above, it is clear that the research hypothesis must be rejected since the sig. value for both administrator and students' are less than the 0.05 level of significance. Because all the significance values for the devices are less than the significance value, the hypothesis is rejected. Hence there is a significant difference between the schools with respect to LAN availability

Malcolm and Godwyll (2005) sharing their views on the availability of ICT tools concluded that, ICT in Ghanaian schools, in particular and Africa is generally increasing and dramatically growing. The study however, indicated that, ICT in Central Region for that matter Ghana is not enjoying any massive growth in our schools. But Mangesi, (2007), the Ghana Poverty Reduction Strategy Paper (GPRS I & II) and the Education Strategic Plan 2003-2015 all recommend the use of ICT (network) as a means of reaching out to the poor in Ghana. Maclay (2005) concluded that the schools had low levels of ICT use and integration with no significant differences between private and state schools. He added that most students and their teachers did not access a network (Network) in schools, and used computers only on a weekly basis.

Hypothesis 2: The geographical extension of LAN has no effect on data communication in the school setting with regard to which places within the school have access to LAN connectivity. The accessibility of LAN in the ICT LAB, Headmasters office, assistants headmasters offices, general offices, account office, et cetera

Linear Regression test was ran to predict the contribution of LANs geographical extension within the school setting to data communication and the results are shown in Table 24, 25 and 26.

Table 24: Summary Model: Linear Regression predicting Extension of LAN to Data Communication

Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.754*	.556	.550	.256

a. Predictors: (Constant),

Table 25: ANOVA[a]: Linear Regression predicting Extension of LAN to Data Communication

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	27.450	4	6.863	104.680	.000[b]
	Residual	21.962	335	.066		
	Total	49.412	339			

a. Dependent Variable: How is digital communication mostly accomplished in your school?

b. Predictors (Contant).

Table 26: Coefficients[a]: Linear Regression predicting Extension of LAN to

Model		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	.913	.038	
	What is the satisfaction level of the geographical extension of LAN to the schools ICT Lab?	.279	.022	.772
	What is the satisfaction level of the geographical extension of LAN to your classroom?	-.084	.041	-.136
	What is the satisfaction level of the geographical extension of LAN to the schools book Shop?	-.224	.031	-.384
	What is the satisfaction level of the geographical extension of LAN to the schools science laboratory?	.112	.019	.301

a. Dependent Variable: How is digital communication mostly accomplished in your school?

The results from the Linear regression to investigate how the geographical extension of LAN in the schools LABs contribution to data communication, indicated that, the results were statistically significant with the variance (R^2 = .550, F (2,338) = 104.680, p< .05. it was found that LAN extension to the ICT labs significantly predicted aggressive tendencies (β = .279, p<.000. Again, the result of the regression to investigate how the LAN is extended geographically to the classroom and its impact to data communication are statistically significant showing the variance (R^2 = .550, F (2, 338) = 104.680, p< 0.05. It was found that LAN extension to the

classrooms significantly predicted aggressive tendencies (β = .-084, p<.043. The results from geographical extension of LAN in the schools bookshops and its contribution to data communication, were statistically significant with the variance (R^2 = .550, F (2,338) = 104.680, p< .05. It was found out that LAN extension to the ICT labs significantly predicted aggressive tendencies (β = -.224, p<.000. Finally, the test results to predict the geographical extension of LAN in the schools science LABs and its contribution to data communication, were statistically significant with the variance (R^2 = .550, F (2,338) = 104.680, p< .05. It was found out that LAN extension to the school bookshop significantly predicted aggressive tendencies (β = .279, p<.000.

The above shows that the research hypothesis must be rejected since the sig. among students are less than the 0.05 level of significance. Due to this, the null hypothesis which states that: The geographical extension of LAN has no effect on data communication in school setting must be rejected. Hence the geographical extension of LAN has a great impact on schools data communication and resource sharing.

According to Alexey (2005), computer is never autonomous but, rather, connected to a growing number of electronic digital devices, aggregation and networks for data and information acquisition, storage, processing, distribution and multimedia delivery. This implies that, administrators, teachers and students learning ICT in the senior high schools are expected to possess basic knowledge in the their usage. It is, therefore, important to extend LAN to promote data communication in our schools.

Hypothesis 3: The utilisation of LAN has no statistical significant effect on schools data communication

Regression test was run to predict the contribution of LANs utilisation and its effect on school data communication. The results are shown in Table 27, 28 and 29

Table 27: Model Summary: Linear Regression Predicting Students' LAN Utilisation to Data Communication

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.831[a]	.691	.685	.214

a. Predictors: (Constant).

Table 28: ANOVA[a]: Linear Regression Predicting Students' LAN Utilisation to Data Communication

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	34.124	6	5.687	123.883	.000[b]
1	Residual	15.288	333	.046		
	Total	49.412	339			

a. Dependent Variable: How is digital communication mostly accomplished in your school?
b. Predictors: (Constant)

Table 29: Coefficients[a]: Linear Regression Predicting Students' LAN Utilisation to Data Communication

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.671	.054		12.508	.000
	What is the satisfaction level of the utilisation of LAN for printing in the school?	.152	.021	.351	7.259	.000
	What is the satisfaction level of the utilisation of LAN for sharing DBMS in the school?	-.045	.037	-.065	-1.203	.230
	What is the satisfaction level of the utilisation of LAN for communication among colleagues in the school?	-.179	.046	-.139	-3.865	.000
	What is the satisfaction level of the utilisation of LAN for submitting assignments?	-.018	.020	-.041	-.891	.004
	What is the satisfaction level of the utilisation of LAN for record keeping in the school?	.242	.031	.426	7.916	.000
	What is the satisfaction level of the utilisation of LAN to fill student report?	.116	.028	.313	4.101	.000

a. Dependent Variable: How is digital communication mostly accomplished in your school?

The results from the simple regression to investigate how printing on LAN in the schools contribute to data communication were statistically significant with the variance ($R^2 = .685$, F (2,338) = 123.883, p< .05. It was found out that LAN utilisation in printing significantly predicted aggressive tendencies ($\beta = .154$, p<.000. The test of the regression to investigate the utilisation of LAN for sharing DBMS in the school and its impact to data communication was not statistically significant with the variance ($R^2 = .685$, F (2, 338) = 123.883, p< 0.05. It was found out that LAN utilisation in sharing DBMS significantly predicted aggressive tendencies ($\beta = -.045$, p<.245. Again, the test of the regression to predict LAN utilisation for communication among colleagues in the school and its contribution to data communication were statistically significant with the variance ($R^2 = .685$, F (2, 338) = 123.883, p< 0.05. It came out that LAN utilisation in communicating among colleagues significantly predicted aggressive tendencies ($\beta = .179$, p<.000.

Furthermore, the test to predict the utilisation of LAN for submitting assignments between teachers and their students as well as its contribution to data communication, was statistically significant with the variance ($R^2 = .550$, F (2,338) = 104.680, p< .05. It was found out that, LAN utilisation in submitting assignments significantly predicted aggressive tendencies ($\beta = -.018$, p<.004. Again, the test of the regression to predict level of the utilisation of LAN for record keeping in the schools data communication was statistically significant with the variance ($R^2 = .685$, F (2, 338) = 123.883, p< 0.05. it was found that LAN utilisation in record keeping significantly predicted aggressive tendencies ($\beta = .242$, p<.000.) Finally, the test result to predict the contribution of LAN utilisation in filing student report and data

communication was statistically significant with the variance ($R^2 = .550$, F $(2,338) = 104.680$, $p < .05$. It was found out that, LAN utilisation in filling students report significantly predicted aggressive tendencies ($\beta = .115$, $p < .000$.).

From the above, the research hypothesis must be rejected since the sig. among students are less than the 0.05 level of significance. Due to this, the null hypothesis which states that: The utilisation of LAN has no statistical significant effect on schools data communication in the school setting must be rejected. Hence the utilisation of LAN has a great impact on schools data communication and resource sharing.

Table 30: Linear Regression Predicting LAN Utilisation to Data Communication by Teachers and Administrators

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.753[a]	.554	.550	.213

Predictors: (Constant)

Table 31: ANOVA^a: Linear Regression Predicting LAN Utilisation to Data Communication by Teachers and Administrators

Model		Sum of squares	df	Mean square	F	Sig.
	Regression	34.124	9	4.082	113.110	000.
1	Residual	15288	30	.046		
	Total	49.412	39			

a. Dependent Variable: How is digital communication mostly accomplished in your school?

b. Predictors: (Constant)

Again, regression test was ran to predict the contribution of LANs utilisation and its effect on the school data communication by teachers and administrators and the results are shown in Table 32.

Table 32: Coefficients[a]: Linear Regression Predicting LAN Utilisation to Data Communication by Teachers and Administrators

Model	Unstandardized Coefficients		Standardized Coefficients	t
	B	Std. Error	Beta	
Constant	.671	.051		14.106
What is the satisfaction level of the utilisation of LAN for printing in the school?	.121	.021	.351	7.259
What is the satisfaction level of the utilisation of LAN for sharing DBMS in the school?	.110	.037	-.065	-1.203
What is the satisfaction level of the utilisation of LAN for communication among colleagues in the school?	.096	.046	-.139	-3.865
What is the satisfaction level of the utilisation of LAN for submitting assignments?	-.019	.020	-.041	-.891

Table 32 Continued

What is the satisfaction level of the utilisation of LAN for record keeping in the school?	.312	.031	.326	7.116
What is the satisfaction level of the utilisation of LAN to fill student report?	.211	.028	213	4.101

a. Dependent Variable: How is digital communication mostly accomplished in your school?

The simple regression was ran to investigate how printing on LAN in the schools contribute to data communication was statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< .05. It was found out in the study that LAN utilisation in printing significantly predicted aggressive tendencies (β = .110, p<.030). The test of the regression to investigate the utilisation of LAN for sharing DBMS in the school and its impact to data communication was statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< 0.05. It was found that LAN utilisation in sharing DBMS significantly predicted aggressive tendencies (β = .196, p<.000.) again, the test of the regression to predict LAN utilisation for communication among colleagues in the school and its contribution to data communication were statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< 0.05. It was found that LAN utilisation in communicating among colleagues significantly predicted aggressive tendencies (β = .096, p<.000. Furthermore,

the test to predict the utilisation of LAN for submitting assignments between teachers and their students as well as its contribution to data communication were statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< .05. It was found out that LAN utilisation in submitting assignments, significantly predicted aggressive tendencies (β = -.019, p<.002. Again, the test of the regression to predict level of the utilisation of LAN for record keeping in the schools data communication were statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< 0.05. It was found out that LAN utilisation in record keeping significantly predicted aggressive tendencies (β = .312, p<.000.) Finally, the test result to predict the contribution of LAN utilisation in filing student report and data communication was statistically significant with the variance (R^2 = .550, F (2, 38) = 113.110, p< .05. It was found out that LAN utilisation in filling students report significantly predicted aggressive tendencies (β = .211, p<.001.)

From the above, the research hypothesis must be rejected since the sig. among students are less than the 0.05 level of significance. Due to this, the null hypothesis states that: The utilisation of LAN has no statistical significant effect on schools data communication in the school setting must be rejected. Hence the utilisation of LAN has a great impact on schools data communication and resource sharing.

Data from both the students and administrators show that LAN utilisation in the schools does not meet the standard technological world. This goes contrally to Alexey (2005) assertion that administrators, teachers and students learning ICT in the senior high schools are expected to possess basic knowledge in the their usage of LAN in sharing resources because computer is

never autonomous but, rather, connected to a growing number of electronic digital devices, aggregation and networks for data and information acquisition, storage, processing, distribution and multimedia delivery.

Hypothesis 4: The installation and maintenance cost has no statistical significant effect in the utilisation of networking systems for data communication.

Regression test was ran to predict if the installation and maintenance cost has a statistical significant effect in the utilisation of networking systems regarding data communication. The results are shown in table 33, 34 and 35.

Table 33: Model Summary: Regression Analysis of Installation and Maintenance of LAN to its Usability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.601[a]	.361	.267	1.86906

a. Predictors: (Constant).

Table 34: ANOVA[a]: Regression Analysis of Installation and Maintenance of LAN to its Usability

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	67.000	5	13.400	3.836	.007[b]
	Residual	118.775	34	3.493		
	Total	185.775	39			

a. Dependent Variable: LAN_availability.
b. Predictors: (Constant)

Table 35: Coefficients[a]: Regression Analysis of Installation and Maintenance of LAN to its Usability

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26.308	1.839		14.303	.000
	Who is responsible for the purchasing of LAN tools in the school?	4.507	2.071	.627	2.177	.037
	Does your school have a qualified Network Administrator?	-2.876	.943	-.557	-3.050	.004
	Who paid for the cost	-5.547	2.354	-.678	-2.356	.024
	How often are LAN devices purchase?	-.819	.542	-.267	-1.513	.140
	How often is the network extended?	1.064	.491	.413	2.166	.037

a. Dependent Variable: LAN_availability

The results of the simple regression to investigate how the purchase of LAN in the schools contribute to its availability were statistically significant with the variance (R^2 = .267, F (2,38) = 4.242, p< .05. It was found out that purchasing of LAN tools and its contributing to availability significantly predicted aggressive tendencies (β = 4.507, p<.037. The test of the regression to investigate availability of LAN administrators with respect to LAN maintenance indicated were statistically significant with the variance (R^2 = .267, F (2,38) = 4.242, p< .05. It was found that purchasing of LAN tools and its contribution to availability significantly predicted aggressive tendencies (β

= -2.876, p<.004. Again, The test of the regression to investigate the institution responsible for paying the cost involved in installation and maintenance of LAN tools and its availability indicated that, the results were statistically significant with the variance (R^2 = .267, F (2, 38) = 4.242, p< .05. it was found that purchasing of LAN tools and its contribution to availability significantly predicted aggressive tendencies (β = -5.547, p<.024. Furthermore, the analysis of the regression to investigate how often LAN devices are purchased indicated that, the results were statistically significant with the variance (R^2 = .267, F (2, 38) = 4.242, p< .05. it was found that how often LAN devices are purchased insignificantly predicted aggressive tendencies (β = -.819, p<.140. Finally, the test result to predict that, how often LAN is extended and its contribution of LAN utilisation indicated that, the results were statistically significant with the variance (R^2 = .550, F (2,338) = 104.680, p< .05. It was found that LAN utilisation in filling students report significantly predicted aggressive tendencies (β = 1.064, p<.037.)

From the above the research hypothesis must be rejected since the sig. among administrators are less than the 0.05 level of significant. The null hypothesis which states that: The installation and maintenance cost has no statistical significant effect in the utilisation of networking systems for data communication was rejected. Hence the installation and maintenance cost of LAN has a great impact on schools data communication and resource sharing. Even though Greg et al. (2007) stated that, the availability of wireless equipment at a good price with reasonable performance makes going unwired an attractive option, especially for new installations with a fairly small number of computers. It was realised from the study that, wired LAN was not mostly

seen in the schools due to the high cost involved in its installation and maintenance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter gives a summary for the study. In addition, recommendations are made to ensure the availability and the utilisation of LAN in Senior High Schools in the Central Region of Ghana.

Summary of the Study

The study was undertaken to examine the availability and the utilisation of Local Area Network in selected Senior High Schools of Ghana. A sample size of three hundred and eighty students, ICT teachers and administrators in Senior High Schools in the Central Region was selected for the study using probability and non-probability sampling techniques to select respondents for the study. The study revealed that students, teachers and administrator were not satisfied with the availability of LAN and its utilisation in their respective schools. Again, it was established that, the cost setting up LAN remains the main challenge that had contributed to low accessibility of LAN tools and its replica effects on data communication.

Major Findings

The major findings from the study included the following:

(i) Respondents indicated availability of LAN in Senior High School but were not satisfied with the availability of computers, servers, and switches, access point, trucking pipes, printers and scanners used as tools to facilitate data communication. Students, teachers and

administrators were dissatisfied with the availability of LAN in the school ecology.

(ii) In the area of LAN utilisation, students, teachers and administrators were not satisfied with the utilisation of the LAN tools or equipment such as printing, sharing DBMS, securing school data, communication, among colleagues, sending notification for meetings, assessing students, record keeping and filling students report. It was ascertained that, students, teachers and administrators were dissatisfied with the utilisation of LAN in schools.

(iii) There was no extension of the LAN to ICT labs, headmasters' offices, assistant headmasters' offices, account office, bookshop and science laboratories.

(iv) The school administration remained the core state holder challenge to provide LAN tools in the schools and since lack of funds are their main challenge. This was the reason for the inadequate LAN tools in the schools.

(v) There was poor data communication in the senior high schools because students, teachers and administrators lack some fundamental ideas and concepts on digital data communication.

Conclusions

The following were the major conclusions for the study:

(i) Senior High Schools do not have LAN tools and this is having a negative effect on information sharing leading to poor academic work.

(ii) The absence of network administrators and ICT laboratory administrators would breakdown the limited LAN tools available in our schools due to lack or maintenance

(iii) The over-dependence of school administration for LAN tools means that schools in The Central Region of Ghana would lag behind in the utilisation of LAN tools since schools do not have the requisite financial resources to acquire them.

(iv) The limited number of computers in our senior high schools would derail Ghana government effort of promoting computer literacy.

(v) Most schools lack basic LAN tools for data communications, I have my doubts as to whether the few LAN tools available in some of schools are put to effective use. The stakeholders must provide LAN devices in schools to hence effective data communication.

Recommendations

On the basis of the findings from the study and conclusions drawn, the following recommendations are made for policy and practice:

(i) The government through the Ghana Education Office, should provide Senior High Schools with LAN tools to facilitate data communication. In addition funds should be solicited from PTAs and other well-to-do individuals, organisations and non-governmental organisations to help purchase these devices on regular basis to promote teaching and learning.

(ii) Also, Network Administrators and ICT Lab administrators should be employed to regularly maintain the available LAN tools in order to increase their life span.

(iii) Stake holders in education should purchase access points or cables and laid to areas such as the headmaster's office, assistant headmaster's offices, science Labs, and classroom, et cetera, to promote digital data communication.

(iv) The Ministry of Education should employ experts temporally or permanently through the schools to manage and educate the school population on the use of LAN in printing, sharing DBMS, securing school data, communicating, filling students' database and more importantly, record keeping to which provides access points for student's information.

(v) Students should be given the opportunity to experience LAN usage in their respective schools by providing network node which will enrich their technological knowledge.

(vi) Virtual or Paperless educational system should be facilitated by digitising all documents to enhance the mode of information circulation in our schools to reduce time wasting in information sharing.

(vii) Server services should be employed to enable ICT and other subject area teachers to mount their designed school base programmes, drills assessments in other to promote self-pace learning and constructivism.

Suggestions for Further Research

Considering the outcome of this study it will be necessary for further studies to be conducted into the following topics:

(i)   The effects of poor LAN administrations on schools

(ii)   The cost and effect of snakenet as a medium of data communication on schools

(iii)   The efforts of stakeholders in the provision of LAN in Senior High Schools.

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Appendix A: Questionnaire for teachers and administrators

UNIVERSITY OF CAPE COAST

MASTER OF EDUCATION INFORMATION TECHNOLOGY

Questionnaire for Assistants Headmasters and Teachers

Questionnaire on the availability and utilization of Local Area Network on Senior High School in the Central Region of Ghana.

This questionnaire is designed to find out your opinion on the availability and utilisation of LAN and LAN systems in your school.

A student of the Master of Education Information Technology Department, University of Cape Coast, is using this questionnaire for a study. It is meant solely for academic purposes, so you are assured of confidentiality.

You are however requested to answer all the questions that follow as openly and frankly as possible. Thank you very much in advance. Please tick (√) or write in the spaces provided below.

SECTION A: Demographic data

1. Name of your school? …………………………………………………

2. Sex   Male [   ]   Female [   ]

3. Age ……………………….(age in years)

4. Which of the following category of school embodiment do you

   belong?

   ICT teacher [   ]   assistant headmaster [   ]

SECTION B: Satisfaction with the availability and utilization of LAN
tools in the schools.

5. What is the population of the school?

   Below 1000 [ ]   1000 – 1500 [ ]   1500 – 2000 [ ]   Above [   ]

6. Do you have ICT laboratory?   Yes [   ]   No [   ]

7. What is the average number of students per class?

   Below 45 [   ]   45-60 [   ]   60-80 [   ]   Above 80 [   ]

8. Does your school have a Local Area Network in your laboratory?

   Yes [   ]   No [   ]

9. Do you have Local Area Network in other part of your school?

   Yes [   ]   No [   ]

   i.   If yes please what category of LAN is the sign with work with:

       Peer-to-peer [   ] server/client [   ]

10. How is digital communication mostly accomplish in your school?

    Snakenet [   ]   Network [   ]

11. Do you have Local Area Network in your office? Yes [   ]   No [   ]

12. Which medium is the LAN connection in your office?

    Wired [   ]   Wireless [   ]

13. Does your school use Network Operating System?

Yes [   ]   No [   ]

i.   If yes, what type?   Windows [   ] Linux [   ]   others [   ]

ii.   Please specify………………………………………………

14. For each of the statements listed below, please tick (√) in the space which best describes your opinion about each statement in your school.

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
Computers				
Server				
Switch				
Access point				
Trucking pipes				
Printer				
Scanner				

15. Indicate the satisfactory with the geographical extension of the LAN in your school.

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
ICT Lab				
Assistants headmasters office administration				

Assistant headmasters office Academic				
Account office				
Book shop				
Science laboratory				

16. **Satisfaction with the uses of the local area network in your school.**

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
Printing				
Sharing DBMS				
Securing School Data				
Communicate among colleagues				
Send notification for meeting				
Giving assignments				
Record keeping in the school				
Fill student report				

17. Section c: Does installation and maintenance cost has an effect in the utilization of networking systems?

a. Who is responsible for the purchasing of LAN tools in the school?

   The school Administration [ ]   GES [ ]   NGO [ ]   others [ ]

   If others Please specify ………………………………………..

b. Does your school have a qualified network administrator?

   Yes [   ]   No [   ]

c. Who installed your LAN?

   School Network Technician [   ]   ICT teacher [   ]   Technician

   from outside the school [   ]

d. What are the reason for lack of LAN systems in your school?

   Funds [ ]   lack of knowledge of LAN [ ]   Lack of computer

   laboratory [   ]   others [   ]

   If others Please specify ………………………………………..

e. How often are LAN devices purchase?   Below 1-years [   ]   1-2

   [   ]   3-5 [   ] 5 years and above [   ]

f. What is the average of computer to students' ratio? _____

g. How often is the network extended? Below 1-years [   ]   1-2 [   ]

   3-5 [   ] 5 years and above [   ]

Appendix B: Questionnaire for students

UNIVERSITY OF CAPE COAST

MASTER OF EDUCATION INFORMATION TECHNOLOGY

Questionnaire for Students

Questionnaire on the availability and utilization of Local Area Network on Senior High School in the Central Region of Ghana.

This questionnaire is designed to find out your opinion on the availability and utilisation of LAN and LAN systems in your school.

A student of the Master of Education Information Technology Department, University of Cape Coast, is using this questionnaire for a study. It is meant solely for academic purposes, so you are assured of confidentiality.

You are however requested to answer all the questions that follow as openly and frankly as possible. Thank you very much in advance. Please tick (√) or write in the spaces provided below.

SECTION A: Demographic data

18. Name of your school? ………………………………………………

19. Sex   Male [   ]   Female [   ]

20. Age ……………………….(age in years)

21. Which of the following category of school embodiment do you

    belong?

    Student [   ]   ICT teacher [   ]   assistant headmaster [   ]

SECTION B: Satisfaction with the availability and utilization of LAN tools in the schools.

22. Do you have ICT laboratory?   Yes [   ]   No [   ]

23. Does your school have a Local Area Network in your laboratory?

    Yes [   ]   No [   ]

24. Do you have Local Area Network in other part of your school?

   Yes [   ]   No [   ]

   ii. If yes please what category of LAN is the sign with work with:

      Peer-to-peer [   ]   server/client [   ]

25. How is digital communication mostly accomplish in your school?

   Snakenet [   ]   Network [   ]

26. Which medium is the LAN connection in your class?   Wired [   ]

        Wireless [   ]

27. For each of the statements listed below, please tick (√) in the space which best describes your opinion about each statement in your school.

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
Computers				
Server				
Switch				
Access points				
Trucking pipes				
Printer				
Scanner				

28. Indicate the satisfactory with the geographical extension of the LAN in your school.

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
ICT Lab				
Class room				
Book shop				
Science laboratory				

29. **Satisfaction with the uses of the local area network in your school.**

Area of Satisfaction	Very Satisfied 4	Satisfied 3	Dissatisfied 2	Very Dissatisfied 1
Printing				
Sharing DBMS				
Submitting projects				
Record keeping in the school				

APPENDIX C:

Reliability Statistics of the Students' Questionnaire

Case Processing Summary

		N	%
	Valid	340	100.0
Cases	Excluded[a]	0	0.0
	Total	340	100.0

a. Listwise deletion based on all variables in the procedure

Reliability Statistics

Cronbach's Alpha	
	N of Items
.926	59

APPENDIX D:

Reliability Statistics of the ICT Teachers and Assistant Heads' Questionnaire Reliability

Case Processing Summary

		N	%
	Valid	40	100.0
Cases	Excluded[a]	0	0.0
	Total	40	100.0

a. Listwise deletion based on all variables in the procedure

Reliability Statistics

Cronbach's Alpha	
	N of Items
.829	49